



IN FOCUS

ENERGY USED EFFICIENTLY

Rising energy costs, government restrictions on emissions and at the same time limited resources. Reason enough for SMS group to take an active interest in technologies for energy saving and environmental protection. The possibilities opened up by digitalization help to meet these challenges.

DIGITAL LEARNING

SMS TECademy opens a digital classroom for interactive learning in Mönchengladbach.

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Prof. Dr.-Ing. Katja Windt, member of the Managing Board of SMS group GmbH since April 2018, is responsible for the Digital Solutions and Electrics and Automation Business Units.

“The article on leading automation in steelworks points out our possibilities of digitalization. We have already developed the learning steelworks which is now followed by further projects that will be presented at the METEC.”



METEC 2019
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HALL 5/BOOTH
E22-01 – E22-02

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CHINA

AN EYE ON EVERYTHING

In the control room of Shandong Iron & Steel Group Rizhao, China, the operating staff can watch all production processes. At the country's east coast, in the province of Shandong, the Chinese steel producer is operating an integrated flat steel complex with equipment mainly supplied by SMS group. The complex comprises a hot wide-strip mill, a pickling line/tandem mill as well as one hot-dip galvanizing line and two annealing lines. The investment in high-quality equipment, combined with comprehensive process analyses by MET/Con and

the innovative product quality analyzer (PQA®), made Shandong the owner of one of the most advanced plants worldwide. For a detailed report on Shandong Iron & Steel Group Rizhao please refer to page 82 of this issue. ♦



Further information
www.sms-group.com







WORLDWIDE

LESS ACHIEVES MORE

Products from SMS group improve energy efficiency.

All studies and findings from practice leave no doubt about it: Sustainability provides both economic and ecological benefits, making it a win-win situation for companies and the environment. For SMS group and its customers, who operate plants that partly have to deal with very energy-intensive processes, this is not a new story, as associated research and development have been going on for decades. In joint efforts, innovations have been brought to market maturity and to application in the industry. Below we provide an overview of latest developments, technologies and examples from practice that illustrate how the customers of SMS group achieve more with less energy.

This overview includes, besides future-oriented and sustainable solutions for complete newly built works of latest technology, particularly examples of effective revamps of existing machinery and plants. As the “Leading Partner in the World of Metals”, SMS group’s mission is to accompany its customers along the entire life cycle of their plants in order to permanently safeguard their competitiveness and sustainability within the framework of current and future environmental regulations.

Future-oriented Ecoplants concept

This commitment of SMS group takes shape in the “Ecoplants” concept. Since 2012, plants and plant concepts that distinguish themselves from reference plants through sig-

Energy-efficient production. A benefit for the plant operator and the environment.



A challenge that virtually all markets around the globe are presented with is to find ways of how to balance sustainability and economic growth. Also or particularly in the metals industry where energy savings potential is high by comparison, this has become an increasingly important issue.

nificantly lower consumption of input materials, consumables or energy, reduced emissions or a higher recycling rate have been given this label.

SMS group has augmented the Ecoplants concept in order to cater to a great many plant operators’ current endeavor to make their operations more future-safe in terms of efficiency and environmental compatibility. As a matter of course, also the modernization of existing plants can significantly reduce the environmental footprint. To indicate the numerous solutions available along the process routes they are labeled “Ecomodules”. Involving reasonable ▶

investments, the technologies under this label provide a significant contribution to more sustainability in addition to positive economic effects.

Energy efficiency is a strategic factor for plant operators

The economic benefit of improved energy efficiencies is most perceptible in the metals producing and processing industries, i.e. the customers of SMS group. Energy efficiency is a strategic factor not only in the effort to achieve cost and competitive advantages, but also in exercising social responsibility for the environment and the climate. The German Ministry for Economic Affairs and Energy puts it this

way: “The environment-friendliest and cheapest kilowatt hour is the one we do not consume at all. The more consciously and efficiently we use electricity and heat, the less we need to generate. This saves money while improving supply security and helps us achieve our climate targets.”

