

SMS group

newsletter

THE SMS GROUP MAGAZINE
ISSUE 02 / 2020

New roadmap for the future

IN FOCUS

With virtual reality and projects such as green steel production, battery recycling and container port logistics SMS group enters new or changing markets.

MODERNIZATIONS

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WELCOME

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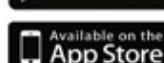
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The **SMS group Connect App** is available in the App Store and at Google Play.



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Dear friends of SMS group,

The first half of 2020 took a completely different course than all of us had expected at the beginning of the year. The COVID-19 pandemic has set in motion – in virtually no time – a process that has changed the whole world, redefining our private and business routines. A lot has changed during the last few months, again and again challenging our ability to adapt – a quality that SMS group has demonstrated on many occasions during its history. We have, for example, restricted travelling in connection with our projects to the absolutely essential. Still, even the few remaining business trips involve a lot of effort and require many precautions to be taken. Therefore we are glad that we started very early – many years ago – to actively pursue the development of digital solutions and have a global network of branches, workshops and representations in place that guarantee closeness to customers the world over at all times. All this now pays in the form of highly efficient project support enabled by our digital solutions and the direct and intensive cooperation with our colleagues right there in the various local markets. This means that even in these challenging times we can efficiently and successfully handle our projects in close dialogue with our customers, as show the examples featured in this Newsletter.

Growth in strategic areas

We look forward. We bank on growth in strategic areas. For example, our majority stake in Viridis Energy Solutions and Vetta Technologies, two Brazilian digital enterprises, is primarily an expansion of the product

portfolio of SMS digital to include activities in the field of energy management. The innovative energy and sustainability platform provided by Viridis is a successful and well established product in the Brazilian market used by customers from various industries. We are very pleased about the potential provided by the addition of 200 experienced specialists to our digitalization team. The two companies have joined SMS group under the name Vetta. SMS group has been active in the Brazilian market for about 50 years, with a highly convincing portfolio of services, as you can read in the country profile on Brazil. In addition to Brazil, we are featuring our activities in South Africa, the Middle East and Italy in this newsletter.

Investing in the future

Our investments in Italy, for example, are aimed at further strengthening our competitiveness and market position in the field of extrusion presses and ring rolling machines. Building on our successful cooperation with OMAV in the past, we are now going to acquire the remaining 75 percent of shares in the company. In addition, we will be acquiring all of Hydromec's stakes in two stages. Hydromec has been a highly successful international player in the field of forging presses and ring rolling machines. Both companies will become important assets to our Forging Technology business unit. With these latest investments, we are further strengthening our already excellent market positioning: We are advancing our future-oriented digitalization technology, further consolidating our global positioning, safeguarding our technology leadership,

and expanding and enhancing the know-how and expertise of our teams, ensuring that we will remain the Leading Partner in the World of Metals for our customers – also in the future.

Green steelmaking

We will definitely continue investing in key innovations. Green steelmaking is a central topic here. The first ever green slab is due to be produced with SMS group technology and equipment. We are excellently positioned to be the first company to achieve hydrogen-based direct reduction of steel using green electricity. We have been further promoting and will continue to turn into reality our New Horizon initiative. We are entering new and changing markets with the projects of this program. The best known of which is probably BOXBAY, our port logistics project. The pilot plant in Dubai has become operational this year, as scheduled, despite the disruptions caused by the COVID-19 crisis. A new activity is our participation in the lithium battery recycling business and the sustainable recovery of valuable substances from used batteries, for which we have founded the 50:50 joint venture "Primobius" together with Neometals. Enjoy reading all about these exciting topics on the following pages.

Yours,



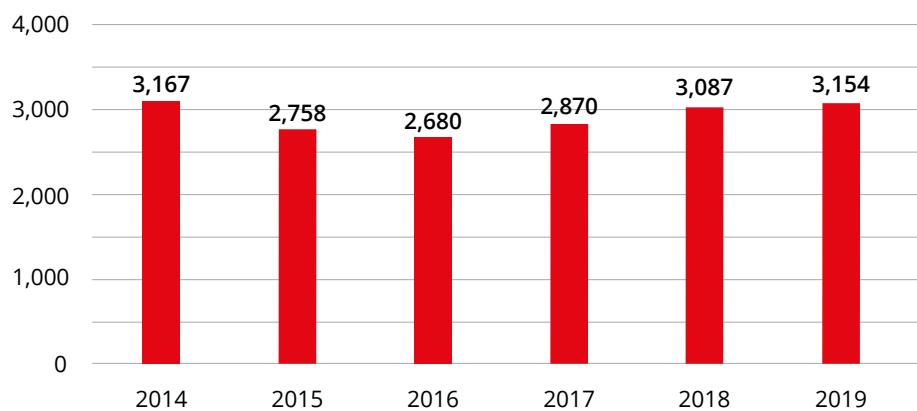
Burkhard Dahmen

Chairman of the Managing Board
SMS group



Executive Summary

SMS group figures



Order intake in
EUR million¹⁾

SMS group in EUR million ¹⁾	2014	2015	2016	2017	2018	2019
Order intake	3,167	2,758	2,680	2,870	3,087	3,154
Sales	3,406	3,310	3,052	2,887	2,805	2,935
Order backlog	4,613	4,018	3,566	3,472	3,623	3,850
Employees²⁾	14,003	14,342	13,903	14,305	13,872	13,793

Figures in accordance with
International Financial
Reporting Standards (IFRS).

¹⁾ Including others/
consolidated.

²⁾ Average with apprentices/
others.

Order intake

At EUR 3,154 million, SMS group's incoming orders in the past business year were EUR 67 million higher than the previous year's figure (2018: EUR 3,087 million). Overall, we are satisfied with order intake in 2019. At around EUR 3.2 billion, we generated our highest incoming orders since 2014. Our key growth issues service, digitalization and New Horizon confirm our targets in these areas. We therefore slightly outperformed our forecast of stable order intake at the previous year's level (+2.1%).

Order intake came to EUR 2,913 million in metallurgical plant engineering (previous year: EUR 2,812 million). This

corresponds to a volume increase of EUR 101 million against 2018. Order intake in plant business picked up slightly, coming to EUR 2,173 million at the end of the year (previous year: EUR 2,113 million). Our service business continued to enjoy steady growth, reaching EUR 740 million by the year-end (previous year: EUR 698 million).

At exelis, the level of incoming orders generated in the previous year could not be sustained, with booked incoming orders in 2019 coming to EUR 197 million (previous year: EUR 222 million) on account of restrained demand and a number of projects being postponed. The trend of a signifi-

cant slowdown in demand also continued at Elotherm in the 2019 business year. At EUR 47 million, order intake even declined on the low previous year's figure (previous year: EUR 56 million).

Sales

At EUR 2,935 million, sales generated in the past business year was up by EUR 130 million on the previous year (EUR 2,805 million). Our forecast that sales will rise slightly (+4.4%) was confirmed.

This good performance is thanks to metallurgical plant engineering. Sales came to EUR 2,669 million in the 2019 business year, higher than in the previous year (EUR 2,517 million). Sales generated in plant business improved to EUR 1,956 million (previous year: EUR 1,842 million), with sales in the service business climbing to EUR 713 million (previous year: EUR 675 million).

The regional distribution of the SMS group's sales was as follows in 2019:

→ Western Europe:	29.9%	(previous year: 27.3%)
→ North America:	17.8%	(previous year: 15.0%)
→ China:	14.2%	(previous year: 15.7%)
→ Eastern Europe:	12.0%	(previous year: 10.5%)
→ India:	9.1%	(previous year: 8.8%)
→ Asia, other:	6.3%	(previous year: 8.3%)
→ MENA:	5.1%	(previous year: 8.8%)
→ Latin America:	4.6%	(previous year: 4.7%)
→ Africa:	1.2%	(previous year: 0.8%)

elexis generated sales of EUR 206 million in the past business year, almost on par with the previous year (EUR 211 million). Sales at Elotherm came to EUR 65 million.

The sales trend is negative (previous year: EUR 82 million) on account of weak order intake in the last two years.

Order backlog

As order intake exceeded sales, order backlog totaled EUR 3,850 million (previous year: EUR 3,623 million).

Employees

The SMS group employed an average of 13,793 people in the past 2019 business year (previous year: 13,872). This corresponds to another, albeit slight, decrease in the number of employees by 79 people in comparison to the end of the previous year.

The number of employees at elexis/Elotherm was on par with the previous year's average figure at 1,563 (previous year: 1,562).

Result

In the business year 2019, SMS group generated pre-tax profit of EUR 64 million, which was well above the previous year's level (EUR 28 million). Thus, our forecast of a significant improvement in earnings before taxes compared to the previous year was entirely borne out.

Liquidity

Cash and cash equivalents were up by EUR 11 million against the previous year to EUR 695 million (previous year: EUR 684 million).

The advance payments received that are customary in the industry are secured by way of bank guarantees. The share of guarantee and borrowing facilities utilized is approximately 45%.

Investments

The volume of investments in intangible assets and property, plant and equipment was EUR 39 million (previous year: EUR 38 million). Investments essentially related to the purchase of replacement equipment for mechanical production and to the expansion or replacement of current IT systems, especially for the introduction of Windows 10.

We invested EUR 23 million in other business interests and investment securities (previous year: EUR 55 million). By way of comparison, proceeds from the disposal of financial assets amounted to EUR 17 million (previous year: EUR 18 million).

Burkhard Dahmen,
Spokesman for the Managing
Board, SMS GmbH

Torsten Heising,
Member of the Managing
Board, SMS GmbH

Vision of a modern working world is becoming a reality

Construction work on the new SMS group Campus in Mönchengladbach, Germany, has been officially kicked off with a groundbreaking ceremony. Mönchengladbach will be home to a new technology, service and digitalization center built on the SMS premises and providing 1,500 modern workplaces. The shell construction will be completed as early as by the summer of 2022. The Campus will be ready for occupancy in mid/end-2023.



Further information

[www.sms-group.com/sms-group/about-us/
sms-group-campus/](http://www.sms-group.com/sms-group/about-us/sms-group-campus/)



Groundbreaking ceremony (from left to right): Hans Wilhelm Reiners, Mayor of the City of Mönchengladbach, Heinrich Weiss, Chairman of the Shareholders' Committee of SMS Holding GmbH, Burkhard Dahmen, CEO, SMS group GmbH.



Into the future with new technologies

GERMANY

Prof. Hans Ferkel talks about SMS group's new concepts of plant supply and approaches to high-efficiency plant revamping.



PROF. DR. HANS FERKEL,
CHIEF TECHNOLOGY OFFICER, SMS GROUP

Professor Ferkel: The 2020 Aluminium trade fair, originally scheduled to take place in Düsseldorf this October, has been postponed due to the COVID-19 pandemic. For all who had planned to visit the trade fair in October, could you please explain why SMS group is the Leading Partner also in the aluminium industry?

SMS group's portfolio is extremely wide and comprehensive, ranging from modern plant engineering through to financial services. As Leading Partner in the World of Metals, SMS group responds to the specific requirements of each individual customer and those of the local markets. Through our local points of contact in all key regions of the world, we are within easy reach for our customers and always ready to listen to their needs and demands, and advise them on our efficiency-enhancing concepts for new plant projects and plant upgrades. We offer integrated solutions for all process stages from the liquid phase through to the finished product - including ultra-modern hot and cold rolling mills for flat products, complete with strip processing and finishing lines, and extrusion shops. For our customers this means one-stop shopping in the true sense of the word: everything is available from a single source, including life cycle partnerships and future-proofness of their investments.

Being a light-weighting material, aluminium is also used in the transportation and mobility sector. What kind of technologies does SMS group provide to the automotive industry, for example?

The EHS factors (environment, health and safety) play a central role for our customers, and equally for us. This encompasses resource-saving and safe production all the way through to the finished products and their environmentally compatible application. An important trend here is the production of wide aluminium sheets for weight-saving designs in the transportation sector. These products open new engi-



"We are absolutely convinced of the process of high-temperature electrolysis, as it is not only more economic but also more eco-friendly."

neering potential for weight-optimized designs in automotive and wagon construction, for semitrailers and for the aviation industry.

SMS group provides a whole host of options for plant building and revamping projects for producers of high-grade aluminium products for the transportation sector and e-mobility. In addition to rolling equipment, SMS group's portfolio for the production of high-grade automotive sheets also includes Heat and Chemical Treatment Lines (HCTL). In these integrated lines, aluminium products for lightweight engineering receive a chemical surface treatment in addition to a heat treatment. The strips made in automotive and aero-

space grades are initially treated – on the basis of mathematical models – in a long floatation furnace equipped with a special cooling system. The temperature tolerances are extremely tight: +/- 3 K (certified to NADCAP). Subsequently, automotive grades – of the 5000 and 6000 series range, for example – are cleaned in a chemical process and coated.

What other requirements come from the automotive industry?

Besides the above mentioned weight reduction of vehicles, e-mobility is another area of focus, as environmental issues have been and will be playing an increasingly important role

– not only for our direct customers, but also for the companies they supply with products made on our plants. It is our aspiration to be a strong partner also in all aspects of environmental technology.

The coil coating line supplied by SMS group to Henan Zhongfu in China shows that investments in innovative environmental technologies pay off both ecologically and economically. The special feature of this line is that the solvent-containing exhaust gases are extracted from the curing oven and used as thermal energy by the RTO (regenerative thermal oxidizer), a regenerative post-combustion system. Once the autothermal process has started, the ovens operate without any additional energy input. SMS group company Hertwich Engineering uses a similar principle for the recycling and melting of aluminium scrap. The company's Ecomelt furnaces combust contaminants, such as oils or paints, on the scrap and recycle the released combustion energy back into the process. This minimizes the requirement of natural gas, providing a two-fold benefit for the plant operator. Another innovation is the clean induction furnace technology for aluminium extrusion shops. In connection with gas-fired furnaces, it provides high-precision process control during billet pre-heating.

What environmental concepts outside the aluminium industry does SMS group pursue?

As a system supplier, SMS group has made it its task to offer future-proof technology that is able to eliminate in particular the high CO₂ emissions from the steelmaking process. The first ever green slab, for example, is due to be produced with technology and equipment from SMS group. Hydrogen plays a pivotal role in making pig-iron production green. For SMS

group, a leading plant engineering company for the steel producing and processing sector, the issue of hydrogen production is just as relevant. Our cooperation with the start-up company Sunfire sends out a clear signal to the market: we develop technologies for the future of a carbon-free steel production.

What are the benefits of the cooperation with Sunfire?

We want to be able to offer our customers technologies that enable them to produce hydrogen in the most efficient way. Therefore, SMS group – via our group company Paul Wurth – has entered into a cooperation agreement with the start-up company Sunfire. We are convinced of the advantages of high-temperature electrolysis (HTE). HTE uses steam instead of liquid water, as the classical electrolysis processes do. In the steel industry and many other sectors of industry, waste heat – especially low-calorific heat at temperatures between 150 and 250 degrees Celsius – is usually released to the atmosphere unused – in other words, it is “cooled away”. It is very often not economically efficient – and ecologically rational – to convey this waste heat to other uses, for district heating, for example. However, this heat is perfectly suitable for the production of steam for the HTE process right on site. Water in the form of steam requires much less dissociation energy than liquid water.

We use this so far unexploited heat to raise the efficiency of hydrogen production via HTE to more than 82 percent. As a comparison: conventional electrolysis methods using liquid water reach only 60 percent – at the maximum. In this way, we not only reduce the amount of waste heat released to our increasingly warmer climate, but also help to use the – preferably green – electricity in the electrolysis process much more efficiently. This means we act more eco-responsibly and more cost-efficiently at the same time.

SMS group recently announced another new joint venture.

Yes, we have founded a 50:50 joint venture with project developer Neometals Ltd., based in West Perth, Australia. The new company is named Primobius GmbH.

What is the business purpose of Primobius GmbH?

The company's business purpose is the commercialization of a joint recycling technology for lithium ion batteries. This technology provides a very sustainable way of recovering valuable substances from vehicle batteries and rechargeable batteries for electronic devices. In this joint venture, SMS group merges its comprehensive mechanical engineering and service expertise with Neometal's process know-

“Aluminium sheet products provide new potentials for weight-saving designs in automotive engineering.”

how. Primobius is another step along SMS group's strategic path of developing ever new business models as a system supplier – also with a view to making value chains more sustainable every time. There had been a lot of research and development activity before we signed the joint venture – activity that has resulted in a new pilot-tested, patent-pending process. This process is based on hydrometallurgy and is capable of recovering more than 90 percent of the alloying elements in batteries. The recovered elements can be reused as input material in battery production. In other words: we are closing a process circle here. Scrapped batteries become new batteries again – in a highly efficient and environmentally friendly way.

What are each partner's roles within the joint venture?

As early as in 2019, Neometals and SMS group had signed a Memorandum of Understanding under which we performed the technical Due Diligence and determined that the future pilot plant was to be built at SMS group in Hilchenbach, Germany. As the project was evaluated positively by both partners, the MoU was transferred into a joint venture. Neometals contributes the technological know-how, which includes its recycling technology, and SMS group the engineering and the construction of the future recycling facilities.

In which regions will we see this recycling technology being introduced?

The technology is specifically designed to meet the requirements of lithium battery producers worldwide and of the global e-vehicle sector. The market entry of Primobius coincides with the current boost in e-mobility. Our recycling solution supports this trend in that it provides the possibility of recycling batteries sustainably and recovering substances – in an ethically responsible way – from old batteries to make new ones. In this way, we reduce the carbon-footprint of battery production and make an overall contribution to more sustainable supply chains in the lithium battery industry.

What comes next?

The next steps will be the construction and start-up of the pilot plant in Hilchenbach and the optimization of the technology with a view to the design of a full-scale facility. We will invite potential customers to see for themselves how the demonstration plant recovers valuable substances from their own or third-party battery scrap material.

We see great potential in this sector. With our metallurgical expertise and our plant engineering know-how, we will contribute to a soon-to-come start of commercial operation. Also the timing is good for the new technology to win ground,



Primobius
Battery recycling without limits

Primobius is the new byword for modern recycling.



Watch the video on battery recycling at primobius.com.



sunfire

World-leading supplier of patented high-temperature electrolyzers: Sunfire knows how to transform electricity from renewable sources, water and CO₂, into fuels at highest efficiency rates.

Further information www.sunfire.de

last but not least among OEMs who have recognized the potential provided by the closing of this gap in the battery value chain. The world over, we have been observing growing awareness of environmental issues and the willingness to promote sustainable acting and new forms of circular economies. This is why we are absolutely convinced of the Primobius project. We plan to commission the pilot plant in the second half of 2021 and look forward to enquiries from potential customers wishing to test the recycling of their batteries in the new facility. ♦



Further information
www.sms-group.com

150 years of success

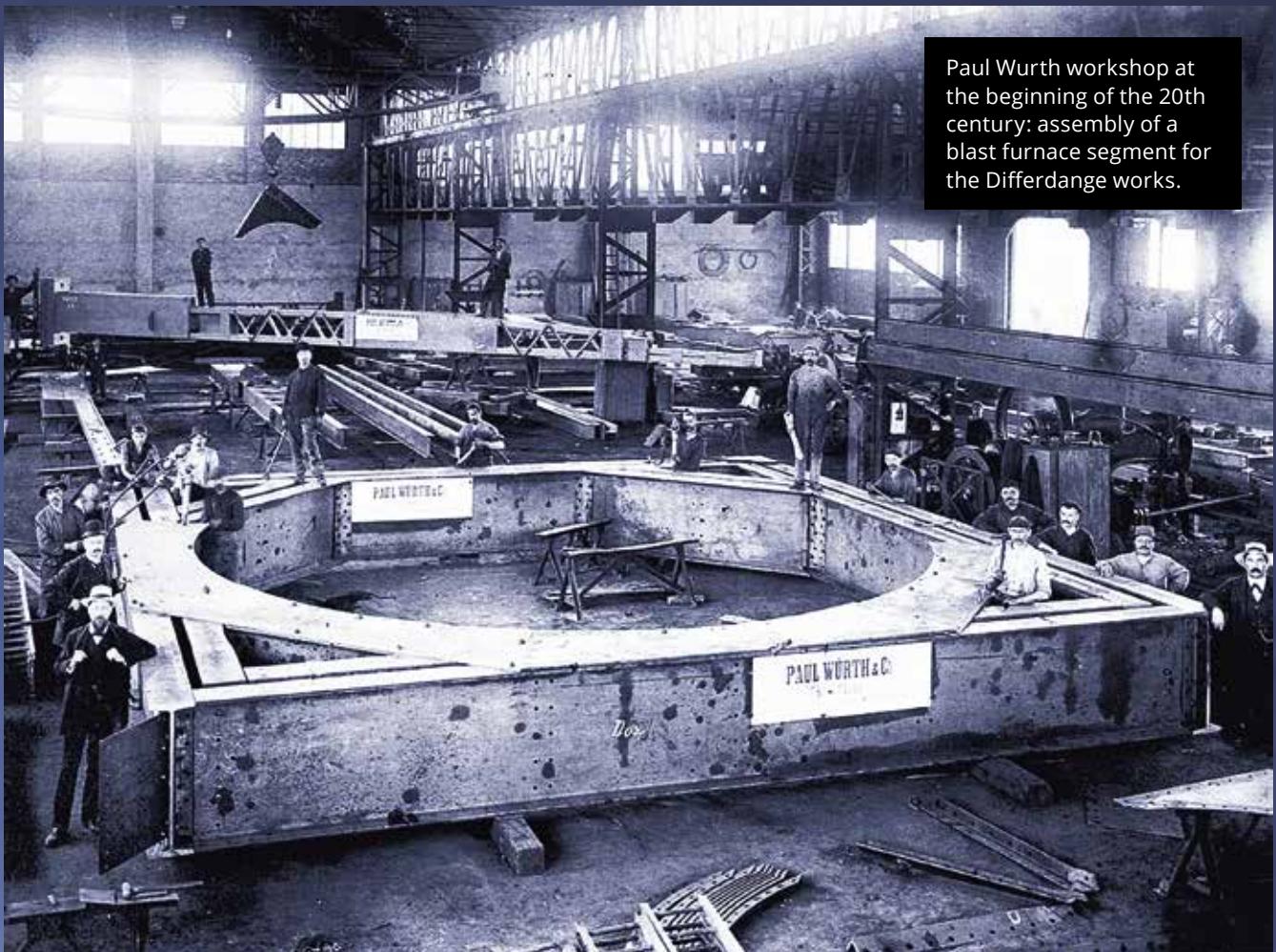
LUXEMBOURG

Founded in 1870, technology company Paul Wurth, based in Luxembourg, is a world-leading mechanical and plant engineering company covering the complete process route of iron making. Paul Wurth – since 2012 a part of SMS group – is a market leader in the design and supply of complete blast furnace plants and cokemaking facilities. The company's portfolio of technology for the primary phase of steelmaking is rounded out by direct reduction plants, environmental protection technology, and waste treatment and recycling facilities. Currently, a strong focus of Paul Wurth's activities is on the development of innovative technologies promoting the trend towards carbon-neutral steelmaking.

 Further information
www.paulwurth.com

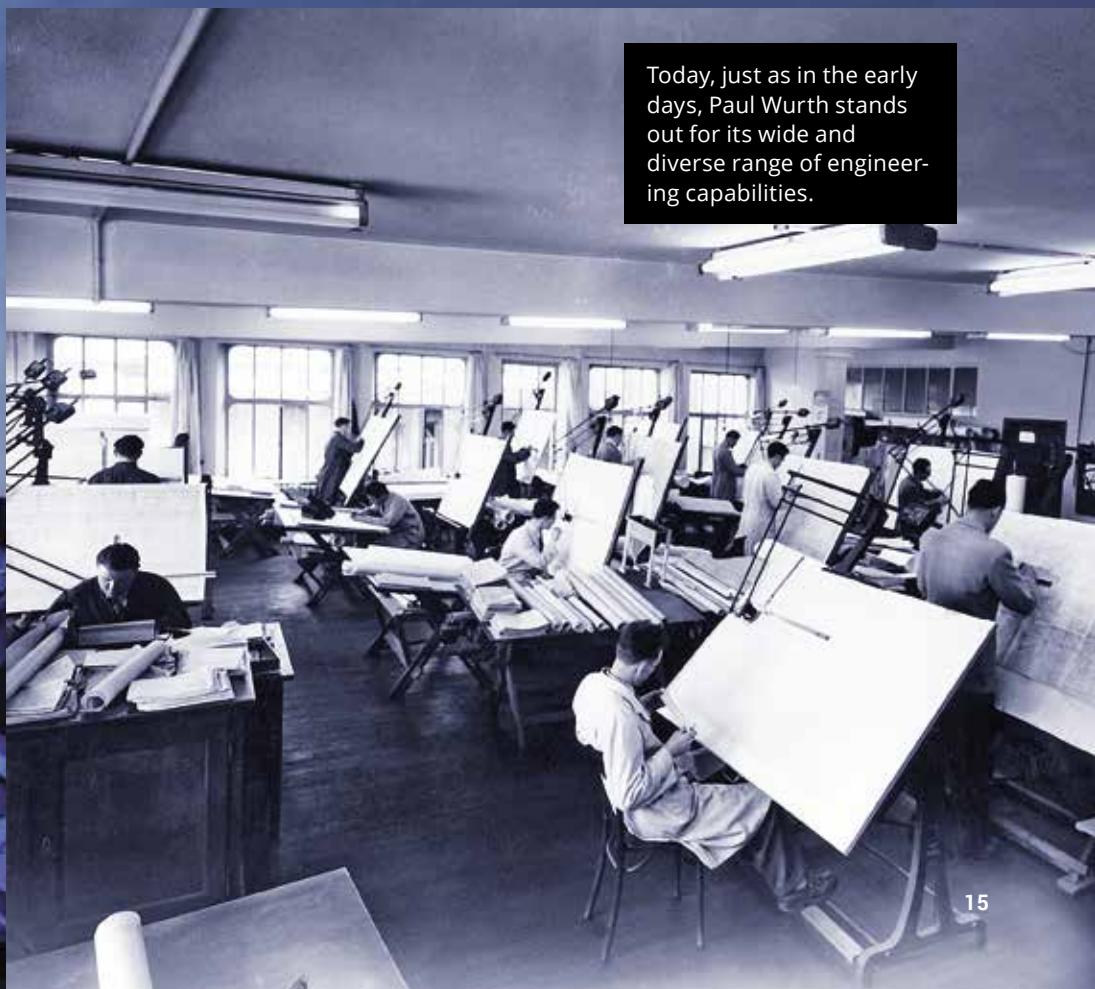
As well as technologies for hot metal production, which is Paul Wurth's core business, the group's recent developments provide significant potential for diversification into other sectors of industry.





Paul Wurth workshop at the beginning of the 20th century: assembly of a blast furnace segment for the Differdange works.

150
YEARS OF
EXCELLENCE
1870-2020



Today, just as in the early days, Paul Wurth stands out for its wide and diverse range of engineering capabilities.



A highly competent partner

INTERVIEW

Georges Rassel, CEO Paul Wurth, talks in an interview about the success story Paul Wurth and explains how the company is making the steel industry greener.

Mr. Rassel, Paul Wurth celebrates its 150th anniversary this year. What is the formula for the success of the company?

I can summarize the formula of Paul Wurth's success in three terms: innovative strength, flexibility and our employees. During all those years, our innovations have enabled us to promote the development of the market and be regarded as a highly competent and reliable partner by our customers. And, thanks to a great deal of flexibility, we have proved to be able to adapt not only to the requirements and demands of the market, but also to the specific needs of the regions in which our customers are based. Last but not least, our highly qualified staff is a key to the success of Paul Wurth. It's our employees who are in regular contact with our customers around the globe. They discuss with

them the potentials and benefits of innovations, and they are the ones who listen to our customers' proposals and understand their concerns, should there be any. Good leadership and team spirit are two other essential elements of our company's success. As a company with its roots in Luxembourg, we benefit yet from another aspect: The inhabitants of Luxembourg – and therefore most of our employees – are generally multi-lingual, with a multi-cultural background. This additionally facilitates communication with our customers located on all five continents.

Were there any decisions and strategies that – in retrospect - turned out to be milestones in the company history?

The company started as a boilermaking facility 150 years ago. During the first decades of its existence, Paul Wurth was a typical manufacturing company, fabricating products on the basis of drawings provided by the customers. We were subsuppliers to a wide range of companies active in steel production and construction. An important milestone event took place in the early 1950s, when Paul Wurth acquired a license to build complete blast furnaces, including the engineering. This was the starting signal to expand the engineering department, marking the transition from a manufacturing to an engineering company. Engineers became a key asset of our company, not least due to the fact that they became the developers of many of our innovations.

In 1970, we launched an entirely new, revolutionary blast furnace charging system. The new technology enabled rapid productivity increases and was – given the standards of that time – considered an ecofriendly production process. Blast furnace operators from all over the world got in contact with us, as they were interested in our innovative system and considering using it on their furnaces. Definitely from that time on, the name Paul Wurth has been standing for innovation among ironmakers the world over. For us, our BELL LESS TOP® blast furnace charging system was a door opener to the world markets. Before, our activities had been limited to Luxembourg and the rest of Europe. 50 years ago, we started to establish what is today a world-spanning network.

In 2004, we decided to close down our workshop in Luxembourg. In other words, we had to give up what had formed the roots of the company

150 years ago – our manufacturing activities. An extremely painful, though essential, process, which – thanks to the lower overhead costs – enabled us to enhance our competitiveness. As a matter of course, Paul Wurth continued to maintain its highly efficient worldwide network of third-party manufacturing partners.

In 2012, we became a company of SMS group. This marked another key milestone in the history of Paul Wurth, as SMS group supported us, for example, in acquiring the license for building Midrex® direct reduction plants – a future-oriented technology that will play an important role for promoting CO₂-free steelmaking. The exchange with SMS group forms a solid base for our future. Developing today technologies for tomorrow will result in both our companies growing together even closer.

What is your view of the current market situation?

The world over, ironmakers have been and are still suffering hardships due to overcapacities in China. CO₂ reduction is an issue predominantly for the European steel producers. This is understandable because blast furnaces and cokemaking facilities account for up to 85 percent of CO₂ emissions in the steel industry. On top of that, we have been feeling the repercussions on global trade due to the current COVID-19 crisis. These are dire times for all plant operators. Apart from production-related issues and over-capacity, our customers are confronted with uncertainties of a different nature. A blast furnace is likely to be operated for about twenty years. This means that a company that may consider investing in a new blast furnace or completely modernizing an existing one should - before placing the order - take into due account the likely development of the market in next twenty years. Currently, it is extremely difficult to make any forecasts at all. Under these circumstances, investing in a blast furnace may become a risky endeavor. Nevertheless, our customers can rest assured that, even during these difficult times, we will remain by their side with our advice and support.

What is it that makes Paul Wurth stand out from its competitors?

It's our technologies that distinguish us from the rest of the market. Our technologies are our USPs, protected by patents. We can say with pride that our customers want and explicitly ask for products

made by Paul Wurth. We often hear from our customers that they expect that at least the core components of the facilities they order are supplied directly by us. Paul Wurth and our product range stand for high quality, utmost reliability and maximum availability. Another important factor that sets us apart from the competition is our market presence and closeness to our customers. Thanks to the cooperation with SMS group, we are even better positioned worldwide and very close to our customers.

**Paul Wurth's locations span the entire globe.
How important is customer intimacy to you?**

You only get deep insight in local markets when you are right there. This is something you cannot



From its Luxembourg headquarters, Paul Wurth manages its locations in all parts of the world, which ensure closeness to local markets.

achieve from our headquarters in Luxembourg. Especially, when it comes to handling smaller-scale projects local presence is crucial to efficient customer support.

Paul Wurth supports plant operators with a range of services. What's the role of service today?

During the last few years, we have made service one of our top priorities. This is why we have established service workshops at locations the world over – including Brazil, China, India, Russia and the U.S.A. This allows us to overhaul, repair and service products originally made in Europe. Apart from the technical service they perform, our workshops are also able to take in manufacturing jobs.

An area where we are planning to expand our activities is after-sales support. We want to be a life cycle partner to our customers, a partner they rely

on at all times. We will make increasing use of digitalization – for example in order to be able to log in to our customers' facilities to render immediate support whenever required.

More and more plant operators have been asking us whether we would make our service know-how also available for third-party equipment. Yes, we also offer service for third-party equipment in addition to the service of Paul Wurth plants. Actually, it is not all about selling services. It is our aim to support our customers as best as we can in making their production plants even better.

How do you manage to stay in contact with your customers as we are going through the COVID-19 crisis?

Especially during the last few months, it has proved extremely helpful that Paul Wurth can count on its reliable and solid global network. It has enabled our local staff to stay in personal contact with our customers throughout the last few months of the COVID-19 pandemic. And, thanks to digitalization, we can hold customer meetings online. In such meetings, our local representatives may be physically present at the customer's, while our experts log in remotely, from Luxembourg, for example. Also, for the commissioning of plants, we make active use of digital support.

Currently, digitalization and environmental protection are much-discussed topics in the media and the public. How does Paul Wurth go about these issues?

As early as several years ago, we set up an internal digitalization team to push this extremely important topic ahead - with great success, as we have made great advancements in this area. And, we maintain an extremely efficient exchange with SMS digital. Products developed by Paul Wurth are now also available on the digitalization platform of SMS group.

When we developed the BELL LESS TOP® 50 years ago, productivity increases and environmental protection were considered as two entirely separate issues. This, however, has dramatically changed with the launch of many innovative technologies we have developed, as our pressure control system for blast furnaces, for example. We have been concentrating on developing solutions that optimize production and reduce emissions at the same time. Recently, we have been seeing cus-

tomers ask for products that have been part of our range long since, but for which there is now an increasing need in order to be able to comply with the ever more stringent environmental standards. In other words, it now pays off that we have been very active in the field of environmental protection for so many years.

Especially today, our development activities continue to concentrate on environmental topics. Last year, for example, we joined Sunfire, a Clean-tech company, as a lead investor. This cooperation marks another chapter of our initiatives to develop climate-neutral technologies for the steel industry. Sunfire develops and commercializes own innovative electrolysis processes for the production of hydrogen from water and for the production of synthetic fuels.

This sounds like a highly promising cooperation. What can the market expect as a result of your partnership with Sunfire?

We believe that hydrogen will be crucial on the path to CO₂-free industries. Sunfire has developed a hydrogen technology, which is based on high-temperature electrolysis, using waste heat from ironmaking processes. A very special feature of this process is that it uses steam instead of cold water. Thus, it requires 20 to 30 percent less energy for the production of hydrogen than the common electrolysis process. Hydrogen will in the future be increasingly substituting coking coal as a reducing agent. It can also be used as a base material for synthetic fuels, enabling the production of e-fuels which are likely to become the fuels of the future - for planes, trucks and ships, for example, for which electrical propulsion technologies may not be available in the near or even the more remote future.

In a first pilot project in Norway, in which we participate together with Sunfire, hydrogen and CO₂ coming from an industrial source are processed into e-kerosene by means of a technique that involves the rearrangement of molecules. This will certainly become a highly interesting market, in which we can build on our expertise as a global player in plant engineering. For the steel industry, we are developing another lighthouse project in cooperation with Sunfire, so that the first "ton of green steel" can soon be produced. 2025 - this is the deadline we have set ourselves to demonstrate the feasibility of this project.



"Never will wings grow on those who do not dream of flying. And we do want to fly!"

Looking into the future, which topics is Paul Wurth going to focus on in the next few years?

Hydrogen technology for industrial applications may become a second mainstay of Paul Wurth. Should this materialize, it is good to know that SMS group will be around to back us as a strong partner in implementing the technologies and the newly to be created infrastructures.

However, this will not keep us from continuing to satisfy our traditional customers' requirements and wishes. We will continue helping blast furnace and cokemaking plant operators reduce their production costs and the CO₂ footprint of their existing facilities. In addition, we will continue working to enhance the availability of their production plants. We will no cease cooperating closely with research institutes and universities to make the steel industry greener. In our endeavor to develop technologies that will lead to the greening of the steel industry, we once in a while hear people uttering doubts about the feasibility of the technology. In such cases I would quote the writer Robert Lerch: "Never will wings grow on those who do not dream of flying." And we do want to fly! ♦



Further information
www.paulwurth.com



Visualization of the facility to be built in the Herøya Industry Park.

Wind- and hydropower convert CO₂ into renewable fuels

NORWAY

Norsk e-Fuel is planning Europe's first commercial plant for hydrogen-based renewable aviation fuel.

- **Leading industry consortium joins forces to achieve climate-neutral transportation via production of renewable fuels.**
- **Norsk e-Fuel generates renewable fuels from CO₂, water and 100 percent renewable electricity.**
- **Located in Herøya, Porsgrunn, the first plant to be built will provide enough e-fuel to cut CO₂ emissions from the five most important domestic aviation routes in Norway by half.**

Norsk e-Fuel AS, a European industry consortium headquartered in Oslo, has announced to industrialize Power-to-Liquid technology (PtL) for the European market. What is going to be the world's first ever project of this kind will allow the conversion of Norway's extensive renewable electricity resources into renewable fuel. Alongside Paul Wurth, the joint venture is composed of three further partners: Sunfire GmbH, the world's leading PtL-technology provider; Clime-works AG, the pioneer in CO₂ air capture technology; and the green investment company Valinor, parent company of Norsk Vind, the largest private wind power developer in Norway. "We are proud to have the best industry players including our Norwegian business partners at our side to implement this ground-breaking project," says Norsk e-Fuel General Manager, Karl Hauptmeier. "Together, we combine

the necessary corporate strength with the most advanced and efficient technologies to convert Norway's extensive resources of wind- and hydropower into renewable fuels." At present, the European transport sector is still heavily reliant on fossil fuels. Especially for hard-to-electrify sectors such as the aviation industry, this new project holds the promise for a radical change towards climate-neutral transportation.

Staggering potential

Using a single step co-electrolysis process, the innovative technologies from Sunfire and Climeworks convert renewable electricity, water and CO₂ captured from ambient air and unavoidable CO₂ sources into syngas (a mixture of hydrogen and CO). Renewable fuels, such as jet fuel, are then produced through further processing and refining. The certified end products can be directly used in existing infrastructures. "The potential for this project is staggering. Norsk e-Fuel makes the supply of renewable fuel possible on a scale that is larger than has ever been achieved before – something that is crucial if we are to make global transportation truly sustainable. We are glad to contribute our direct air capture technology and know-how to help create renewable crude oil products together with our partners", adds Climeworks co-founder and co-CEO Christoph Gebald. The first plant with a production capacity of 10 million liters annually will go into operation in 2023, followed by the upscaling to 100 million liters of renewable fuel by 2026. The in-

dustrial-scale plant will then save 250,000 tons per year of CO₂ emissions from industries such as the aviation industry. The upscaled, industrial-sized plant will eventually serve as blueprint for the nationwide roll-out of the project. "To put this in perspective, only one industrial-scale plant will provide enough blended renewable fuel for the five most important domestic aviation routes in Norway combined (Oslo-Trondheim, Oslo-Bergen, Oslo-Stavanger, Oslo-Tromsø and Oslo-Bodo). This would effectively cut current flight emissions between these cities by about 50 percent," explains Lars Helge Helvig, Founder of Valinor and Chairman of Norsk Vind. Herøya Industry Park in Porsgrunn has been confirmed as the perfect location for the first plant. Engineering is already well underway. In addition to its existing vital infrastructure, the location in Herøya offers sufficient space for the planned upscaling. Other locations for the following nationwide roll-out have already been identified. Besides generating a large number of jobs both locally and nationally, the Norsk e-Fuel initiative will be a catalyst for the creation of a new clean energy sector in Norway. ♦



Further information

www.norsk-e-fuel.com

"Climate change and rising costs for CO₂ emissions result in a growing market for renewable solutions. This new project holds broad possibilities for Norway and Europe, offering the key to a deeper decarbonization than has ever been feasible before. The transition towards green energy has been progressing quickly in the consumer-oriented sectors – it is time for industry to step up and bring technologies to scale to decarbonize the sectors that power our societies behind the scenes."

Georges Rassel, CEO of Paul Wurth

Highly efficient hydrogen production

THE NETHERLANDS

MULTIPLHY - Green hydrogen for renewable products refinery in Rotterdam.





Photo: gettyimages / Frans Lemmens

CEA, Neste, Paul Wurth, ENGIE and Sunfire have announced a project partnership for the building and operation of the world's first multi-megawatt scale high-temperature electrolyser for highly efficient hydrogen production.

The MULTIPLHY project – “Multi-megawatt high-temperature electrolyser to generate green hydrogen for the production of high-quality biofuels” has recently been launched at Neste’s renewable products refinery in Rotterdam. Involved in the project are Neste, the world’s leading producer of renewable diesel and renewable jet fuel, the French research organization CEA as key technology partners, the energy provider ENGIE, Cleantech company Sunfire, and Paul Wurth as plant engineering company. The consortium will install, integrate and operate what will be the world’s first high-temperature electrolyser (HTE) in multi-megawatt scale. The project consortium led by CEA as project coordinator will receive EU-funding totaling 6.9 million euros as part of the Horizon 2020 FCH2-JU program.

Tangible progress in the technology

MULTIPLHY is the first demonstration project of a high-temperature electrolyser in an industrial refining process. It will have a nominal power input of 2.6 megawatts and a hydrogen production capacity of 60 kilograms per hour, reaching an electrical efficiency of up to 85 percent AC to LHV H₂.

“This project shows the great progress being made in bringing our green hydrogen production technologies to the next level and paving the way for a further scale-up to 100 megawatts,” says Sunfire Managing Director Nils Aldag.

“Neste is a global forerunner in renewable fuels with the ambition to become a global leader in renewable and circular solutions. Demonstrating green hydrogen production at our Rotterdam refinery enables us to drive the development of new sustainable technologies aiming at decreasing the carbon footprint of our customers’ operations,” explains Lars Peter Lindfors, Senior Vice President, Innovation, Neste.

“ENGIE is delighted to be part of MULTIPLHY to decarbonize Neste’s bio refinery. This is the world’s first multi-megawatt high-temperature electrolysis project

“Our investment in the MULTIPLHY project is an important part of our strategy towards the transformation to a carbon-neutral industry, especially as hydrogen is considered THE reducing agent of the future in the world of ironmaking.”

Georges Rassel, CEO of Paul Wurth

to produce hydrogen. We will contribute our expertise and increase our knowledge to further enhance ENGIE’s renewable hydrogen-based solutions and enable our customers to embark on a zero-carbon journey,” says Michèle Azalbert, Chief Executive Officer of ENGIE’s Hydrogen Business Unit.

By the end of 2024, the electrolyser is expected to have been in operation for 16,000 hours or more, producing a total of around 960 tons of green hydrogen while avoiding approximately 8,000 tons of GHG emissions. The project supports the most promising Carbon Direct Avoidance (CDA) approach by substituting “grey” hydrogen currently generated via steam-methane reforming (SMR) by certified green hydrogen. ♦



Further information
www.paulwurth.com

Smaller carbon footprint

GERMANY

Coke oven gas injection at ROGESAs starts according to schedule.

In November 2019, ROGESAs Roheisengesellschaft Saar mbH awarded Paul Wurth the order to design and supply coke oven gas injection systems for the company's blast furnaces No. 4 and No. 5 at Dillingen.

In this new technology, coke oven gas takes over the function of a metallurgical process gas, partially replacing metallurgical coke as reducing agent and decreasing both the carbon intensity in the blast furnace and the carbon footprint of the overall ironmaking operations.

In preparation of the project, Paul Wurth supported the customer with research work and trials on a pilot plant. The current order is being executed on a turnkey basis. It includes design and engineering of the two coke oven gas injection plants, supply of technological key components,

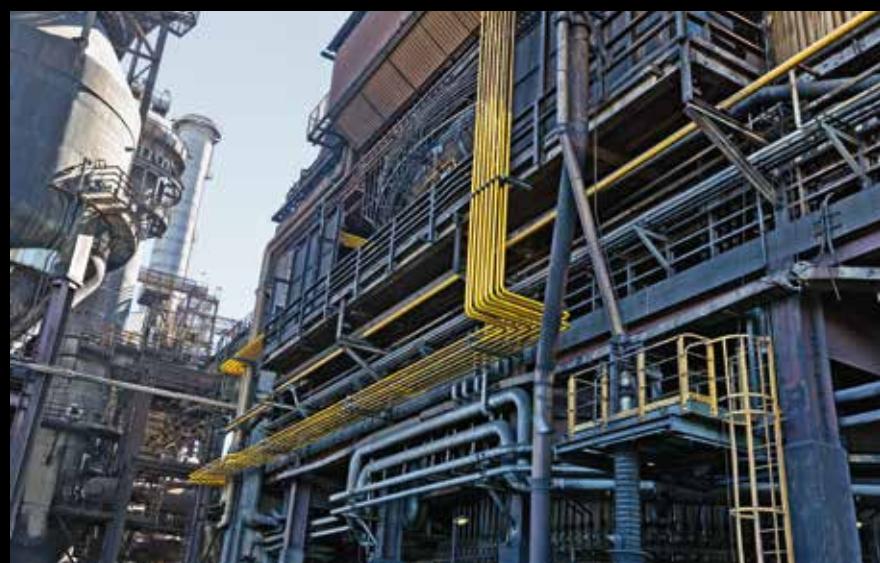
such as flow-control and check valves, supply and installation of pressure vessels, piping for the process gases including supporting structure, the automation of the equipment and integration of the new system into the existing process technology and plant configuration.

Jointly developed commissioning procedure

Despite the difficult conditions under which the project had to be executed since last spring and the challenging economic environment, Paul Wurth fulfilled all contract obligations and successfully supported the operator during the commissioning of the first phase of the newly installed coke oven gas injection plant at blast furnace No. 5. The work was completed – according to schedule – by the beginning of June. Paul Wurth's responsibility up to that deadline was to have the injection lines and coke oven gas supply ready for half of the total of that furnace's 32 tuyeres. Upon completion of this task, ROGESAs and Paul Wurth started up the new technology for four injection lines. The operation start with coke oven gas followed a jointly developed procedure and was executed jointly by specially trained operator and Paul Wurth personnel with a special focus on safety aspects. ♦



Further information
www.paulwurth.com



CO₂ REDUCTION

In Paul Wurth's strategy aimed at supporting steel plant operators on their way towards carbon-neutral primary metallurgical processes, the injection of coke oven gas at the tuyere level of blast furnaces represents a technological solution within the Paul Wurth portfolio readily available for the stepwise reduction of carbon emissions.



BAT

Paul Wurth's cold-water granulation system with steam condensation, pollution control and the dynamic INBA® dewatering technique is an officially recognized Best Available Technology (BAT) in the steelmaking industry.

Flexible operation of cooling tower cells

GERMANY

Successful modernization of INBA® slag granulation system at Rogesa's No. 4 blast furnace.

AG der Dillinger Hüttenwerke (Dillinger) and Paul Wurth have recently completed the modernization of the slag granulation plant at Dillinger's No. 4 blast furnace. Paul Wurth's INBA® granulation and dewatering technology has been operating there since its initial installation in 2003. The technology consists of a cold-water system with steam condensation designed for a daily capacity of 1,600 tons of blast-furnace slag sand and a slag flow of up to 8 tons per minute.

Between March and September 2019, after 16 years of operation, the plant was relined by Paul Wurth and Dillinger. A special focus of this modernization project was the cooling tower area and the hot-water tank located below the INBA® dewatering drum.

No interruption of regular operation

For the customer, it was crucial to ensure that not more than one monthly production of blast furnace slag sand

would be lost. Therefore, Paul Wurth suggested to reline the complete cooling tower gradually during uninterrupted, regular production, while using the planned stoppage for four weeks in August to modify the hot-water tank and implement the new water recirculation concept, which inevitably required the complete shutdown of the granulation operations.

In a first step, the existing water distribution of the complete cooling tower underwent a provisional modification. This was done during a short stoppage of only a few days, which made it possible afterwards to shut down each tower cell individually, while the remaining cells compensated the water losses of the cell under renovation. These consecutive modifications were executed between March and August 2019. Paul Wurth was responsible for the engineering, supply and erection of the new water distribution system itself, installation of a new pipe collector and its connection to the existing piping as well as of noise reduction panels.

Successful performance tests

The four-week stoppage in August was used to completely replace the lower part of the old hot-water tank and the connected process water recirculation system with a new design. Further activities during that time included the completion of the cooling tower relining, modernization of the water pump reservoir and replacement of its clogged coke filters downstream the hot-water tank. At the same time, Dillinger - in their own responsibility - replaced some of the staircase structures and refurbished the granulation tank and the hot slag runner. During those four weeks, on average, 80 workers were present at the site 24/7.

In January 2020, Paul Wurth and Dillinger conducted the performance tests of the cooling tower to verify guaranteed parameters, including plant availability.

Paul Wurth's design represents a new, specific cooling tower concept and a new way of process water handling within the hot-water tank. This significantly reduces the amount of suspended solids entering the cooling tower with the process water. Furthermore, the cooling tower can be flexibly used now, meaning that Dillinger can operate each cooling tower cell independently. This includes the possibility of shutting down or bypassing a cell, depending on the current production and maintenance needs, but without any effect on the granulation capacity. ♦

Eco-friendly and sustainable extension of battery life

SWEDEN

SSAB relies on Paul Wurth service for strategic renewal of coke oven battery in Luleå.

Early this year, SSAB EMEA AB chose Paul Wurth's service team to carry out, on EPC basis, a revamp of its coke oven battery at the Luleå steelworks in northern Sweden. The project focuses on battery life extension and emission reduction.



In line with the group's motto to be a Leading Partner to its customers, Paul Wurth initially supported SSAB with a detailed feasibility study, defining the most appropriate implementation scenario for a battery life extension. Being a frontrunner in environmental compliance, SSAB commissioned Paul Wurth, experts in emission abatement of coke plants, to also study the applicability of best available technology (BAT) in the context of the planned revamp, in order to achieve significant reduction in emissions and a further improvement of the coke quality.

The successfully concluded feasibility study included the implementation of Paul Wurth's patented Single Oven PREssure Control (SOPRECO®) system for emission reduction. Also the sequence of the dismantling and preparation activities in relation to the existing by-products plant and the new equipment was pre-planned. This approach led to optimized overall project

costs, in terms of capital and operation expenditures, while minimizing production losses.

As this proposal fitted into SSAB's strategy, the company awarded Paul Wurth the order for the project, which covers the replacement of the entire raw gas system including ascension pipes, goosenecks, gas collecting main (GCM) and off-takes, and the installation of the SOPRECO® system. Furthermore, taking the occasion of empty ovens during the replacement of the gas collecting main, Paul Wurth will also modify the oven roof, replacing the rails for the charging machines, the transversal tie rods and some of refractory layers.

Since in the Scandinavian winter conditions are extreme, the replacement activities will be carried out in two steps: while the first phase has already been completed, the installation of the new equipment will take place in summer 2021. Thanks to Paul Wurth's approach tailored to SSAB's specific needs, this revamp will ensure an extended and environmentally friendly life cycle of the 54-oven coke battery at Luleå – promoting its future sustainability. ♦

 **Further information**
www.paulwurth.com



Going strong in the Middle East

UNITED ARAB EMIRATES

From Dubai, SMS Gulf FZE, a representative office of SMS group, serves the whole Gulf region and scores with deep market insights and direct communication with customers.

In view of the growing market potential for metallurgical plants and related services SMS group decided in 2006 to establish its own base in charge of the GCC countries and neighboring markets. The six countries included in the GCC (Gulf Cooperation Council) are the United Arab Emirates, Oman, Kingdom of Saudi Arabia, Kuwait, Bahrain and Qatar. Due

to ongoing and increasing construction activities and the rising demand for the regional oil and gas industries, SMS group's intention was to participate stronger with its machinery, plant and service portfolio. A further aspect were initial plans and activities of the GCC countries to diversify their mainly oil- and gas-based industry in other industrial fields such as value-added manufacturing and new technologies. Beside the market potential, SMS group's decision was also driven by the understanding to be closer to the market and, in particular, to its customers.

Dubai, UAE, was selected as location of the new office. SMS Gulf FZE established its base in the greater GCC region in Dubai Airport Free Zone. This location offers best conditions as a regional hub and central meeting point and, at the same time, provides easy and quick connections to other countries in the region.

Dialog with the customer

For marketing its products, SMS started to be active in leading regional events such as the annual Middle East Iron & Steel Conference. Meanwhile, SMS group's bi-annual pre-conference seminar has become a well-known and popular information and exchange platform for customers. In addition, SMS group utilizes the Arab Steel Summit and the annual Aluminum Summit to introduce its latest technological developments.

In the initial years of operation already, the Dubai office proved to be the right decision enabling deeper market insights and research as well as increasing direct and intensified communication with customers and business partners in the Gulf region.



SMS Gulf FZE employees.



828 METERS

Burj Khalifa is the tallest building in the world.

Megaproject Burj Khalifa

GCC countries are cumulatively producing approx. 5.1 million tons of primary aluminium per year. The UAE share in annual aluminium production is 2.4 million tons which makes them the fifth largest aluminium-producing country in the world. Hertwich Engineering, also part of SMS group, has supplied furnaces and equipment to all smelters in the GCC countries. SMS group is the preferred partner in the region for all upstream and downstream equipment used in the aluminium industry. Famous Burj Khalifa was built with aluminium profiles produced on an SMS group extrusion press operating at Gulf Extrusions in Dubai.



Megaproject Al Gharbia

One of the most advanced plants for longitudinally welded large-diameter pipes has been established for Al Gharbia Pipe Company between Abu Dhabi and Dubai. The 56-inch large-diameter plant was set up by a consortium consisting of Larsen & Toubro Limited and SMS group as EPC (Engineering, Procurement, Construction) contractor.



Megaproject BOXBAY

The pilot plant for a container terminal is being established within sight from Dubai. For this project, the BOXBAY joint venture uses a proven technology that has been applied for decades to store steel and aluminium coils. The goal is to revolutionize container handling and storing in ports all over the world.

Major orders

With the office in place and operating, SMS group secured significant orders in the region, among others:

- minimill for PKI South Steel, Kingdom of Saudi Arabia, to produce one million tons of billets and 0.5 million tons of rebars per year (later on expanded to 1.0 million tons of rebars and wire rod per year)
- rebar mill for Hamriyah Steel, Sharjah, United Arab Emirates, for an annual production of one million tons
- seamless tube facility for ArcelorMittal Tubular Products Co, Jubail, Kingdom of Saudi Arabia, with an annual capacity of 600,000 tons
- modernization of bar quenching system for the high-speed line at Qatar Steel, Qatar

Due to more direct and local communication, additional potential for modernization and expansion projects could be identified and executed over the years, for instance at National Pipe Sumitomo, Emirates Steel Industries and Sabic Hadeed.

In order to better meet local requirements and to be prepared to provide project handling services in the Kingdom of Saudi Arabia, SMS Saudi Arabia LLC. was established in the year 2007.

Turnkey projects

Working in the GCC region is accompanied with new challenges as, for example, customer requests for turnkey solutions. These are met by SMS group in cooperation with international EPC (Engineering, Procurement, Construction) companies. Due to these collaborations SMS group gained further expertise and experience that helped optimize its supplies and services.

Another successful footprint for the aluminium business in the Gulf region was Ma'aden Aluminium. In the years 2012 and 2013, SMS group supplied a complete aluminium hot strip rolling mill and a tandem cold rolling mill for the production of can sheets, end and tab stock for

beverage can manufacturing and sheets for the automotive industry. The contract was carried out as a sub-supplier of Samsung Engineering, the EPC partner of the Alcoa – Ma'aden joint venture in Saudi Arabia.

When being awarded the order for an integrated steel and heavy section rolling mill by United Steel Company (SULB) in Bahrain, SMS Concast and SMS group joined forces with Samsung Engineering to meet the customer's requirements for a turnkey plant solution. On the service side, SMS group operated the plant warehouse for spare parts on the customer's premises.

Technical service hub

Established in Bahrain in 2014, the SMS Technical Services Gulf S.P.C. has meanwhile become a regional service hub and is base of the Technical Service engineers.

Thanks to continuous support by the regional base in Dubai and deep commitment of the respective business units in Germany, Italy and Switzerland, further projects were won and implemented in the region.

In 2019, SMS group commissioned a state-of-the-art LSAW pipe mill with a capacity of 240,000 tons per year to produce pipes for use as onshore and offshore line pipes, including sour-gas applications, at Al Gharbia Pipe Company (AGPC), UAE.

Another highlight in the region is the minimill SMS group supplied to Oman-based Moon Iron & Steel Company (MISCO). It has an annual capacity of 1.2 million tons of billets, out of which 1.1 million tons are rolled to straight rebars. The minimill operates to the CMT® concept which means the cast material is directly fed to the rolling mill.

New Horizon

Besides focusing on SMS group's traditional business, management and staff of SMS Gulf FZE, today headed by Mr. Raman Handa, have a close eye on these plans and initiatives with regard to additional business opportunities for SMS group.



"We have managed to achieve the Leading Partner position in the region. This is reflected by the major projects and contracts over the past decade in our traditional business field as well as in the emerging New Horizon market."

Raman Handa, Managing Director of SMS Gulf FZE

The New Horizon product and solution portfolio is actively promoted and, with the BOXBAY investment by Dubai Port World and a first contract for SMS digital in Bahrain, shows first success. This development once again proves the right location and positioning of SMS Gulf FZE in the Gulf region.

Additional potentials are in developmental phase to qualify for the industrial diversification quota of the Gulf countries and are coming up in the field of urban mining and additive manufacturing. ♦



Raman Handa

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Further information

www.sms-gulf.ae



Everything from a single source: SMS group was responsible for engineering, project planning and scheduling as well as coordination supplying all key machines and process equipment.

Turnkey project successfully mastered

UNITED ARAB EMIRATES

Cutting-edge large-diameter pipe mill for Al Gharbia Pipe Company completed through cooperation between SMS group und Larsen & Toubro.

- One of the world's most modern mills for longitudinally welded large-diameter pipes has been installed between Abu Dhabi and Dubai.
- It operates with state-of-the-art digitalization, tracking and automation systems for almost fully automated processes – for example the SHAPE Automation System for enhanced pipe quality and higher performance.

In addition to construction, project planning, scheduling and coordination, SMS group provided all core machinery and process equipment – including workshops, laboratories and MES (Manufacturing Execution System). The production line encompasses among others a plate edge milling machine, a crimping press, a JCO® pipe forming press of the second generation, a tack welding machine, inside and outside welding machines, a mechanical expander and hydrostatic pipe tester.

Optimum machine parameters

With the JCO® pipe forming process, Al Gharbia will benefit from a multitude of advantages in future: the plant operator is able to change quickly to other pipe dimensions and thus



Abu Dhabi is characterized by the rapid development of its economy, urbanization and mobility. In the newly developed and continually growing Khalifa Industrial Zone (KIZAD) located almost equidistant between Abu Dhabi and Dubai one of the most modern plants for longitudinally welded large-diameter pipes has been installed. The 56-inch large-diameter pipe mill of Al Gharbia Pipe Company has been constructed by a consortium composed of Larsen & Toubro Limited and SMS group as EPC (Engineering, Procurement, Construction) contractor.

SMS group was responsible for engineering and supply of the process equipment for the large-diameter pipe mill in Abu Dhabi. This also includes state-of-the-art digitalization, tracking and automation systems for almost fully automated processes.

"Together with SMS group we have realized a successful turnkey project, always cooperating based on partnership and at eye level and developing really future-oriented solutions for large-diameter pipe mills."

Mitsuru Anezaki, General Manager, Al Gharbia Pipe Company



Likewise part of SMS scope of supply: Tack welding machine of state-of-the-art large-diameter pipe mill.

produce also efficiently smaller lot sizes with utmost precision. The SHAPE Automation System developed by SMS group directly specifies the optimum machine parameters, while controlling the forming process fully automatically. The system minimizes the influence of yield strength distribution among the same grade plates on the forming process and thus ensures high pipe quality.

The JCO® pipe forming press and the crimping press are equipped with variable-speed pumps ensuring that an efficient hydraulic

system is available and proportional valve technology is dispensed with. This is reflected in reduced wear and very minimal hydraulic losses.

Saving of energy and water

In the planning of the new plant one of the main focal points was saving energy and water – the reasons for this are not only the desert climate of Abu Dhabi but also increasing requirements as regards ecology and sustainability. To achieve this, electricity is among others fed back into the grid. Process water circulates in circuits and is possibly not disposed but treated and discharged into the canal system.

SMS consortium partner Larsen & Toubro Limited was responsible for buildings, plant periphery and equipment assembly. From extensive planning and preparation through predictive simulations to the successful operation, the teamwork resulted in a cutting-edge turnkey LSAW large-diameter pipe mill in Abu Dhabi. And always in close agreement with the customer.

Minimal personnel costs

Another plant highlight is the optimized welding process by means of the digital power source PERFECT arc®. Thanks to a “secondary clocked” power source technology, electrical fluctuations of the power system do not affect the arc process. A fast and precise control of voltage and power ensures a very uniform energy input into the material – and consequently a constant, reproducible, metallurgical and geometrical quality of the weld seam. Connected to a uniquely programmable welding database, the welding control system of the power source already preselects the most well-known welding process parameters in order to adapt the power source optimally to the welding process.

A high level of automation and digitalization ensures that the mill is operated with minimal personnel costs. The entire process know-how, optimal operation and flexible adaptations are already implemented in the plant by SMS group.

The mill is designed for a production capacity of 240,000 tons per year. Pipes comply with stringent quality standards of API, ISO und DNV and are mainly designed for on- and off-shore line pipes including sour gas applications. Al Gharbia is now able to produce on the mill longitudinally welded large-diameter pipes at a length up to 13 meters, outside diameters from 18 to 56 inches and wall thicknesses of 44.5 millimeters. Steels are processed up to X80 with yield strengths of 700 Newton per square millimeter. Thus, Al Gharbia predomi-

nantly serves the energy sector aiming at markets in Bahrain, Kuwait, Oman, Saudi Arabia and United Arab Emirates.

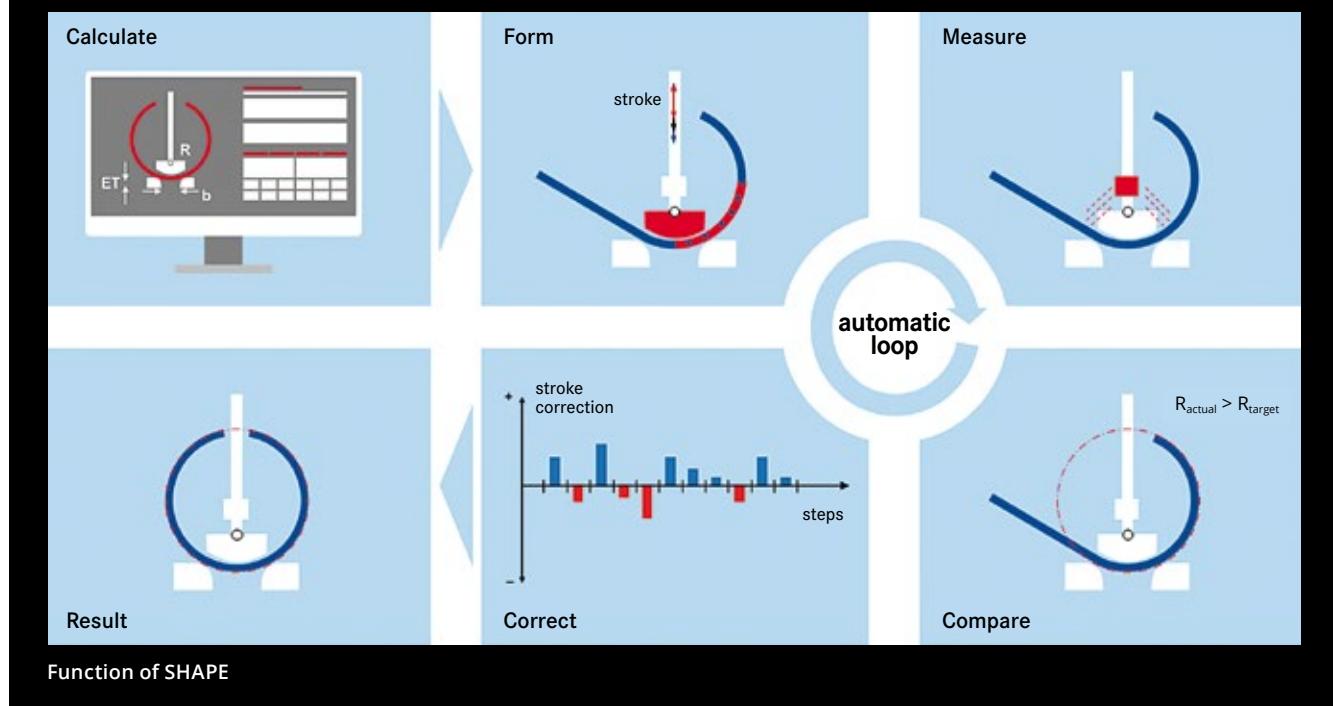
With this large project SMS group affirms that it is the right choice as Leading Partner in the World of Metals when it comes to green-field and turnkey projects. ♦

 **Contact**
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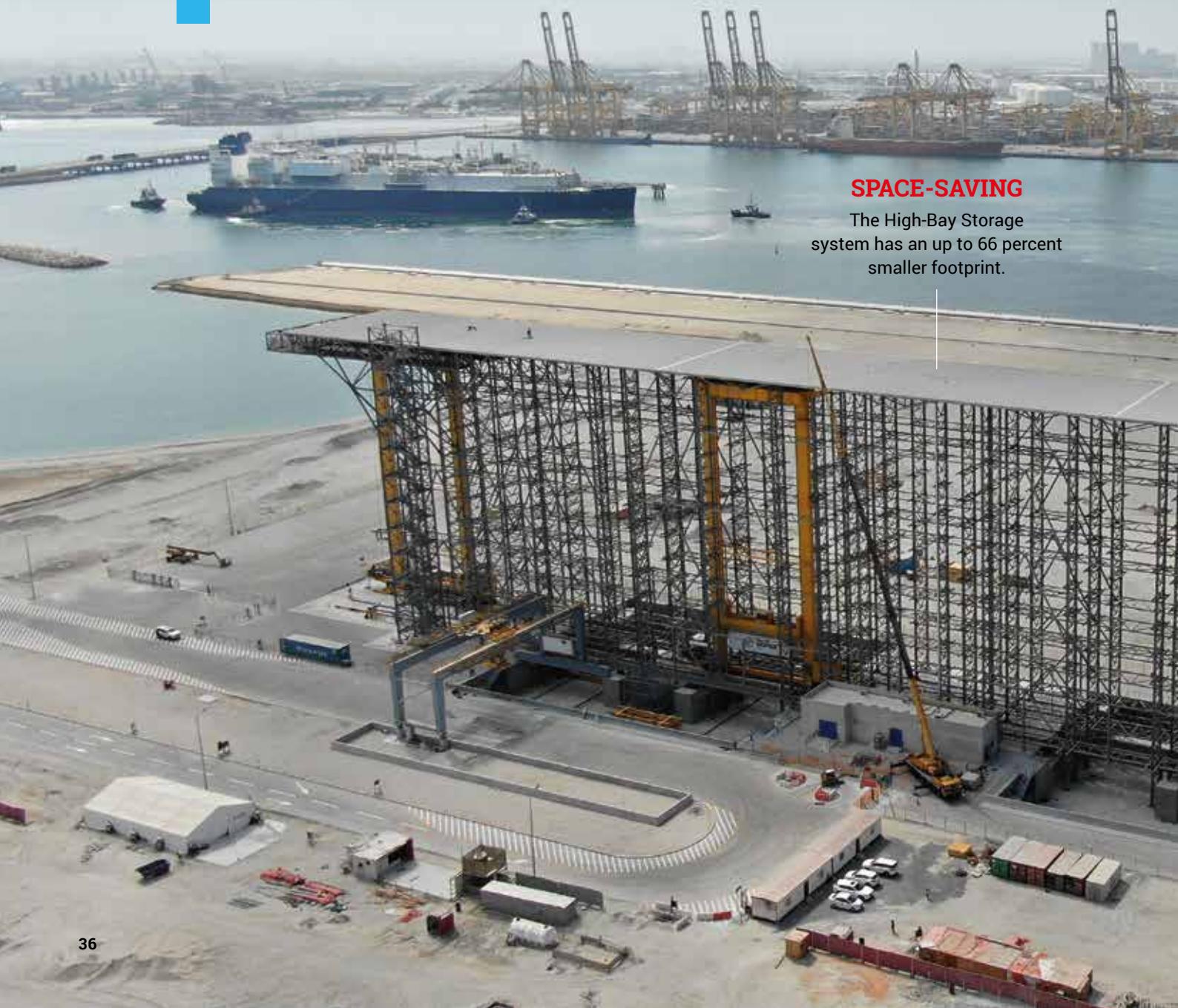
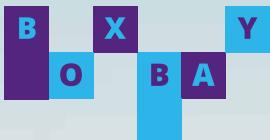


ADVANTAGES OF SHAPE

- Fully automatic pipe forming – operator independent
- Improved and consistent pipe quality despite material inhomogeneities – reduced standard deviation of geometrical parameters
- Full line capacity from the 1st pipe – requires no "teaching" and no "downstream feedback"
- Instant determination and setting of optimum machine parameters - within seconds
- Selection of individual forming strategies – target geometry, performance vs. local out of roundness, number of forming steps, outside closing
- Quick pipe outside closing – time saving up to 75 percent



A revolutionary milestone in container logistics



SPACE-SAVING

The High-Bay Storage system has an up to 66 percent smaller footprint.

ACCESSIBLE AT ALL TIMES

Each container is stored in its own compartment. This avoids time-consuming re-arranging of containers.

REVOLUTIONARY

Triple the amount of containers can be transshipped on the same surface area.

Megaproject BOXBAY

A new revolution in container handling and storage in ports around the world is becoming reality. BOXBAY is a joint venture between Dubai-based global port operator DP World and SMS group. Most recently, the first ever High-Bay Storage (HBS) system has been successfully commissioned at Terminal 4 of the Jebel Ali Port in Dubai. BOXBAY is a disruptive system setting an entirely new standard in terms of performance and transshipment capacity. All involved in this project are proud of what has already been achieved and eager to go ahead with the next steps of the project.



Dr. Mathias Dobner
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Further information
www.box-bay.com



The video provides you with further information to BOXBAY.



"I have been working intensively for years to develop BOXBAY from the first ideas to a market-ready system. I've initiated and shaped the development of numerous conceptual designs, held early discussions with interested operators, sensed skepticism and enthusiasm, and finally established contacts with our later JV partner DP World. Now, a few weeks before the start of the test operation of the first system, I feel euphoria, joy and pride in what we have achieved and I am sure that BOXBAY will make its successful way in the container ports of the world."

Volker Brück, Director Business Development BOXBAY



"We have transferred a reliable technology from its previous longtime industrial field of application to the new environment of container ports. The only significant difference to the application with coils is how the container is gripped, where we looked at proven container spreaders. The Stacker Crane itself, the PLC, the warehouse management software, the steel structure of the warehouse building, and the underground conveyor system, all these components are similar to what we have been using in the steel and aluminium industry for already 40 years. The customers will get a mature and proven system."

Bernd Klein, CEO of AMOVA, SMS group



"We at DP World have a vision to enable smarter trade for the benefit of everyone around the world through innovation and data-driven logistics. We are convinced of High-Bay Storage systems for container applications. This disruptive innovation in our industry solves several problems that we are facing in many of our more than 80 container ports worldwide. Therefore, it was easy for us to found the promising joint venture BOXBAY together with SMS group."

Sultan Ahmed bin Sulayem, Group Chairman and CEO of DP World



"In order to develop growth opportunities outside its core industry, SMS group has launched the New Horizon initiative. BOXBAY is a direct result of this offensive, in which SMS transfers proven technology from the metallurgical sector to other industries. The expansion of plant engineering business to container handling systems is a strategic step for us into an attractive but new market and we are glad to have DP World as an operationally competent partner."

Burkhard Dahmen, CEO of SMS group





"In many of our ports, new land for further port expansion is too expensive

or simply not available. Higher stacking costs time and money. A disruptive change in the operational concept, that's what we needed, and that's what BOXBAY delivers. And it's a great feeling that after years of design reviews, slides, animations and pictures we now see real containers moving in and out of a High-Bay Storage. We made it!"

Ronald van der Meer,
Project Director HBS , DP World



"I am convinced that BOXBAY will develop into a standard operating system

in our business. Many market participants may have probably already guessed that something fundamental has to change in how container ports are operated today. The usual measures faster (equipment), higher (stacking) and better (software) cannot be the permanent solutions when land becomes more expensive and ships get bigger and bigger."

Patrick Bol, Director Global Operations, DP World



"In the steel and aluminum industry, SMS group has always supplied turnkey solutions for innovative plant technology. With its many

years of expertise as general contractor or consortium leader for large-scale industrial plants, the SMS group will now offer together with its new joint venture BOXBAY container handling solutions on one-stop-shop basis to its customers – complete with plant design and construction with foundation, structural steel, equipment and infrastructure."

Hubertus Jakobi , Sen. Vice President Turnkey Solutions, SMS group



"I have been involved in the development of automatic container handling systems since the 1990s, I have participated in the delivery of automated guided vehicles (AGV's), automated stacking cranes (ASC's) and was responsible for the delivery of automated container handling systems in many ports of the world. All these systems were certainly extremely innovative but, in the end, everything was still based on the old principle of stacking containers on top of each other. However, BOXBAY is now a truly disruptive innovation, and in my opinion, this means a turning point for many terminals: direct access to each container, no time-consuming rearranging, shorter throughput times, immediate reaction behavior, decoupled processes. The effects, a 20 percent increase in performance and triple the storage capacity in the same footprint is really something completely different than just a little bit better every now and then."

Dr. Mathias Dobner, CEO of BOXBAY



Italy

Italian SMS group S.p.A. sees itself as a partner of its customers supporting them and collaborating with them from the very first idea up to full production.





Customers benefit from high-value solutions



MARCO ASQUINI,
PRESIDENT & CEO OF SMS GROUP S.P.A.

INTERVIEW

Marco Asquini, President & CEO, SMS group S.p.A., is proud that his company has been appointed a Center of Competence within SMS group due to its expertise along the complete process chain.

Mr. Asquini, you are the President & CEO of SMS group S.p.A. What is your business strategy and how is your market going on? SMS group S.p.A. is born from the merger of three important and solid enterprises present and active in the market for more than 50 years each. These are, in the order of date of birth, former INNOCENTI, CONCAST and SIMAC. Nowadays, we are a unique company striving to reinforce our position in the market by giving to customers only one partner who is able to satisfy their demands and to get closer to their envision day by day. This goal is achieved thanks to the wide range of products that increased after the mergers and is now part of our portfolio and that allows us to serve almost the whole world of metals.

Due to our high competences along the complete process chain, we can almost consider ourselves a "mirror" reality of our parent company - though on a smaller scale.

Innovation, improvement and continuing research of new technologies and processes are the fundamental keys to guarantee our success and our future sustainability in an increasingly fierce market.

We aim to improve product performances and to decrease direct costs along the entire supply chain. At the same time, we want to increase our competitiveness to make our customers benefit from high-value solutions that provide them better economic results.

How does SMS group S.p.A. fit into the group?

We have been part of SMS group GmbH for many years. Organizing and shaping activities and processes together are the basic ingredients for long-lasting success. It is precisely the SMS group site in Mönchengladbach, Germany, that we have been closely cooperating with for more than 20 years now. The Long Products business unit is based on product areas at both locations and jointly managed by Thomas Maßmann in Mönchengladbach and me in Tarcento. As a result, we are able to ensure that crucial decisions are made jointly and irrespectively of location factors. This is a benefit not only within the SMS group, but also for our customers.

We are able to cover the complete process chain thanks to our know-how of metallurgical processes and our technological expertise. With innovative products and methods for the industry we take up the challenges of digital transformation and aim to help our customers improve their operational sequences sustainably and profitably.

For the above competences, SMS group S.p.A. is well affirmed, established and recognized as a supplier of processes – not only of individual machines – and as a reliable partner, too, for high skills in the field of electric and automation.

The trust placed in us is also proven by the fact that we in Italy have become a Center of Competence with respect to a number of products from the SMS group portfolio.

Would you please outline the opportunities arising for your company by being appointed a Center of Competence?

The transition of some products is part of a long-term project undertaken by SMS group with the aim of being more competitive in terms of prices, while guaranteeing and maintaining the quality and professionalism that distinguishes the group and its plants worldwide.

Being Center of Competence is an important milestone for us since the product range has been greatly expanded in all our business units. In the field of long products, it includes PQF® (Premium Quality Finishing) and MPM (Multistand Pipe Mills) plant. Hydrotester machines, bars and light sections, wire rod, and SBQ (Special Bar Quality) rolling mills. In the flat rolling mills sector, the focus is on hot and cold skinpass mills. For primary and secondary metallurgy, we ensure high competences in EAF, LF, VOD and fume treatment plants while reheating furnace processes and heat treatment furnaces stand out in the business unit processing lines and furnace technology. In short, a very wide range of products covering a large market slice.

SMS group is the Leading Partner in the World of Metals, and with its global network of locations it is close to its customers. This holds true also for Italy where SMS group S.p.A. employs more than 500 persons. The headquarters is domiciled in Tarcento, from where Marco Asquini, President & CEO of SMS group S.p.A., manages the constantly growing company.

All this is due to the high level of competence achieved over the years not only from a technical point of view, but in all processes from the commercial phase to management and further to commissioning.

All of us employed at the four Italian locations are truly proud to have received this important award. It is another proof of the trust in SMS group S.p.A., but also of its additional responsibility.

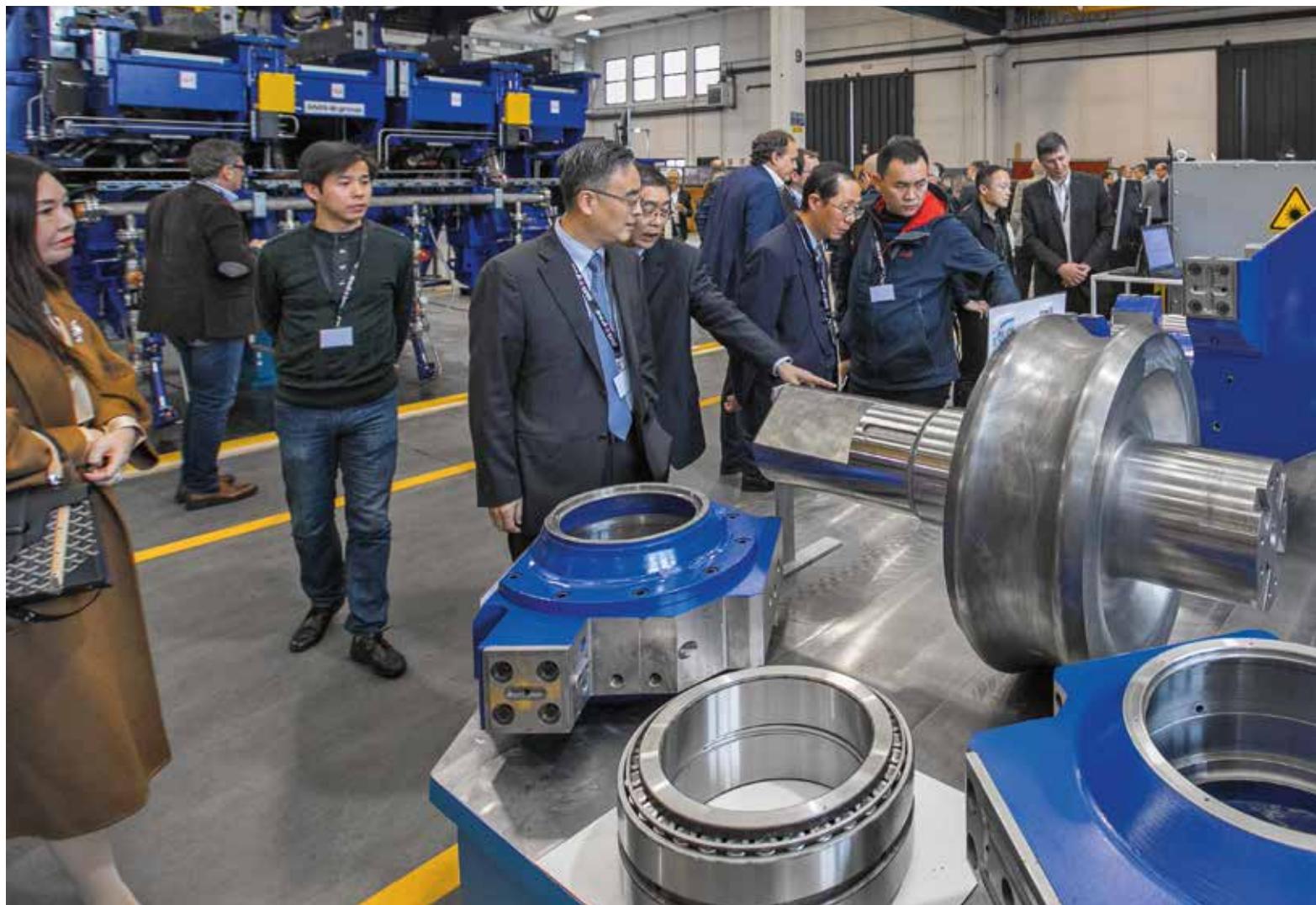
What are the strengths of SMS group S.p.A.?