SMS group customers are trailblazers

72 percent of the companies interviewed by Fraunhofer Institute for a study on “Energy efficiency in daily operating practice in Germany” stated that they apply energy efficiency strategies. Very commonly applied are measures to power off idling machines and plants. What other kinds of measures are taken strongly depends on the industry and the size of the operation. Large-scale operations and energy-intensive industries like the metals producing sector often resort to the implementation of expensive and complex energy-saving solutions. These also include smart closed and open-loop control systems for energy-optimized process control and energy recovery technologies with their associated control systems. According to the study, 62 percent of the large operations (those with more than 250 employees) have retrofitted or are considering to retrofit their existing plants with energy-saving components.

In other words: The customers of SMS group are trailblazers in energy efficiency and in the application of innovative technologies. The availability of solutions is great and varied. The choice depends on the customer’s objectives and the processes in place.

Convincing new developments and examples from practice

The new X-Pact® Leading Automation system for steelworks provides great power saving potential. Given the high energy consumption of the steelmaking process, this system saves significantly on costs and provides a fast ROI. It includes the scalable modules X-Pact® Temperature Assist, Gas Cleaning Assist, X-Pact® FEOS for the EAF process and Energy Demand Control. These automation modules come as integrated parts of new plant installations or they can be integrated into existing plants as independent add-on products.

For voestalpine BÖHLER Edelstahl, SMS group is going to supply the main meltshop equipment for the new stainless steel plant in Kapfenberg, Austria. This steel plant will set new standards in terms of energy efficiency. Closed cooling water circuits and heat recovery systems will minimize emissions and the consumption of resources. Also the electrical and automation systems based on X-Pact® MES 4.0 and the digital process control system X-Pact® Process Guidance (PGS) will contribute to a very high efficiency level.

THE ADVANTAGES OF ECOPLANTS



Since 2012, SMS group has combined its sustainable technologies and its energy-efficiency enhancing and emission reducing activities under its Ecoplants label. Along the entire process chain, SMS group evaluates on an ongoing basis how the sustainability of the offered solutions and innovations can be continuously enhanced.

When a technology is proposed to be labeled as Ecoplants, the responsible engineers will perform a sustainability check.

An Ecoplants solution must meet the following criteria:

- Significant reduction of raw material use
- Significant reduction of energy and consumables
- Significant reduction of emissions
- Significant improvement of recycling rates

The checks are performed on a reference plant. If the criteria are met, the plant or the technology receives the SMS group Ecoplants label. Apart from the above listed criteria, another key requirement must be met: Investing in an Ecoplants solution must provide the customers economic added value.

Uddeholm AB in Sweden is upgrading the gas cleaning system of its EAF together with SMS group. As part of this project, preparations are underway aimed at recovering energy by decoupling hot water. Also Swedish steel producer SSAB is investing in high-efficiency gas cleaning and recovery technology.

In long-product mills, energy savings of more than 90 percent can be achieved by applying the Continuous Mill Technology – CMT® in short. In CMT® plants, billet casting is directly connected to the rolling process. Coupling casting and rolling saves dramatically on energy because no furnace is needed to reheat the billets before rolling. Temperature equalization is performed by a highly efficient, inductive system.

The new HI_{BOX} heat shielding system developed by SMS group for hot strip mills minimizes the heat loss of the transfer bars over the complete length by up to 50 percent. HI_{BOX} is installed above the connecting rolling table between the roughing stand and the finishing mill.

For the customer MMPZ-group, based in Miory, Belarus, SMS group has developed an edge scrap coiler of compact, highly-efficient mechatronic design. The machine can achieve a total efficiency rate of 98 percent thanks to its innovative direct drive solution. Also the SMX radial forging machines come with new energy-efficient drives. The optimized drive strategy provides the customers energy savings of between 13 and 28 percent. Additionally, more energy-saving technology is under development specifically for radial forging machines.

The Elo-ICE (Inductor Concept Efficiency) system developed by SMS Elotherm saves up to ten percent of the energy otherwise used to heat the steel prior to forging. The newly developed Elo-ICE system cuts the typical thermal loss versus a conventional refractory lining by half. As a result of this, forging plants with about 6,000 yearly operating hours can save up to 100,000 euros per year.

SMS group customers in the aluminium industry can reduce their energy demand by about 95 percent by applying smart solutions in aluminium recycling operations. Such technology is going to be integrated into the new multi-chamber melting furnace supplied by Hertwich Engineering to Hydro Extrusion Lichtervelde NV. The highlight of the furnace is that the environment-friendly Ecomelt process exploits the energy contained in the organic impurities.

Imagineering the future of energy efficiency

SMS group customers can distinguish themselves within the global competitive environment through most advanced, energy-efficient and eco-friendly technologies that minimize production costs while guaranteeing highest quality. In no

ENERGY MANAGEMENT AT SMS GROUP

SMS group has an ISO 50001 energy management system in place at its production and administration facilities. Numerous specific measures – analyzed, developed and implemented by an energy management team in close cooperation with the respective departments – have led to a marked decrease in energy use; for example, by switching off ancillary and air purging systems of idled machines, by optimized lighting, adaptation of room temperatures, e.g. in server and production areas, partial replacement of hard disk drives (HDD) by solid-state drives (SSD), substitution of air heating for radiation-based heating, centralized acquisition of energy data based on more than 350 metering devices installed at the facilities in Hilchenbach and Mönchengladbach, etc.

In 2016 and 2017, these and many other energy-saving measures resulted in:

- 1,647,000 kWh of energy saved
- CO₂ reduction totaling a weight of 858 tons

way does energy efficiency impose constraints on the development and production of new materials. On the contrary: Technological innovations often bring to bear sophisticated measuring and control features and open new opportunities through digitalization, all of which may result in extremely precise process guidance - a key requirement for the development and production of new materials and hence excellent prospects for the future. ♦



Further information

www.sms-group.com/expertise/ecoplants/

WORLDWIDE

REDUCING CO₂ EMISSIONS

Hot Metal Production Before opting for complete technological change, the step-by-step implementation of CO₂ emission mitigation technologies should help the integrated steel industry to reduce its carbon footprint.

Blast furnace plant of the 12-ton steelworks of Hyundai Steel Corp. in Dangjin, South Korea.



- **Paul Wurth develops technologies** that stepwise reduce CO₂ emissions from iron and steelmaking via the classical blast furnace route.
- **One option** is to install systems that use power from renewable energy sources when retrofitting existing facilities with new technology.

The Paris Agreement negotiated at the 2015 United Nations Climate Change Conference (COP 21) set the goal of limiting global warming to well below 2°C, preferably 1.5°C compared to pre-industrial levels. According to scientists, this 1.5°C goal will require zero emissions sometime between 2045 and 2060 and is therefore calling for immediate action.

The iron and steel industry is one of the major sources of industrial CO₂ emissions. Within an integrated steel plant, 70-80 percent of the carbon input is attributable to the iron-making process, while only 20-25 percent of the CO₂ emissions are directly generated by the blast furnace. Coke based blast furnace technology, known for more than 300 years, is still considered as the most economical route of producing hot metal, at least in Europe. Blast furnaces (BF) are more flexible and dynamic with respect to ore quality and they excel in terms of production capacity compared to other ironmaking routes. Owing to these advantages, the BF converter route represents the major share (60-70 percent) of the total crude steel production in the world.

To comply with the targets set by the Paris Agreement, steel plant owners and operators have to implement drastic measures to cope with future CO₂ emission reduction requirements. Political uncertainty makes it very difficult for them to define measures for technological shift, as moving away from the traditional BF route implies very high costs and puts at danger the profitability of the complete steel plant, with a real risk of losing competitiveness in the global market.

Having always been committed to providing pragmatic solutions to its customers, Paul Wurth is presently developing in an intensive way a number of technologies applicable to the classical blast furnace route for allowing a stepwise reduction of CO₂ emissions, well balanced between ambitious environmental targets and given economic constraints. These solutions mainly concern the efficient utilization of off-gases produced by a steel plant for reaching progressively lower emissions.

METALLURGICAL USE OF PROCESS OFF-GASES GENERATED BY STEEL PLANTS

While about a fourth of the carbon output leaves the blast furnace as direct CO₂ emissions, the remaining carbon exits the blast furnace in form of blast furnace gas, which is used as fuel gas in different steel plant units, such as the coke oven plant, the sinter plant and rolling mills. Similarly, a high amount of carbon is exported from the coke oven plant in the form of coke oven gas to the different units of the steel plant. The volume of process off-gases such as coke oven gas, blast furnace gas and basic oxygen furnace gas generated within a steel plant is much higher than their internal use as a fuel. The surplus is mostly used in the power plant for the production of electricity.