Being a partner of a customer means supporting him and collaborating with him from

his very first idea up to full production. We can do this thanks to our acknowledged know-how and our efforts in research and development.

One example of the partnership-based cooperation with our customers is an event we organized at the beginning of the year when there was a PQF® Technology Day held at our Treviolo location. In the workshop there, a seamless tube plant was under construction for a Chinese plant operator. During a guided shop tour, interested customers had the opportunity to satisfy themselves of our manufacturing skills and discuss new technologies directly with our experts in personal talks.

On occasion of a PQF® Technology Day held at the Treviolo location, customers had the opportunity to see for themselves the quality of manufacture.



Several papers read by the customer and our experts completed the PQF® Technology Day.

Innovations and new technologies hence play an important role. Can you give us some special highlights?

We are constantly working on the development of innovative, custom-tailored products and processes.

In 2018, SMS group S.p.A. has decided to invest, together with other companies in the Friuli-Venezia Giulia region and with the support of Friuli Innovazione and COMET, in Additive Manufacturing. A forum was created dedicated to research and development

"Our aim is to improve the operational sequences of our customers sustainably and profitably."

Marco Asquini, President & CEO of SMS group S.p.A.



activities as to where selected resources, by experimenting with new design methods, can create new applications. This new technology is suited to manufacture innovative products.

In the field of steelmaking, the focus is on safety and energy efficiency. To assist operators and to optimize melting and refining processes, SMS group has introduced robot applications in all process stages. We are the first company to attempt and successfully implement automated operation of the plant in the most hazardous section of the electric arc furnace, namely the slag door area. Our solution, which was developed and built entirely in Italy, offers steel producers major benefits that ensure a fast return on investment.

The Technical Service is paying special attention to environmental sustainability to the "Zero Solid Discharge" principle, a new concept in water treatment plants working with bioaugmentation. Biocultures are continuously fed to the water treatment plant, with no modifications at all required to the existing system. In this way, the quantity of organic sludge, which would normally have to be removed and disposed of, can be reduced by 80 percent at least. ♦

LOCATIONS

SMS group S.p.A.
~ 500 employees

- San Donato Milanese (Milan)
Operational Headquarters
- Genua
Operational Headquarters
- Tarcento (Udine)
Headquarters, Workshop & Logistics
- Treviolo (Bergamo)
Workshop & Logistics



Manuela Magnani

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South Africa

SMS group Technical Services South Africa (Pty) Ltd. provides sophisticated support services to customers as well as noncustomers in the south of Africa.

Top-class service for Southern Africa

Being an experienced technology partner, the South African subsidiary of SMS group provides the right support for all applications.



"We are well positioned and able to provide operators in Southern Africa with custom-tailored support and services."

Pieter Bezuidenhout, Managing Director, SMS group Technical Services South Africa

The strong global network of companies known as SMS group includes a subsidiary in South Africa that was established as early as in 1958 and, since then, has been by the side of the Southern African plant and metallurgical industry. After several changes of the name, it is now known as SMS group Technical Services South Africa (Pty) Ltd. and domiciled in Sandton, about 30 minutes away from Johannesburg CBD.

Following the philosophy of being a trusted partner to its clients, SMS group provides support and services not only to all SMS group customers in South Africa and the SADC (Southern African Development Community) countries, but also to plant users whose facilities are not yet operating with equipment from SMS group.

Short response times

Based on a well-established infrastructure and a highly qualified team, SMS group South Africa is able to act fast and send experienced experts or teams to the customers' locations even within the same day, if so required. It supports the customers with sophisticated solutions and a wealth of know-how only a most reliable and experienced technology partner like SMS group can provide.

Within SADC, the customer base of SMS group includes a number of well-established global and regional companies. Activities in South Africa are widely spread on plants producing flat and long products, minimills, cold rolling and processing lines, tube plants, aluminium rolling, forging and extrusion plants, as well as EAF and SAF furnaces. The focus in Zambia is on minimills, SAF and copper producing plants, while the focus in the rest of the region is mainly on minimills, cold rolling and processing lines and tube plants. ♦

A selection of completed projects is presented on the next double-page.



Pieter Bezuidenhout

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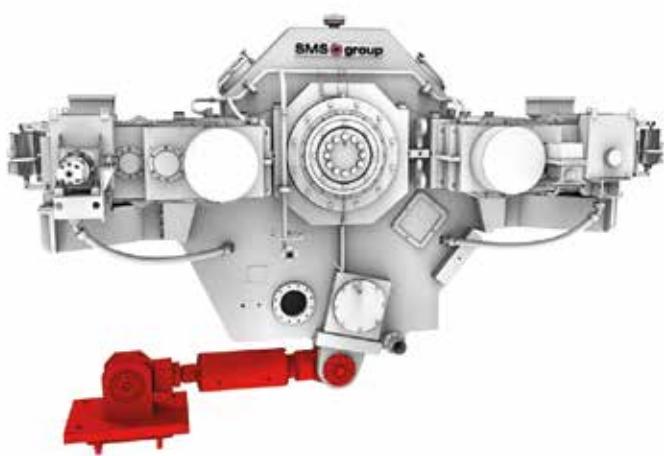


SAF Center of Competence in South Africa

Metix, a company of SMS group, offers competitive solutions for the submerged arc furnace operations.

Specializing in submerged arc furnace (SAF) technology, Metix was founded as a private enterprise in South Africa in 2003. Since the year 2011, Metix has been part of SMS group, initially as a South African location, but from 2018 on in its role as worldwide Center of Competence (COC) covering all SAF activities of SMS group.

More information
www.metix.co.za



New torque supports for two AOD converters increase availability and safety.

Guaranteed values reached three days after commissioning

In 2018, SMS group successfully supplied and installed new torque supports for two 100-ton AOD converters. The aim of the modernization was to minimize the destructive forces acting on the gear unit, the bearings and foundation during AOD converter operations. In addition, installing the new electrohydraulic torque supports led to a substantial reduction in uncontrolled vibrations of the gear unit and the converter vessel. The new torque supports from SMS group are an innovative target-oriented solution consisting of tried and tested components, which means the whole system is very easy to maintain. The first converter reached the guaranteed values three days after hot commissioning, while the second converter attained these values after only one day. Both, cold and hot commissioning were performed jointly with the customer who awarded the final acceptance certificate shortly thereafter. ♦

Significantly improved mill reliability

Due to surface defects caused by vibrations in its cold mill, a leading South African producer of semi-finished and aluminium products decided to install the Genius Condition Monitoring System from SMS group. This proprietary solution monitors and controls the causes and effects of mill chatter and provides information to improve mill reliability. The Genius CM® system is a standalone software linked to the process automation software and can be connected to the internet via the network port thus allowing for remote condition monitoring analysis as well as for remote support. Further benefits for the customer are high plant efficiency, fast diagnosis, lower operating and maintenance costs, better product quality, and improved general reliability. This helps the customer to meet the ever higher demands on product quality and productivity. ♦





Improved operational reliability through tailored gear design

Gearing measurement for an individually optimized tooth geometry.

Nowadays, gears are designed by SMS group with an individually calculated tooth geometry optimized for the relevant application. The goal is an evenly applied load of the gearing over the entire load flank. Under high loads the gear components are elastically deformed. The new Advanced Gear Design by SMS group compensates these elastic deformations of gear components thanks to a specific gearing geometry and achieves an ideal, homogeneous load distribution under high load. By replacing conventional gearings with SMS spare parts including the Advanced Gear Design, the transmissibility of the torque and the reliability of the existing gears can be significantly increased. This was one of the main considerations by a long-standing customer of SMS group when he ordered three new gearsets of SMS group's Advanced Gear Design for his works in South Africa. The gearsets were manufactured in SMS group's Hilchenbach workshop and accepted by the customer after a contact pattern inspection and before they were shipped to South Africa. ♦

The partner for South America

BRAZIL

Established about 50 years ago as Demag Ltda., SMS group Metalurgia do Brasil Ltda. is a 100-percent subsidiary of SMS group. It serves the South American market with all products contained in the SMS group portfolio.



The Vespasiano headquarters with office building and 2,000-square-meter workshop.



- In Brazil, SMS group employs far more than 150 people at three locations.
- To maintain and upgrade their facilities, customers are provided innovative, high-quality and competitive solutions.
- Safety, quality and detailed planning are the key focus.

Since its foundation, SMS group Metalurgia do Brasil Ltda. has managed to successfully complete numerous projects of SMS group in the steel and non-ferrous metals sector, including metallurgical plants such as electric furnaces for steel and ferroalloys, converters, secondary metallurgy plants, continuous casters, hot and cold rolling mills as well as processing lines for long and flat products and also several projects in the field of forging technology and extrusion presses.

The result of this broad range of experience is a technically highly qualified staff able to quickly respond to local market requirements and to offer high quality at competitive prices. In Brazil, SMS group employs a total workforce of more than 150 persons distributed over three locations.

Vespasiano, Minas Gerais

The headquarters of SMS group Metalurgia do Brasil Ltda., including main office and workshop, is located in the city of Vespasiano close to Belo Horizonte. Representing the majority of sales force, engineering team, workers and administration staff, about 130 persons are working at this site.

The workshop comprises an area of 2,000 square meters and specializes in the repair and upgrade of products, for example copper plates, including the UNIGUARD™ premium coating, rolls from processing lines such as zinc pot and furnace rolls, core components from rolling mills like mandrels and coilers, caster molds and segments as well as parts for submerged arc furnaces.

Besides the complete electroplating facilities needed to repair copper plates of slab caster molds, the workshop is equipped with a thermal spray unit, an HVOF (High Velocity Oxygen Fuel) machine and a five-axis machining center supplied by reputed European companies.

In addition, the Vespasiano site has a dedicated workshop to manufacture welded parts like BOF hoods, ducts for cooling stacks, cooled panels for electric arc furnaces and submerged arc furnaces, electrode arms and columns, ladle furnace and EAF roofs as well as dedusting channel parts. Long-life performance of the cooled parts is ensured through special coatings applied by welding or spraying. This makes customers benefit from high quality combined with favourable prices.

The technology to manufacture laying head tubes for wire rod and bar mills has been provided by the SMS group headquarters in Germany. Trained in intensive sessions, a dedicated team of technicians impresses the customers at their facilities with excellent performance.

Serra, Espírito Santo

Employing a force of more than 30 experts, this workshop is located in the city of Vitória and started its activities in 2010. Based on long-term contracts, it exclusively dedicates to the repair of segment rolls from continuous casting machines and can be considered an extension of the mold and segment workshops of the customers. Among others, the activities comprise caster rolls assembling and disassembling, spare parts management, roll cladding and the performance of tests.

Santana do Parnaíba, São Paulo

This office with workshop located in Santana do Parnaíba city, close to São Paulo, concentrates on the scope of SMS Elotherm and specializes in the supply and repair of inductive furnaces and components for the automotive, forging and extrusion industries. The facility counts ten employees.

Know-how. A broad range of experience has formed a technically highly qualified staff able to quickly respond to local market requirements and to offer high quality at competitive prices.

Diagnoses, modernizations and repairs

Thanks to its long history, the large number of projects implemented and to the intensive interaction via the global SMS group network, SMS group Metalurgia do Brasil Ltda. is able to provide innovative, high-quality and competitive solutions to its customers to maintain and upgrade their facilities.

With a strong engineering team using the most modern software, tools and proven methods, SMS group Metalurgia do Brasil Ltda. can identify customers' needs by a first diagnosis of the equipment condition. Whenever applicable, the specialists perform on-site 3D scans, thermographic measurements, NDT tests, metallographic analyses, dimensional tracking via laser and visual checks using augmented reality glasses for connection with the worldwide SMS experts to identify critical points. The on-site measurements are evaluated taking into account the experience gained from worldwide reference projects to propose the best technical solution. All of this is done by means of 3D modelling, finite element analyses (taking into consideration the 3D scans collected on site) and computational fluid dynamics simulation. Some recent examples:

- Redesign and optimization, based on thermal analysis, of copper plates and tundish of continuous casting machines, steel and pig iron ladles, etc. Such upgrades improve performance and equipment availability.
- Calculation of equipment residual life to avoid accidents and loss of production, giving the customer the opportunity of a more detailed maintenance planning.
- Capacity increase and campaign optimization of electric furnaces and ladles.
- Customized saving of staff in the operational area through modern technology.
- Equipment redesign aiming at better maintenance conditions, reliability and performance of roller tables, caster molds, rolling mill stands and mandrels, among others.

Customers in South America benefit from a great advantage and that is the capability of SMS group Metalurgia do Brasil Ltda. to implement such measures locally, quickly and at attractive conditions, while always keeping the proven worldwide SMS quality standard.

Field service

Safety, quality and meticulous planning are the issues the field service experts in Brazil pay particular attention to. The service portfolio of SMS group Metalurgia do Brasil Ltda. includes



scheduled and non-schedule maintenance activities, assembly work, repairs and modernizations at the customer's site within the complete portfolio of SMS group.

Examples of recent services:

- Repair and refurbishment of converters: four references over the last two years, comprising the replacement of a complete vessel or its parts, such as trunnion rings and linear guides
- Slab caster alignment
- Boiler repair in a thermal power plant
- Torpedo car repair
- Rolling mill stands for flat and long products: alignment work, replacement of liners, upgrade and adjustment of drive systems
- Alignment of extrusion and closed-die forging presses.

At the end of each service measure, a detailed report including all relevant information related to the executed services is prepared and transferred to the customer.

Know-how for the South American market

Copper plates of caster molds

The Vespasiano facility is designed and fully equipped to offer to the local market, on an exclusive basis, the UNIGUARD™ technology of ceramic coating that makes the mold achieve excellent results.

The UNIGUARD™ coating method for copper plates is a breakthrough in mold coating because it unites a hardness of 1,100+ Vickers, which rivals hard chrome, and the ability to withstand the meniscus temperature of most continuous casting molds. As a result, the life of molds provided with UNIGUARD™ coatings is substantially increased, well beyond what was previously attainable. In addition, some steel producers may use the thermal properties of the UNIGUARD™ coating to alter the hot-face temperatures of near-scrap copper plates and, consequently, produce products with more consistent quality.

The traditional electroplating method for segment roll coatings with standard nickel and nickel alloy is also available. ▶



The SMS workshop meets all customer requirements.

Repair of caster segment rolls

Repairing and manufacturing caster segment rolls is one of the key activities, regardless of OEM parts or other segment roll design. SMS group Metalurgia do Brasil Ltda. applies a weld overlay process that can be adapted to the caster segment roll condition as caused by wear and corrosion.

Long-bodied, short-bodied or shell-type rolls require different welding processes. Overlay materials, too, are manifold and address specific caster issues. The Vespasiano and Serra facilities are equipped for open-arc and submerged-arc wire welding and include all machines required for related services such as heat treatment, CNC turning, and milling.

The close and strong relation to other SMS group companies worldwide with years of experience in the repair of continuous caster segment rolls allowed the Brazilian colleagues to acquire the knowledge needed to offer reviews

of the whole segment roll assembly. Based on the results thereof, the experts can suggest and carry out improvements to the housing design of bearings and to roll axles and couplings that will enable the customer's segments to achieve record tonnages.

Repair of rolling mill rolls

The workshop of SMS group in Vespasiano is equipped with the most advanced technology to repair rolling mill rolls to the overlay cladding method, with the focus and expertise being targeted at most challenging rolls as are operating in hot rolling lines, for example descaler rolls, looper rolls, wrapper and pinch rolls.

Working closely with the South American customers to better understand their situation, their demands and challenges is an important factor. Paired with the work of the tribology and welding specialists, it is possible to create solutions for issues of welding wire and procedure that will

help the customers achieve extraordinary results. In addition, continuous research opens up new opportunities to upgrade rolls and auxiliary equipment. This work is supported by the OEM know-how in hot strip lines and the CFD/FEM analysis performed by the engineering team.

The success of SMS group Metalurgia do Brasil Ltda. in this business has grown over the years thanks to the experience and the technical skills of the staff, to the high technological equipment, to laboratory testing and the strong cooperation between all SMS group sites worldwide that have deep experience in the roll cladding process, too.

Repair of continuous galvanizing line rolls

Rolls installed in continuous galvanizing lines (CGL) place particularly high demands. Their surface quality must always be perfect even in a very rough environment as a zinc bath with temperatures above 400 degrees Celsius or in a furnace with high tension, wear and temperatures of up to 1,000 degrees Celsius. To meet these challenges, SMS group Metalurgia do Brasil Ltda. relies on the OEM technology and know-how of DUMA-BANDZINK and Drever for the repair of CGL rolls. This applies to pot rolls and furnace rolls. Further support is provided by TOCALGO Co., Ltd., the technological specialist for the development of powder and the coating process. Based on this strong partnership, CGL rolls can be repaired worldwide with best results. The process is standard in all SMS group workshops and is strictly controlled due to its technological complexity.

The first step of a CGL roll repair procedure is to carefully inspect the mechanical condition of the used roll. After that, the roll is machined, individually ground and prepared, in the case of sink rolls according to the special grooves, in the case of furnace rolls according to the accurate profile. In the next step, the HVOF (High Velocity Oxygen Fuel) machine applies the SMS group Cermet coating. With the objective of providing additional resistance to dross formation, the roll surface receives a further special sealing and heat treatment before it is delivered to the customer. All steps are closely monitored to ensure high roll performance.

Due to these developments on the Brazilian market it was possible to extend the lifetime of a zinc bath roll by 600 percent compared to conventional rolls. Achieving the highest performance level is a must that SMS group Metalurgia do Brasil Ltda. is always pursuing. The keys to meet this target are strong technological capacity and strict quality control of all steps taken in a CGL roll repair procedure. ♦

 **Marcellus Piedade**
marcellus.piedade@sms-group.com



Fully digitalized: Working together remotely during the COVID-19 pandemic. Even the contract signing took place via digital channels.

INVESTMENT IN INDUSTRIAL DIGITALIZATION

SMS group has invested in the acquisition of shares of two Brazil-based companies, Viridis and Vetta, thus expanding its market presence in Latin America. Part of the transaction was the merger of these two Brazilian companies to create a Center of Competence for industrial digitalization, with emphasis on efficiency and sustainability technologies. The new business operates under the name of Vetta in cooperation with SMS digital.

The acquisition adds the energy and sustainability business to the portfolio of SMS digital. These areas are of key importance for the entire steel and metals industry, with decisive influence on the cost-efficiency of companies and acting as a lever in reducing their carbon footprint. With Vetta's established solutions, SMS digital is now in a position to globally provide digitalization solutions that integrate all production areas of the steel and metals industry. Also, an expansion into other sectors, such as chemicals, pulp & paper, etc. becomes feasible. The SMS Data Factory and further data integration solutions will enable SMS group to intelligently interlink the important energy management area in addition to condition monitoring, quality control and production planning, generating significant efficiency improvements in all of these areas.

 **Further information**
<https://vetta.digital>

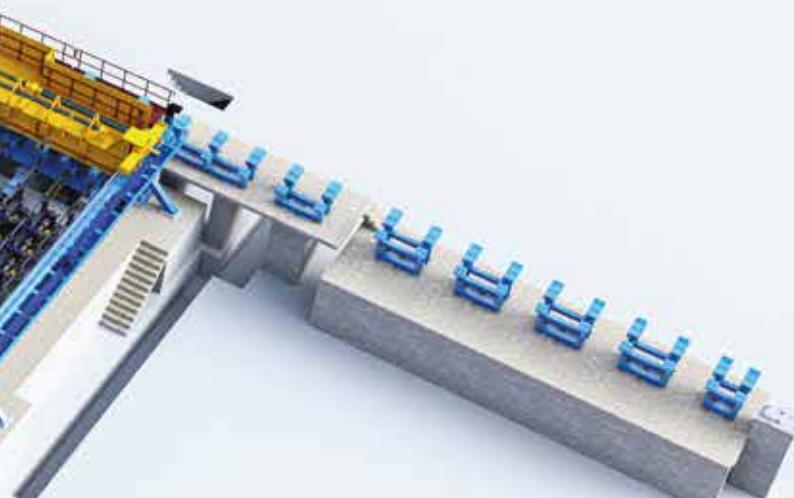


Out of SMS Concast's comprehensive portfolio, two products have proven their excellent performance in recent projects: the CONDRIVE oscillation drive and the SMS Concast deburrer. Both are supplied as EaaS-solutions to a lean production.

How small things make the difference

WORLDWIDE

For the application on continuous casters for long products, SMS Concast offers a wide range of solutions optimizing operational costs and reducing capital expenditure. The CONDRIVE Oscillation drive and the SMS Concast deburrer represent two of these solutions.



In times difficult for big investments, small solutions helping optimize operational costs (OPEX) or reducing tied-up capital (CAPEX) are even more in demand. SMS Concast supplies a wide range of such solutions for application in continuous casting machines for long products. They include EaaS-Solutions (Equipment as a Service), by means of which high capital expenditure can be transferred to operational expenditure, providing the steel plant operator much higher predictability.

CONDRIVE – Oscillation drive

Reaches the milestone of 70 strands in continuous casters for billets and blooms

Mold oscillation plays an essential role for the product quality in continuous casting processes. Inline adjustment of the oscillation curve – quickly and precisely according to the specific steel grade and section size processed – can make the difference. Simple electric drives are compact and cheap, but they do not have the ability of inline adjustment. Hydraulic drives, on the other hand, are the classical solu-

tion when inline adjustment is required. However, hydraulic equipment is expensive, both in terms of investment and maintenance. Instead, CONDRIVE combines compact design with advanced inline control features and is even more precise than the other solutions.

In addition, CONDRIVE's control unit can be an integrated part of Industrie 4.0 applications - such as SMS group's product condition analyzer (PCA) – supporting, for example, early detection of possible breakouts.

Since the introduction in 2016, all CONDRIVE oscillation drives have been operating successfully and have to date been sold 70 times in total. One of the first CONDRIVEs has now been in field service for four years - without major maintenance (no bearing exchanges needed). In addition, it has been consuming 50 percent less energy than the former electromechanical drive.

A recent modernization project at TMK Seversky in Russia demonstrates CONDRIVE's suitability for bloom casters and the short revamping time required: in only half a day per strand, the system was ready for casting, running successfully now for more than half a year.

"Thanks to the great cooperation between our commissioning team and the SMS Concast specialists on site, the FAC was released only one week after the start-up", says Aleksandr Murzin, Head of Metallurgy at TMK Seversky.

In particular, for the small section sizes cast at higher casting speeds, TMK Seversky could strongly reduce the break out rate to almost zero thanks to the CONDRIVE oscillation drive.

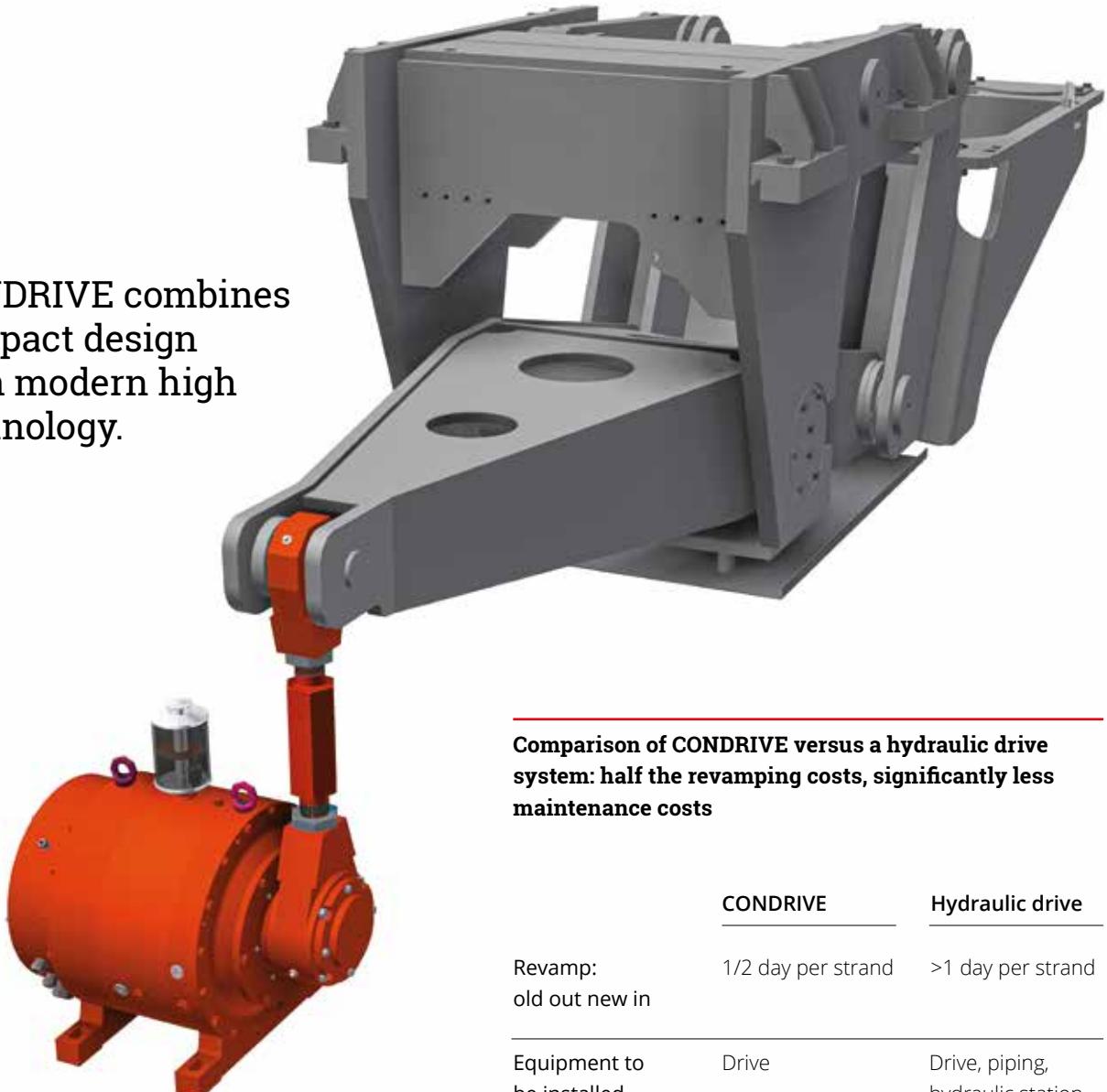
In order to reduce your CAPEX, you may also lease CONDRIVE as EaaS (Equipment as a Service), including the complete CONDRIVE service package.

SMS Concast deburrer cuts burrs, OPEX and CAPEX

Install a deburrer at the discharge of your continuous casting machine and cut cost downstream at the rolling mill. Rolls are expensive, the downtimes to repair or replace them, too. The deburrer cleans your cast billets and blooms from burrs, which damage the rolls in the rolling mill, and helps you reduce your OPEX. If that was not enough, you may also con-



CONDRIVE combines
compact design
with modern high
technology.



Comparison of CONDRIVE versus a hydraulic drive system: half the revamping costs, significantly less maintenance costs

	CONDRIVE	Hydraulic drive
Revamp: old out new in	1/2 day per strand	>1 day per strand
Equipment to be installed	Drive	Drive, piping, hydraulic station, test stand
Maintenance	No maintenance for 3-5 years	Once a year: oscil- lation test, oil check and flush- ing, seal check (and change)

All values are of indicative nature and depend on the conditions on site.



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Further information

www.sms-concast.ch



The modernized bloom caster provides higher production flexibility and improved product quality.

Modernized bloom caster

CHINA

Nanjing Iron and Steel Group commissions upgraded bloom casting machine from SMS Concast.

In the first quarter of 2020, Nanjing Iron and Steel Group Co. (NISCO) commissioned - together with SMS Concast, a company of SMS group - the upgraded four-strand bloom caster at its Nanjing plant No. 2. NISCO is a leading Chinese steel producer with approximately ten million tons of steel produced per annum. The modernized caster, designed for an annual production of 800,000 tons of blooms, has fully achieved the project targets in terms of product quality enhancement and increase in production flexibility for a broad range of steel grades.

The four-strand continuous casting machine - with a nominal radius of 12 meters - is designed for the production of two bloom section sizes. Currently, it casts 255 x 300 millimeter blooms. Commissioning of the second size - 330 x 420 millimeters - is scheduled for the end of 2020. The product mix mainly consists of high-carbon grades, such as bearing and spring steels, and the full range of steel grades demanded by the automotive industry. This product portfolio provides NISCO more production flexibility and the ability to respond more effectively to the market demand. ♦

"Their comprehensive technological know-how and profound experience made SMS Concast the perfect partner for this project. Thanks to the highly efficient cooperation between both project partners, we were able to immediately achieve the specified product quality."

Zhu Ping, Vice General Manager
at NISCO

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High-speed casters for China

CHINA

Yongfeng places follow-up order with SMS Concast for the supply of two eight-strand billet casters.

Following the recent order for two five-strand billet casters to be installed at its Dezhou location, Shandong Iron and Steel Group Yongfeng Lingang Co., Ltd. (Yongfeng) has again chosen SMS Concast, a company of SMS group, as supplier of high-speed billet casting technology.

SMS Concast will supply the two eight-strand billet casters for the newly built basic oxygen furnace (BOF) steel-making plant in Linyi City in the Shandong Province. The two casters will have a combined production capacity of approximately 2.6 million tons per year of steel bars.

Both casters will have a radius of 10.25 meters. While the first one will produce on eight strands right from the beginning, the second one will initially be equipped with seven strands, but prepared for the addition of an eighth strand in the future. Both machines will cast billets of 165 millimeters square.

Starting with a range of low-carbon and cold-heading steels, it is planned to expand the production range to also include SBQ grades (Special Bar Quality), such as spring and bearing steels, in the future. For this extension of steel grades cast, the casting machines will be prepared for the retrofitting of electromagnetic mold stirrers (CONSTIR-MEMS), powder feeding systems and submerged casting technology.

Very high casting speeds

The casters for this innovative project will include high-speed casting molds featuring INVEX technology and compact oscillation mechanisms with CONDRIVE direct drives, which enable the oscillation stroke and frequency to be adjusted electrically even at very high casting speeds. Secondary water cooling and the five-roller withdrawal and straightening units (WSU) will be designed to handle these high casting speeds. The equipment will be controlled via Level-1 and Level-2 X-Pact® automation systems.



High-speed casting in eight strands on an SMS Concast casting machine.

Yongfeng Lingang Co., Ltd. selected INVEX mold tubes in order to reach very high casting speeds and billet temperatures of above 950 degrees Celsius at the discharge. These high temperatures will enable direct rolling without the need for any billet temperature conditioning and equalizing before rolling.

With the latest generation of SMS Concast's INVEX technology – in combination with the classical cartridge mold design – very high casting speeds can be achieved. The specific design of the copper tubes enables a higher heat transfer. The installation of this latest high-speed technology will provide an increase in throughput without the risk of breakouts and an extraordinarily high productivity with low CAPEX compared to traditional casters.

This caster project will also include Industrie 4.0 digitalization features and new safety- and productivity-enhancing functionalities. In particular, the temperature measuring and tracking system will optimize the billet temperature, enabling direct automatic hot-charging of the billets into the rolling mill. ♦



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The CONDOOR® slag door from SMS group helps reduce operating costs.

Modernized electric arc furnace

THAILAND

Improving the furnace seal lead to an increase in productivity and made the upgrade very effective.

Siam Construction Steel Company Ltd., Thailand, a subsidiary of Tata Steel (Thailand) Public Company Limited, has successfully put on stream the 80-ton EAF (Electric Arc Furnace) at its Rayong site after an upgrade by SMS group within only ten months. The scope of supply of SMS group included a new CONDOOR® slag door (enhanced automatic slag door) and a new advanced electrode regulator, known as AEREG.

The aim of the upgrade was to improve the furnace seal and thus to increase productivity.

In addition, the installation of a CONDOOR® slag door improves safety for the operating personnel as direct working in this area is no longer required.

The new electrode regulator is capable of automatically regulating the injection of carbon with less energy and, at the same time, significantly lower electrode consumption.

Thanks to the good cooperation between SCSC and SMS group, the final acceptance was granted prematurely. The modernization reduced specific energy consumption by 2.5 percent and increased production yield by 0.3 percent. Moreover, the iron oxide content in the slag could be reduced by 10 percent. ♦



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SIAM YAMATO banks on injector technology

THAILAND

ConSo injector technology works highly efficiently, is maintenance-friendly and provides highest safety.

SIAM YAMATO has awarded SMS group the final acceptance certificate for the upgrade with ConSo R6 injector technology of the No. 1 electric arc furnace at its Rayong, Thailand, location.

Based on the good experience gained from the modernization of electric arc furnace No. 2 with ConSo R6 injector technology, which had been supplied by SMS group in 2010 along with a complete minimill, SIAM YAMATO decided to have furnace No. 1 revamped in the same way by SMS group.

The favorable results - good performance of coal injection and of the new refractory lining, reduction of electricity, natural gas and oxygen consumption – achieved by the installed highly efficient ConSo R6 injector led SIAM YAMATO to grant SMS group the acceptance for the project.

SMS group's ConSo R6 injector technology with a monolithic head, optimized piping and a water-cooled copper box assures an optimized flame length, high safety and high efficiency.

SMS group supplied five complete ConSo R6 combined oxygen injectors (5 MW each), oxygen and valve stands, a new carbon injection system and the automation system complete with an HMI station. ConSo R6 injectors come with a fully automatic early detection system (Back-Flash Detection System BDSC) to prevent damage of the injectors and the water boxes due to back-flashing flames. The early detection of back-flashing by sensors increases injector lives.

By upgrading electric arc furnaces with ConSo injector technology from SMS group, steelmakers can make their furnaces more efficient, more productive, more user-friendly and safer. ♦

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48 heats in 24 hours

INDIA

SAIL's Rourkela Steel Plant has set a national record with its new basic oxygen furnace. Rourkela Steel Plant, a unit of Steel Authority of India (SAIL), has achieved a national record in India with the new Steel Melting Shop 2 supplied by SMS group. On July 2, SAIL produced 48 heats in 24 hours with the 150-ton basic oxygen furnace No. 3 of the Steel Melting Shop 2 in Rourkela. This record has reiterated the customer's trust put in SMS group technology and demonstrates the high quality of the supplied equipment, along with state-of-the-art automation systems.

 Further information
www.sms-group.com



Converter in operation.



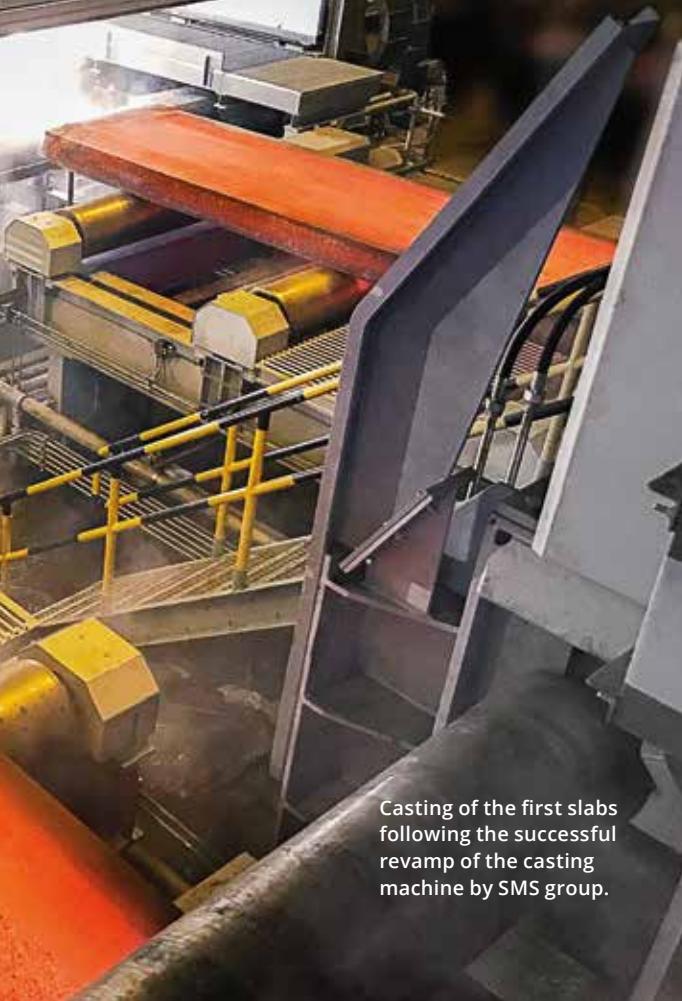
High quality for special steels

SPAIN

Modernized continuous casting machine at ArcelorMittal Asturias produces over 100,000 tons of steel slabs just one month after the 14-week revamping period.

At ArcelorMittal Asturias, Avilés, Spain, SMS group has successfully put back into service the two-strand slab caster No. 2, after completion of a comprehensive revamp.

Thanks to the revamp carried out by SMS group, the continuous caster is now able to produce slabs with thicknesses of 235, 300 and 365 millimeters (235 and 280 mm before the modification) and widths of 800 up to 2,200 millimeters (up to 1,600 millimeters before the modification). The caster is



Casting of the first slabs following the successful revamp of the casting machine by SMS group.

designed for an annual production capacity of up to 2.9 million tons of steel slabs.

SMS group developed a customized concept to extend the slab width produced from 1,600 to 2,200 millimeters. The existing foundations were reused without any modifications.

Dismantling of the old plant and installation of the new components were completed in just 96 days around the turn of the year.

Efficient use of Plug & Work

SMS group utilized its Plug & Work concept to bring the X-Pact® electrical and automation systems on stream in only two weeks. Plug & Work is a concept that enables the customer's operating crew to test and optimize the automation system - prior to its installation on site - under realistic conditions in SMS group's test facility by means of a simulation model that exactly maps all the mechanical equipment, drive technology and processes.

Just one month after the 14-week revamping period, the continuous caster was producing over 100,000 tons of steel slabs without a hitch.

The continuous caster has been completely rebuilt from the curved mold through to the runout section. Its metallurgical length has been increased from 33.2 to 36.7 meters. The modernized caster is designed for a maximum casting speed of 1.6 meters per minute. The slab caster has been

fitted with the X-Pact® Width Control system. This enables the width to be adjusted and the mold taper adapted automatically during production, without having to reduce the casting speed. In the process, the system takes into account the steel grade cast and the current casting speed. The original mechanical oscillator has been replaced with a hydraulic oscillation system, which enables the stroke length and the frequency to be modified during the casting process.

The straightening segments and the segments in the horizontal section have been equipped with an online gap control system with position-controlled clamping cylinders.

The new No. 2 continuous slab caster operates with various X-Pact® Level 2 process models for enhanced quality control. X-Pact® Solid Control monitors the temperature distribution in the strand shell. In this way, stickers can be detected and the risk of breakouts eliminated early in the process. In conjunction with the Dynamic Soft Reduction® process model, X-Pact® Gap Control enables the slab to be specifically compressed in the final solidification zone to improve the internal microstructure. The cooling circuits for the mold, the casting machine and the spray cooling system have been completely renewed; the hydraulic equipment has been adapted and extended.