By applying technologies that allow the utilization of all process off-gases for metallurgical purposes within the blast furnace, CO₂ emissions from steel plants could be significantly reduced. In this case, the required electric energy, preferably from renewable sources, shall be purchased from an external power grid.

UTILIZATION OF COKE OVEN GAS IN BLAST FURNACES

With a high calorific value (16 to 18 MJ/Nm³), coke oven gas (COG) is a potential energy source allowing substitution of coke in the blast furnace, and thereby leading to CO₂ savings. COG can be injected into the blast furnace at tuyere level as well as at lower shaft level. Utilization of COG at the BF tuyere increases the heating value of the blast furnace top gas. Presently in integrated steel plants, COG is mainly used in the hot blast stoves, reheating furnaces and coke oven plants, whereas process off-gases with lower calorific value are consumed in power plants. In order to utilize COG for metallurgical purposes in the blast furnace, internal redistribution of gases within the steel plant is required and the internal electric power production will be reduced.

COG tuyere injection

Known for decades, COG injection at tuyere level is relatively easy to implement. Paul Wurth is proposing different technologies, amongst which COG injection via a separate lance at the tuyere. Currently, Paul Wurth is designing a new tuyere injection system for a COG utilization range of 15,000 to 30,000 Nm³/h. ▶

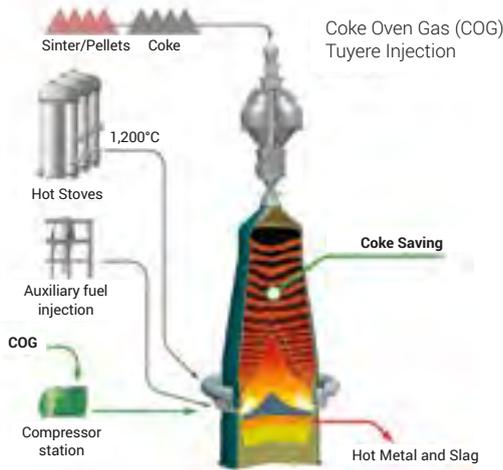
COG can be injected in the blast furnace as a substitution of natural gas, pulverized coal or coke. For economic reasons however, customers often prefer to maintain a high rate of pulverized coal injection (>150 kg/tHM), taking benefit from the market price difference of PCI coal versus expensive coke. Considering that injection of cold COG along with a high rate of pulverized coal leads to a significant drop in the raceway adiabatic flame temperature (RAFT), only a relatively small amount of cold COG can be injected into the tuyere. This limits the CO₂ saving potential of this technology to approximately 3 to 4 percent.

COG shaft injection

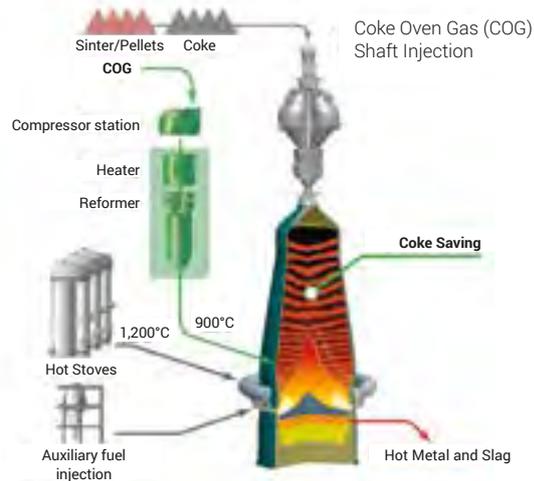
COG injection in the lower shaft of the blast furnace is an alternative technology to utilize a higher amount of COG in the BF. Shaft injection is advantageous in many ways as it does not limit the furnace operation in terms of RAFT. On the contrary, it improves the top gas temperature thanks to a larger shaft gas volume.

In case of shaft injection, COG temperature should be equivalent to the temperature of the lower shaft (900-1,000°C) in order to not cool or overheat the shaft zone. However, heating up COG to such high temperatures brings

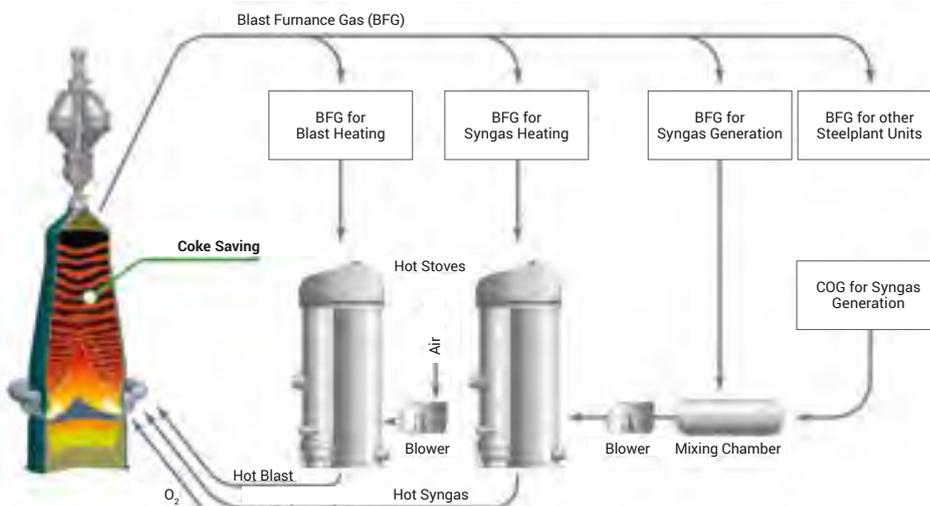
a) COG tuyere injection



b) COG shaft injection



Utilization of blast furnace gas along with coke oven gas



COG dry reforming with blast furnace gas and syngas injection into the blast furnace.

about many technological challenges, such as carbon deposition and poisoning of the reactor surface due to impurities present in the COG. Furthermore, this option may lead to a redistribution of temperature isotherms near the shaft wall. To overcome these problems, reforming of COG can be carried out in order to convert the contained hydrocarbons into H₂ and CO. Paul Wurth is presently working on the development of a COG reforming technology based on partial COG oxidation.

Combining tuyere and shaft injection allows significant savings in CO₂ emissions (up to 10 percent), as the entire COG present in the steel plant is used. To target higher CO₂ savings from steel plants, it is essential to develop technologies, which utilize not only coke oven gas but also convert blast furnace gas (BFG) into fuel suitable for utilization in the blast furnace.

UTILIZATION OF BLAST FURNACE GAS ALONG WITH COKE OVEN GAS

Proposals to utilize blast furnace gas within the BF have already been made in the past, especially in the frame of the ULCOS - Ultra Low CO₂ Steelmaking project. The idea is to capture the CO₂ contained in the blast furnace gas and to reinject the remaining portion into the blast furnace at tuyere and/or shaft level. A major concern is then the profitable use of the huge amount of CO₂ captured from a typical industrial blast furnace. Therefore, Paul Wurth is following another concept based on dry reforming, in which hydrocarbons react with CO₂ in order to produce H₂ and CO containing reducing gas. Paul Wurth is developing a technology to execute the dry reforming reaction at a higher temperature level not requiring a catalyst, which is usually prone to poisoning with COG.

Laboratory tests are run to define the best process conditions for this approach. The process shall take place in a specially designed reforming regenerative heat exchanger (a modified hot blast stove), which will convert the COG/BFG mixture into hot syngas. The COG dry reforming hot stove will operate in a similar way as a conventional hot blast stove. The compressed COG and BFG will be reformed and heated up to a temperature similar to the hot blast temperature (1,100-1,300°C). The generated hot syngas can now be injected as reducing gas into the BF at tuyere level.

This technology provides the opportunity to exploit a significant amount of process off-gases in the blast furnace, thereby achieving CO₂ savings. Compared to the ULCOS BF, this process is interesting since it is based on hot blast stove technology, well known to steel plant operators and not requiring complex equipment.

STEPWISE MODIFICATIONS OF BLAST FURNACE PLANTS

Considering political indecisions with regard to CO₂ emissions trade and cap system, the tremendous investment needed for switching to new technologies and the therewith related competitiveness risk for European steelmakers against the global market, the actual CO₂ reduction calendar is uncertain.

A solution would be a stepwise CO₂ reduction approach based on the modification of the existing installations, together with retrofit integration of renewable power in the processes. COG dry reforming technology proposed by Paul Wurth fits into this scheme and would allow stretching the required investment over the time.