Digital plant assistant

Also for caster No 2., the workshop at ArcelorMittal Asturias utilizes the digital plant assistant HD LASr [mold] and HD LASr [segment], developed by SMS group. Due to the positive experience made with the system on continuous caster No. 1, ArcelorMittal did not order any straightedges for the measurement of the mold and segments of caster No. 2 either. The high quality of the laser measurements and the precise and reliable recording and informative evaluation of the measured objects make HD LASr far superior to the systems used up to now. Given the high crack sensitivity of the steel grades to be cast and the extended slab thickness, the higher alignment precision of the strand guide system plays a key role in meeting the exacting quality requirements on the final product.

The integrated steel plant of ArcelorMittal Asturias Avilés produces high-quality steel grades for automotive sheet, tinplate and heavy plate production. ♦



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Digital Worksite Assistance

FINLAND

Jointly with its customer SSAB, SMS group has carried out a modernization project with digital support.

For its production location in Raahen, Finland, customer SSAB awarded an order to SMS group to supply new mill pinion drives for two finishing stands operating in the hot strip mill. These new mill pinion drives were to replace the old gear units, which had been in operation for many decades, and designed to meet the future planned capacity increase.

The gear units were replaced during a long-scheduled shutdown in July 2020. Due to the COVID-19 pandemic, however, the project was accompanied by specific challenges that could be mastered by both partners applying the latest digital technology. In particular, digital communication media were used by SMS group for technical assistance before and during the replacement of the gear units. Without the option of digital supervision, the modernization project would have had to be postponed to a much later date.

Hardware and software for the customer

Long before the planned shutdown, a multi-disciplinary team of SMS group experts was concerned with testing and selecting appropriate software and hardware for this "digital worksite". Particular attention was paid to such aspects as work safety, ergonomics and suitability for the harsh environmental conditions in a hot rolling mill. Another important criterion was easy and intuitive operation of the selected software and hardware.

Finally, the decision was made in favor of a special rugged drop-proof tablet and safety-helmet-mounted Augmented Reality (AR) glasses. Completely preconfigured with several software modules, these tools were supplied to SSAB. This

way, the staff of SSAB was able to operate the digital equipment just after a very short familiarization phase. One of the first tasks was to check the supplied equipment in an Open Package Inspection (OPI). This was performed online with the aid of a tablet software application. The results were immediately documented. Similar applications were available for daily progress monitoring and deadline control. In addition, all documents discussed in the daily meetings were automatically saved in an online diary.

Win-win situation

Both project partners expressed their full satisfaction with the digitally handled project implementation at Raahen. "This kind of cooperation makes project handling much easier. If so required, experts from both sides may join the online meetings thus making the discussions very effective. To both parties, customer SSAB as well as SMS group, this is a win-win situation," summarizes Karl-Friedrich Müller, Sales/Project Management CSP® at SMS group, the experience gained from this digital cooperation.

Alpo Riekki, Project Manager at SSAB, supplements: "Generally speaking, we are highly impressed by the digital support services rendered by SMS group. Thanks to the camera technology applied we were able to keep the experts in Germany up to date about what was going on at the worksite. Last but not least, the computer-aided reporting function was very helpful as it simultaneously saves and stores an electronic log file. We are definitely considering to use the system also for future projects."

Custom-tailored, top-quality gear units

After SMS group had received the order for the project from SSAB, the engineers of SMS group examined the foundation situation in Raahen and designed the gear units such that the existing anchor bolts and foundations could be reused. Using the Advanced Gear Design technology, the gearing was designed to meet the future, higher loads also in the long term.



Gear tooth measuring machine at work.



**MISSION
ACCOMPLISHED**
The installation at SSAB
was carried out with the
aid of data glasses
and tablets.

Quality assurance using the example of a gearwheel

To ensure the operational reliability of the gear units SMS group counts on consistent quality management starting with an exact specification and control of the materials to be used. Especially for the toothed components that have to bear high loads it is essential to check and completely document during and after each production step whether or not the specified properties and dimensions have been attained. This ensures the gear unit will permanently meet the high requirements. ♦



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The current upgrade focuses on the hot strip coiler area.

Increased productivity

GERMANY

Salzgitter Flachstahl places order for upgrading the coiler section in its hot strip mill.

Salzgitter Flachstahl GmbH placed an order with SMS group for an upgrade of its hot strip mill. The current revamp applies to the coiler section of its hot strip mill (HSM), which has been in operation since 1963. During this 57-year period, the HSM has been systematically modernized and updated with the latest technology. Salzgitter Flachstahl GmbH has been supported throughout this time by its long-standing supplier and technology partner SMS group.

Around 10 years ago (2010 to 2011), for example, SMS group carried out essential upgrade work on various sections of the HSM. This included the installation of a third hot strip coiler, which was configured as a UNI plus coiler, being capable of coiling pipe grades up to 25.4 millimeters thick. With this and other measures implemented, the company was able to increase both the productivity and product quality of its hot strip mill.

Salzgitter Flachstahl GmbH has had excellent experience with its newest No. 3 coiler. Among other things, it requires very little maintenance. This is where polishing equipment, with which the pinch roll unit has been equipped, comes into play. The polishing devices keep the pinch rolls clean, thus significantly reducing the amount of maintenance required in this area. Manual grinding, for example, is usually no longer required. The positive experience is something Salzgitter Flachstahl GmbH now intends to transfer to its hot strip coilers 1 and 2.

Latest-generation polishing devices

SMS group is supplying new rocker arms with the latest generation of polishing devices for coilers 1 and 2. New polishing devices for the bottom pinch rolls will be fitted to the pinch roll housings. The existing switch gates will be provided with hydraulic position and force control. This integrated solution will increase the life of the pinch rolls and significantly reduce pinch roll maintenance.

SMS group's scope of supply includes the delivery of the mechanical components, the X-Pact® electrical and automation systems, and the assembly of the equipment.

To minimize interruptions during ongoing production, the revamp will take place in 2021 as part of the scheduled main maintenance shutdowns. ♦



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Higher performance

CHINA

At Wuhan Iron & Steel, the installation of advanced work-roll bending and shifting systems has provided a further boost in the availability of the high-capacity hot strip mill.

Wuhan Iron & Steel, based in Wuhan, China, has granted SMS group the final acceptance after the successful modernization of finishing stands F4 and F7 in their High-Capacity Hot Strip Mill No. 2. The objective of the project was to increase plant availability.

The High-Capacity Hot Strip Mill No. 2, supplied by SMS group, has been in operation at Wuhan Iron & Steel (WISCO) since 2003. In 2015, a modification by SMS group of the mill's coiler enabled WISCO to expand its range of high-strength and pipe grade products.

The recent installation of advanced work roll bending and shifting systems has provided a further boost in plant availability.

Future-oriented design

The modernization of finishing stands F4 and F7 by SMS group included the installation of CVC®plus systems of ± 150 millimeters shifting stroke and the adaptation of the hydraulic valve stands. The modifications could be performed as planned during the regular 2019 annual shutdown of the mill, because the mill housings needed just little machining, and very few adaptations had to be made of the machine piping.

Through specifically tailored, well-conceived revamps, SMS group can boost the performance of hot wide strip mills, enabling its customers to respond flexibly to growing market requirements.

The robust and future-oriented design of plant and equipment supplied by SMS group guarantees the mill operators decades of high and growing added value. ♦

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At high level:
growing added
value in the
long term.



High-capacity hot strip mill similar to the facility at Wuhan Iron & Steel.

New development offers high forming forces

CHINA

Shanxi Taigang Stainless Steel Co., Ltd. orders the most powerful 4.3-meter heavy-plate mill from SMS group.

On June 18, 2020, Shanxi Taigang Stainless Steel Co., Ltd. placed an order with SMS group for the supply of a 4.3-meter heavy-plate mill. The company is located in Taiyuan, capital of the Chinese province of Shanxi.

The heart of the new heavy-plate production plant will be a mill stand group consisting of a four-high rolling mill and attached edger.

A high rolling force and a correspondingly high forming capacity characterize the four-high stand. The combination of a very large roll gap opening with the coaxial CVC®plus system (Continuously Variable Crown) is a new development and al-

lows the rolling stock to have an input thickness of up to 960 millimeters and thus an extremely large product range. To be able to process even short slabs, the heavy edging stand will be equipped with a newly developed support roller table.

The equipment will be designed to roll both, extreme casting block dimensions as well as small slab dimensions, down to plates. This will make production flexible and dynamic and ensure tightest geometrical tolerances.

Well prepared for future requirements

The maximum rolling force of the four-high reversing stand will be 109 MN in order to be able to reliably roll also special materials. The mill stand will be equipped with the latest actuators to set the required plate geometry. In addition to the hydraulic roll gap adjustment, these include the patented coaxial CVC®plus technology with integrated work roll bending.

The vertical edger will be provided with a combined mechanical/hydraulic roll gap adjustment for extremely tight width tolerances.

Designed for an annual production of 700,000 tons, the heavy-plate mill will produce plates between five and 120 millimeters thick and from 1,550 to 4,200 millimeters wide.

The product range will include carbon steels, quality steels, low-alloy steels, grades for ship, bridge and pressure vessel construction, weather-proof and wear-resistant plates, pipe grades according to the API standard, as well as stainless steel and nickel-based materials.

With this rolling mill, Shanxi Taigang Stainless Steel will be able to cover a very wide range of products meeting the needs of infrastructure, chemical industry and shipbuilding and will

therefore be well prepared to meet future requirements. This includes in particular the aspects of sustainability and environmental compatibility.

The mill stand group will be equipped with a newly developed integrated dust exhausting system, which picks up dust directly at the roll gap during the rolling process. This way, emissions generated when rolling special alloys, for example, will largely be prevented.

International team

The order scope includes the complete engineering and the supply of all mechanical core components for the most powerful heavy-plate mill stand so far in the width range of up to 4.3 meters, with attached edger, and of the X-Pact® electrical and automation system for the hot area of the heavy-plate mill.

Level-1 automation will be carried out entirely based on X-Pact® technology. The X-Pact® Vision operating concept will be implemented according to latest ergonomic findings and enable the staff to operate the system intuitively for optimal process control.

Level-2 process automation will include the technological process models from PSC® (Pass Schedule Calculation) to PFC® (Profile and Flatness Control) and up to the higher-level MTS (Material Tracking System).

Before delivery, the X-Pact® electrical and automation system will be prepared for quick commissioning using the Plug & Work integration test developed by SMS group. An international team will take care of order processing and the timely commissioning of the plant. The heavy-plate mill is scheduled to start operating in mid-2022.



Comparable heavy plate mill from SMS group

The new mill is another item in a series of metallurgical equipment supplies by SMS group to Shanxi Taigang Stainless Steel in the past. The order once again affirms the customer's trust in SMS group and his positive experience with product quality. ♦



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Heavy plates
for a wide range
of applications.

Partnership-based cooperation

CHINA

SMS group supplied three cold rolling mills for the production of copper strip to Chinese producer Jintian Ningbo Copper Co., Ltd. The mills were commissioned in March and April 2020 with good results.

Thanks to the partnership-based cooperation, the teams of SMS group Technology Co., Ltd. in China and Jintian Ningbo Copper Co., Ltd. have mastered the special challenges involved in mill commissioning against the background of the global restrictions due to the COVID-19 pandemic. Now, Jintian Ningbo Copper operates all process stages needed for the production of copper and copper alloy cold strip.



Excellent teamwork was the key to successful commissioning at Jintian Ningbo Copper Co., Ltd. In the background: the CVC®plus six-high cold rolling mill with Multi-Plate®-Filter.

Rolling thick strips

In line with the process sequence for copper strip production, the first plant which was commissioned on March 19, 2020 was the so-called roughing mill.

The strips of copper and copper alloys are transported to the cold rolling mill as loosely wrapped coils with variable inner diameter and charged to the pertaining payoff reel station. Due to the wide range of strip thicknesses the entry- and exit-side coiler stations consist of a combined coiler wheel and coiler drum with different coiling diameters.

Finish-rolled strips are coiled on the coiler drum and carried away for further processing. To keep the processing of the high-quality material economically efficient, SMS group designed the cold rolling mill for maximum material utilization.

Proven actuators make sure the required strip thickness of 0.5 millimeters and the desired strip quality are attained.

Intermediate and finish rolling in one mill

On April 16, 2020, less than one month later, the second cold rolling mill was put on stream. Its task in the process sequence is the so-called



The first coil produced is ready for removal.

intermediate and finish rolling. The minimum strip thickness that can be rolled in this stage is 0.1 millimeter as final product or as intermediate product for further processing.

The six-high cold rolling mill is equipped with the latest rolling technology ensuring maximum flexibility in product planning as well as top quality of the rolled products.

Finish rolling

The third reversing cold mill (RCM) supplied by SMS group is particularly made to produce thin strips in the so-called finish rolling process and is designed as six-high mill stand, too. Its high-quality technical equipment is comparable to the intermediate and finish-rolling mill that started operation in April 2020. The interaction of all actuators results in tightest product tolerances and economical plant operation with high yield.

An essential factor is the proven X-Pact® electrical and automation system from SMS group to control and monitor the rolling processes. The system includes Level 2 which perfectly matches the plant type and product portfolio.

In addition, SMS group supplied all fluid and media systems. Both six-high RCMs were equipped with one Multi-Plate® Filter each to ensure environmentally friendly rolling oil cleaning.

With the three new reversing cold rolling mills, Jintian Ningbo Copper now has a total annual capacity of 50,000 tons of flat-rolled copper and copper alloy products. ◆

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Technical data and technical features of the three RCMs in comparison

	RCM 1: Roughing	RCM 2: Intermediate rolling and finishing	RCM 3: Finishing
Stand design	4-high	CVC®plus 6-high	CVC®plus 6-high
Technical features	<ul style="list-style-type: none"> • Hydraulic gap control (HGC) • Positive and negative work roll bending • Multizone-cooling 	<ul style="list-style-type: none"> • Hydraulic gap control (HGC) • CVC®plus • Positive and negative work roll bending • Multizone-cooling 	<ul style="list-style-type: none"> • Hydraulic gap control (HGC) • CVC®plus • Positive and negative work roll bending • Multizone-cooling
Strip width		max. 650 mm	
Strip thickness entry	max. 18 mm	max. 3.0 mm	max. 2.0 mm
Strip thickness exit	min. 0.5 mm	min. 0.1 mm	min. 0.03 mm

Successful ramp-up

GREECE

Particular challenges had to be mastered during the installation and commissioning phase of the new finishing mill at ElvalHalcor S.A. due to the COVID-19 pandemic.

On May 29, 2020, the first aluminium hot strip coil was rolled on the new finishing mill of ElvalHalcor S.A. at the Oinofyta plant near Athens in Greece. SMS group supplied and commissioned the mill. Caused by the COVID-19 pandemic, ElvalHalcor S.A. and SMS group had to face special challenges in the installation and commissioning phase. Among other things, these concerned the restrictions in travelling and ensuring the protection of employees on site. All challenges were successfully and jointly mastered thanks to a partnership-based cooperation.



The new four-stand finishing mill of ElvalHalcor S.A.

High quality and plant flexibility

The new finishing mill was installed behind an existing reversing mill. With the new plant, ElvalHalcor S.A. can produce hot-rolled aluminium strip in thicknesses from 1.8 to 12.7 millimeters and up to a width of 2.6 meters for a wide range of industrial applications.

The plant flexibility and the high quality of the rolled products is ensured by advanced rolling technology of SMS group in connection with the X-Pact® automation. In addition to CVC®plus (Continuously Variable Crown) in all four roll stands, the profile and flatness system and the thickness control should be mentioned here. Also, the finishing mill is provided with an advanced roll and strip cooling. It includes the transfer bar cooling in the entry section and the cooling devices in the interstand section. Regarding profile and flatness control, CVC®plus, work roll bending and work roll cooling interact, while thickness control is carried out via the hydraulic adjustment system.

Creative solutions

Despite strong external limitations, final installation and cold commissioning were successfully completed. Above all, this is the result of the far-beyond-normal commitment of the teams of ElvalHalcor S.A. and SMS group. Creative problem solutions on site were just as in demand as modern online-based communication and cooperation with the SMS group's colleagues from all over the world. The experience gained from the successful commissioning that SMS group has implemented in various countries during this period will have a lasting impact on the future commissioning strategy.

In the coming weeks, the experts from ElvalHalcor S.A. and SMS group will jointly focus on further optimizing process and product quality. ♦

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Final assembly of the Multi-Plate® filters at Hydro.

Efficiency increase after conversion of rolling-oil filter system

GERMANY

Hydro Aluminium Rolled Products GmbH, a company of global Hydro Group, operates a facility for rolled aluminium products in Grevenbroich, Germany. There, SMS group has replaced two existing plate-type filters for the cleaning of rolling oil from aluminium foil production with new Multi-Plate® filters of types MPF 3-13 and MPF 3-16. Multi-Plate® filters from SMS group assure high efficiency and sustainability in rolling oil cleaning.

During the supplier selection process, SMS group stood out not only thanks to its high-quality filter technology, but also thanks to its highly convincing conversion concept, capable of complying with the very tight project schedule, even under the challenging space conditions on site.

After an installation time of only two weeks, both new filters were put into operation. The customer was very pleased with the implementation of the project.

The limited space available on site called for the successfully preassembled and function-tested Multi-Plate® filters to be dismantled again in parts at SMS group's manufacturing facilities in Hilchenbach and shipped to Hydro in modules.

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All-renewed and future-proof

RUSSIA

Successful revamp of
PAO Severstal tandem mill.

The drive motors
of the mill stands
have been completely
renewed.

The first strip was successfully rolled on the tandem cold mill TCM "2100" at PAO Severstal in Cherepovets, northwest Russia, after the mill modernization performed by SMS group. After SMS group had comprehensively modernized the entry area in 2016, including the rolling stands and the automation system (Phase 1), the most recent measures concentrated on the exit area and the stand drives.

For the implementation of these measures, two project phases had been defined. Phase 2 included the supply of a tension reel including drive motor, replacement of the Ward-Leonard converter with an AC converter featuring active energy recovery, an offline strip inspection station of the Rotary Inspect type and two coil cars. The tension reel design enables strip coiling at high tension, which is supportive particularly when rolling high-strength grades. The Rotary Inspect offline inspection station enables exceptionally fast and – for the operator – highly ergonomic strip inspection. The coil cars are used to transport the coils to the offline inspection station and to the coil store in an adjacent building.

The new installations also required the hydraulic equipment to be adopted in the form of new hydraulic valve stands for the coil cars and the inspection station. Also the X-Pact® automation system was expanded to meet the requirements of the new equipment layout. Decentralized I/O systems were used to enable fast conversion of the equipment.

Higher rolling speeds and higher strip tension

Project phase 3 was initiated and carried out in parallel to Phase 2. The main drive motors of mill stands 2 to 4 of the tandem mill including the converters have been completely renewed. In addition to the main drive motors, the mechanical drives of the mill stands, including the spur gear-pinion gear units, motor couplings and drive spindles, were replaced. The scope of supply additionally included a new, centralized oil circulation lubrication system. The existing Ward-Leonard DC converters were replaced with an AC converter featuring active energy recovery and with AC synchronous motors. The medium-voltage system was adapted to cope with new requirements. Thanks to these measures, the power electrics is now state of the art. In addition, the rolling speeds and strip tensions have been increased. As a result of new drive equipment, maintenance costs are significantly lower now. The X-Pact® master control system, including the HMI (Human Machine Interface), has also been adapted to the new mill layout.

In order to minimize effects on the ongoing production at PAO Severstal, SMS group combined the dates for the installation activities of both phases within one 42-day shut-

Thanks to the successfully commissioned, revamped tandem cold mill (TCM) "2100", PAO Severstal can respond flexibly to changing requirements of the market.



Successful production start in February 2020.

down. The ramp-up phase after completion of the measures took only two days. With the revamped mill successfully commissioned, PAO Severstal now has a "completely renewed" and state-of-the-art tandem mill enabling full exploitation of the maximum rollable strip width of 1,850 millimeters. In addition, thanks to the revamp, PAO Severstal is now able to react flexibly to all market requirements. ♦



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First cold strip coil produced

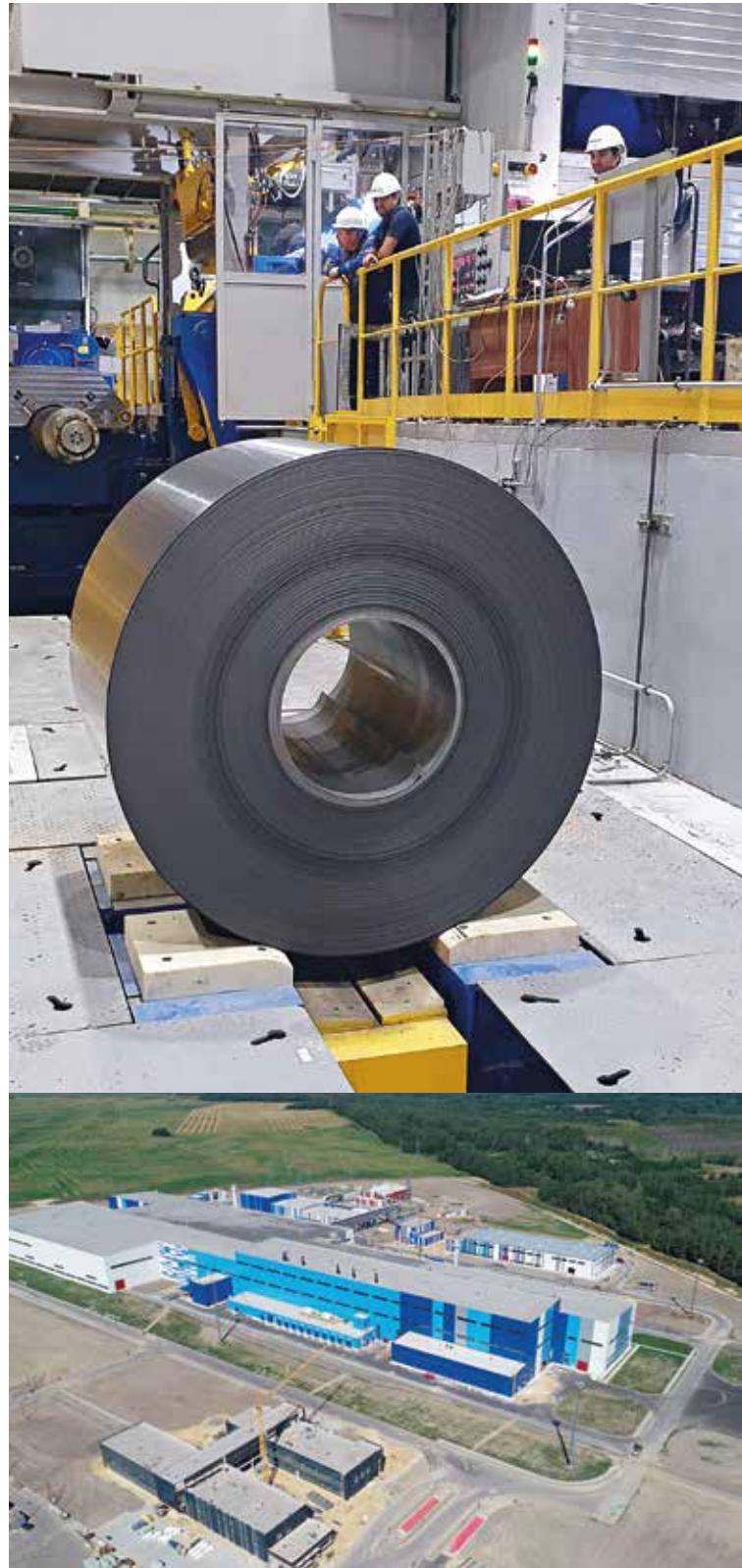
BELARUS

Tinplate production in Belarus reached important milestone.

On August 6, 2020, the first coil has been rolled on the new reversing cold rolling mill (RCM) supplied by SMS group to Miory Steel (MMPZ - Miorskij Metalloprokatnyj Zavod). The RCM is part of the completely new, integrated and expandable production complex for the manufacture of tinplate, which was built in Miory in the north of Belarus.

SMS group supplied all essential production equipment for the new facility, including the complete rolling and strip processing lines and the X-Pact® electrical and automation systems. In the first stage of expansion, equipment for an annual capacity of 150,000 tons was implemented. It serves Miory Steel to produce tinplate grades T1, T2, T3, DR7 and DR8 as well as thin sheet grades CQ and DQ. In the course of further expansion, capacity is planned to be increased to 240,000 tons. With its rolled products, Miory Steel meets the needs of the packaging industry as well as the demand for cold rolled thin sheet. The majority of the production is intended for export, especially to Russia and other CIS countries (Commonwealth of Independent States) and to the European Union.

The RCM was built in six-high design, provided with the proven CVC®plus technology (Continuously Variable Crown) from SMS group. It was also configured in the new high-performance design. This means that the rolling mill can be operated with particularly slim work rolls having a minimum diameter of 260 millimeters. This permits high pass reductions



to be achieved with comparatively low rolling forces. CVC®plus in combination with work and intermediate roll bending, multi-zone cooling and the dry-strip system (DS system) ensure all requirements for strip quality in terms of thickness, flatness and surface are met. In order to enable later capacity increase, the flexible mill design allows conversion into a Compact Cold Mill (CCM®).

Implementation of operator expertise

Besides the RCM, SMS group supplied an electrolytic cleaning section, a batch annealing furnace, a two-stand combined reduction/skin pass mill (DCR mill), an electrolytic tinning line, as well as one coil and one sheet packaging line. SMS group also supports Miory Steel in the implementation of the necessary operator expertise. This is of particular importance, as the new plant produces tinplate for the first time in Belarus.

The ultra-modern plant is provided with the integrated X-Pact® MES 4.0 production planning system from SMS digital. As an integral solution, X-Pact® MES 4.0 includes planning,

support, optimization, delivery and shipping, quality control, and reporting functions. The system seamlessly integrates into the X-Pact® automation for all equipment in the facility.

Thus it is possible to optimize utilization of the plant production capacities, while simultaneously reducing stocks, and to ensure complete material tracking. Furthermore, production scenarios can be simulated in advance and reliable delivery dates be determined accordingly. Coil Yard Management takes care of coil tracking from the incoming warehouse through the various intermediate storage facilities ahead of the production lines to the finished coils or sheets to be delivered to the end customer.

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

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New works

In the north of Belarus, this ultra-modern cold strip production facility has been established for Miory Steel. It is equipped with cutting-edge rolling and strip processing plants from SMS group (bottom left). On August 6, 2020, the new RCM rolled the first cold strip to a final thickness of 0.45 millimeters in seven passes (top left). All process-relevant data accumulate in the main pulpit. During commissioning, the teams from SMS group and Miory Steel cooperated closely in order to optimize plant performance step by step (right).



New processing line

U.S.A.

To Nucor Steel Gallatin, domiciled in Ghent, Kentucky, U.S.A., systems supplier SMS group delivered a new "heat-to-coat" pickling and galvanizing line, including engineering, process technology, furnace equipment, pickling and galvanizing technology as well as electrical and automation systems, all from one source.

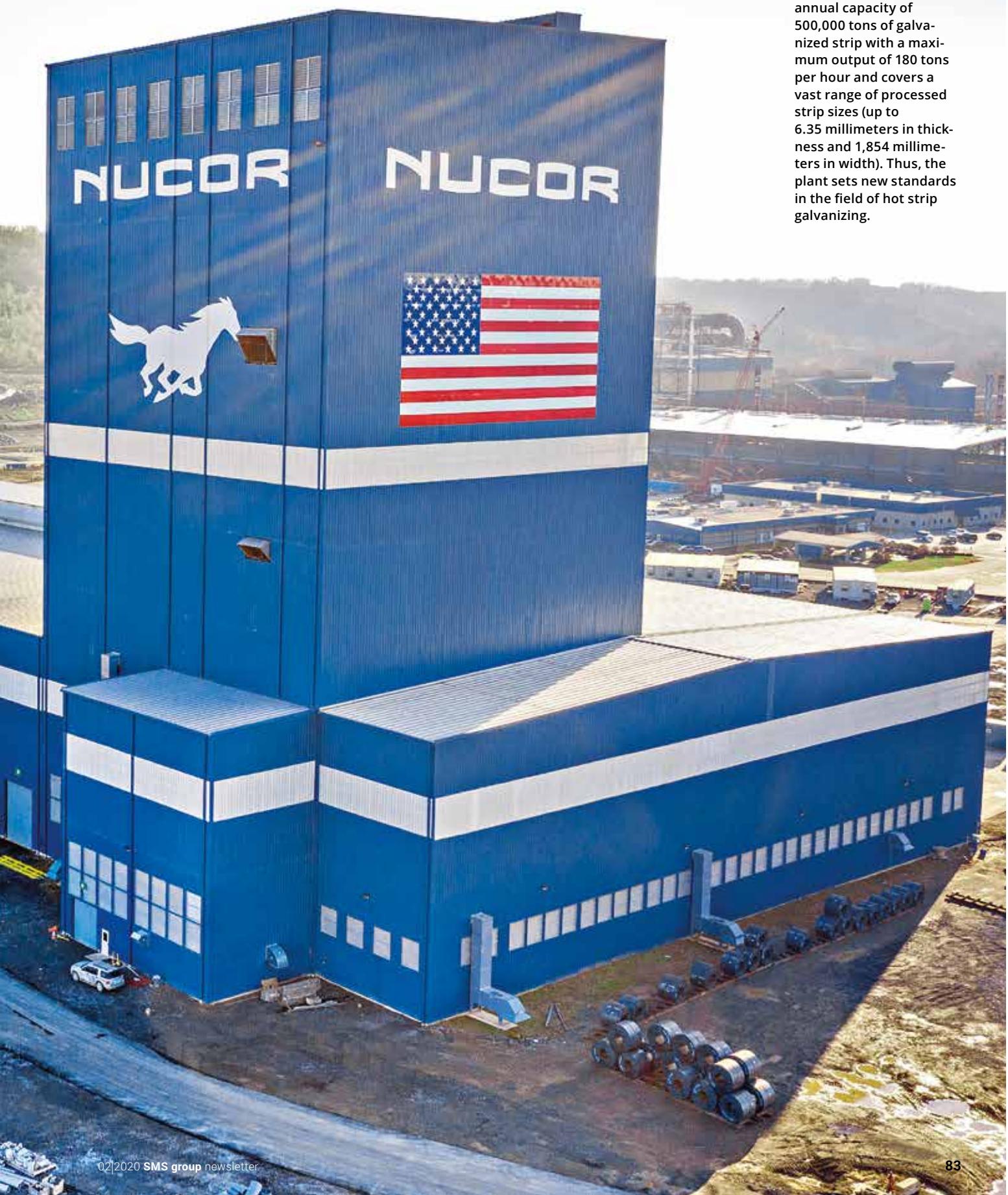
The line was put on stream in September 2019 and, since then, has continually increased capacity. Meanwhile, the line produces even strips with so-called galvannealed surfaces. In a "heat-to-coat" line this is a worldwide unique achievement. Right behind the air knives, the liquid zinc is inductively re-heated and allows a zinc-iron alloy layer to develop. Even strips of maximum possible dimensions, i.e. 6.35 millimeters thickness and 1,854 millimeters width, can be produced with galvannealed surfaces. This is another one of the line's unique features. ♦



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The new "heat-to-coat" line is designed for an annual capacity of 500,000 tons of galvanized strip with a maximum output of 180 tons per hour and covers a vast range of processed strip sizes (up to 6.35 millimeters in thickness and 1,854 millimeters in width). Thus, the plant sets new standards in the field of hot strip galvanizing.



The latest generation of X-Pro® laser welding machine safely and quickly welds together the individual steel strips to produce endless strip. An efficient solid-state laser is used for this purpose.



The turbulence technology in the shallow tanks achieves a maximum pickling effect with a minimum of acid and energy.





In the control station, all processes and results are shown in a clear overview and consistently logged for certified quality grades. The line features a high level of digitalization and automation. All electrical and automation systems were supplied by SMS group, just as the complete plant digitalization technology including X-Pact® automation and pertaining process models, the material tracking system with quality documentation, the advanced X-Pact® MES 4.0 (Manufacturing Execution System) plus the digital sensor system for the whole plant.



"I would again choose SMS group as a partner for future projects. The reasons for this are their technical resources and understanding of how the processing line works as well as their professionalism in executing the project. Just for being a partner in general. In my view, SMS group did a great job."

Ben Williams, Electrical Engineer and Project Manager, Nucor Steel Gallatin



The galvanized hot strip is used for a broad range of applications, in particular in the construction, transport and automotive industries.

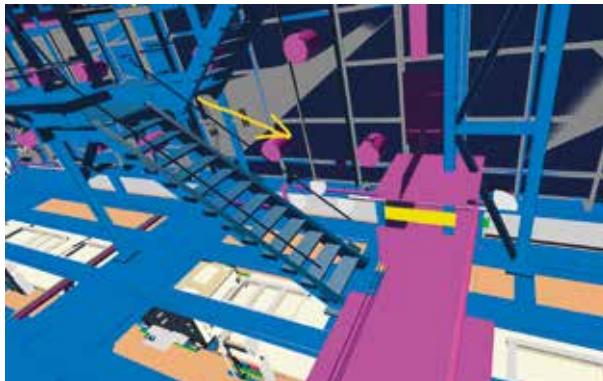
Knowing where - virtual plant planning for strip processing lines

BELGIUM

Plant planning with the aid of intelligent engineering tools. Aperam Stainless Belgium has contracted SMS group to supply an annealing and pickling line for stainless steel cold strip for its Genk location.



Collision control – shown here are the supporting steel structure, process piping, cable routes and planned walking paths.



VR tour – shown here are escape routes from the furnace platform down the stairway.

The conditions at the customer's site require a very complex layout configuration with a plant length of almost 400 meters. The technically demanding layout extends over several floors and includes besides a horizontal annealing furnace and a multi-stage pickling section, many other mechanical components. Therefore, modern VR technology (Virtual Reality) was used for layout and plant planning allowing the local conditions to be viewed from a full 360-degree perspective.

This innovative use of virtual reality offered Aperam numerous advantages. Among others, the customer had the opportunity to directly experience the machines and systems in their original size in the virtual room. When preparing a 3D plant layout, potential collisions of components or neighboring machines could rapidly be revealed and eliminated at an early stage.

Based on 3D virtual plant tours it was possible to continually check and improve the suitability of the concept and thus to facilitate communication within the project team. Detailed planning and project work on issues as risk assessment, workplace safety and escape route planning for the operating staff brought clearer and safer results and could be finished much earlier. Improvements



Equipment planning – operating platforms and access ways for the maintenance staff.

could also be achieved for pipework planning. Many further advantages will arise in the course of project handling since the VR technology helps to considerably enhance the understanding of the current status of design activities and modification steps. In the erection phase. The model will also be used as a basis in regular meetings and video conferencing to coordinate interfaces and communicate on technical issues jointly with Aperam.

Improvements identified

In the engineering phase and the early implementation phase, the use of VR led to a number of improvements in design. Discussions on equipment planning with participants from different technical departments were held via VR, so to speak "on site", providing distinctly more transparency in the planning process. This method also reduced the risk of misinterpretations, prevented misunderstandings in communication and optimized internal procedures.

Virtual Reality is not merely 3D. In the first place, Virtual Reality is a tool to avoid mistakes or a technology for preventing errors with great potential at many different levels.

Efficient coordination

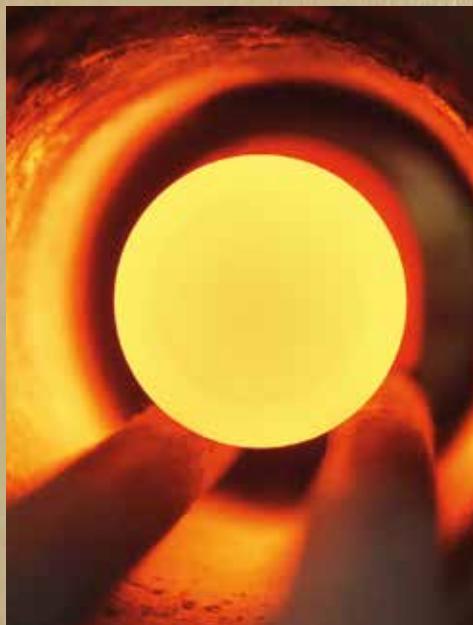
As early as in the sales phase, 3D plant and layout planning provide seamless access to the project model for all persons involved. This "knowing where" ensures the precise and efficient coordination of all participating departments. Also, layout planning in 3D minimizes sources of error and optimizes pipework and cable route planning in addition to realistic collision detection. Ideas and concepts can thus be visualized in the sales phase already, and the customer has the opportunity in the virtual room to move along his plant and view the equipment configuration in original size. ♦

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Induction heating solutions for aluminium

WORLDWIDE

Since the target settings for CO₂ emissions have become more and more stringent and this development is accompanied by an ongoing trend, especially in the automotive industry, towards ever lighter structures and hence to an increased use of the material aluminium, there is consequently a higher demand for innovative heating and heat processing applications.



Different characteristics of inductive heating

Induction heating has long been one of the most suitable and flexible heating processes for conductive materials. The scope of applications ranges from classical heating for forging purposes to tempering and from induction hardening to crystal growing. The induction technology can be used for locally focused heating, for example in surface hardening (picture on the right), but also for homogeneous heating as required for forging purposes (picture on the left).



- Inductive heating of aluminium is 100-percent CO₂-neutral.
- The plant concepts of SMS group offer maximum flexibility in production as the required energy is applied precisely where it is needed just by "pushing a button".

This article provides an overview of the induction heating technologies for aluminium duly considering the different requirements resulting from the broad range of dimensions and cycle times.

Induction heating of aluminium

The advantages, in addition to a small footprint, are flexible, dynamic temperature setting, low scale formation or oxidation and most recently the use of CO₂-neutral electrical energy.

In steel forging, induction heating systems are used to heat steel bars or billets to typically 1,250 degrees Celsius. Meanwhile, it has become state of the art that the heating section can be automatically adjusted to optimize energy



consumption. Also, emptying systems are used to ensure that, at the end of a production cycle or in the case of material change, forging can be continued up to the next to last part. In case of a short interruption in operation, the material can be kept hot in the induction heating system and quickly be made available at the specified temperature on demand by the press. If production is interrupted for a longer period, the operator may choose between heat-holding mode with reduced throughput or automatic emptying of the system.

The size range for this kind of system is from 15 to 300 millimeters, in diameter or edge length.

Similar boundary conditions apply to the heating of aluminium. However, due to its different physical properties there are differences in the usual size ranges and required temperatures.

The good electrical conductivity reduces the attainable electrical efficiency of the induction heating process for aluminium compared to that of steel. According to the physical law of Wiedemann-Franz, the good electrical conductivity of a material is proportional to its thermal conductivity. This means that temperature differences within the material are compensated faster than in steel parts, for instance. For that reason, aluminium workpieces, usually cylindrical billets, with diameters of up to 800 millimeters can be inductively heated in a fast and efficient manner.

State of the art

At present, the most widely used induction heating procedures for aluminium billets are individual heating and pusher-type heating.

In the individual heating mode, billet diameters rather range from medium to large size (150 to 800 millimeters) with long cycle times in the minute range - from just a few up to 30 minutes.

In the pusher-type mode, diameters are small (between 20 and 150 millimeters) and cycle times short lasting just a few seconds.

Individual heating

The individual heating mode is preferred for long cycle times as encountered in the extrusion of aluminium billets with large diameters and provides the advantage of flexibility when heating different billet lengths. Additionally, non-productive times for billet transport are of little significance due to the long cycle times involved. The typical procedure is to feed in the billets via a portal and deposit them on a transport system ahead of the inductor. Together with the billet, this transport system moves into the inductor without any friction between workpiece and system. After the inductor has heated the billet

to the specified temperature, the billet is returned to the loading position ready for further processing. Individual heating may be advisable for smaller diameters as well. This applies to small quantities in medical technology, for example, or when aluminium is to be heated up to the thixotropic state. In such cases, billet transport may be accomplished with or without relative movement between transport system and workpiece.

One fact has turned out a special advantage in the heating process, in particular for isothermal extrusion where the temperature setting over the length of a billet is not homogeneous, but rises along the length (taper). Therefore, independently controlled heating zones are integrated in the inductors with each zone being controlled by a separate temperature measuring unit. This allows a temperature profile to be pre-selected in several temperature steps, which is then adjusted and compensated depending on the performance in the individual zones. Due to the good thermal conductivity of aluminium the temperature profile over the length is almost linear.

Pusher-type heating

In pusher-type heating systems the material may be fed to the induction heater in different ways, for instance via a vibrating chute or by a robot. One after another, the billets are then pushed through the machine. Pinch roller systems have proven to be reliable driving units in practice as they can move the material column either continuously or clocked. During the heating process, the column rests and slides on water-cooled guide tubes.

Belt conveyor

Since unit weights of smaller sizes (< 60 millimeters) are low, pusher-type heating hardly creates problems with surface quality. Exceeding a critical combination of unit weight and required surface quality, however, may have negative impacts on the surface in the hot area caused by the skid rails. Simultaneously, cycle time in this diameter range is not yet long enough for individual heating and the effort involved would be disproportionately high.

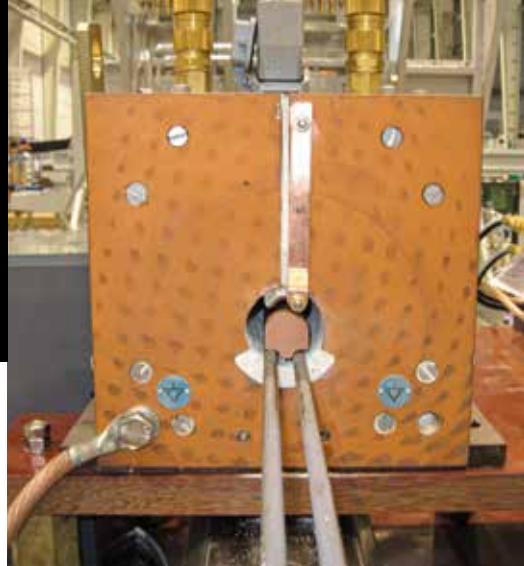
This is where the belt conveyor comes in. It unites the advantages of the heating methods mentioned above, and for medium diameters it can implement short cycle times without relative movement between workpiece and machine. Here, the workpieces are supported by an endless textile belt instead of a pinch roller and skid rail combination.

This is a challenge to the belt material. It must not be electroconductive but be capable of withstanding temperatures of about 500 degrees Celsius for an extended period of time. The transport concept selected was a combination of pulling and pushing to keep the mechanical load on the belt as low



Individual heating

Examples of individual induction heating systems for extrusion (top) and individual heating with small workpiece diameter (right).



as possible and thus attaining a long belt service life. The pinch roller already mentioned above is operated in sync with a belt drive and has just a supporting function to prevent the belt from crumpling. Deflector rollers at both ends of the inductor unit are used to thread the belt in and out of the inductor. Thus, a billet resting on the belt is pushed by the pinch roller while, at the same time, the belt is synchronously pulled by the drive. As a result, the material is transported without any relative movement whatsoever at the surface of

the workpiece. Hence, the surface quality complies with the initial state.

Hybrid system

If the demand for mere aluminium production is not sufficient to fully use the capacity of a press line, it will possibly be beneficial to have the option for switching. The hybrid concept provides for operation of a conventional inductor set for steel and simultaneously offers the opportunity, just by ▶



Pusher-type heating

Examples of a pinch roller system for billets and a roller transport system for bars.



changing the inductor set, to heat aluminium as well with a belt conveyor. Thanks to the thermophysical properties of aluminium and the lower forging temperature, it is possible to operate the two inductor sets with the same maximum throughput. This means that the installed inverter capacity can be optimally used for both products.

Summary

The growing importance of aluminium in light-weight construction is accompanied by increasingly exacting requirements on heating technology.

Contrary to conventional heating solutions with gas-fired furnaces, the inductive solution is 100-percent CO₂-neutral during the production process.

In addition to the vast range of possible, customized solutions, the plant concepts of SMS group offer maximum flexibility in production as the required energy is applied precisely where it is needed just by "pushing a button". ♦



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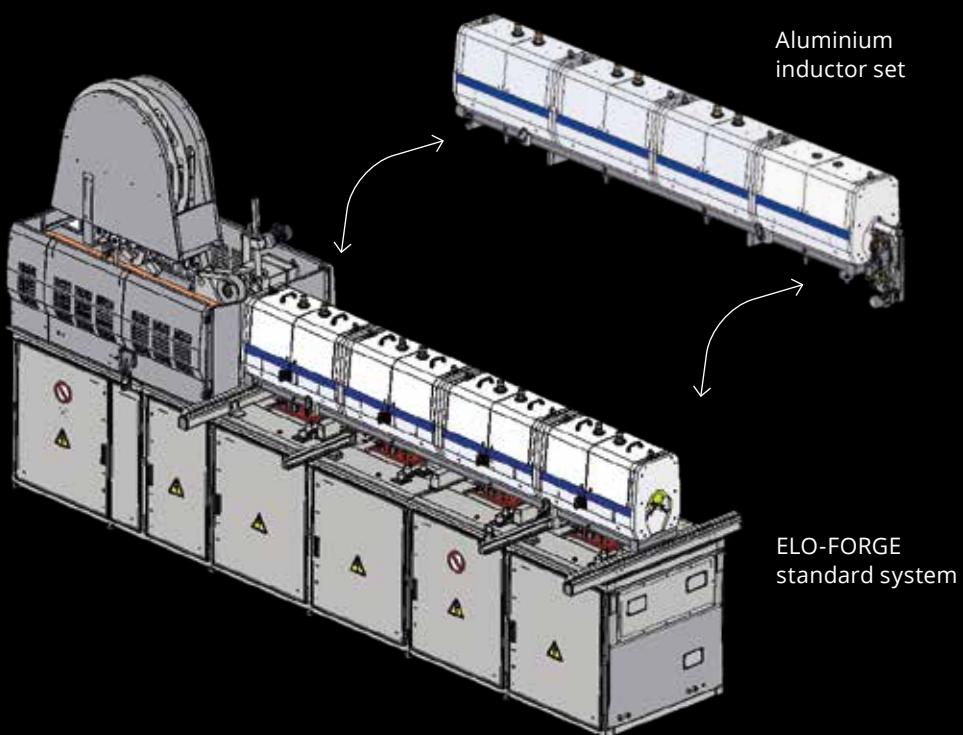
Dr.-Ing. Markus Langejürgen

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Elotherm hybrid concept for heating aluminium and steel

The plant concept offers a modular design and can be customized to the respective requirements. All resonant circuit capacitors and inverter modules needed for operation are integrated in the related substructure. Inductors and inverter modules can be added depending on the desired throughput.

Options and overall lengths of the ELO-FORGE series are shown in the table below.



Overview of the ELO-FORGE series

Type	Number of inductors	Inductor lengths [mm]	Max. throughput steel (1,250 °C) [kg/h]	Max. throughput aluminium (530 °C) [kg/h]	Max. inverter capacity [kW]
ELO-FORGE 2400	1	2,400	2,000	2,000	800
ELO-FORGE 3600	3	1,200	3,000	3,000	1,200
ELO-FORGE 4800	4	1,200	4,000	4,000	1,600
ELO-FORGE 6000	5	1,200	5,500	5,500	2,400
ELO-FORGE 7200	6	1,200	6,400	6,400	2,800



Horizontal strip looper in an annealing and coating line for non-grain-oriented electric steel strip.

effective electrification in China. SMS group is thus making a contribution to the mobility of the future. The contract was completely negotiated and concluded via digital media, due to travel restrictions. Commissioning of the lines is scheduled for 2022.

In addition to designing the mechanical and process equipment and to the manufacture of various core components, SMS group's supply package also includes the supervision of part of the local manufacturing scope and of equipment installation and commissioning. Furthermore, SMS group is to supply the X-Pact® electrical and automation system.

Highly efficient

Due to its magnetic properties, electric steel strip, also called silicon steel strip, is widely used in electrical engineering. With its advantageous magnetic properties, it contributes to improve the energy efficiency in electrical systems and thus helps to save resources. In non-grain-oriented strip, the grain orientation is irregular so that the material features isotropic properties. It is therefore used in rotating machines such as electric motors and generators. The material is especially used for electric vehicles, where high-quality electric steel strip determines the efficiency of the drives.

In both lines, the process includes cleaning, annealing, coating and drying of the material. Therefore, the lines will feature, besides the terminal equipment, cleaning sections, annealing furnaces, coating sections and drying ovens. The terminal equipment will comprise entry and exit sections as well as horizontal loopers. ♦

Order for two strip processing lines

CHINA

SMS group to supply two annealing and coating lines for electric steel strip to Shougang in China.

Shougang Zhixin Qian'an Electromagnetic Material, China, has awarded an order to SMS group for the supply of two annealing and coating lines for electric steel strip. The lines will expand the annual production capacity of fully-finished non-grain-oriented electric steel strip with high silicon content at the existing production location in Hebei province by 360,000 tons. In both annealing and coating lines, the internal microstructure of the cold rolled material will be adjusted during the annealing process and the material then be provided with an insulating layer. The steel will mainly be used for the production of motors and generators to meet the increasing demand for efficient and

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Jubilee batch produced

RUSSIA

Taganrog Metallurgical Works (TAGMET) produces five million tons of pipes on a continuous PQF® mill.

At its Russian location Taganrog, TAGMET as part of TMK's Pipe Metallurgical Company, has produced the five-millionth ton of pipes on the PQF® (Premium Quality Finishing) seamless tube plant supplied by SMS group at the end of May. For the production of this jubilee batch of linepipes for oil with a diameter of 168 millimeters and a wall thickness of 18 millimeters, continuously cast feedstock was used from a steel plant also supplied from SMS group.

Commissioned in 2008, the continuous PQF® mill at TAGMET was the first tube rolling mill in Russia to employ state-of-the-art PQF® technology for seamless oil and gas pipes. Today, TAGMET with its six thousand employees is one of the leading companies in the pipe industry at national and also interna-

tional level. In the size range from 73 up to 273 millimeters, the plant produces virtually all types of seamless steel tubes, including high-strength tubes with special properties to meet the increasingly high market demands.

"Undoubtedly, the record set is a merit of the whole plant staff. The components of success were well-coordinated actions of all technical plant service staff maintaining the equipment in such a way that stable and faultless production was ensured, and of all workers involved in the technological process," said Sergey Bilan, Managing Director of TAGMET.

The trusting cooperation over the years led to constant further technological development of the PQF® seamless tube plant. Evidence of this is the order placed by TMK to supply a newly developed mandrel thrust block for the cone-type piercer. ◆

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Modular, flexible and individual

WORLDWIDE

For more than 30 years, stretch-reducing mills have benefitted from the advantages of the production planning and process optimization system CARTA®. It convinces with a robust process model and intuitive operation. CARTA® neo is the systematic further development offering cutting-edge and automation technologies of SMS group.



The last process stage in the production of seamless tubes is stretch reducing. This is where the diameter of the shell is reduced in the individual stands – up to 30 in total – in the stretch reducing mill (SRM). By selectively adjusting the roll speeds, a longitudinal tension can also be applied, and this is used to stretch the tube and so attain a precise wall thickness. As part of this process, there may be variances in the geometry of the incoming shell at this point. In addition, the tension created in the SRM causes thick ends, which result in lower mill yield. With CARTA® neo, these anomalies in the shells can be corrected, crop ends reduced, and SRM productivity increased.

Process planning and optimization solution CARTA®

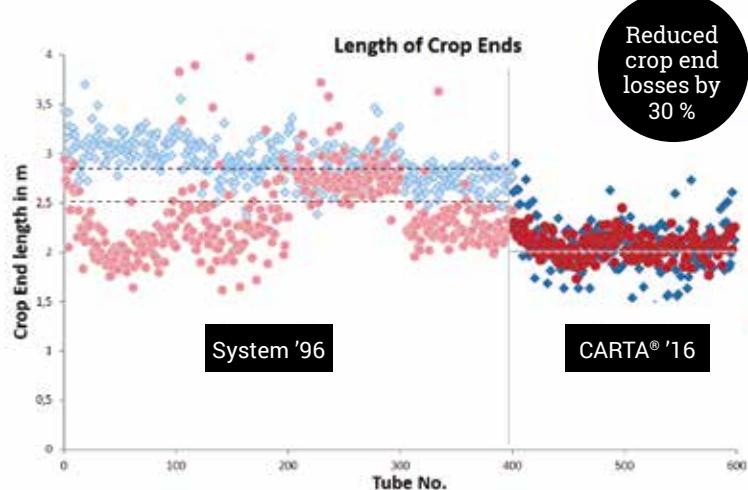
CARTA® (Computer-Aided Rolling Technology Application) is a process planning and optimization solution, which is run in addition to the basic automation system. In order to control and optimize all possible characteristics and features of an SRM, the system's modular design allows it to be adapted easily to any particular stretch reducing mill. Every configuration is supported, from the group superposition drive with between 4 and 8 motors, to the stand or even individual roll drive with 30 to 90 motors. New or previously installed measuring technology and basic automation can be flexibly integrated with minimum effort. Further to the automation of stretch reducing mills, there are also special solutions for the 2-roll piercer and the PQF® (Premium Quality Finishing) in the form of CARTA® CPM and CARTA® PQF® respectively.

The CARTA® success story

Built on the first crop end control (CEC) programs at the beginning of the 1980s, which at that point were still installed in the PLC of the drive units, the first CARTA® generation was introduced in 1989. Alongside CEC, it also featured wall thickness control (WTC). The first upgrade appeared as early as 1993 and finally, in 2001, the most advanced generation to date was launched. While very few modifications

were made to the technology, the real time component was completely redesigned and the process management system fundamentally reengineered. Over the next 20 years, new functions were always being added and existing functions optimized. However, this architecture has slowly reached its limits, and the fourth generation is now ready to take over: CARTA®neo.

Evolutionary improvement As with previous generation changes, the technological core of CARTA®neo, our proven process model, has only been slightly upgraded and adapted, however, an evolutionary improvement took place. The results speak for themselves: During revamping a CARTA® of the second generation to a CARTA® of the third generation in 2016 crop end losses could be reduced by up to 30 percent and pipe wall quality be increased significantly.





Visualized process optimization: Optimized crop end loss control via CARTA®neo.

The CARTA® system's primary task is to support the process engineer with the planning and optimization of the rolling process, and give the operator comprehensive control over the process to make sure that quality and yield of the SRM are continually enhanced. To achieve this, the engineer is provided with tools for configuring the reduction series, preparing the groove design, and determining the static and dynamic rotational speeds for rolling. The operator, on the other hand, is shown all process-related data and is able to control the ongoing process directly. The process data recorded by CARTA® are then prepared for the engineer so that he can optimize the process plans. This ensures that the quality and output of the SRM can be continuously improved.

In order to manage the complexity of stretch reducing, CARTA® provides special technological functions that each deal with specific aspects of the process. These include, for example, reducing crop end losses, achieving constant tube walls or minimizing the loads on individual stands and motors.

30 years of experience go into CARTA® 4.0 – CARTA®neo

As a result of intensive exchanges with our customers and the continual development of the automation technology and software, we have accumulated a wealth of experience and identified many opportunities for making improve-

ments. These aspects have been incorporated into the fourth generation of CARTA®. The goal here is a robust and reliable system that is designed for long-term support and easy update and upgrade capability.

The hardware concept has been completely redesigned. The application servers benefit from the significant improvement in the performance of modern hardware over recent years, with more compact and efficient configurations now possible. As far as real time is concerned, the expertise accumulated by SMS group's X-Pact® Electrics and Automation Department over the last 30 years has been utilized in the form of the embedded system. This is not only well established, it also allows the use of advanced field buses (Profinet, Profibus, or Ethercat) and the integration of PDA solutions (like ibaPDA for example). What's more, the scope of the hardware is also reduced considerably. The software has also been completely revised. The new, modular architecture allows for easy and incremental updates. Dependencies on third-party suppliers, which jeopardize long-term availability, have been removed and replaced with open, advanced solutions. As a result, either Windows or Linux operating systems can be used. For better reliability, a self-replicating database is used; this synchronizes the working memory and supports a variety of different backup strategies. This enables the implementation of a hot standby feature, which means that, in critical situations, the productive server is switched over in under ten seconds without any loss of data. In addition, the hardware monitoring function ensures that defects in the hardware are detected early on. By using web technologies for user interfaces, any number or configuration of clients, PCs, or tablets can be incorporated with no extra effort providing users with only the data and options that are relevant for them. As such, it creates the conditions for role-based working practices of the future.

Not only was the technology upgraded, the entire workflow was updated. Since humans as operators and technologists make a substantial contribution in terms of quality and output, with more and more information being made available at the same time, great care was taken to ensure that the overall concept is coher-

ent. On the one hand, all screens were tidied up and only the information required to make decisions is displayed. And on the other hand, CARTA®neo provides users with more consistent support. The rolling process is monitored continuously, and any deviations or problems are detected, reported, and partly eliminated automatically. The process engineer receives summaries of the production process and indications of problems and possibilities for optimization. Planning and process optimization were combined, and new functions were introduced.

Evolutionary improvements of new CARTA® generation

The technological core of CARTA®neo, our proven process model, was only slightly revised and adapted, as with previous new generations. However, there was one evolutionary improvement. The results speak for themselves: Following an upgrade from a second- to the third-generation CARTA® in 2016, crop ends were again reduced by up to 30 %, and the tube wall quality was significantly improved. With a shutdown period of less than three days, which took place at the same time as the regular maintenance work – this is an outstanding outcome in terms of both output and quality. The result of 20 years of continuous improvement.

Yet CARTA® is more than just automation. A complete process and communication simulation system was also implemented with the new software solution. This not only enables the excessive testing of CARTA®neo before it is put into operation, which in turn reduces the time spent on installation and commissioning at the customer's site, but also offers entirely new training opportunities. For example, the customer can be trained on his system in advance, so the start-up phase is shorter.

This is something that has already impressed our Chinese customer Jiangsu Chang-Bao. During a November 2019 visit to SMS group in Mönchengladbach, Germany, the customized, in-house training course included both the theory of stretch reducing and practical demonstration training on how to operate the system. In SMS's own test center, the customer also had the opportunity of familiarizing him-



During the training course in the SMS group test center the customer is provided with all necessary operating information.



Tidily arranged screens and optimized user support reduce also training and personnel costs for customers.

self with process control, thanks to the simulation, and with the planning programs. The combination of both theory and practice gave Jiangsu ChangBao the ideal foundation for working with CARTA®neo in its new PQF® seamless tube plant. ♦



Increased added value

WORLDWIDE

The TCG thread cutting machine for OCTG pipes provides a synthesis of the highest level of reproducible thread quality and high productivity, availability and profitability at the same time.



- TCG thread cutting machines operate according to the principle "rotating pipe, stationary tools" producing high-precision premium threads for seamless tubes and longitudinally welded pipes.
- Premium threads make a substantial contribution to secure future extraction and thus worldwide oil supply even under difficult conditions.

Generously dimensioned workspace of TCG thread cutting machine for API and premium threads.



Model overview of TCG thread cutting plant for API and premium threads

Machine type	Diameter range	
	inches	mm
TCG 22	2 3/8 – 7 5/8	60.3 – 193.7
TCG 30	2 3/8 – 10 3/4	60.3 – 273.0
TCG 38	4 1/2 – 13 3/8	114.3 – 339.7
TCG 43	5 1/2 – 16	139.7 – 406.4
TCG 54	9 5/8 – 20	244.5 – 508.0

After a short startup phase of a supplied thread cutting machine of the TCG type SMS group has received the FAC (Final Acceptance Certificate). The customer is a Japanese tube and pipe producer who is considered one of the globally outstanding manufacturers of high-strength OCTG pipes (oilfield tubulars) with top-quality premium threads. It is already the second machine of the TCG series ordered by the Japanese company after positive experiences with SMS group which is now in productive continuous operation.

Dr. Thomas Maßmann, Executive Vice President Long Products, SMS group: "This project very clearly revealed how important teamwork is apart from our technological competence, namely the joint coordination and close cooperation with the customer as well as the interdisciplinary interaction within the SMS group. Sales and Marketing, Engineering, Assembly, Technical and Commercial Processing, Site Planning, Electrics and Automation, Field Service and many more of our Business Units are functioning as homogeneous entity which is crucial for a successful implementation."

How can customers benefit from a TCG thread cutting machine?

The TCG thread cutting machines are a success story because as with the Japanese producer they meet the expectations of our customers worldwide in every respect. About ten years ago, the innovative machine type was redesigned in the course of a complete design overhaul and has since then been continually developed. Thread cutting machines of the TCG type operate according to the principle "rotating tube, stationary tool", producing high-precision premium threads for seamless tubes and longitudinally welded pipes. The machine is a synthesis of highest and permanently reproducible thread quality and high productivity, availability and effectiveness at the same time. Those customers producing OCTG pipes with premium threads by means of the TCG thread cutting machine will increase their added value by a significant factor and thus secure sustainable competitive edges.

In Falk Rößeler's words, Vice President Bright Steel & Finishing Plants, SMS group: "As

Leading Partner in the World of Metals we not only keep an eye on technical solutions for our customers but above all also on their markets and future prospects. The TCG thread cutting machines clearly underline this ambition – the threads meet topmost quality standards and are thus characterized by almost unique properties, i.e. a strong demand exists for these pipes also in precarious market situations and they achieve high profitability."

Premium threads produced on thread cutting machines of SMS group meet the demanding standards according to ISO 13679: 2019 / 2011 and API 5C5 and in addition to that attain outstanding results for threads to API 5B and GOST R 53366 (formerly GOST 631/632/633).

Why are premium threads decisive in the future?

The conditions of oil production are becoming more and more severe, yet safety and strength of the pipes and particularly their connections must be assured. Only with premium threads of the highest ISO standards as produced on the TCG thread cutting machines can the most varied and complex requirements be fulfilled and the oil deposits be safely tapped. Benjamin Henkel, Product Manager Threading & Finishing Lines, SMS group: "Our machines produce top-quality premium threads with optimum productivity to make sure that our customers are ideally positioned in competition."

With premium threads OCTG pipes are prepared for the most demanding oil extraction conditions. This includes that oil drilling with these high-performance pipes is able to penetrate into further depths of several thousand meters onshore as well as offshore. So-called sour service pipes with premium threads withstand aggressive and corrosive conditions such as hydrogen sulfide and sulfuric acid. Large deposits near the polar circles can only be tapped since the high-strength and highly alloyed pipes including their threads withstand extreme temperature differences, such as in Siberia with minus and plus temperatures. In the offshore area near oil platforms premium threads help to ensure that oil extraction pipes permanently withstand high

movement intensity. And drilling operations not only take place vertically, but change directions for geological reasons – even these enormous challenges are mastered by OCTG pipes and premium threads. To put it briefly, premium threads make a decisive contribution that future oil extraction and thus worldwide oil supply can be ensured even under difficult conditions.

How does SMS group achieve this unique thread precision?

"Significant for precision and quality are machine rigidity and vibration reduction," Tim Küppers, Head of Design Department Finishing Lines, SMS group, explains. "We have subjected all components of a thread cutting machine to continual testing which has resulted in new developments. In conclusion, they are interacting optimally and are gaining optimum thread results."

"Significant for precision and quality are machine rigidity and vibration reduction."

Tim Küppers, Head of Design Department
Finishing Lines, SMS group

In the development, SMS group has applied state-of-the-art FEM simulations. By means of finite element calculations structural components such as machine frame, gear units, turret arrangement and drive elements with linear guides and prestressed ball screws were examined and optimized. The results were then again subjected to an objective and independent examination and then confirmed by the RWTH Aachen University: the TCG thread cutting machine attains supreme values in machine rigidity and vibration-free running.

Key factors of precision and main innovations include the positioning of the turret (tool holder) with its short distances to the pipe and vertical arrangement to the machine axis as

well as a separate, self-supporting centering chuck. With this construction the excess pipe length for clamping can be kept as short and stable as possible, whereby also welded thin-walled OCTG pipes can be processed in a highly precise manner. In addition, the pipes can be optionally stabilized by using an internal clamping device. The newly developed chuck is characterized by its compactness, low inertia and flexibility, enabling to pick up each pipe optimally. Turret tools not required during the thread cutting process cannot collide with the clamping chuck. In this way, the pipe can be clamped as short as possible and the tendency to vibrate can thus be minimized.

result, the production processes can be carried out in an interruption-free and highly productive way. Pre-positioned tools enable the production of most varied thread types and are provided with a powerful coolant application so that maximum process speeds are reached. Coolants are collected, cleaned and once again fed to the production cycle which in addition to energy efficiency contributes to the sustainability of the thread cutter.

To avoid downtimes, all sensitive machine parts such as tool carriages are protected against direct penetration of chips or coolant emulsion. The pipe is protected with a plug fitted fully automatically and variably depending on pipe and thread. In addition to that, the whole interior space is provided with smooth surfaces ensuring that adhesion of chips is prevented. Continuous chip removal is realized fully automatically. A chip extraction system can be installed additionally.

An automatic lubrication system also contributes to high availability and minimization of maintenance assignments. Moreover, an up-to-date plant design enables optimum accessibility of all assemblies. The machine equipped with integrated access and security systems provides wide sliding doors with roof opening, whereby production staff is not affected by dripping coolants and crane application is simplified when assembly groups are replaced.

What are the prospects for customers in terms of digitalization and Industrie 4.0?

As regards controls, digitalization and Industrie 4.0, the TCG thread cutting machines are designed to be open – i.e. with their interface approach as well as an integrated sensor technology. For CNC machine control e.g. Siemens or FANUC systems can be used depending on customer specifications. The HMI operating concept is designed intuitively offering maximum transparency for monitoring fully automatic processes and simple, quick intervention and adjustment options.

Christian Benten, Sales Manager Finishing Lines, SMS group: "Our equipment can be integrated seamlessly into existing ERP systems and pipe finishing lines and it supports the corresponding pipe tracking. Through this con-

"We not only keep an eye on technical solutions for our customers but above all also on their markets and future prospects."

Falk Rößeler, Vice President Bright Steel & Finishing Plants, SMS group

What are the characteristics of high productivity and availability?

Not only the thread quality of the TCG thread cutting machine is excellent but also the short cycle times and high productivity through fully automated processes. This already begins with the transportation systems upstream of the plant. Special pinch roll units ensure fast pipe feeding. By tracking the machine knows among others values such as pipe dimensions and steel grades. Based on this data, the dynamic adaptation takes place automatically and in no time and secondary setup times are reduced to a minimum.

Each of the two turret heads is equipped with six tools so that the machine is provided with a total of twelve tool positions. Consequently, the machine is prepared for corresponding material properties such as highly alloyed steels and machining processes such as roughing, finishing or thread cutting. As a



TCG thread cutting plant for API and premium threads in the Mönchengladbach workshop.



Here you can find more information about the product range of single machines and complete finishing lines for pipe production.

nectivity and networking the machine is perfectly pre-adjusted to the relevant pipe in the ongoing process. At the same time, the process and thread data are provided for downstream production steps and are integrated in the quality documentation of the customer.

"We have optimally prepared the TCG thread cutting machines for the digital future. We are working on very promising digital and intelligent solutions which further enhance the

added value of TCG thread cutting machines for the customers," Falk Rößeler, Vice President Bright Steel & Finishing Plants, SMS group, forecasts future prospects of the new machine type. ♦

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Expansion of spiral pipe mill

U.S.A.

Stupp Corporation commissions SMS group to supply fourth submerged arc re-welding facility for pipe production.

Stupp Corporation has awarded SMS group the contract to expand the spiral pipe mill at its site in Baton Rouge, Louisiana in the United States. The contract consists of two projects: a partial revamp of the spiral pipe machine to increase pipe production capacity, and a new submerged arc re-welding stand to complement the existing three welding stands. The plant's modifications will go into operation at the end of 2020. The commissioning of the new submerged arc re-welding stand has been postponed to 2021.

25 %

production increase is possible by the new re-welding stand, depending on pipe dimensions.
Maintenance and failures on other welding stands can additionally be compensated.

Back in August 2007, Stupp purchased a spiral mill from PWS GmbH – now a company of SMS group. A total of three submerged arc re-welding stands were installed at that time. The mill started production in 2009 and manufactures spiral pipes for oil and gas pipelines within the 24 to 60 inch diameter range and a maximum pipe length of up to 24.4 meters. These are produced in a two-stage process: the first stage is where the spiral pipes are formed and continuously tack-welded in the spiral pipe machine. In the second stage, the pipes are finish-welded on separate re-welding stands using the submerged arc welding (SAW) technique.

To increase pipe mill production at a later date, SMS group made provisions in the original mill plans to include space for the subsequent installation of a – fourth – submerged arc re-welding stand. The foundations for this additional re-welding stand were already cast when the foundations for the three welding stands, which went into service in 2009, were being built. After reviewing the market outlook for the years ahead, Stupp Corporation has decided to have the fourth final welding stand installed as part of an upgrade by SMS group.

Higher strip feeding speeds

The spiral pipe machine will be upgraded with a new de-coiler station that allows for higher strip feeding speeds and is equipped with a programmable braking system. This allows the required strip tension to be maintained between de-coiler station and main drive, so that the coil cannot unwind in an uncontrolled manner. The braking system thereby prevents typical surface damage, particularly with high-strength material grades, which are increasingly used nowadays for oil and gas linepipes.

After years of production using SMS group re-welding stands, Stupp Corporation has selected a drive system with skew roller table, after close consultation with SMS. In addition to that, the new stand shall not only supplement the but also provide comparative data: in the skew roller table system, the pipe is transported by means of rollers, which are employed in the spiral angle, and not by means of double-



In 2007, PWS GmbH – today SMS group – installed the spiral pipe mill of Stupp Corporation in Baton Rouge, Louisiana, U.S.A.

cardanic rollers as used in other stands. The angle of the skew roller table can be changed at the touch of a button from the operator station in order to rotate a pipe in place, or, to convey it longitudinally or helically.

Reduced welding defect rate

A key benefit of the skew roller table is that according to the combined experience of SMS engineering and SMS customers already operating that system the pipes move more uniformly on the roller table. This in turn has a direct and positive effect on the quality and uniformity of the weld seam. For Stupp, this means that the welding defect rate can be reduced and that the weld seam geometry is kept as constant as possible.

The highly automated re-welding stand is equipped with the latest control and drive technology. The automation systems feature drives and sensors that consequently use

network technology, thus allowing all machine parameters to be accessed and recorded. Data analyses are available to help monitor the quality of the pipes and supply the machine's production parameters in order to enable the specific optimization of production processes and cycle times, as well as to forecast maintenance intervals for equipment units.

What's more, the new re-welding stand can boost production by up to 25 percent, depending on the pipe size. As a result, Stupp can increase its existing annual capacity by 40,000 to 60,000 tons. ♦



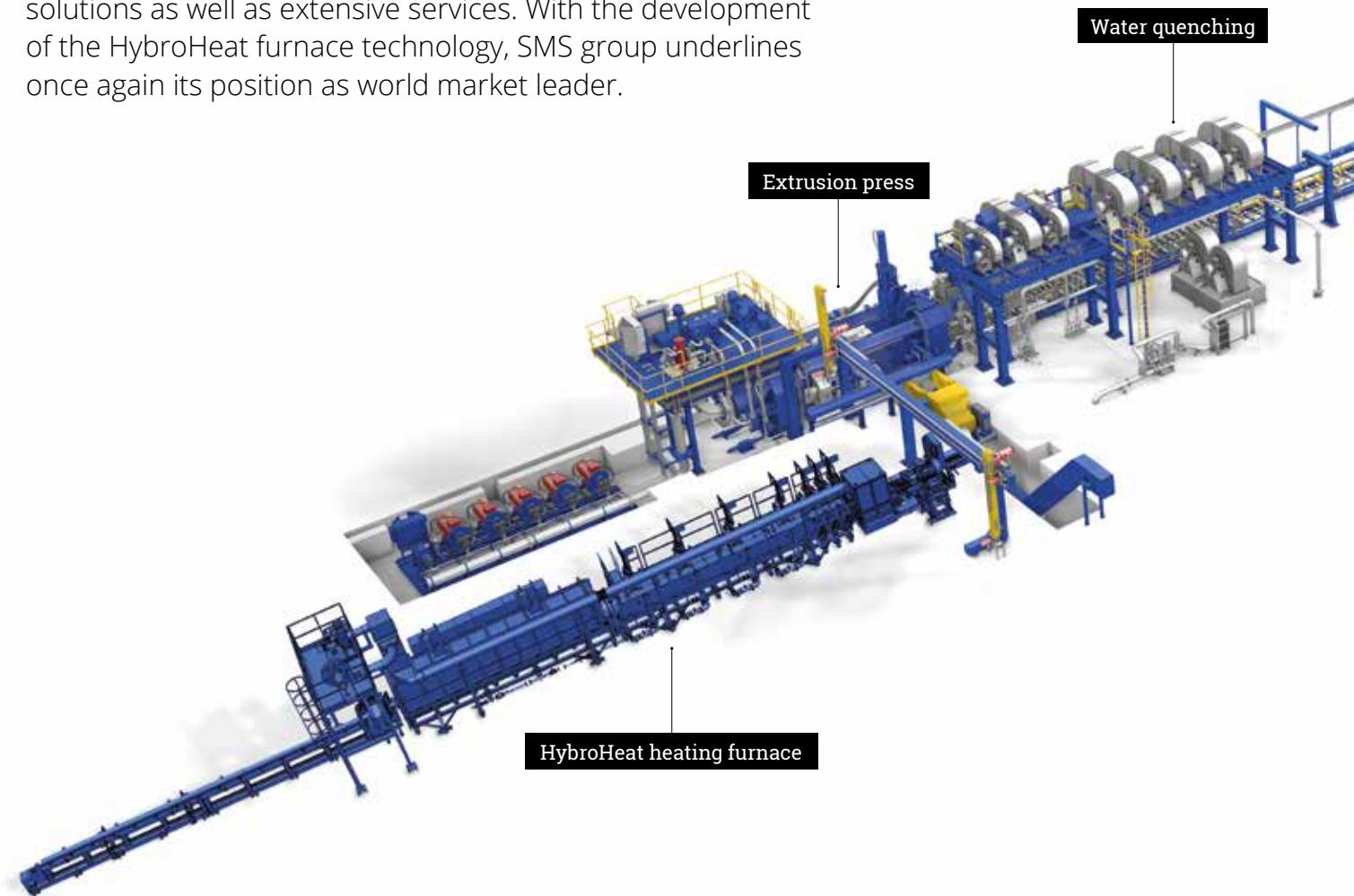
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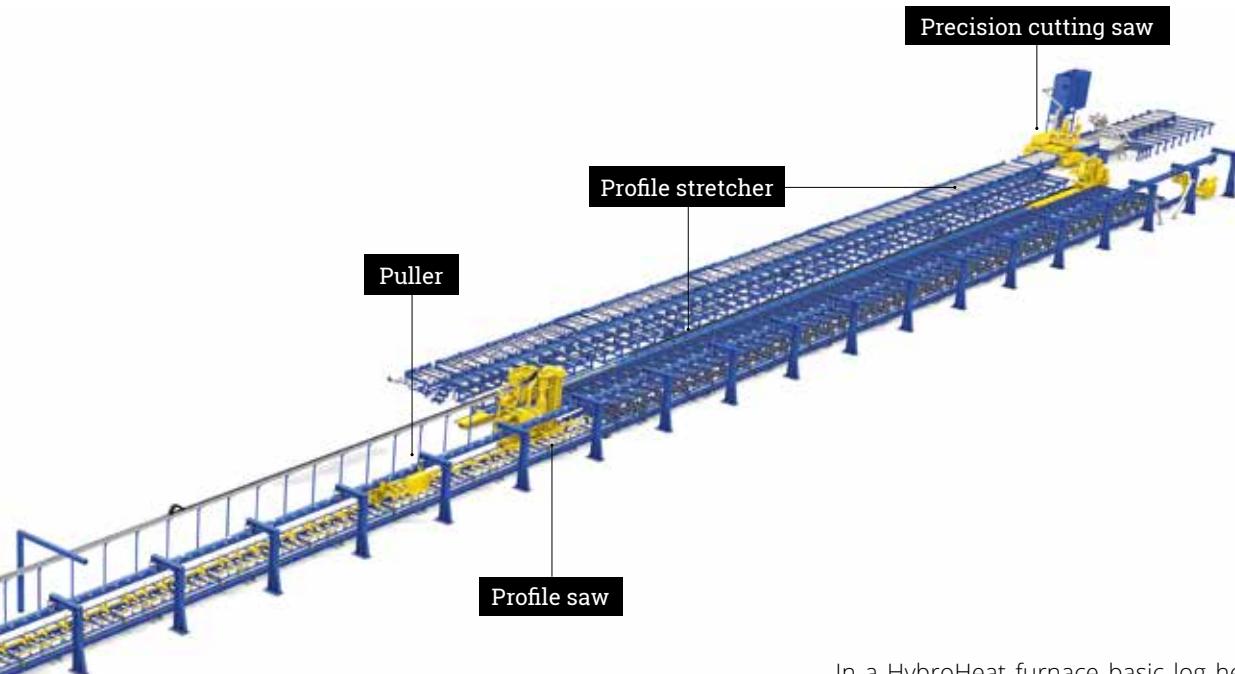
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HybroHeat furnace technology developed

WORLDWIDE

SMS group offers in addition to extrusion presses also all required up- and downstream process and automation solutions as well as extensive services. With the development of the HybroHeat furnace technology, SMS group underlines once again its position as world market leader.





SMS group guarantees operators of extrusion presses a competent contact partner for complete production lines up to the finished profile. In charge of the development of the HydroHeat furnace technology were IAS GmbH and OMAV S.p.A., who belong to SMS group and whose technologies smoothly complement and gear into each other.

HydroHeat furnace technology combines the advantages of cost-efficient preheating of log material in a gas furnace and precise temperature setting by means of induction technology before extruding the billet. The concept is based on proven technologies from both companies in which it joins efficient gas furnaces and saws from OMAV with high-performance induction plants from IAS in a single line. The advantages for the operator are, among others, lower investment and operating costs resulting from a compact design and reduced idle times.

In a HydroHeat furnace basic log heating takes place in a gas furnace developed by OMAV S.p.A. on the basis of the high-performance billet furnace HP7. It is characterized by high thermal efficiency of 75 percent and low average consumption of less than 18 Nm³ natural gas per ton of log material and it is therefore the market leader in this segment. This can be achieved particularly by a preheating zone where the logs are preheated by means of exhaust air of the combustion zone. "A preheat zone is provided on the entry side of the direct combustion zone equipped with a burner. The preheating system uses the outlet of the combustion zone heating up the logs to 200 degrees Celsius. Besides, the fumes pass through a heat exchanger for pre-heating combustion air which is temperature-controlled and always achieves an optimal air/gas ratio. The thermo-couple for measuring the log temperature is designed in such a way that it is mounted at the top of the log and it is air-cooled in standby mode," explains Massimo Marinelli, Managing Director at OMAV.

The final heating zone is realized by an induction coil following the combustion zone of the gas furnace almost seamlessly. Before the log is pushed to the fully-electric operated saw arranged in the runout section and cut to extrusion length, a defined temperature profile is set in the induction furnace. After the cutting process an electrically driven cylinder pushes the remaining log back to the induction respectively gas furnace where the end of the log is again heated to extrusion temperature and provided with a taper.

In order to prevent rejects the saw is equipped with a buffer station for temporary reception of the log end, so that the logs can be processed completely – provided the extrusion process allows the extrusion of a two-piece billet. The entire process is managed by sophisticated software and is executed fully automatically without manual interventions of the operator.