- The first step of the COG dry reforming concept targets 17-18 percent of CO₂ savings. It involves the shift of the steel plant's off-gases from usage in the power plant to injection in the blast furnace, facilitated through internal redistribution of off-gases to avail the entire COG for dry reforming.
- The second step targets up to 30 percent reduction of CO₂ emissions. It is based on the utilization of the entire COG and BFG for dry reforming and the injection of natural gas at different steel plant units.
- The third step targets up to 40 percent of CO₂ savings. It includes the electrification of the steel mills and
- The fourth step involves the complete substitution of hot blast by oxygen injection in the blast furnace. The fourth step provides easy CO₂ capture possibility from the blast furnace.

As the off-gas distribution and usage varies from one steel plant operator to another, Paul Wurth assists customers in the development of plant specific CO₂ reduction strategies and proposes already now a number of CO₂-saving technologies. Driven by its pioneering spirit that has marked traditional ironmaking throughout decades, Paul Wurth is committed to leading the transformation towards finally carbon-free iron ore reduction. ♦



Further information
www.paulwurth.com



WORLDWIDE

X-PACT® LEADING AUTOMATION IN STEELWORKS

Automation Energy efficiency improvement through smart software solutions.

Steelmakers are today presented with the highly challenging task of operating their plants in such a way that while meeting the growing quality standards also the best possible energy efficiency is achieved. The operator has to see to it that the processes run without a hitch and the quality of production is as required. Measures taken to optimize the energy efficiency, such as coal injection into the EAF, selection of the optimal casting ladle for the existing thermal conditions, scheduling casting ladle maintenance and repair as well as tilting of the converter for the tap, should be performed fully automatically. Without manual intervention, errors are minimized or completely avoided. This provides the basis for efficient operation of all systems.

With X-Pact® Leading Automation, SMS group offers a completely newly developed automation system which in addition to its innovative process and operator guidance also includes numerous features for energy efficiency improvement. For metallurgical processes, the use of these new features provides significant savings on electrical and fossil energy, as a rule resulting in a Return on Investment of distinctly below two years.

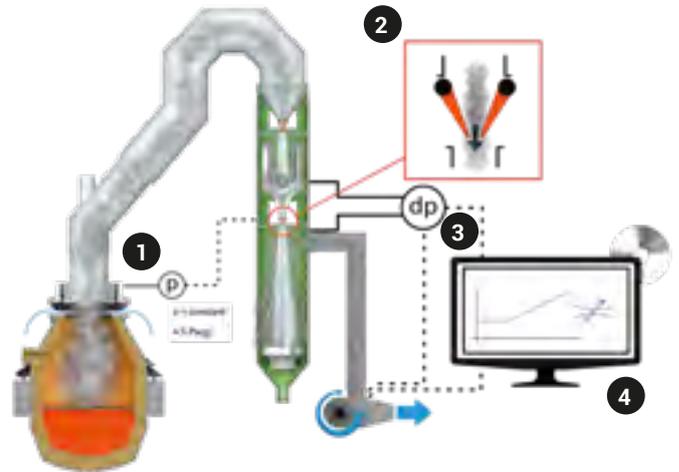
The modular structure of X-Pact® Leading Automation also allows individual assistance systems or optimization modules to be installed in existing plants as add-ons. Presented below is a selection of innovative applications in electrical and automation systems of metallurgical plants taking into account aspects such as energy and material costs, plant utilization and productivity.

X-Pact® Gas Cleaning Control – Mastering exhaust gases

Original situation

In the converter gas cleaning process (BAUMCO system) the rising primary gas is first cooled in a cooling-water or steam stack, then cleaned in a gas scrubber and from there, via the main fan unit, conveyed to a stack or a gas recovery system for extraction and further cleaning.

Varying operating states of the converter lead to varying pressure conditions in the exhaust gas duct. In order to ensure a sufficiently high flow rate at all stages, the induced-draft (ID) fan – arranged downstream of the cleaning process – as a rule operates at maximum speed. This results in high energy consumption and high costs. In such a situation, the venturi throat at the gas scrubber adjusts only the negative pressure at the mouth of the converter's adjustable skirts.