"For induction heating a coil developed by IAS GmbH is used reaching an efficiency of up to 70 percent due to its multilayered structure and the use of a copper profile particularly matched to the process. The entire coil length is divided into several zones depending on the billet length and which can be charged with power ranging from 0 to 100 percent. This enables a temperature profile setting over the length of the billet and thus creates the conditions for an isothermal extrusion process. In each zone, the billet temperature is monitored by means of thermocouple tips and the heating process is controlled by an inverter based on IGBT technology, so that temperature tolerances of < 3K are achieved," explains Torsten Schäfer, Head of Sales at IAS.

Induction furnaces of IAS:
Billets are precisely and reproducibly heated before extrusion according to a specified temperature profile.



The same technology is also applied for stand-alone inductive solutions. By using high power densities the required extrusion temperature is reached quickly. Apart from a friction-free transport of the billets for optimum surface and thus profile qualities, a high temperature accuracy and process reproducibility, this solution creates an environmentally friendly workplace for customer staff since no CO₂ emissions arise.

With this development, SMS group underlines its commitment to be at the side of the operating company of extrusion presses as a partner offering all the required technologies. SMS group, IAS GmbH from Iserlohn, Germany and OMAV S.p.A. from Italy with their customized solutions and tailor made machines are international technology leaders and have been partners of the extrusion press industry for decades. With worldwide locations the group is positioned in such a way that experts of SMS group are always close to customers.

Extrusion presses not only for aluminium

More than 1,700 extrusion presses installed all over the world impressively confirm many years of experience and the ex-

pert knowledge of SMS group. Extrusion presses are predominantly used in the aluminium industry. SMS group supplies extrusion presses with a press force from 10 to 160 MN, both as direct or indirect front loader as well as tube press or as combination from all these extrusion methods. Profiles and tubes from aluminium alloys produced on extrusion presses of SMS group are normally used in automotive, aerospace and construction industries. In addition to aluminium, extrusion and tube presses among others for copper and brass alloys, titanium and stainless steels are also part of the scope of supply of SMS group.

Extrusion press structure

Except a few special designs, all extrusion presses including large presses from SMS group are characterized by a short, prestressed press frame ensuring the necessary rigidity. The prestressed system of a rectangular pressure box with laminated tie rods is a development of SMS absorbing all process forces occurring in the forming process. The laminated tie rods assure low dynamic load changes with evenly distributed pressure and tension. Thanks to this process, the tensile stress is almost halved protecting the plants against material fatigue and therefore significantly contributes to a prolonged service life.

To attain good product quality, proper alignment of die, container and stem is crucial. An alignment of extrusion press tools may possibly last several hours per month. Here, SMS group was able to substantially increase plant availability by using linear guide systems in recent years. Initially, the guide systems were only meant for container holder and moving crosshead of extrusion presses with a press force up to 25 MN. Meanwhile, the guide systems are also successfully employed in medium-sized extrusion presses up to around 60 MN.

Drive systems ensure energy savings

SMS group realizes various drive systems – from classical oil hydraulics to water-hydraulic drives up to hybrid electro-hydraulic systems.

Water-hydraulic presses are realized for classical steel applications. However, improved heavy-flammable hydraulic oils have started a predatory competition. For example, a stainless steel tube extrusion press line which SMS group recently supplied to SeAH Steel, Korea, was fully equipped with oil hydraulics.

Current developments in oil hydraulics are towards highly available and energy-efficient systems at the same time. In this case, the start-stop systems of SMS group, with which pumps are switched off and restarted in no time, have

A 25/27-MN extrusion press for eight-inch aluminium ingots.



established themselves in the market. In addition, variable-speed pump systems are advantageous for optimized plant control systems.

While oil-hydraulic drives with electrically driven pump systems are currently still predominating, there is a clear trend towards hybrid systems as realized in the HybrEx® model.

HybrEx® – Innovative extrusion press generation for energy-efficient production

With HybrEx® extrusion presses from SMS group plant operators benefit from large energy savings – between 35 to 55 percent depending on the area of application. This is possible thanks to a newly developed hybrid drive: peripheral movements in which mainly speed and precision are of importance

are executed by quick electric servo drives, while the hydraulic drive is only used for generating high forces during extrusion process, discard shearing and cassette shifting.

The advantages at a glance:

- Reduced hydraulic drive only for press cylinder, discard shear and cassette shifting
- Low installation height and smaller base area
- Lower heat radiation and heat loss
- Reduced oil pendulum volume and downsized tank volume
- Reduction of dead-cycle time and maintenance effort
- Energy saving – up to 55 percent depending of area of application

Use of robots

SMS group meets every challenge and finds a solution, for example by means of robot systems. In Austria, a customer operates a 50-MN non-ferrous metal extrusion and tube press from SMS group. The extrusion press is equipped with fully automated handling equipment, while two industrial robots, a mandrel lubrication robot and a dummy block robot of SMS group take over all work operations previously performed manually. This saves time and increases the production flow.

Digital optimization tools for extrusion presses

Can the extrusion press actually achieve optimum results in each shift with respect to quality, performance and productivity? Although we are in the digital age, many operators of extrusion presses rely on their intuition or keep manual lists. In fact, already minor errors could be found that seriously put at stake the overall profitability of the plant.

To make sure that such scenario is prevented efficiently, the experts of the Technical Service of SMS group focus on a combination of measures which in total result in a holistic and sustainable solution: the use of most modern digital tools, the qualification of the operating staff through training courses by the plant manufacturer and smart, preventive maintenance concepts.

Transparent production

Four modern software tools which have been developed by SMS group and which are perfectly matched with the extrusion presses form the core. Thanks to their sensor system and the evaluation of large data volumes in real time, the tools PICOS®.NET, MIDIS®+, SMS-Metrics and CadEX® enable deep insights into the processes and the state respectively the behavior of the entire plant components. Dr. Thomas Winterfeldt, Division Head at SMS group: "The plant operator

enjoys transparency and receives supporting analyses that have never been available before. Even the smallest deviations are recognized at an early stage."

PICOS®.NET: with the Human-Machine-Interface (HMI) PICOS®.NET (Process Information and Control System) the press operator monitors and controls the entire process flow. The tool visualizes the production specifying the required process parameters. Actual values are displayed, an alarm function is available and diagnoses are provided if malfunctions in the production flow occur. PICOS®.NET coordinates the control of individual plant sections.

MIDIS®+: the technology package MIDIS®+ (Management Information Diagnostic Indication System) enables the management of all product-relevant data. With MIDIS®+, the OEE (Overall Equipment Effectiveness) can be improved. Through recording of numerous parameters and by clear visualization the plant operator easily detects potentials to increase the performance of his extrusion press.

SMS-Metrics: this is an innovative and efficient tool for gathering, saving and evaluating machine data in real time. It focuses on plant components. Thanks to transparency, plant operators are able to expand their process know-how. Evaluations can be easily prepared on a dashboard browser and be retrieved worldwide.

CadEX®: the CadEX® (Computer-Aided Direct Extrusion) software enables an optimization of the extrusion process by means of thermal simulation. In this way, productivity can be increased by up to ten percent. To achieve this, the heat balance is calculated for each billet to make it possible that the material is formed at the optimum billet and taper temperature.

Sound basis for economically efficient maintenance

The digital tools PICOS®.NET, MIDIS®+, SMS-Metrics and CadEX® allow us to evaluate and consider developments even over a long period of time. Ben Zander, Head of Technical Service Extrusion Presses at SMS group: "Based on these clear and illustrative analyses, we are able to selectively develop economically efficient maintenance concepts together with the customer. The tools identify trends and we are able to determine the best possible time and scope for maintenance measures in advance."

Smart alarm for extrusion presses

Smart alarm is a web-based application for different users such as operators, shift managers, maintenance staff or also

plant managers. In view of the countless alarms triggered every day in the plants, smart alarm provides you with a more complete overview and better control. Thanks to intelligent prioritization, various analysis options and other options to link solution hints and set automatic notifications, lengthy and complicated error analyses are simplified. A smart alarm displays all relevant alarms clearly on a dashboard with details of the plant tree. Responsible persons can be informed everywhere in good time by automatically sent SMS and email messages. For each area, a separate customizable view is also possible. Via long-term storage of historic alarm data alarm trends can be calculated that will permit to detect potential downtimes. The web-based application was developed by SMS digital, a subsidiary of SMS group.

Plug & Work at customer's request

If the customer desires, SMS group offers the proven Plug & Work concept safeguarding shorter commissioning times and faster plant rampup phases. With hybrid real-time simulation, SMS group illustrates mechanics, drive engineering and the technology of the respective plant individually and under realistic conditions. Already before delivery and startup the automation systems can be tested and optimized close to daily practice in the SMS group test center. With Plug & Work, future operating staff is also trained by SMS group experts with the help of 3D simulation on original control desks. Complex functions and processes can thus be displayed more clearly and comprehensibly. A large amount of automation components are therefore installed in a functional manner including original switch cabinets, computers, control desks and software in order to inspect and test them carefully before start-up by means of simulations under realistic conditions.

Handling systems

The handling equipment offered by OMAV is highly versatile and depends on the process types. For the production of architectural profiles soft alloys such as 6060 or 6063 are normally used. Heat treatments are performed with air and the equipment is usually lighter and of smaller size. In contrast to this are water-spray cooling systems used for automotive-related processes where harder alloys such as 6082 are employed. When using the quench treatment for industrial-related processes – these are bars of hard materials – OMAV always proposes stationary water-wave systems.

Water quenching

With regard to the water quenching process SMS group can draw on decades of experience. OMAV offers a particularly suited high-performance model. By using its own cooling simulation software the water volume is individually set on

various nozzles taking place in extrusion direction for each cooling zone. This model combines 23-bar spray water with high-pressure air knives.

The construction of the water quenching system is made entirely from AISI steel. Instruments such as valves, pumps and sensors are always accessible and thus enable simple and ergonomic control and maintenance. According to customer's requirement, the lifting system can be realized by hydraulic cylinders or alternatively in an electric manner. To determine the dimensioning of the cooling systems OMAV uses its self-developed software. The employed mathematical model has proved successful over the years.

Puller equipment with rack-and-pinion drive

In the past 20 years, all puller systems supplied by OMAV were provided with rack-and-pinion drive and the tensile force is from 1,000 to 100,000 newtons. With regard to positioning (no slipping possible) and motion control (no flexible elements such as chains or cables provided) a rack-and-pinion drive offers adequate advantages. The safety factor is guaranteed since the on-board motor and stiff kinematics ensure that the puller cannot break in case of collision.

Stretcher

The stretcher is a core component for extrusion. According to market requirements, OMAV offers various types with tensile forces from 0,3 up to 8 meganewtons.

Precision cutting saw

In the cold-cut area a precision cutting saw with optimum exhaust system is particularly important. It offers optimal chip extraction, double-blade machines for special sizes, double-cut machines for high production of short profiles, precision-cut dimensional stops up to ± 1 millimeter accuracy, fully automatic scrap management systems with scrap reduction up to 250 tons as well as automatic double- and triple-axis stacker systems and single, double and triple stackers for profiles up to 30 meters.

Aging and annealing furnace

As far as the aging and annealing furnace is concerned, SMS group supplies batch furnaces and continuous single or double batch furnaces. Depending on customer requirements, gas-fired furnaces with jet tubes or electric furnaces with regenerative burners in longitudinal and cross flow can be supplied.

Data management system

The service portfolio of OMAV is completed by an automatic

basket management with chain-/roller-type and all-round movable transport carriages, basket stacking systems, automatic overhead cranes and fully automated basket storage systems. Product data tracking, product recipe, reporting and primary management functions are taken over by the integrated data management system (DMS). A modular software package can be expanded according to customer needs.

Digitalization needs practice

Karsten Weiβ, Head of TECademy at SMS group, explains: "Digitalization in connection with servicing, maintenance, and operation of extrusion presses produces maximum benefits only when the staff has been particularly trained and qualified." For that reason, know-how transfer is also part of the range of services of SMS group Technical Service. "We enable operators and technicians to properly interpret



the state of maintenance by making use of these tools and thus safeguard yield and quality of the produced products within our planning and tolerances. This saves additional costs and prevents downtimes," says Dr. Hansjörg Hoppe, Head of Sales Extrusion Presses at SMS group. According to his words, the training courses not only contribute to a better but also to the same educational level of the operators so that yield and quality variations of different work-

shifts to be frequently observed in practice are avoided. It is important to implement the new systems in the plant of the operator quickly and secure the acceptance of staff members at the same time. "Only then the use of digital tool is a real success", Dr. Hansjörg Hoppe sums up his practical experiences. ◆

Technical Service everywhere and anytime

Irrespective of whether spare parts, upgrades, tailor-made service packages to support maintenance activities, special training courses or digital technologies for extrusion presses are required, the Technical Service of SMS group is available

at 50 locations worldwide to offer operators of extrusion presses an efficient service totally according to their requirements along the entire process chain.

An advantage is the comprehensive know-how of SMS group, whose staff members provide services tailored to customer's plant – on time, on budget and with the required quality. Operators of extrusion presses can fully rely on the services and global presence of SMS group – and this throughout the life cycle of their plant and always with the focus on increasing quality, productivity and availability.

Competence in complete solutions

In summary that means: no matter whether plant operators of extrusion presses are planning a new production plant or want to modernize their existing equipment, it is decisive that a reliable partner with specific know-how and long-time experience is able to assist. SMS group offers turnkey solutions for innovative plant technology – completely with buildings and infrastructure, customized logistics and necessary ancillary facilities. As general contractor or consortium leader SMS group ensures that projects are implemented swiftly and it matters to SMS group that all components are taken into service on schedule in addition to an on-time delivery of the main facilities to make sure that the customer can quickly focus again on his core business: a successful production. ◆



Cooling
table for eight-
inch extrusion
press line.



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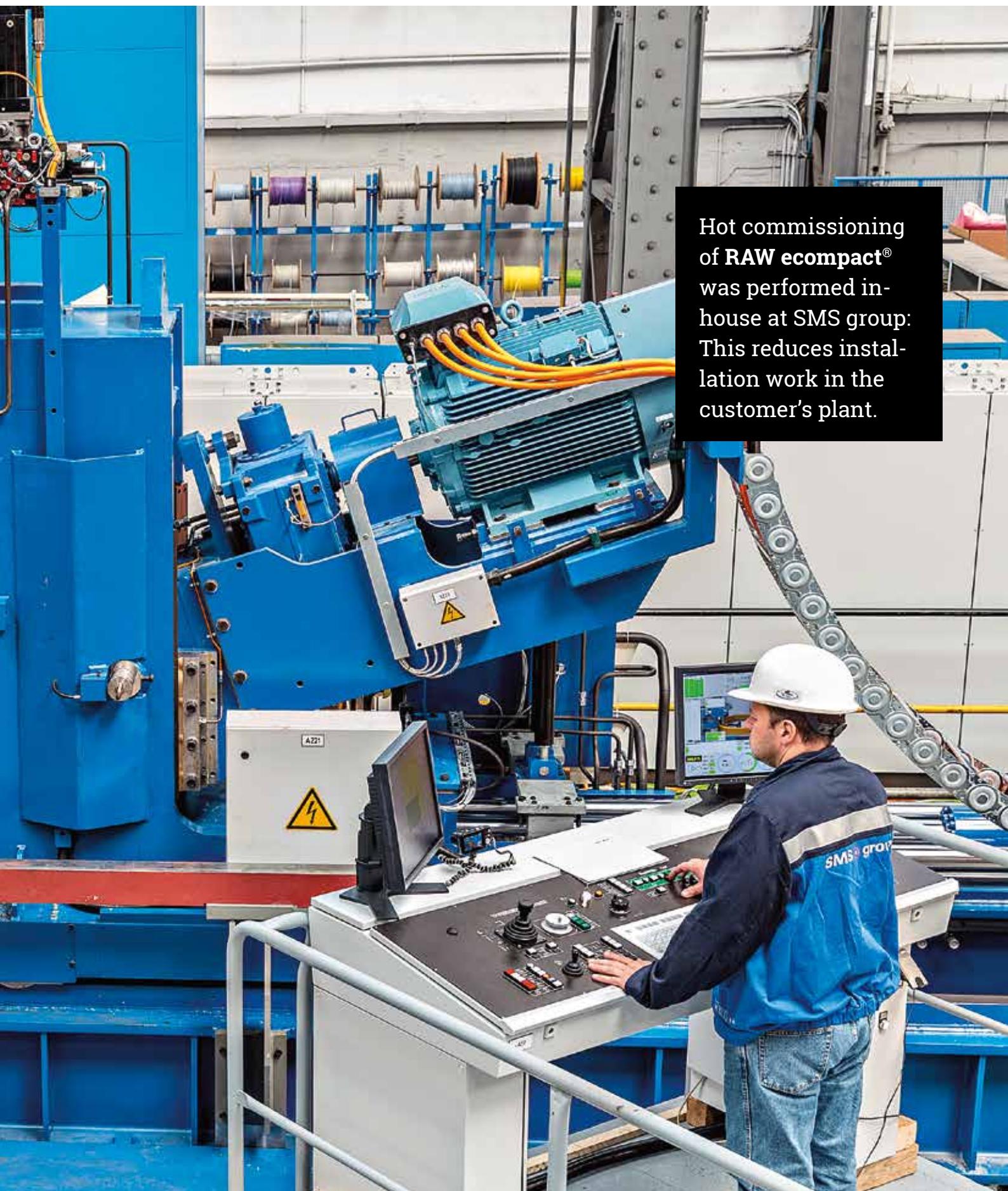
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The right drive unit every time

GERMANY

SMS group has set itself the goal of creating competitive advantages for its customers with innovative ideas. To this end, new drive concepts are being implemented for closed-die forging presses and ring rolling machines. These can also be transferred to other plants and equipment.





Hot commissioning of **RAW ecompact®** was performed in-house at SMS group: This reduces installation work in the customer's plant.

For years now, the demands on suppliers to the automotive industry have been heading in one direction only: up; stricter emission standards, increasing performance requirements, and higher expectations in terms of driving comfort are making life difficult for manufacturers – and are also having an impact on business in upstream sectors. Musashi Europe is facing this challenge head on. For almost 100 years, the company has been supplying components for driveline and chassis technology. At its plant in Bockenau, Germany, Musashi soon plans to manufacture large, rotationally symmetric forgings on a new press that utilizes an innovative drive concept that was designed and built by SMS group.

Low speed, great effect

The first new press of this kind went on stream in 2015. The machine, which was actually developed for test purposes at the time, quickly found a buyer. Its energy consumption – which is easily confirmed after more than 25 million strokes – is around 20 percent lower than comparable conventional presses. To exploit potential like this to its full, SMS group started looking at new drive system options. This led to the idea of utilizing torque motors. A characteristic feature of torque motors is their very high torque at relatively low rotational speed. Used in the right application, they replace a conventional servo motor and its complex reducing gear.

"Our customers in the automotive supply sector are under tremendous cost pressure," explains Martin Scholles, Project Manager for Sales Closed-die Forging Presses at SMS group in Mönchengladbach. "They have to demonstrate savings on an ongoing basis – in most cases these can be between two and three percent every year." At the same time, however, their expenditure is increasing – for wages and energy, for example. That is why automotive suppliers are under particular pressure to reduce costs.

Concentrated knowledge

At SMS group, sales, technology, and design experts pooled their knowledge to find solutions to the problem and gain a vital edge over the competition. And it worked. "No one else has this torque drive for presses," adds Scholles proudly.

At the first glance, the drivetrain of the press looks alike the drivetrain of a conventional press with a clutch and a flywheel. The special feature of the system is its type of acceleration. Instead of a standard motor with belt drive, it uses a torque drive, which is attached directly to the eccentric shaft. As soon as the shaft reaches the same speed as



The first MT 630 eccentric press with MEER-torque® drive unit at SONA BLW Präzisions-schmiede GmbH, Germany.



the flywheel, the clutch is engaged without any friction losses. The energy provided by the flywheel can then be used for the required forming work. After forging the clutch is released again. To decelerate the drivetrain, the torque motor is switched to generator mode. The energy is either fed back to the power supply net or charges the flywheel to bring it back up to speed. "In conventional presses, this energy would be lost but our press can use it again. In this way, we are now one step closer to perpetual motion," says Scholles.

The flywheel itself is also accelerated, maintained at speed and decelerated by a torque motor. This concept al-

lows a swift startup and stop of the flywheel which saves precious time when interventions at the tools are needed.

"The drive also separates motion sequences that, in the past, were necessarily performed in direct succession," remarks Scholles. "This gives us a greater degree of freedom, from which the customer can benefit." The time windows for transfers, for example, are longer as a result.

SMS group stands by flywheel concept

With the new press type, SMS group is standing by the design variant with built-in flywheel. "We firmly believe that this

is still the most efficient way of providing energy," says Scholles. By contrast, the servo presses offered by our competitors have no flywheels. Their energy input, which can be in the megawatt range, needs to be supplied from the mains. This results in voltage peaks and in higher energy consumption costs with rival products. "Our system has also peaks, but they stay within the intermediate circuit of the inverter. It has no exceptional external impact, i.e. on the mains."

The idea for this "unconventional servo press" was born in 2014. With this machine, the goal – as well as improving efficiency – was to make it more maintenance-friendly and so reduce costs for the customer even further. According to Scholles, this works because the rate of wear is far lower with this system. Whole assemblies are no longer required, like the operating brake, for example; only the motor is used for braking. In addition, the clutch can be sized smaller and shows virtually no wear, as the clutch is engaged when the eccentric shaft and flywheel are running at synchronous speed. Due to the use of the torque motors, all these advantages can be achieved while avoiding complex gearsets.

Electrohydraulic drives for ring rolling machines

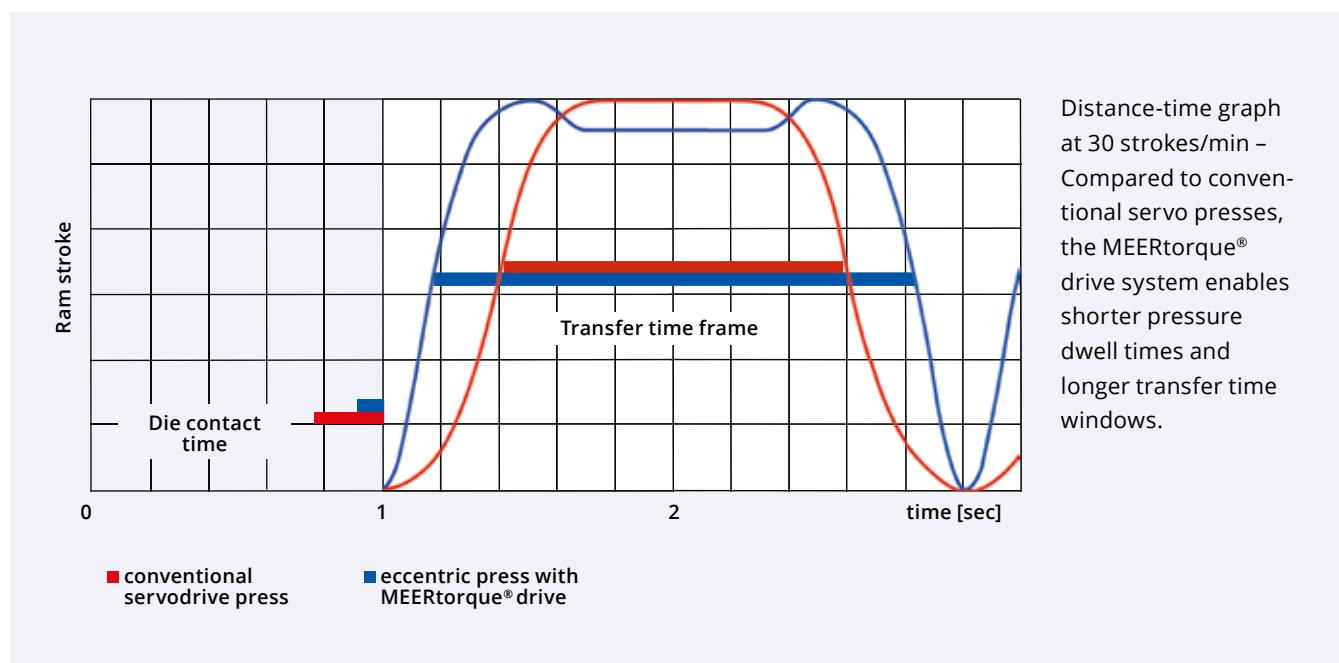
The new concept pays off in many respects at once. As a result, it meets the objective SMS group set itself – to work with customers to find the most cost-effective solution for man-

facturing the products they want. "We are always thinking about what we can change to create unique selling points that bring benefits to our customers," adds Martin Gellhaus, who is in charge of sales for ring and wheel rolling plants at SMS group. He prides himself on a new development for ring rolling machines that has been on the market since 2016. Up to now, machines with a rolling force of 100, 200, and 1,000 tons were sold.

What drove this development was the desire to reduce energy consumption, especially as the machines are at a standstill for up to half the time during the ring rolling process – either because they are being loaded or unloaded, or because the operator has to wait until the workpieces have been heated. So, to reduce energy losses resulting from these relatively high non-productive times, experts at SMS group came up with the idea of using electrohydraulic direct drives. "Our colleagues in the specialist departments have very wide-ranging knowledge of electrical and hydraulic systems," explains Gellhaus. "So for them the obvious question was: why not use the drives that work well in other areas for ring rolling machines too?"

Precisely controlled movements

With the electrohydraulic direct drive, a motor drives a pump, and this is converted into a movement in a hydraulic cylinder. If the speed of the pump is reduced, energy consumption



The drive power required is around 25 to 40 percent lower. The noise level is also reduced by about 15 percent.

and noise emission levels also drop significantly at the same time. In the case of ring rolling machines, these drives are mounted directly on the rolling axes. This means that they can be controlled extremely precisely – without the movement losing any of its force. When the axes are stationary, the pump is decelerated, at which point the motor does not consume any energy.

Therefore, the drive power required is around 25 to 40 percent lower. The noise level is also reduced by about 15 percent. Another major advantage of the concept known as RAW EH is the lower investment and operating costs compared to conventional ring rolling machines. As the central hydraulic system is no longer required, a room does not have to be built specifically for it, as was usually the case up to now. The costly and labor-intensive pipework is also no longer needed. The volume of hydraulic oil can be reduced by 90 percent. In addition, there is no danger of environmental pollution from escaping oil. This concept incorporates the expertise accumulated with over 500 ring rolling machines that have been built to date. The experience gained with the electrohydraulic compact drives shows just how well the position and force of the axes can be controlled. The reduced number of components means the system is highly robust and barely susceptible to faults.

The RAW ecompact® series was developed for newcomers to ring rolling as well as for job shops. It is available in five sizes – from 63 to 125 tons of rolling force. The RAW ecompact® boasts SMS group's Ecoplants plants label, which the company awards to efficient plant solutions.

Transferable concept

These innovations do not signify any major change for either SMS group engineers or customers. "Nothing is different for the operating personnel – the look and feels of the machine are still the same. We have to train the maintenance person-

nel, but that's also the case with conventional drive units," explains Martin Gellhaus. "In terms of the mechanical equipment, other cylinder types that are installed differently in the machine are used," he says in reference to his own team's work. "But those are typical modifications, which are an engineer's daily bread."

Gellhaus can well imagine fitting electrohydraulic drives in other products – like wheel blank presses, for example. "With wheel blank or dishing and piercing presses, we could apply the same principle we introduced for our ring blank presses," he continues. In 2014, SMS group developed a concept for utilizing speed-controlled axial piston pumps in a 2,000-ton ring blank press. Each cylinder drive train consists of four motors. What's special about this principle is that the power supply for the actual forging process is separated – in this case from the power used for lifting and lowering. The cylinder surface areas can be adjusted by means of valves: the cylinder surfaces are large during forging, which produces high forces at low press speeds. During rapid traversing movements – i.e. lifting and lowering – small surface areas bring about small forces and high speeds. The movement of the press is reversed by switching the rotational direction of the servo drives.

This allows energy to be used efficiently here too. As well as applying the power-on-demand principle, the potential energy of the moving mass during lowering is converted into electrical braking energy, just like the decompression energy and the elastic spring energy of the press frame in an unloaded state. This energy is saved in the converter's intermediate circuit and fed back into the mains. ♦



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IOT – SILENT HEROES IN PRODUCTION

WORLDWIDE

Production and maintenance departments co-determine the beat of extrusion plants. For decades, SMS group has been operating as manufacturer of extrusion presses and extrusion press technology and as constructor of increasingly higher-performance, more reliable and more flexible plants.



- During operation an extrusion plant generates large data volumes.
- These data have to be converted into information and used as basis for decisions.
- IOT and related technologies will significantly contribute to the profitability of an extrusion press operation.

Customers' requirements on higher quality, shorter delivery times and falling prices are growing. The management and the teams on the shop floor of SMS group had successfully mastered these and many other challenges for a long time. Then all of a sudden IOT – Internet of Things – arrived at the company gates. Soon afterwards, everybody started talking about terms such as Big Data, Artificial Intelligence (AI), Machine Learning or Digital Twins. Before you knew it, numerous new projects of utmost urgency were on the way, because swift action was top priority. In the end, the SMS group should not fall behind its competitors and risk its leading market position.

Back to square one?

After the dust of the digital gold rush started to settle, reality set in again. Questions were asked like: What does it take to be successful in the future? Which IOT projects create a quantifiable benefit for us? Do we have the ability / capacity to handle this on our own or do we need assistance? Hopefully you have found satisfying answers to those and probably several more questions that had to be asked. Maybe you were able to distill some basic insights from the IOT projects you had to deal with:

- We were successful already in the days before IOT because our decisions mostly proved to be correct in retrospect.
- There is no silver bullet that will solve all of our challenges in one go. Instead, we need to be able to advance step by step, evaluate the results carefully and hold on.



Advance

The comprehensive product and service portfolio of SMS group covers all areas and aspects of a commercial extrusion press operation. As OEM it designs and builds extrusion presses and the related equipment which are also taken into operation at the customer. The software packages PICOS®.NET, MIDIS®+ and CadEX® form the solid foundation to establish a stable production process environment including user interface, die management, billet length optimization, isothermal extrusion, shift reports (unplanned downtimes, alarms, productivity, etc.), data exchange between ERP systems and production machines and the collection of QA data. PICOS®.NET, MIDIS®+ and CadEX® are indispensable tools in numerous extrusion press operations around the world. Of course, the core functionalities can easily be extended by customer-specific features.

An operational extrusion plant produces a significant amount of data on a daily basis such as sensor readouts from furnaces, presses, runout section and other equipment. Order data, QA documentation and maintenance data add to complexity. Collecting and storing data must not end in itself. The collected data need to be transformed into information, the information then supports decision-making. SMS-Metrics and Smart Alarm convert data into comprehensible visualizations. Complex production scenarios can be perceived at a glance; drill-down mechanisms allow to quickly pursue the root cause of malfunctions. As SMS-Metrics and Smart Alarm are fully internet-based, information and notifications can be received anytime, anywhere with inter-net access without system-specific limitations.

Evaluate

Now we brought state-of-the-art extrusion press technology and adequate software to the shop floor. What might be left to do? Right: people, production engineers, maintenance specialists and technologists need to evaluate the plant data that were collected from the machines and transformed into information by smart software. And finally, decisions have to be taken based on the evaluation. Decisions that influence the three pillars of successful operations: cost, quality, output. Here, SMS group is able to assist its customers by providing extrusion technologists, engineers and last but not least data analysts that help to implement reliable and fast decision-making strategies at our customers. Then, decisions have to be implemented by optimizing processes (in production and/or in maintenance) or possibly also by directly modifying plant components.

INTERNET OF THINGS

The Internet of Things is a term used to describe an increasing networking with the internet between "smart" objects among each other as well as to the outside. The aim is to dissolve the boundaries between real and virtual world.

SMS group executes press optimizations and modernizations as well as maintenance operations already on a daily basis around the world together with its customers.

Hold on

Nothing is as old as the success of yesterday. Which technologies can be employed today to solve tomorrow's challenges? SMS group is convinced that IOT, AI, machine learning and related technologies will contribute to a profitable extrusion press operation in the future. Therefore, SMS has formed a team consisting of mechanical engineers, technologists, process engineers, software developers and data analysts eager to learn about new challenges from our customers. ♦



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A replacement that pays off

GERMANY

First high-speed open-die forging press with 3D-printed hydraulic manifold block from SMS group goes into operation at Gustav Grimm Edelstahlwerk.



GUIDO SCHRÖMGES,
HEAD OF PRODUCT MANAGEMENT
AND TECHNICAL FIELD SERVICE,
FORGING TECHNOLOGY, SMS GROUP

SMS group has put into operation the 31.5/34-MN high-speed open-die forging press at forging company Gustav Grimm Edelstahlwerk GmbH & CO. KG based in Remscheid, Germany. Demolition of the old and assembly of the new press, including the subsequent acceptance tests, were successfully completed during a construction phase of just under eleven weeks.

Mr. Schrömges, what are the advantages of the new open-die forging press for the customer?

Gustav Grimm specializes in the manufacture of forgings in high-alloy materials. The new high-speed forging press meets all the relevant requirements for this. Thanks to the built-in, state-of-the-art hydraulic and control systems, Gustav Grimm can reap the benefits of higher process efficiency, as the new high-speed forging press achieves time savings of around ten percent compared to the old press.

For quick tool changes, the press is equipped with a hydraulic forging-tool changing device. As the die turning and clamping device now comes with significantly fewer mechanical components, it requires much less maintenance.

In addition to the mechanical equipment SMS group also supplied core electrical and automation components. Which are worth mentioning?

The supplied high-speed open-die forging press is equipped with a data monitoring system. All target and actual parameters are captured during the forging process. In the event of a fault, the SMS specialists can analyze the machine condition and operating data, and perform a remote fault diagnosis within a short time. The data monitoring system can also be used for process optimization and quality assurance.

For the first time on this project, SMS group has applied an additively manufactured machine component for an open-die forging press. Could you explain this method in more detail? ▶





"With our new open-die forging press from SMS group, we can manufacture customized forgings of highest dimensional accuracy for our customers and expand our existing product mix even further. What impressed us most about the press were the high-quality, state-of-the-art components, the high level of automation, and the improved process efficiency."

Götz Grimm, CEO of Gustav Grimm Edelstahlwerk

The 3D-printed hydraulic manifold block designed by SMS group made of aluminium alloy, weighs just one tenth of the component conventionally designed in steel. The manifold block is used to distribute the hydraulic oil for operating and venting the cylinders. The optimized valve arrangement takes into account the direct, optimized flow of fluid through the individual channels and provides easier access to the manual valves for maintenance. The monolithic component design significantly reduces the number of potential leakage points. Despite its high complexity, the 3D-printed hydraulic manifold block can be delivered in much less time. ♦



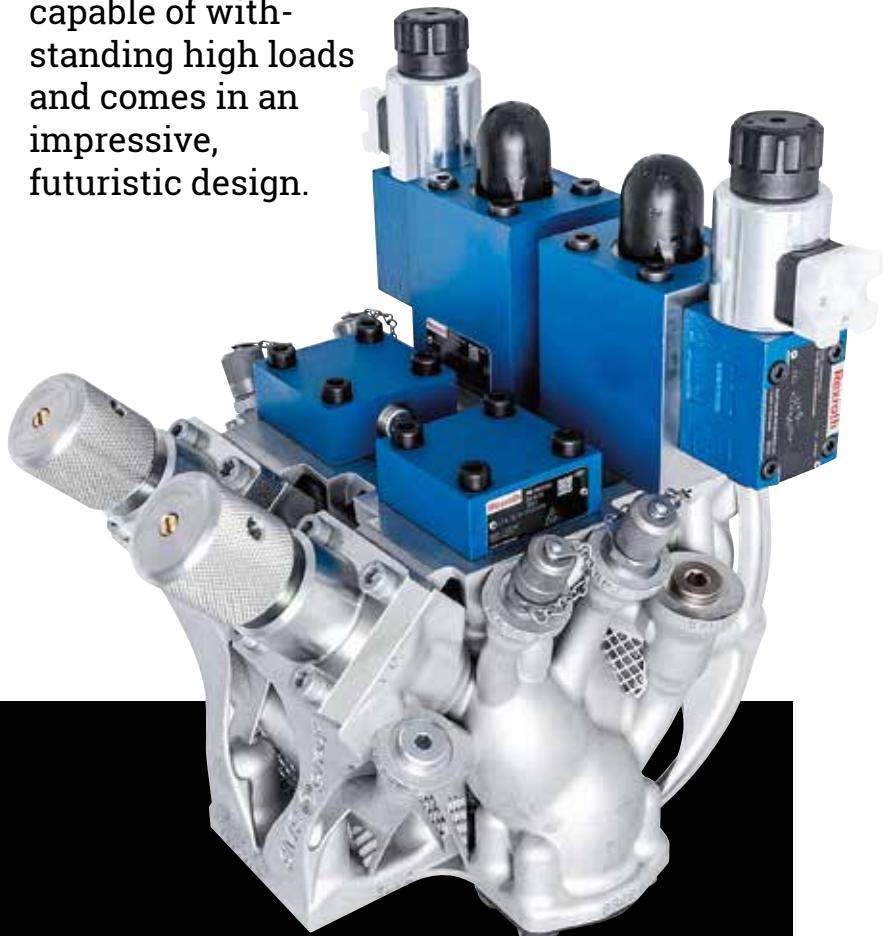
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The 3D-printed hydraulic manifold block developed by SMS group is capable of withstanding high loads and comes in an impressive, futuristic design.



3D-PRINTED HYDRAULIC MANIFOLD BLOCK

The 3D-printed hydraulic manifold block is lighter and more compact, and has a flow-optimized design.

Additive manufacturing enables a high degree of freedom on component design so that hydraulic components with a fluid-conducting function, in particular, represent optimum application scenarios. Thanks to this new manufacturing technology, channels are engineered for optimized flow and installation space plus mass are reduced due to a much more compact design. With this new approach of a function-oriented "inside out" design principle, the components are shaped from inside to outside. In this case, the fluid volume is first simulated and then the required wall thickness is generated, so that material is only used where it is actually needed for functional reasons.

Dr. Tobias Brune, Head of Additive Manufacturing and Powder Metallurgy, SMS group, summarizes the successful assignment at Gustav Grimm as follows:

"Additively manufactured components offering new opportunities beyond function-optimized design are becoming ever more important for us. This can be clearly seen on the introduced media block which has been provided with additively manufactured flow-optimized channels and which could be designed and manufactured much easier with 3D printing. This new construction and manufacturing method of such components with 3D printing enables us to reconsider the components completely. We are a driving force of such development and see very large potential for further innovations."

Higher productivity and energy efficiency

GREAT BRITAIN

Garner Aluminium Extrusions grants FAC for HybrEx®35 extrusion line.

Garner Aluminium Extrusions, also known as Garnalex, based in Denby, United Kingdom, has awarded SMS group the final acceptance certificate for the extrusion line it supplied. Together with OMAV S.p.A., consortium leader SMS group installed an integrated line with the HybrEx®35 as the core machine. OMAV S.p.A. supplied a billet heating system with billet furnace and billet saw, a runout system including an intensive profile cooling station, a profile stretcher, and a finishing saw. The addition of an ageing furnace rounds off the production chain.

The company, founded in 2018, plans to use the new press to manufacture aluminium profiles for a fully integrated door and window system. "The philosophy of our newly established business is to offer excellent products at high qual-

ity standard and competitive prices. With this HybrEx® extrusion line, we are not only investing in advanced technology from the market's leading plant constructor, but also benefiting from lower investment costs at the same time," emphasizes Roger Hartshorn, CEO Garner Aluminium Extrusions.

The new HybrEx® technology will enable the company to boost its productivity by up to 20 percent, depending on the relevant application, and to continue manufacturing high-quality products for its customers in an environmentally-friendly and resource-efficient way thanks to significantly lower energy consumption levels. With the hybrid drive concept developed for the HybrEx® extrusion press, the hydraulics are only used to generate the required forming forces. The ancillary movements of the extrusion press are performed by dynamic, electric servo drives.

Really compact design

The installed HybrEx®35, whose entire hydraulic drive unit has been integrated in the machine's soundproof enclosure, is capable of extruding billets with a diameter of up to 9 inches (228.6 millimeters) and a maximum length of 1,400 millimeters to produce aluminium and aluminium alloy profiles. The aluminium billets are loaded quickly and precisely into the center of the press using a patented linear loader. What's more, the HybrEx® boasts a deflection-resistant, three-part triple-layer counter beam and patented precision guide for the container and moving crosshead, thus enabling the production of high-precision profiles with extremely thin walls. ♦

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Up in the Air

CHINA

Chinese company Wuxi Paike orders the world's largest ring rolling machine for the production of engine rings

ENGINE RINGS

Thanks to the new ring rolling machine supplied by SMS group, Wuxi Paike New Materials Technology is able to roll safety-relevant components for aircraft engines made in titanium and nickel-based alloys.

Wuxi Paike New Materials Technology Co., Ltd., based in Wuxi, Jiangsu Province, China, has placed an order with SMS group to supply what will be the world's largest ring rolling machine for the manufacturing of components for aircraft engines. The RAW 1000/800-10000/1500-EH is the first ring rolling machine in the world capable of rolling jet engine rings with a maximum height of 1,500 mm. This dimensional capacity will enable Wuxi Paike to manufacture the rings required for the next generations of jet engines in a highly efficient way. "SMS group's decades of experience in ring rolling machine engineering and its significant technological edge over the competition were crucial factors in our decision to award the contract for the ring rolling machine to SMS group," says Mr. Shi, CEO of Wuxi Paike New Materials Technology.

Innovative direct drive concept

Another major advantage for the customer is the innovative electrohydraulic direct drive concept for all process axes developed by SMS group. The RAW-EH ring rolling machine offers not only more precise control compared to hydraulic-only drives, it also achieves substantial energy savings. The time required to assemble and install the machine is much shorter, as it does not have a central hydraulic station, consequently requiring much less foundation pipework. The ring rolling machine ordered will come with a radial rolling force of 1,000 tons and an axial force of 800 tons.

As well as the main product - rings for civil aircraft jet engines made in difficult-to-form materials such as titanium and nickel-based alloys - the machine will also be designed to roll carbon steel rings of up to a diameter of 10 meters. Thanks to this multi-purpose configuration, the first of its kind so far, Wuxi Paike is able to respond flexibly to both current and future market demands and to manufacture a wider range of different high-end products.

Wuxi Paike is a medium-sized company with 350 employees, based in Wuxi, Jiangsu Province, China. Forgings made by Wuxi Paike are used in the chemical, shipbuilding, power engineering, and aerospace industries. As a well-established manufacturer of seamless rolled rings for aerospace applications, Wuxi Paike has all the necessary infrastructure in place to operate the new ring rolling machine.

SMS group will supply the machine fully equipped with electrical equipment, hydraulics, rolling tools, and an innovative software and technology package. This order represents a further expansion of SMS group's leading market position in the field of ring rolling machines for the aerospace industry. ♦

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Innovative business segments

GERMANY

Outokumpu ordered a powder atomizing plant from SMS group to produce the basic material needed for 3D metal printing.

Outokumpu has selected SMS group to supply a powder atomizing plant for the production of high-quality metal powder for use in additive manufacturing. For SMS group this plant is the first one worldwide that has been contracted to the subscription model. The mutual agreement paves the way for a long-term and partnership-based cooperation and to both companies means exploring new territory.

According to the subscription business model, SMS group will remain the owner of the powder atomizing plant and will be refunded by operator Outokumpu proportionately to the volume of high-quality metal powder produced.

The powder atomizing plant will produce up to 330 tons of high-quality metal powder per year and is expected to start operation at the beginning of 2022.

Performance-based contract model

Tobias Brune, Head of Additive Manufacturing & Powder Metallurgy at SMS group, says: "Right from the beginning, the whole project sailed under the flag of partnership. The performance-based con-

tract model clearly shows that, jointly with the customer, our company as the Leading Partner in the World of Metals is breaking new ground and will thus advance its expertise. Additionally, the subscription contract model enables both companies to focus on their core competencies and hence to be successful in the market."

Outokumpu is a leading producer of stainless steel products. With plants in Finland, Germany, Great Britain, Sweden, the U.S.A. and Mexico, and a global service center network the company offers its customers in the most diverse industrial sectors a wide range of tailored solutions comprising a great variety of stainless steel products for nearly all applications. These include architecture, infrastructure and the automotive industry as well as heavy industries, medical technology or household appliances.

The scope of supply by SMS group will comprise the complete powder atomizing plant including grading equipment, spare parts over the entire contract duration and digital solutions. The powder atomizing plant, including induction melter, atomizer, two cyclones and filter elements, to be supplied by SMS group is designed for the complete process to take place in an inert atmosphere. With this process situation it is possible to measure temperature, take samples and charge material without disturbing the existing atmosphere. Arranged beneath the distributor which contains the melted material there is the atomizing nozzle. The melt runs through this jet nozzle and is atomized by means of inert gas in the atomization tower. Thereafter, the powder produced is carried to the cyclone unit, also under inert conditions, separated from the inert gas and collected in containers. Finally, the finished metal powder can be sieved and graded.

The metal powder atomizing plant is designed to atomize stainless steel grades, maraging steels, high-grade steels, superalloys, nickel-based alloys, cobalt-chromium alloys and alloys on copper basis, among others.



SMS group will supply a metal powder atomizing plant to Outokumpu.

The starting stock may be lumpy material (for example metal scrap, new metals, master alloys) or powder (fine or coarse fractions) not complying with the specification.

SMS digital, an SMS group company, will supply a smart alarm system providing better overview and improved control in alarm situations caused inside the plant. Thanks to intelligent priority scheduling and direct linking of indications for possible solutions, the system permits plant availability to be increased and cares for better system understanding through automated notifications.

Parallel to establishing the plant at Outokumpu's site, the customer's staff will be trained at the powder atomizing plant SMS group is operating at its Mönchengladbach location. ♦

"As the inventors of stainless steel, we are aiming to continuously advance innovation as well as the development and distribution of this versatile and sustainable material. In doing so we are always searching for innovative applications suited to enthuse our customers for new products. Metal powder for additive manufacturing purposes is such an innovative business segment. We are looking forward to entering it jointly with SMS group."

Philip Salfeld, Manager Strategic Investments, Outokumpu

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New coiler mandrel design presented

U.S.A.

The newly developed closed construction type characterized by increased rigidity and reduced wear susceptibility.

During various meetings between several American customers and SMS group hot coiler mandrels were in the focus in the U.S.A. On this occasion, SMS group introduced the new closed coiler mandrel design and comprehensive possibilities of the SMS group workshop in Washington, Pennsylvania.

Closed coiler mandrel design

Many U.S. plant operators still have an open coiler mandrel design (four-finger design). Compared to the obsolete version, the advantages of SMS group's newly developed closed construction type are characterized by increased rigidity and reduced wear susceptibility of the coiler mandrel. Consequently, it achieves a longer service life in the plant which means higher tonnages during operating time. Another advantage is an internal lubrication system with the effect that hose lines can almost be completely dispensed with.





View on optimized grease lubrication system without mounted protective cover.

Closed coiler mandrel with internal lubrication.



From old to new without plant adaptations

With the new closed coiler mandrel design the plant operator is provided with a "Plug and Play" replacement unit instead of an older open coiler mandrel. A revamp of other plant parts is thus not required. Improvements of the main components such as mandrel body and shaft for mandrel elongation become apparent in the design. By using new materials on wear parts and core components and by special upgrading of components customers also benefit from the new design of the coiler mandrel.

Additional modernization including optimization of the coiler section and maintaining the drive unit is also possible and has been implemented several times. This process can be realized for example on a coiler mandrel which is inserted in a gearbox (gearwheel on mandrel body) and is not driven from behind by an independent gear unit. Modernizations of this type have been realized by SMS group several times for customers who are in possession of such coiler mandrel designs.

The possibilities of the SMS workshop in Washington, Pennsylvania, include repairing core components such as HGC cylinders, CVC® shifting and bending systems, spindles, gearboxes, oil film bearings, chocks and coiler mandrels. As a result, coiler mandrels of old design can also be repaired in the workshop and improved with upgrades.

In addition, SMS group provides on-site service in the mandrel area. This includes measuring the coiler area to determine deviations of individual actuators and to define together with the customer measures for aligning or replacing components. Regular repair work increases the service life and ensures consistent quality and reliability of the component.

Plant operators show great interest in coiler technology

After initial customer visits the first measuring assignment took place on the coiler plant at a CSP® plant operator. Another customer announced to send its next coiler mandrel for repair to the workshop in Washington, Pennsylvania. The overall customer feedback was very positive and for that reason other customer visits are planned by SMS experts from various departments. ♦

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Successful modernization

INTERVIEW

In 2003 Třinecké Železárny had ordered from SMS group two new converter vessels complete with suspension systems, trunnion rings and two new tilting drives. This modernization has led to a significant increase in capacity and reliability of the steel plant. After 15 years of operation, the bull gears of the second gear had shown some wear and Třinecké Železárny decided to have both tilting drives checked and modernized in order to keep availability and reliability at the highest possible level. In 2018 and 2019, both tilting drives were replaced during regular shutdowns. In an interview, René Dzivý, Head of Steel Plant Maintenance at Třinecké Železárny, recalls the challenges and milestones of the project.



RENÉ DZIVÝ,
HEAD OF STEEL PLANT MAINTENANCE
AT TŘINECKÉ ŽELEZÁRNY

Mr. Dzivý, what were the reasons to order the new tilting drives from SMS group?

Our experience with the existing drives had been very good. However, at regular inspections, which were carried out twice a year, we had detected some damage on the gearing of the main gearbox and had been observing that that damage was increasing. Therefore, we decided to replace both drives at appropriate times to avoid unplanned downtimes.

What role did the fact that the project was divided into two sections play in the decision?

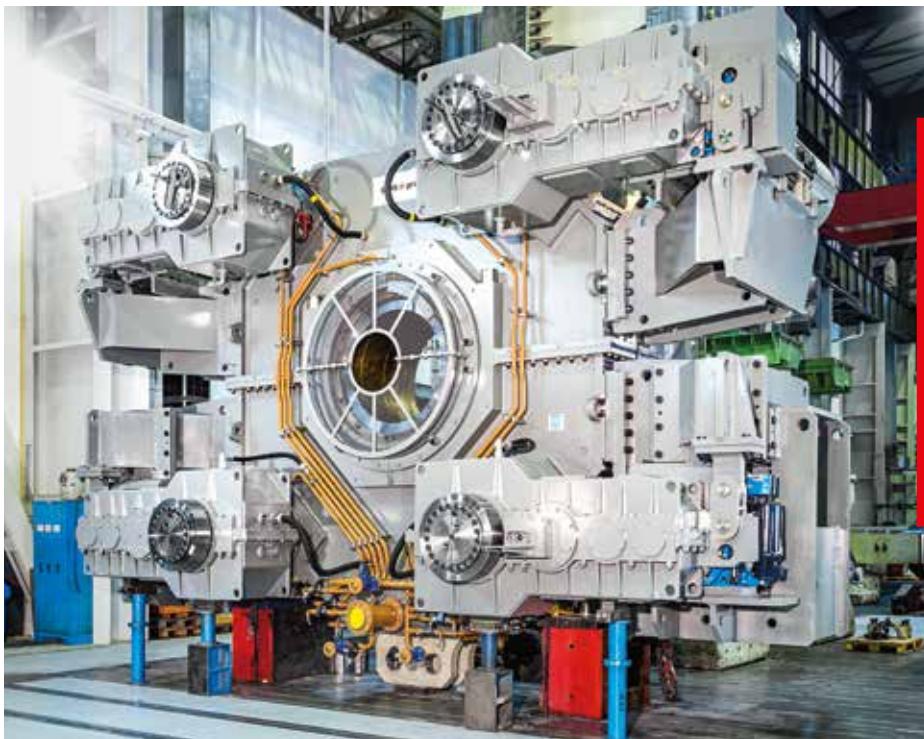
The main reason was that the time needed to replace each one of the drives would have exceeded the duration of a regular converter shutdown.

Every year, we perform major repairs on one of the two converters, in addition to the regular converter repairs. We cannot stop the steel plant completely because we have to make sure that the hot metal from the blast furnaces is processed. Therefore, the second converter has to compensate the loss of production caused by the shutdown of the first converter. Of course, the operation of the blast furnaces and of the sinter and coke oven plants have to be adapted to this situation.

What was the interaction with SMS group like during the project time?

The converter steel plant is the heart of our company. Any unplanned interruption of production has an impact on other plant facilities. That was why we visited the workshops in Hilchenbach several times during the production of the gearboxes to check the progress and, in particular, to be present during the factory acceptance tests.

After the preliminary acceptance in the Hilchenbach workshop had been completed, SMS delivered the tilting



Two tilt drives were replaced at Třinecké Železárny.

drives to Trinec ready for installation well on time, actually two weeks before the converter shutdown. What were the main challenges that had to be overcome during the installation phase?

Probably the most critical situation occurred in 2018 when we were replacing the gearbox on converter No. 2 and found that we could not pull the primary gearboxes out of the pinion shafts as planned. We eventually found an alternative method of dismantling the primary gearbox and were able to finish the job on time.

After analyzing the causes together with SMS group, we found a better method of disassembling the primary gearboxes from the pinion shafts. We used this method on converter No. 2 in 2019, with great success.

How would you describe the support by the SMS group experts?

To put it shortly: the support was excellent. Whether in 2018, when we were looking for an alternative way of pulling out the primary gearboxes under great time pressure, or in 2019, when SMS proposed several variants for disassembling the primary gearboxes.

How would you describe your experience with the original tilting drive equipment?

The original drive from 2004 was absolutely reliable and easy to maintain. Of course, the frequency of replacing consumables such as the rubber parts of the coupling between the motor and the primary gearboxes increased with time. How-

ever, all of these exchanges were preventive. There has never been a downtime due to a failure of the tilting drive.

The new gearboxes correspond to the original gearboxes, however, with some minor improvements. Have your expectations regarding the new tilting gears been met?

Frankly, it is probably too early to judge. As the original gearboxes were already very reliable, we do not expect any significant increase in reliability from the new equipment. As to the minor problems with the rubber elements of the couplings which we had been experiencing towards the end of life of the old gearboxes: we replaced the rubber parts for the first time after the new drives had been in operation for about a year. We found that most of the rubber elements were in good condition, almost as new.

What are the next steps you are planning for the steel plant and the downstream areas? Do you have any requests or recommendations for SMS group?

We plan to further improve the existing steel plant step by step, especially with a view to automation and reducing the impact of the plant on the environment. We certainly plan to get in contact with SMS group requesting an offer for the implementation of these upcoming enhancements. ♦





Always the right service

WORLDWIDE

Technical Service for cold pilger mills.

- The Technical Service of SMS group is always available to plant operators during the entire life cycle of their plants and equipment.
- 50 service locations worldwide offer customers customized high-performance service packages.
- Also in emergency cases and in the event of unscheduled outages you can rely on the Technical Service around the clock.

Cold pilger mills make use of a unique cold forming process which is more cost efficient as well as indispensable for many applications. Thanks to their design, the cold pilger mills of SMS group are characterized by high productivity and availability which is decisive for the competitiveness of SMS customers. Regular maintenance measures and inspections from the comprehensive SMS Service portfolio are essential for maintaining these features over the entire utilization period of the cold pilger mills.

The Technical Service of SMS group is available to plant operators to assist during the entire life cycle of their plants, for example with spare parts, modernizations, customized maintenance concepts, digital concepts or also special training. The 50 locations worldwide of the Technical Service offer high-performance service packages according to the wishes of the customer. With their concentrated know-how, SMS staff members provide services tailored specifically to the plant – and above all on time, in budget and according to quality standards.

Repair and upgrading

To make sure that plant operators are focused on core competencies SMS group offers a large service portfolio along the entire value-added chain.

The concept of the service workshop in Mönchengladbach provides the basis for maximum customer benefit through optimized processes and highly experienced staff. In the service workshop all transportable components of the cold pilger mills such as crank drive, mill stand, roll assemblies, clamping slide, mandrel thrust block and pinch roll units can be repaired and modernized.

Field Service

You can rely on the Service of SMS group around the clock, even in cases of emergency and in the event of unscheduled outages. A worldwide service network and local teams of technicians provide for sufficient personnel to carry out repair work and solve problems rapidly and at short notice.

Preventive maintenance

Planning, frequency and individual contents of maintenance measures are contractually stipulated and are exactly matched to the equipment and customer needs.

Advantages of preventive maintenance at a glance:

- Use of individual components until the end of their technical lifetime
- Optimum balance between operational safety, operating cost and investment capital
- Minimization of scheduled and unscheduled production shutdowns
- Consistent product quality

Individual training courses

Different plants and various processes require specific expertise and individually adapted technical knowledge which may vary widely from machine to machine. These different requirements in mind, SMS group offers completely individual training measures tailored to the specific requirements of their customers. The focal point of all training concepts is to provide detailed expertise of the most important operating parameters of all machines and components.

With a view to strengthen the competence of the plant operator as manufacturer of high-end products, SMS group transfers expert know-how in mechanical engineering and in cold pilger technology to its customers. Apart from providing theoretical knowledge, the focus is also on the practical implementation.

Individually tailored training courses:

- Operation
- Process and technology
- Repair and maintenance (mechanics, media and electrics)
- Plant control

Equipment checks

To be able to safeguard high plant availability and cost efficiency, an early identification of critical components and potential failures above all is elementary. In the course of an equipment check the plant operator receives targeted recommendations for maintenance, repair and modernization measures. In addition to that, SMS group provides machine-specific check lists and detailed service reports.

Services at a glance:

- Determination of machine status
- Evaluation of maintenance condition
- Analysis of weak points
- Demonstration of improvement potential
- Detailed service report incl. machine history
- Recommendations for spare parts
- Explanation of maintenance work and proposals for modernization measures

Digital concepts

Digitalization offers new opportunities for increasing efficiency and it is an essential module on the way to the learning (steel) plant.

Smart maintenance solutions

Smart Maintenance Solutions is a database- and software-aided linkage between individual digital solutions in the equipment area and the interaction with solutions in the areas of process and quality.

eDoc – the first step in digitalization

With the eDoc platform of SMS group the plant operator obtains fast and easy access to spare parts information for optimal maintenance of existing and new plants.

Advantages at a glance:

- Entire plant transparency from construction site up to single part
- Smart and quick navigation through the entire equipment
- Adding to shopping basket function for online tendering (spare parts enquiry)



To make sure that plant operators are focused on core competences, SMS group provides a comprehensive service portfolio.



Equipment checks provide plant operators with specific instructions for maintenance, repair and modernization measures.

- Suited for PCs and mobile devices – either in the office or in the factory
- Simple and transparent price model

Genius CM® – early warning system against failures

Genius CM® is a modularly designed online plant monitoring system controlling and documenting the current state of components subject to wear and failure.

Advantages at a glance:

- Less unscheduled stoppages with follow-up costs
- Higher plant availability
- Reduction of downtimes through fast diagnosis and remote maintenance service
- Utilization of maximum service life and thus less operating and maintenance costs
- Improvement of general plant safety

Smart Alarm – intelligent alarm and maintenance management

Smart Alarm provides clearer overview and better control of many alarms, warnings and instructions displayed every day on the operating monitors of the plant. Thanks to intelligent prioritization, direct linkage of hints to solutions, automatic notifications and intelligent analyses, Smart Alarm does away with lengthy error analyses. ♦

 **Markus Hauer**
markus.hauer@sms-group.com



X-Roll® Oil Bearing

**Backup roll chock
and oil bearing
with new BM
fastening system.**

Less is more

GERMANY

Reduced wear by converting the fastening units on the X-Roll® oil bearings in the temper rolling mill 3 at thyssenkrupp Rasselstein GmbH while simultaneously increasing safety at work.

Oil film bearings in older installations are typically pulled on and off by turning a ring lock nut seated on the roll journal. Due to large dimensions and the resulting high frictional resistance, the lock nut is tightened by means of wire rope sling and shop crane. The reproducibility and the control of the pulling-on forces is difficult, the risk of accidents is high.

A conversion to a hydraulic fastening system – as it is standard with modern oil bearings – is obvious, but often fails when it comes to the available assembly space, the prohibition of changing the existing backup roll geometry or an insufficient budget.

In response to this situation, SMS group has developed a new cost-effective mechanical fastening system. The principle of the BM (Bolt Mount) fastening system is based on generating the required pulling-on and -off forces by several screws uniformly distributed over the circumference tightened in a torque-controlled, reproducible and safe manner. The existing backup roll geometry is maintained. Safeguard-

ing of the axially positioned bearings on the roll journal takes place through form fitting and on a decoupled basis from the pulling-on force.

The practicability has been tested and optimized for 18 months in the temper rolling mill 3 at thyssenkrupp Rasselstein in Andernach, Germany, when four BM fastening systems were employed during 100 pulling-on and -off operations and more than one million tons of tinplate produced. thyssenkrupp Rasselstein confirms the compliance with all requirements on the new BM fastening system. In addition to that, the assumption was confirmed that in the past the bearings had always been fastened too tightly and in a less gently manner to the material. ♦

 **Roland Will**
roland.will@sms-group.com

“With the new BM fastening system we have increased safety at work in our roll workshop and thanks to a controlled pulling-on force, we hardly observe any wear on journal sleeves.”

Martin Höß, Roll Grinding Shop, thyssenkrupp Rasselstein

Hydraulic adjustments tested

GERMANY

Whether it is a new installation or a repair measure – reliability is guaranteed on the test stand of SMS group using a test method for hydraulic adjusting cylinders and position encoders.

Hydraulic adjusting cylinders and their position encoders are crucial components in the rolling mill. Rolling gaps are for example adjusted in flat rolling mills with such sophisticated cylinder systems to make sure that precise product thicknesses are generated. Abnormal operation may result in poor strip quality or unscheduled downtimes.

Each adjusting cylinder of SMS group is tested on its own test stand prior to being delivered. This is realized in a performance test by generating a pressure of up to 500 bar. Adjusting or special cylinders can be clamped with diameters of up to 2,290 millimeters and a height of up to 3,440 milli-

meters. The maximum test force amounts to 25,750 kilone-wtons. Apart from the performance parameters of the pressure and function test, a static and dynamic hysteresis test can also be carried out.

Steady improvement of components

The computer-based test results according to DIN ISO 10100 are neatly documented and then saved in the internal database to ensure that they can also be integrated in a repair history later on.

The hydraulic adjustments are subject to a strict repair procedure. Service staff of SMS group evaluates the damage already prior and during disassembly work to draw conclusions on possible process disturbances which are saved in the database in a written or pictorial manner.

During a repair measure, each adjusting cylinder and its position encoder is provided with a marking which is an important indicator for SMS group as OEM in the future. For example, the benefit of an upgrade is very well comprehensible and the experiences gained and the data collected enable steady improvements of the components with regard to performance, reliability and quality.

In recent years, SMS group has performed several hundred repairs for adjusting cylinders and position encoders, including also components for third-party installations. ♦

 **Stefan Gerhard**

stefan.gerhard@sms-group.com



Prior to being delivered, each adjusting cylinder is tested on a test stand.

Choosing the right time

WORLDWIDE

When do maintenance measures or replacements of wearing parts make sense? Correct – always when the availability of the plant can be increased and costs can be saved.

Maintenance work is often carried out according to standardized maintenance schedules but parts are also replaced when the limit of their service life has by far not been reached. In the same way, it may happen that parts are in use for too long and are then failing during operation. This may result in unscheduled downtimes disrupting the entire production process and in huge financial losses. Optimal utilization of parts and a condition-oriented maintenance strategy may increase the efficiency of the plant significantly and reasonably save costs.

With Genius CM®, SMS group offers an adequate solution for all plant operators. The modularly designed online monitoring system controls and documents the current condition of critical components

and it monitors the actual loads for the determination of the device status. On this basis, a condition-oriented maintenance plan can be created and corresponding measures to prevent a production stoppage or its consequences can be executed – before a serious error occurs.

Several individual modules on a common platform

The individual modules have been particularly designed for the respective tasks and are equipped with a corresponding sensor system adapted to the environment. Data can be transferred via different transmission types, for example via cable or also via Bluetooth. By using a modular structure, the plants can also be upgraded step by step.

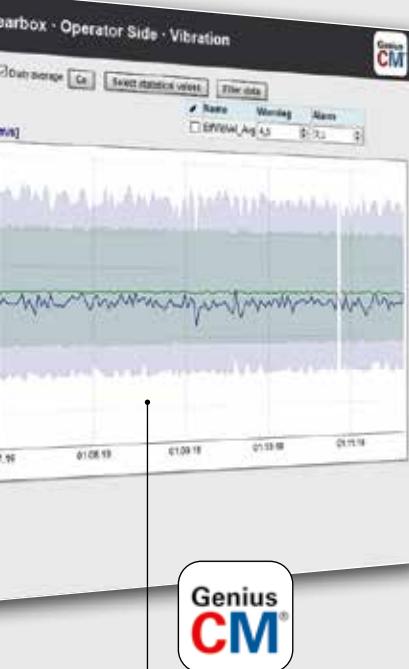
A first step:

The Genius CM® Mobile Service

Genius CM® Mobile Service is not a replacement for the fixed installation: however, as an entry-level solution for preventive maintenance it does come very close to it.

The mobile service includes all cables, software and licenses and our field service experts install it as a plug-in device with the corresponding equipment and the portable measuring kit can be kept in measuring mode close to the gear units for hours, days, or weeks at a time. Upon request, all recordings can





MODULAR

The modularly designed online monitoring system Genius CM® controls and documents the current condition of critical components offering adequate solutions for each plant operator.



The portable measuring kit of SMS group is fully equipped and ready for installation.

CONDITION ASSESSMENT AMONG OTHERS FOR:

- Torque of entire drive train
- Oil film bearing
- Stand vibrations
- Caster oscillation
- Gear teeth
- Converter tilting drives
- Anti-friction bearings
- Upsetting presses
- Gear lubrication
- and many more
- Hydraulic servo control

be viewed during the operation via mySMS group platform. After use, the customer receives an extensive analysis.

Genius CM® Mobile Service can measure up to seven vibration signals and one speed signal. Emerging or imminent anti-friction bearing defects are identified and all the data collected is compared with the rolling and process data. Repetitive measurements, e.g. once or twice a year, give customers the security that no problems will occur during production, for instance due to a bearing failure in the gears.

The measuring procedure is preconfigured with all the necessary details of the bearing and gear characteristics. Up to now, the Genius CM® software

and the requisite analyses were preconfigured for single-stage and two-stage spur gears, mill pinion gears, and spur pinion gears. Other types of gear unit or plant components can be added at short notice and the use of Genius CM® Mobile Service is not restricted to gears of SMS group. ♦



Wolfgang Scheffel

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Intelligent services and new business models

WORLDWIDE

Our business areas Technical Service, Digitalization and Electrical and Automation Systems have seen continuous growth during the last few years. Permanent exchange and regular intermeshing between these three areas has led to increasingly sophisticated smart products and services that open up opportunities for new business models that provide long-term added value for the plant operators in the form of enhanced plant performance, and optimized operating and maintenance costs.





Digitalization – enabler for new service solutions

At SMS group, the new-plants and service business areas work hand in hand. As Leading Partner, SMS group's goal is to provide its customers maximum support during the complete life cycle of their plants and machines and come up with suitable and efficient solutions whenever new challenges arise. During the last few years, SMS group has developed – and is continuously expanding – a comprehensive service portfolio, especially by adding smart, digital solutions.

Digitalization has a tremendous effect not only on our new-plants business, but also on our approach to maintenance, which is closely linked with our service business. As a matter of course, the vision of the Learning Steel Mill also encompasses maintenance as an essential

area. As early as years ago, SMS group established digitalization technology as a key entity within its organization and has expanded its digital service offer ever since. The Smart Maintenance & Asset Health Solutions comprise a whole host of products, from eDoc (electronic equipment documentation) to the IMMS (Integrated Maintenance Management System) and the Genius CM® (Condition Monitoring) system, from Smart Alarm to the 24/7 service hotline through to Automation Remote Support. Our energy management solutions round out our strong service portfolio. The SMS group-developed Data Factory assures effective correlations between the various service solutions and provides the platform for the smart use and efficient evaluation of the captured data. All this is based on the SMS group-developed X-Pact® automation solutions. These solutions contain specific, technological functions, models and assistance systems, all of which reduce process control and plant operation activities to a minimum while enabling maximum product quality. By making optimal use of the data provided by the X-Pact® automation systems and supported by Artificial Intelligence, predictive models help to enhance plant availability, improve product quality and reduce operating and maintenance costs.

SMS group continuously adds new digital products to its range of Smart Maintenance & Asset Health Solutions in close cooperation with SMS digital, a main focus being on real-time condition monitoring and predictive maintenance using Artificial Intelligence and Machine Learning capabilities.

Performance-dependent billing models forge partnerships

The world over we see an increasing number of all-in maintenance packages handled by service providers present right at the operators' production facilities or in their workshops. SMS group has responded to this trend by providing Technical Outsourcing Services. Under this

EQUIPMENT- AS-A-SERVICE

means the integration of SMS group service and expertise in the fields of production equipment, electrics and automation, digitalization and technical service into a customized, performance-enhancing package, from which plant operators benefit in the form of the security of a long-term service agreement and of a performance-based billing system.

business model SMS group takes over a wide range of services, including all maintenance activities of complete plants. During their maintenance missions, the local SMS group teams can – if necessary – at any time call on expert support via the international 24/7 hotline and on Remote Support by automation and technology specialists from the global SMS group network. In this way, the SMS group teams ensure with their know how that the customers' plants are always in an optimum state, while boosting availability and reducing maintenance costs. This gives plant operators extra time to concentrate fully on the production and the marketing of their products.

SMS group also offers performance-dependent billing models, for online and offline maintenance of continuous casting machines and the operation of roll shops, for example. In performance-based service agreements, the amounts payable depend on how well the agreed performance targets have been hit. Possible performance indicators are production volumes or plant availability, for example. As SMS group guarantees the achievement of the specified performance targets under this service model, SMS group also shares the plant operation risk. This gives customers the security that they have a partner at their side who is definitely willing to support them in being successful. Numerous references demonstrate SMS group's expertise in this field and the successful implementation of this model. The fact that longstanding customers have been regularly prolonging the agreements is proof of their satisfaction with this service model and has led to service partnerships lasting for more than a decade.

Intensified focus on value adding with Equipment-as-a-Service

Customers have also been looking increasingly for options to reduce capital investments and the amount of tied-up capital, while concentrating their assets on their core value-adding

activities. For these customer requirements, SMS group offers models under which the customers no longer buy the components, machinery or ancillary equipment from SMS group, but use them within the framework of a service package. These Equipment-as-a-Service models are made up of enhanced customized service packages. In addition to providing common services, these models may also include services aimed at optimizing operating processes in addition to a comfortable pay-per-use financing model. Thus the customers can avoid high capital investments in production equipment. Instead they can conclude long-term service agreements in which performance targets are specified and the services are billed as performance-dependent operating costs.

Most recently, SMS group has entered into an Equipment-as-a-Service contract for a powder atomization plant with Outokumpu: while SMS group will remain the owner of the plant, Outokumpu, as operator of the plant, will pay SMS group pro rata of the quantity of stainless steel powder produced. SMS group is working on expanding the applicability of this model to other areas: ring rolling machines, for example, or components such as coiler mandrels in flat rolling mills, or even complete hydraulic systems for production plants and machinery, and, last but not least, essential electrical and automation solutions. The customers trust in SMS group because they know they can always rely on SMS group providing optimum solutions for their requirements. With the Equipment-as-a-Service business model, SMS group can provide tailor-made solutions that create a win-win situation for both partners. ♦

For more information on how the predictive models developed by SMS group generate added value, please turn to page 150 ff.

Ready for the next level

WORLDWIDE

Predictively controlling the hot-rolling process by means of a self-learning, self-optimizing model.

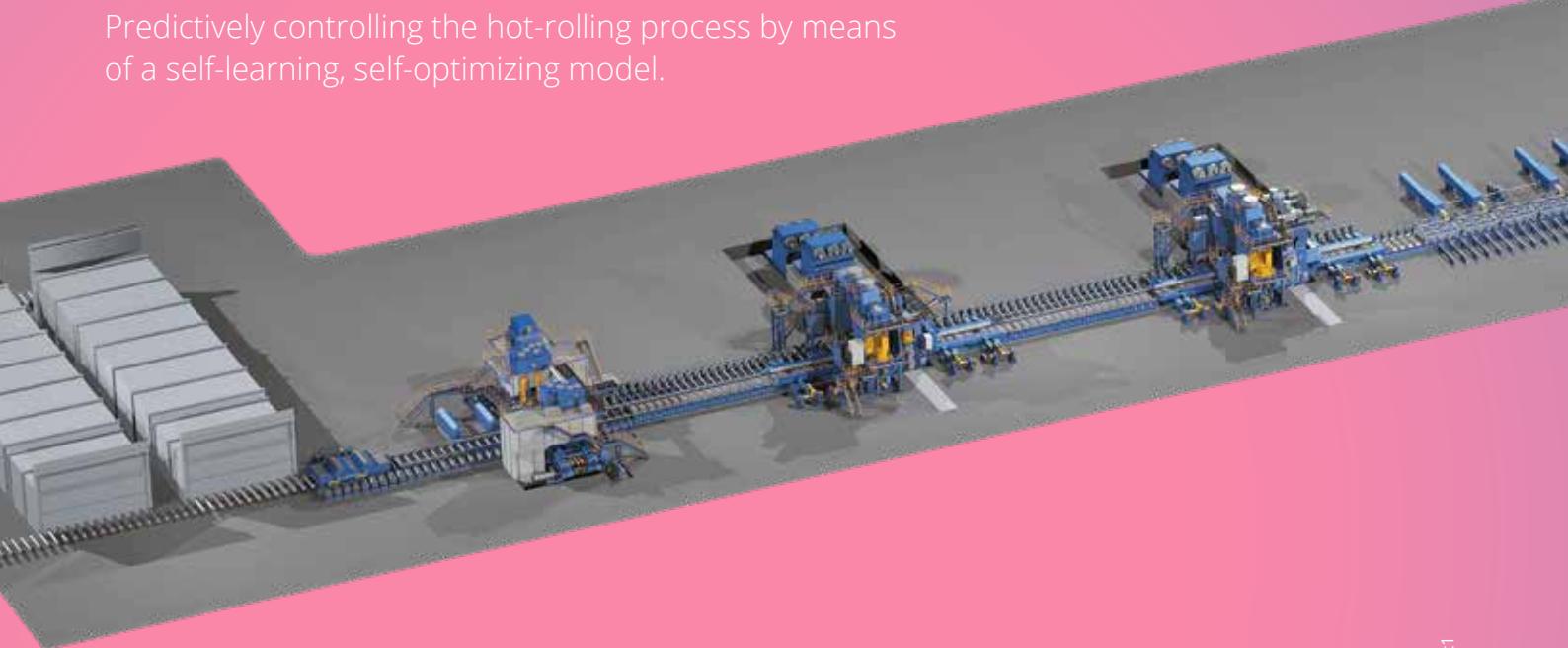
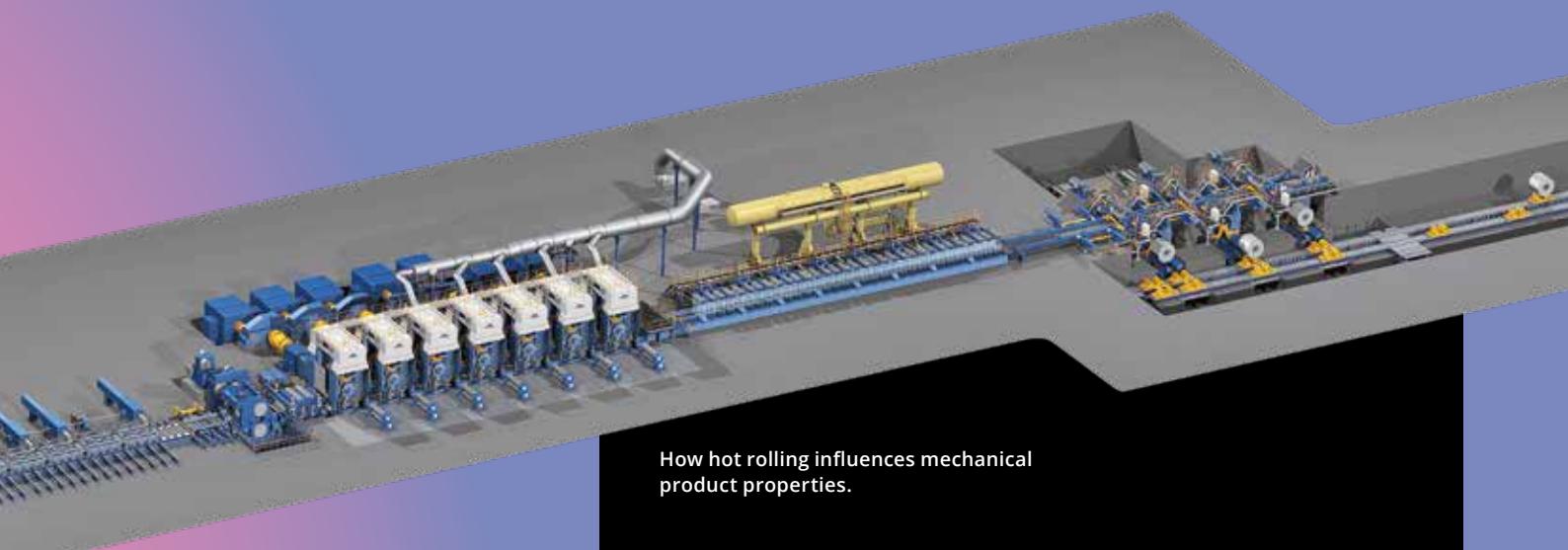


Illustration: iStock / sanchesnet



How hot rolling influences mechanical product properties.

VALUE-ADDING PREDICTIVE MODELS

SMS group develops predictive models for versatile use in a wide range of technological areas. The models are employed in digitalization processes, electrical and automation systems, and by the technical service to implement predictive process control, achieve process optimization and assure consistent quality in production.

Predictive process control

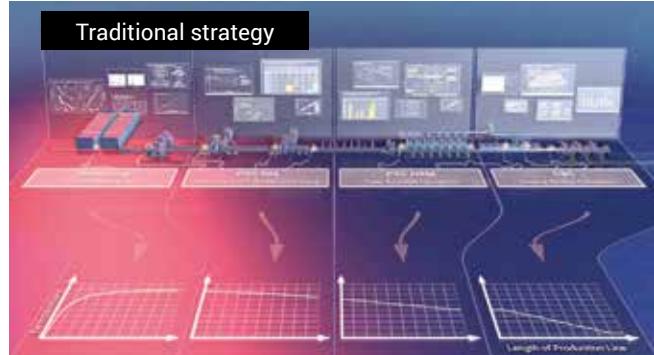
SMS group continuously works to further improve its hot rolling process models, prediction accuracy and technological controls performance efficiency. A new cross-functional - predictive - model takes an integrated temperature/microstructural approach. This takes process control to an entirely new level. Hot rolling involves various consecutive process steps, each of which effect the mechanical properties of the product, for example - yield strength, tensile strength and low-temperature behavior. In addition, the result of the rolling process is influenced by the chemical composition of the steel and the temperature guidance during rolling. Established process control methods are able to minimize deviations from the target process parameters helping to avoid expensive claims, however rolling tests are often necessary, time-consuming and costly.

Assuring consistent quality

For the various process stages, SMS group has developed models and technological controls that enable optimum actuator adjustment and prevent the hot strip quality from being negatively affected by process variations. For many years these advances have been employed successfully in modern hot rolling mills.

Today as a result, the precision of actuator setting and control accuracy have reached very high levels. Nevertheless, the market requirements continue to be increasingly demanding, for example the rolling of ultra-high-strength steels, calls for further sophisticated optimization options. The aim is to make process predictability and controllability even more precise – even for these increasingly challenging steels.

The share of special-grade steels in our customers' portfolios has been growing continuously. Many steel producers have been adapting their production equipment to meet this trend. This goes hand in hand with the demand for more flexible production planning, and more efficient utilization of and linking between available process data and measured values. Consequently, the models that form the basis of process control are becoming increasingly complex. ♦



Physical models form the basis of process automation in hot strip mills.