X-Pact® Gas Cleaning Control – Process illustration

- 1 Standard pressure measurement at the cover for volume reading
- 2 Venturi throat to adjust the volume in the gas cleaning plant
- 3 Differential pressure measurement via the venturi throat to adjust the speed of the induced-draft fan
- 4 Induced-draft fan, AC frequency-controlled via differential pressure and position of venturi throat

Innovation

SMS group has developed a dynamic control for the AC frequency-controlled ID fan and the venturi throat. The gas cleaning control system (an SMS group patent) adjusts the pressure to frequent and rapid pressure changes at the converter via the venturi throat, while adjustments to slower pressure variations are made via the ID fan.

Savings

- An at least 8 percent higher efficiency can be achieved by controlling the gas cleaning plant more efficiently.
- At least 2 percent more gas can be recovered as a result of the more precisely controlled process.
- The constant negative pressure at the converter mouth stabilizes decarburization and facilitates more precise end-point prediction in the process model. If applied in concert with the SMS group's BOF model, the X-Pact® Process Optimizer, even more improvements are achievable.

X-Pact® Gas Cleaning Assist – Optimization of energy consumption

Original situation

In steel mills, gas cleaning plants are used to extract dust-laden and partly toxic exhaust gases directly where they arise. This is to keep the concentration of emissions at the work places down to the allowable limits and, last but not least, contributes to the recovery of resources.

The set points for the valve positions are usually manually entered into the setting matrix. In order to securely achieve the required values at the extraction points, the respective values for the negative pressure in the various process stages are usually set too high (as they are not based on exact calculations). The values are also set higher than necessary to rule out the risk of leaking extracted gases.

Additionally, this way of adjustment makes the commissioning of the dedusting system a very time-consuming procedure.

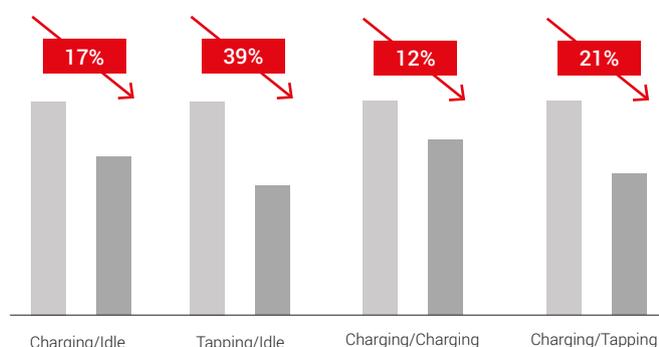
In order for all these tasks to be performed with minimum energy input, SMS group has developed a new system for the energy-efficient control of dedusting plants.

Innovation

A calculation module provides empirically determined values for the optimal valve positions in the duct network.

As network resistances are taken into account, the set points can be determined with very high accuracy.

Thanks to the variable negative pressure ahead of the filter (according to the extraction rate required by the fans), excellent energy efficiency is achieved. By measuring the electricity consumption at a fixed negative pressure ahead of the filter, it is possible to measure depositing dust in the



Process Savings – Examples

Typical savings achieved by X-Pact® Gas Cleaning Assist during the various stages of the BOF process.

ducts. A rising specific electricity consumption is an indicator of blocked ducts.

Measuring the negative pressure ahead of the filter is the only measurement required.

A special feature of the system is the auto-cleaning function, i.e. the cleaning of the ducts at regular intervals by increasing the extraction volume. During periods of low extraction requirements, specific duct sections are subjected to extraction, removing part of the deposited dust.

X-Pact® Temperature Assist – Temperature forecasts save energy

Original situation

Liquid steel is usually transferred in steel ladles. A refractory lining inside the ladle shields the steel armor from the enormous heat. The lining of a ladle with a design capacity of 280 tons weighs approximately 43 tons.

The steel temperature is an important quality parameter and it directly interacts with the big mass of the refractory material. Therefore, there is a direct relationship between the temperature loss and the energy content of the total mass of a ladle.

Innovation

The numerical temperature model developed by SMS group calculates the energy content (enthalpy) of all ladles, taking into consideration process situations such as ladle heating, transfer in the empty and filled state, tapping in the primary metallurgy process area, secondary metallurgy treatment as well as casting with and without ladle cover. Besides the calculation of the current energy content, two further predictive calculations can be performed:

- Forecast of the target temperature of the ladle furnace that ensures that the optimal casting temperature window is hit, and
- Forecast of the tapping temperature for optimized ladle use.