First level Physical models

In hot rolling mills, process control is based on physical models, such as:

→ **X-Pact® Dynamic Furnace Control (DFC)**
used in CSP® plants for homogeneous slab reheating, calculation of temperature control parameters and assurance of uniform temperature distribution.

→ **X-Pact® Pass Schedule Calculation (PSC®)**
prediction of rolling forces, speeds, temperatures and gages.

→ **X-Pact® Profile, Contour and Flatness Control (PCFC)**
for profile and flatness calculation and calculation of the set-points for CVC® work roll shifting and bending, taking into consideration information from the roll state model that calculates thermal roll crown and roll wear.

→ **X-Pact® Cooling Section Control (CSC)**
for calculating the water requirement taking into consideration the selected cooling strategy.

The aims of these models are to predict process parameters and set the targets for the corresponding actuators, based on physical laws and measurements. Initially, they act independently from one another, assuring the achievement of the process objectives within their respective area.

Second level

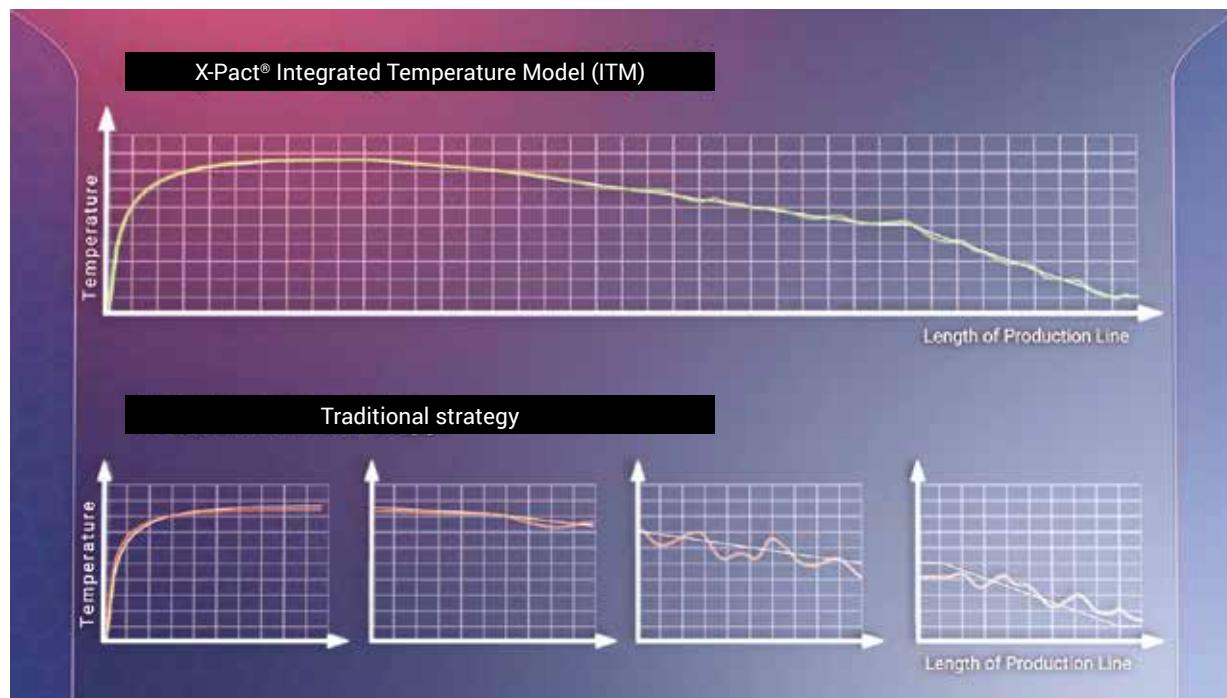
Predictive models for process optimization

At the next level, the individual models' knowledge about the process conditions are linked with one another and enhanced by the incorporation of material-scientific data. The interaction of temperature control in the rolling mill with the achievement of the desired mechanical properties in the produced hot strip is one example showing that SMS group has reached the next level of integration with its predictive X-Pact® Integrated Temperature Model.

Each physical model obtains the data it needs to optimize the overall process from other relevant models, while taking into consideration correlations between the models calculation results and controls. For example, achieving the target temperature of

the strip at the end of rolling is directly linked with the temperature guidance in the finishing mill. The resulting speed-time curve is cyclically updated providing the input value for the cooling model. Thus the cooling model is informed about variations in speed, enabling it to adjust the cooling values just at the right times.

This approach guarantees maximum temperature homogeneity along the complete strip length resulting in optimum mechanical properties.

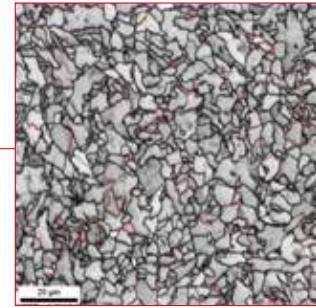


Principle of the integrated temperature model.

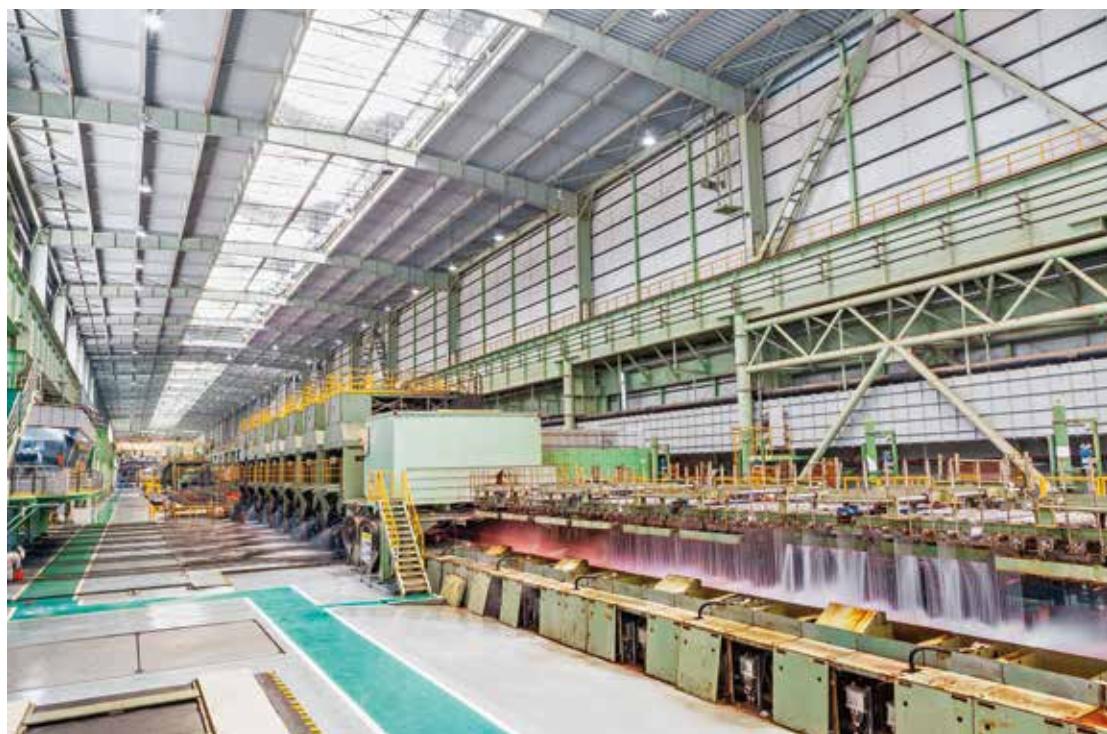
Third level

The self-learning, self-optimizing model

Currently, SMS group is focusing its activities to further develop its X-Pact® Integrated Temperature Model (ITM) on establishing a learning, self-optimizing model. In future, the ITM will be able to make recommendations for appropriate responses to process variations, with the primary goal to further boost the product quality and yield. Additional objectives of the current development - to be achieved by establishing correlations with the X-Pact® Material Property Model (MPM) - include maximizing the production capacity, decreasing energy and water consumption and reducing alloying costs.



Excellent homogeneity of the mechanical properties along the complete strip length.



View of the hot strip mill from the laminar cooling section. High-precision control of the individual process steps in a hot strip mill is an extremely complex task. Predictive solutions enabled by new predictive models developed by SMS group boost the flexibility of production and facilitate the integration of new products.



"A paradigm shift in process control"

INTERVIEW

Klaus Pronold, Vice President, Electrics/Automation Flat Rolling Mills, sees great potential for integrated models.

Mr. Pronold, in your opinion, what is the new quality of self-learning, self-optimizing models?

We are now reaping the fruits of our decades of model development in the field of metallurgy and rolling mill technology. Even today, we are able to pre-calculate extremely accurately the mechanical properties such as yield strength and tensile strength. This enables us to understand how process disturbances and variations influence the process parameters. This clears the way for replacing today's rigid

process objectives, such as finish rolling temperature or coiling temperature, with dynamically calculated target values. This is a paradigm shift in process control. While optimizing the metallurgical parameters, we will soon be able to also maximize production, boost quality even further, enhance plant stability and even minimize machine wear through self-learning predictive models.

Which role do these modern methods play in the context of AI and Machine Learning?

We have been working closely with our subsidiary SMS digital to enhance classical self-optimizing adaptation algorithms by means of AI. Here performance enrichment analyses can help to classify the exceedingly complex process influences. These analyses may also be used in monitoring key plant components to boost the mills' overall performance capacity.

What are the next process milestones?

Our technologists not only interlink the individual process models with regard to the higher-level temperature control. An additional goal, at the forefront is to integrate - the complete process chain – including all relevant geometrical parameters in our predictive models. Here an example: Should a mill reach its performance limits – say, that in one of the mill stands a motor is about to reach its maximum approved temperature - the mill will continue safely operating, simultaneously the control system will make autonomous modifications to the planned production.

What role does the Quality Execution System (QES) play in this context?

The proven QES will have to be adapted to the new dynamic way of calculating the process parameters. In this dynamic process, we will no longer use any static targets. Even so, it will still be possible to use the QES to document that specifications have been met. ♦



Klaus Pronold

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Supply of complete power distribution system

MALAYSIA

SMS group has installed and commissioned two submerged arc furnaces (SAF) at PMB Silicon. Additionally, SMS group supplied the complete power distribution system for the works, drawing on its strong international group network. Thanks to the effective, partnership-based cooperation between the SMS group companies in Germany, India and China, and the right choice of subcontractors, this project is a highly successful commercial and technologically reference.



One of the two 132/33kV step-down transformers of 150 MVA rated capacity with primary taps for secondary voltage regulation. The transformers were sourced by SMS group China.

The range of supplies for the PMB Silicon manufacturing facilities located in the Malaysian state of Sarawak, Borneo, comprised the mechanical equipment and the X-Pact® electrical and automation systems for the two SAFs. Additionally, PMB Silicon had ordered from SMS group the power distribution systems for the works. These systems had to be designed for capacities large enough to serve a second expansion stage in the future.

Advisory services and supplies from a Leading Partner

The customer's specifications, in particular the local mains operator's requirements on the containment of grid disturbances resulting from the operation of the SAFs, were very exacting. Reactive-power extraction from the grid and harmonic current emissions into the grid had to be kept within very low limits – requirements which SMS group, in cooperation with its subcontractors, has fulfilled 100-percent. Also the metering solution for billing provided by SMS group and the design of the high-voltage substation fully meet the customer's expectations. Additionally, SMS group experts supported PMB Silicon as advisors in meetings with the local electricity provider and in the preparation of technical documents for the approval process.

International cooperation

The contract was executed by the Electrical and Automation Systems Business Unit on a direct business basis. The teams from Germany played a key role in the technical implementation of the power distribution systems, building on long-standing experience in the engineering of highly complex distribution networks for separate facilities and works complexes as encompassing as iron and steelworks. The integrated solution supplied to PMB Silicon is the result of per-



Static VAR compensators (SVCs) dynamically compensate variations in the system voltage, keeping grid disturbances due to the melting process within the contractual limits.

fectly tailored packages provided by manufacturers and subcontractors SMS group has been working with successfully in the past.

The high-voltage substation, for example, is an E&A product made by SMS India Pvt. Ltd., using subcontractors based in India. SMS group India has been marketing this class of substations successfully in the Indian market. The step-down transformers, on the other hand, were supplied by SMS group China. Thanks to the international SMS group companies, who played a key role in this project, and the successful sourcing of equipment in the respective local markets, the complete system could be supplied at conditions customary in the Malaysian market. In this project, the German team took on the role of the system integrator. They planned and designed the works power supply system based on grid calculations made using CAE tools and Single-Line Engineering methods. The medium-voltage substation, the static VAR compensators (SVCs) - which dynamically compensate changes in the system voltage – and the control system for the substation were procured from a proven subsupplier. Meanwhile, the Electrical and Automation Systems Business Unit of SMS group is able to supply the control system as a proprietary product, enabled by coupling the protective systems via IEC61850 protocol. This is a manufacturer-independent and Ethernet-based protocol that communicates between the power distribution and the process automation systems. ♦

MAIN E&A COMPONENTS SUPPLIED

- 132-kV high-voltage outdoor substation; bridge-connected
- Two step-down transformers of 132/33kV, 150 MVA
- 33-kV medium-voltage indoor substation
- SVC with three-step filter, for dynamic compensation of changes in the system voltage
- Substation control system for operation, monitoring and troubleshooting
- RC filter as surge voltage protector for the electrical system of the furnace
- Back-up accumulator systems for the substations



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Digital commissioning of automation system

U.S.A.

The complete automation system for Nucor-Yamato Steel's three-stand CCS® tandem reversing group for the production of heavy sections was installed in the Mönchengladbach test center as a complex unit for testing and pre-optimization by means of the Plug & Work integration process.



The Plug & Work concept saves valuable time as early as during installation and commissioning of a plant.

The revamping project at Nucor-Yamato Steel in Blytheville, Arkansas, U.S.A., includes measures to increase the production capacity of the No. 2 H- and I-beam rolling mill. The project is also aimed at expanding the range of rolled steel grades, to include new high-strength grades.

SMS group supplied the mechanical equipment, including three new CCS®-1500 mill stands arranged in tandem as a replacement of the previous UR, E and EF stands, and the X-Pact® automation system. Equipment assembly has already begun as scheduled and will be completed shortly. On-site commissioning is scheduled to start soon.

Digital commissioning with the Plug & Work integration test is already underway. The test results will be used later on in the remote-supported commissioning phase, efficiently supporting the on-site commissioning team.

Everything from a single source

With technological know-how, mechanical equipment, electrical and automation systems, and digitalization technology supplied from a single source, SMS group has the expertise to assure the success of plant revamps and optimizations. Here the future-oriented digital solutions from SMS group, including remote support capabilities, have proved as a key success factor, last but not least in projects to be implemented under challenging conditions.

The Plug & Work concept developed by SMS group helps to save precious time even before the equipment is installed and commissioned on site. The complete new automation system for the No. 2 rolling mill at Nucor-Yamato Steel was set up, tested and pre-optimized in the SMS group test center. This was enabled by means of a near-reality 3D simulation in real time with a digital twin of the exact design of the customer's plant, including all functional and technological features. For the Plug & Work test, the simulated plant - in place of the real plant - was connected to the automation system.



The Digital Twin of the CCS® tandem reversing group for H- and I-beam rolling is a functional and technological replica generated in order to perform real-time near-reality 3D plant simulation.

Fast return on investment

More than 100 reference projects of SMS group – including both new plant installations and revamps – have shown that the Plug & Work concept helps mill operators to achieve the ROI significantly faster because with Plug & Work commissioning times can be markedly reduced compared to a conventional commissioning process.

Apart from this, SMS group provides remote support during commissioning activities. The X-Pact® Service Portal provides a perfect infrastructure for remote commissioning support. During the commissioning of the modernized rolling mill, software experts and technologists from different SMS locations will be available to Nucor-Yamato Steel and ready to remote-support the commissioning team of SMS group Inc. from Pittsburgh, U.S.A.

Perfectly harmonized

The heavy-section mill of Nucor-Yamato Steel Company is the first ever long-product rolling mill going through an integration test in the EA test center in Mönchengladbach using 3D real-time plant simulation. The SMS group's proven electrical and automation solutions are summarized under the brand X-Pact®, an acronym standing for Process, Automation, Control and Technology. Thanks to their high modularity, the X-Pact® packages can be flexibly combined – a key factor for successfully implemented plants and systems. X-Pact® assures that the elements of the customers' plants are perfectly tuned throughout – from power supply and distribution, via drive technology, instrumentation and automation, up to and including production planning. SMS group develops customized solutions, integrating future-oriented technologies in close cooperation with its customers. This enables full-scale automation and digitalization of the entire production chain.

Nucor-Yamato Steel Company operates two rolling mills in total, with a combined annual capacity of 2.4 tons of finished products. Dr. Thomas Maßmann, Executive Vice President Long Products at SMS group: "With this project, which follows the successful modernization of rolling mill No. 1, we have set the cooperation between Nucor-Yamato Steel and SMS group on an even more solid foundation." ♦

 **Stefan Schmidt**
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Start-up ahead of schedule

CHINA

Successful completion of plate mill automation. Jiangsu Shagang Group successfully commissions No. 2 shearing line ahead of schedule, banking once again on automation technology from SMS group.

SMS group has successfully – and ahead of schedule – commissioned the No. 2 shearing line of Jiangsu Shagang Group in Zhangjiagang, China, after the installation of an X-Pact® automation system.

In this project, Jiangsu Shagang Group, one of the biggest private steel companies in China and a Fortune Global-500 company, reconfirmed its trust in automation technology from SMS group. The order for the automation of the 3.5-meter shearing line was placed in December 2018. This order is based on an automation order signed in 2015 and relating to the complete 3.5-meter plate rolling mill, of which the No. 2 shearing line is a part. For the plate mill automation, SMS group had supplied a new X-Pact® basic automation system and a high-precision process automation system. Final acceptance had been granted in 2017. The production line – with a designed annual production capacity of 800,000 tons – eventually increased its production capacity to a record-breaking level of 2.8 million tons.

The X-Pact® automation system of the No. 2 shearing line features powerful functions for the fully automatic transport and cutting of steel plates from the entire rolling mill. Its advanced high-precision full-line plate-position



**Shearing line No. 2
modernized by SMS group.**

tracking system continuously updates the plate data in the PDI (process data information) system. The tracking system also provides support for manual operator interventions, such as delaying a plate or removing a plate from or feeding it into the production sequence.

Commissioning in just ten days

During commissioning, the electrics & automation site team of SMS group joined forces with the team of Jiangsu Shagang to reduce the commissioning time to just ten days. This provided the customer economic benefits of more than 10 million yuans that month. In recognition of the extraordinary effort the SMS group team had performed in line with the spirit of being the Leading Partner in the World of Metals, Hui Zuh, Factory Director of Zhangjiagang Hongchang Plate Mill Co., a company of Shagang Group, presented a letter of commendation to the SMS group team.

December 2018 had also seen the placement of an order with SMS group for Jiangsu Shagang's 5-meter heavy-plate mill No. 1. Jiangsu Shagang here expects from the newly installed X-Pact® automation system the same posi-

tive effects on the production rate and the plate quality as achieved on the 3.5-meter mill. Commissioning of the new automation system is to take place shortly. Preparations have already begun. ♦



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Further information

www.sms-group.com/x-pact

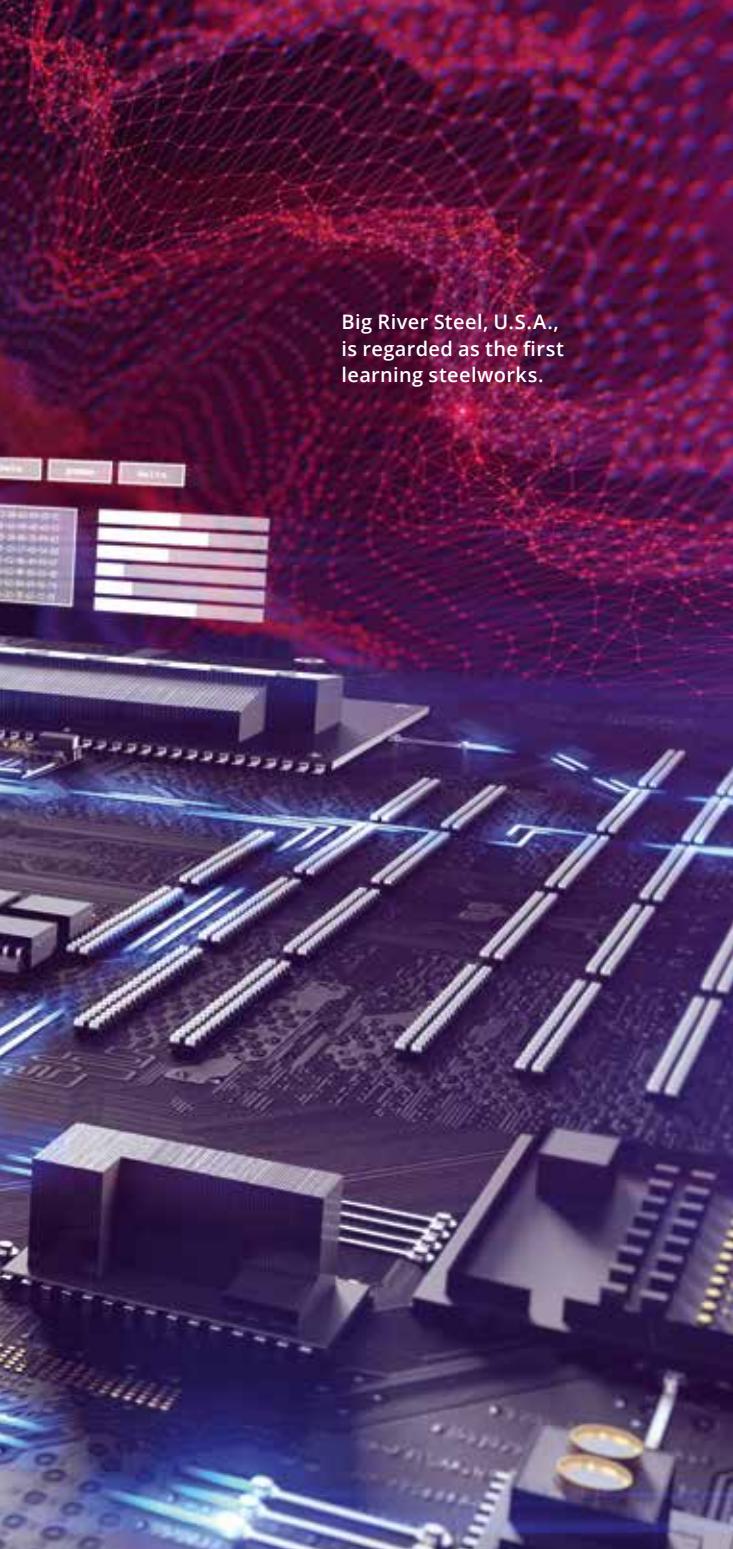


MASTERPIECE

WORLDWIDE

With its new Scheduling App, SMS digital offers three applications for scheduling and production planning.

Noodle.ai, a leading provider of Enterprise Artificial Intelligence® applications based in San Francisco, U.S.A., and SMS digital, headquartered in Düsseldorf, Germany and specializing in digitalization within SMS group, have launched their second jointly-developed application following the announcement of their collaborative partnership in June 2019. The new scheduling application for production planning and scheduling includes three modular applications that are also available individually. The three consist of a demand planning application, a pre-grouping application, and a line sequencing application.



These modules are their answer to the growing demand for smart production planning and are aimed not only at improving traditional performance indicators such as order due date compliance, but also at minimizing transitional losses, which inevitably occur with steel grade changeovers, jumps in the thickness or width, or changes in the process conditions.

By integrating new and existing applications, the whole planning process is further enhanced and automated with artificial intelligence (AI) – from longer-term planning for up to six months to short-term scheduling of line sequences across

various production stages. The modular design of the new application is what makes this possible, and additional applications can be connected in the future with minimal effort.

The three new AlaaS (AI-as-a-Service) modules are fully integrated with SMS digital's manufacturing execution system, MES 4.0. The cloud-based applications with web interface can be easily run using a web browser.

Demand planning application: Enhancing demand forecasting with AI

Faced with a wide range of products combined with a variety of production parameters and dynamic order book changes, production schedulers have a massively difficult task when it comes to production planning optimization.

The demand planning module assists with the creation of production schedules by using AI algorithms to predict customers' future orders for specific products. It works up to six months in advance and the forecasts are directly incorporated into the production planning process. As time progresses, the predicted orders are replaced by actual booked orders. This significantly improves scheduling results, as it allows far-sighted production capacity plans to be created. The forecasts include several types of data: historical order data, sales data, product data, customer data, and other company-specific parameters, as well as external factors, such as market fluctuations. In this way, schedulers can easily turn the forecasts into real demand plans. That means more precise delivery dates can be given to customers and the order placement process is optimized for the sales team. The result is improved deadline compliance and more efficient equipment utilization.

Pre-grouping application: Improving production efficiency with intelligent grouping

"Pre-grouping" is a solution that brings the requirements of each production line together to form groups created in line with common product features, such as the steel grade or chemical composition for example, or using time-based rules. In addition, various KPIs can be included in the deci-

Digital plant planning

U.S.A

sion-making process. The size of the pre-groups created is directly determined by the results of demand planning. The pre-grouping application serves as an important bridge between demand planning and line sequencing, and offers crucial advantages in terms of overall production: increased production efficiency plus reduced transition costs and optimized inventory levels.

Line sequencing application: Optimizing profitability of scheduling decisions using advanced reinforcement learning

The line sequencing module takes the order book, groups the customer orders into heats, and calculates an optimal sequence of a selected subset of the heats for the caster for the next 24 hours. To calculate the heats and their sequence, the module optimizes a total production cost function which balances the transition costs at the caster and the melt shop with customer order delivery requirements. At the heart of the calculation is a reinforcement learning algorithm that can accommodate almost any "black-box" cost component, and technical or best-practice constraints desired by the user. After the module generates its recommended sequence of heats, the user can manually adjust the sequence to his or her choosing, and the module will re-calculate the KPIs of the sequence in real time as feedback. In addition, the user can gain more insights by changing the optimization parameters to see their impact on the sequence. Custom versions of this module have also been developed for other production lines such as continuous galvanizing.

With these jointly developed products, SMS digital and Noodle.ai are helping steel plant owners to optimize the cost of producing customer orders while keeping delivery promises, by utilizing the existing set of production resources more efficiently. ♦

 **Further information**
www.sms-digital.com
www.noodle.ai

North Star BlueScope relies on SMS group technology and integrates digitalization solutions into its hot flat strip production.

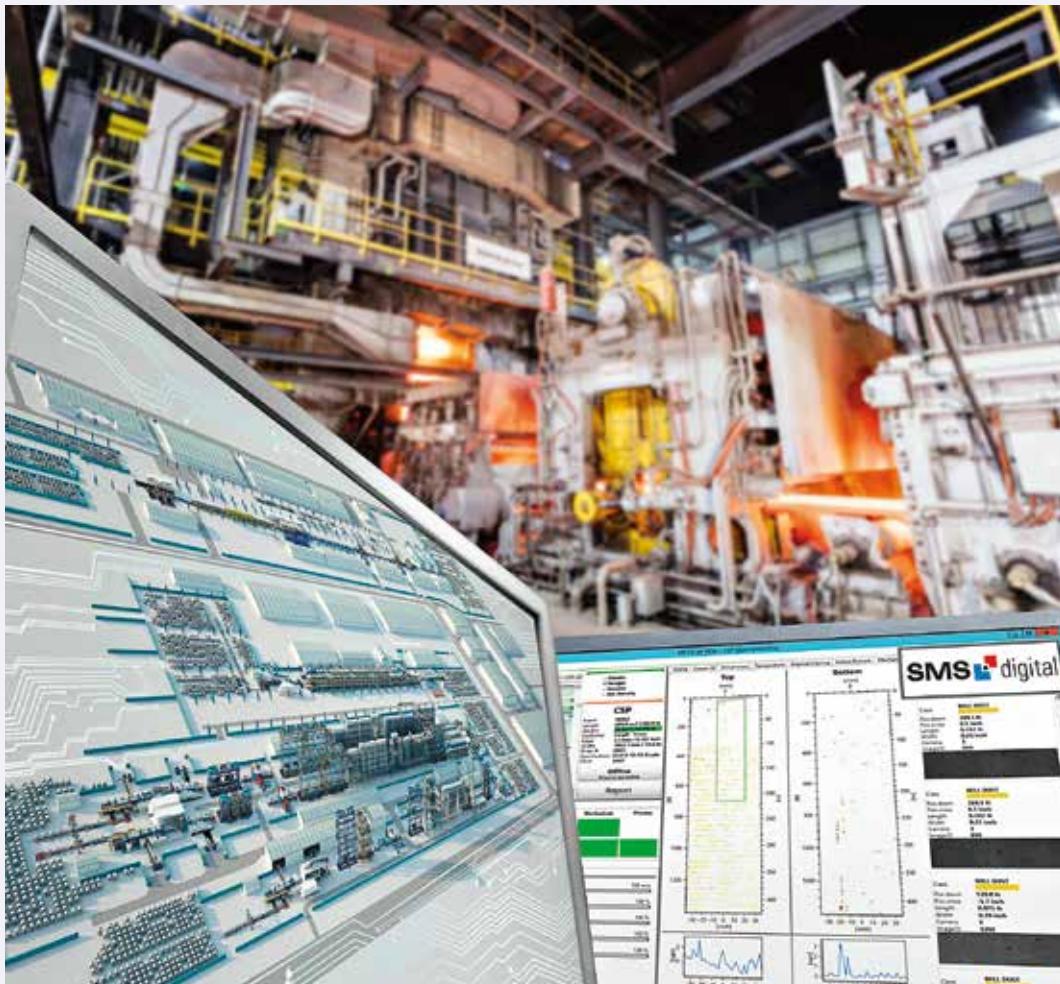
North Star BlueScope (NSBS) located in Delta, Ohio, awarded SMS digital, a company of SMS group, an order for the digitalization of the hot flat strip production at the Delta site in order to raise it to a new digital level.

Following the order placed with SMS group last year to extend the thin slab caster by a further strand, NSBS is now relying on SMS group's digitalization competence and is integrating a digitalization package from SMS digital across the entire production process. A major advantage and also a requirement of NSBS is the digital connection of third-party plants.

The digital solution package includes the SMS digital production planning system MES 4.0 (Manufacturing Execution System) and the QES (Quality Execution System) with the Process Data Warehouse PDW module containing a data history extension.

Plant data including historical data are processed within the SMS Data Factory, to allow for future extension of machine learning and artificial intelligence Apps, as well as for full-plant visualization capabilities. In addition, the Smart Alarm App will enhance maintenance insight through the ability to diagnose cause and effect of signals and alerts. NSBS trusts in the long-standing successful cooperation with SMS group and will further expand the partnership with this joint digitalization strategy.

The digitalization solutions from SMS group are able to integrate all interfaces of third-party suppliers



NORTH STAR STAR BLUE-Scope

North Star BlueScope is part of BlueScope, a leading international supplier of flat steel products based in Melbourne, Australia, and provides specialized steel solutions with a strong focus towards the global construction industry.

SMS digital's advanced production planning and quality management in combination with the SMS Data Factory provides a well-proven digital solution.

in order to represent a complete production flow. MES 4.0 is pre-designed for the capability of further future extensions and enhancement. The flexible modularity offers the possibility to directly add additional features, functions and business intelligence to the system. In the context of digitalization, the MES 4.0 can act as a data hub to quality management systems such as the QES, where quality is monitored, graded and certified for release.

SMS digital specializes in transforming data into information and ultimately into value, incorporating individual customer requirements into the development of digital solutions. At NSBS, the MES 4.0 will initially be successively tested in shadow mode during ongoing production and then implemented step by step, until finally – in mid to late 2021 – the second strand of the thin slab casting plant will also be connected to the MES 4.0.

Key factors for the decision to partner with SMS group for digitally connecting the future twin-strand caster was the high added-value resulting from the strong combination of SMS digital's know-how of technology and functionality with user-friendliness. By incorporating these production planning systems, energy consumption during production can be reduced, rejects minimized and quality increased, thus achieving a faster return on investment.

With this order, NSBS and SMS continue to extend their successful cooperation. ♦



Further information
www.sms-digital.com



Mill housings for Texas

U.S.A.

In Sinton, Texas, US-American steel producer Steel Dynamics, Inc. (SDI), will produce the latest generation of advanced high-strength steel. The Texas mill will have capabilities beyond existing electric arc furnace flat roll steel producers, capable of producing 100 kilopounds per square inch (690 megapascal). Whereas CSP® NEXUS mill will have capabilities to produce a maximum strip thickness of 1 inch (25.4 millimeters) with a strip width of 84 inches (2,134 millimeters). Operations are expected to begin in the middle of next year. With SMS group, SDI relies on a strong partner for its new facility. Among other equipment, the first mill housings for SDI were manufactured and loaded in the German workshops of SMS group in Hilchenbach and Mönchengladbach and have meanwhile arrived at the Texas site.

REAL HEAVY-WEIGHT

Each of the mill housings has a length of 37.73 ft (11.5 m), a width of 15.09 ft (4.6 m) and a height of 3.94 ft (1.2 m). The weight is 176.34 tn. sh. (160 mt).

 **Further information**
www.sms-group.com/expertise/highlight-projects/steel-dynamics-inc

**SHIPMENT OF
MILL STANDS**

Loading of a mill housing on the heavy-duty transporter at the SMS group workshop in Mönchengladbach. The heavy-duty transporter is 117.17 ft (54 m) long and weighs a total of 341.72 tn. sh. (310 mt).





Entire production lines can be explored with a VR headset and controllers.

"The use of virtual reality prevents project participants from talking past each other."

Jan Buchner, responsible for project planning and handling at SMS group

Overcoming spatial distance in real time

WORLDWIDE

SMS group holds project meetings in virtual reality. This allows projects to be planned more precisely and implemented more quickly.

A virtual reality headset and the right computer program open the doors to a new world of project communication. With its virtual reality conferencing system, SMS group is able to share and process complex 3D CAD data quickly and easily with customers and in-house experts – all in real time.

SMS group customers, for example, are able not only to view their future production facility but also walk through it, explore it, and discuss it with the SMS group engineers. In terms of their dimensions, all of the plant components are displayed realistically. Controllers that users hold in both hands help them to move through it virtually. They can examine models of whole production lines or individual machines, for instance, or take them apart for a closer look. What's more, you can zoom in or out as and when required. Users can intuitively grasp all objects visualized; real hand movements are merged with virtual reality via the controller. If a person using a VR headset in a real-world situation starts to move about, for example around a model of a machine, he also does this with his

digital alter ego in the virtual reality conferencing system. Using the controllers, all of the components displayed can also be labeled and highlighted in color with a fictional pen. Notes, documents, videos, and photos can be displayed on digital display boards. The VR headset also functions as a loudspeaker and microphone. This means that any number of project members can meet in a virtual room to work together on complex data, which are played onto the VR goggles in real time. It is also possible to project the view through the VR goggles onto a screen or wall, so that several people can follow in reality, even without a headset, what the user himself is looking at.

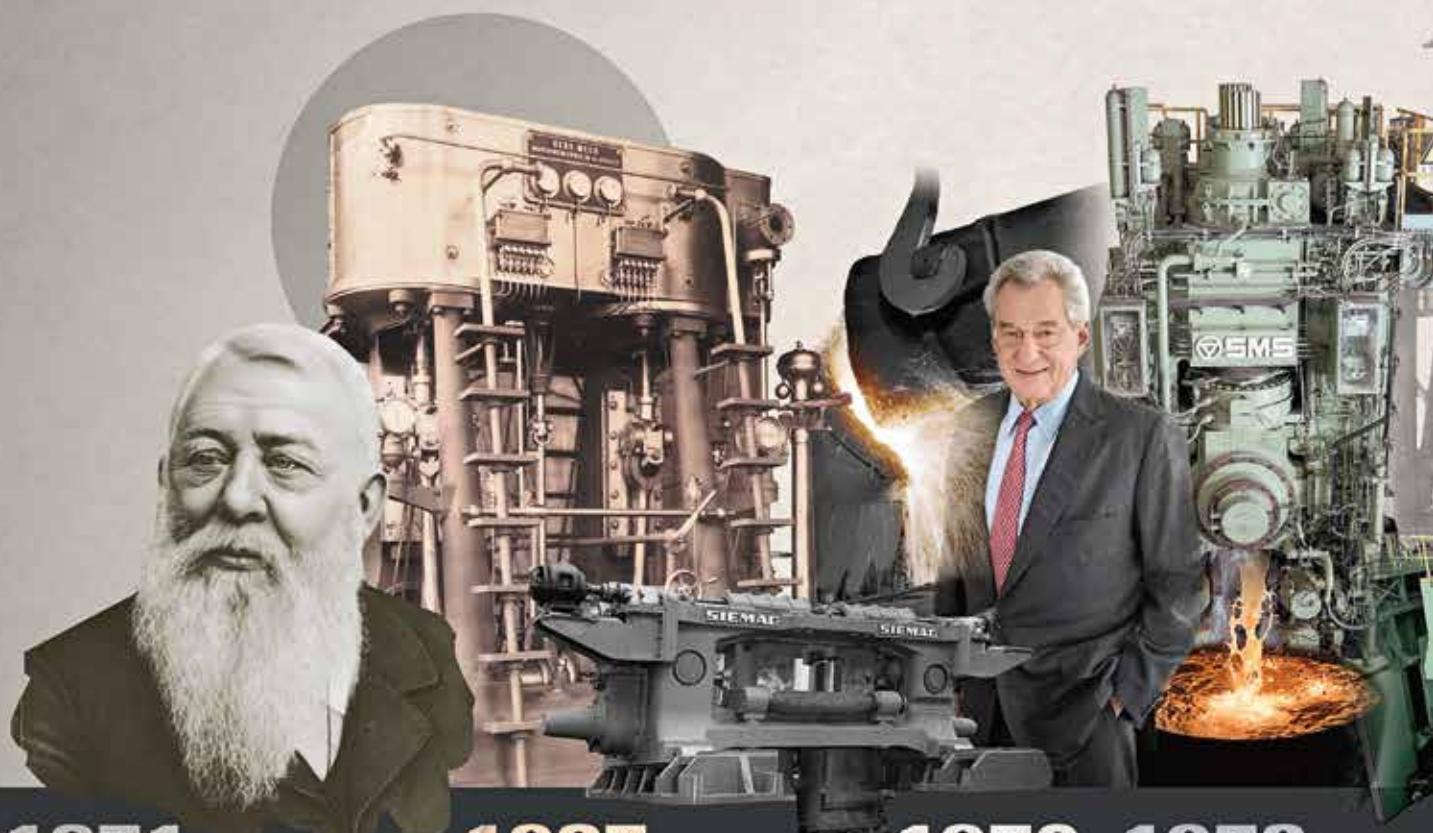
Shorter project times

"Our conferencing system offers a whole range of advantages for project meetings. That includes our interaction with customers and with each other. The use of virtual reality prevents project participants from talking past each other. So now, all of us together have the same view of the plant models shown, without the need for time-consuming drawing preparation or laborious descriptions, no matter where we are in the world. Technical meetings regarding assembly issues, layouts, optimizations, or collision avoidance can be conducted flexibly and more efficiently from anywhere worldwide. This saves time and guarantees tremendous creativity. You could say that project participant meetings are moving into the world of virtual reality," explains Jan Buchner, who is responsible for project planning and handling at SMS group.

SMS group uses the conferencing system for all phases of a project. Not only for the conceptual design but also for the detail planning, manufacture, assembly, and commissioning. ♦

 **Jan Buchner**

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1871

1927

1970 1973



PREVIEW

IN OUR NEXT NEWSLETTER ISSUE ...

... you will read about how SMS group has developed over the past one hundred and fifty years through inventiveness, mergers and acquisitions and internal growth to today's Leading Partner in the World of Metals and the focus is not only on a successful history of SMS group but also on its ambitious goals for the future. Learn more about innovative technologies and successfully completed projects.



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