These two models help operators to significantly improve the temperature control of their steel ladles and, with it, the temperature control of the liquid steel.

Savings

The Ladle-Tracking temperature model can forecast temperature losses. For example, it is possible to precisely calculate in advance the target temperatures the liquid steel should

have at the transfer point to the ladle furnace. Thus the usual practice of superheating can be dispensed with. This reduces the tap-to-tap times of the melting unit and optimizes energy use. The result are enormous cost savings.

X-Pact® FEOS – Cost optimization for the EAF process

Original situation

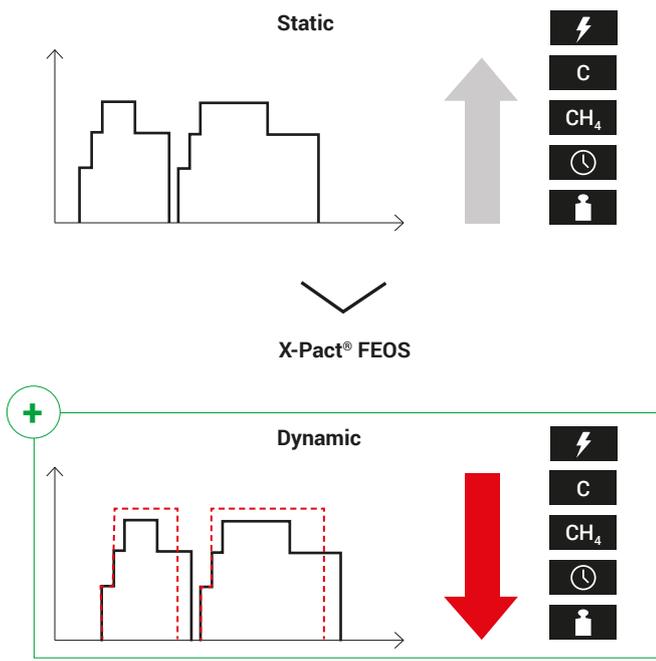
The electric arc furnace process is static. Operation follows strictly defined process patterns for electricity, coal and natural gas input. The coal needed for the process-relevant practice of slag foaming is usually added manually.

This leads to higher than necessary coal consumption and energy input along with longer than necessary power-on and tap-to-tap times. In other words, potentials are left unused.

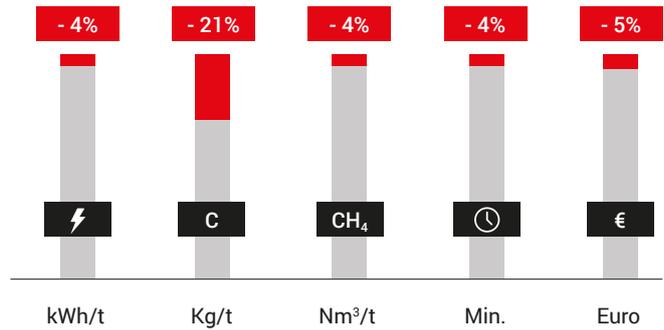
Innovation

FEOS (Furnace Energy Optimization System) optimizes the furnace process during running operation with respect to the maximum energy input while providing best possible protection of the refractory lining, and it determines the exact amount of coal needed for slag foaming.

SMS group has already achieved enormous savings by reducing the specific energy input and injected coal consumption in cooperation with its customers.



Cost savings with X-Pact® FEOS



Reducing tap-to-tap times and operating costs with X-Pact® FEOS.

Plant operators benefit right from the first heat after FEOS has been installed. During a cost-free test phase, FEOS demonstrates what savings potential is feasible. This test phase is used to thoroughly evaluate the benefits of FEOS, providing the customer a solid decision basis for his purchase. The customer can derive the savings potential from the comparison of the data measured before and after the installation of FEOS and decide whether it justifies the investment.

Savings

It has been determined that between two and four percent of energy can be saved with X-Pact® FEOS. The investment can pay back in less than four months.

Energy Demand Control – Optimization of energy procurement through energy demand forecast

Original situation

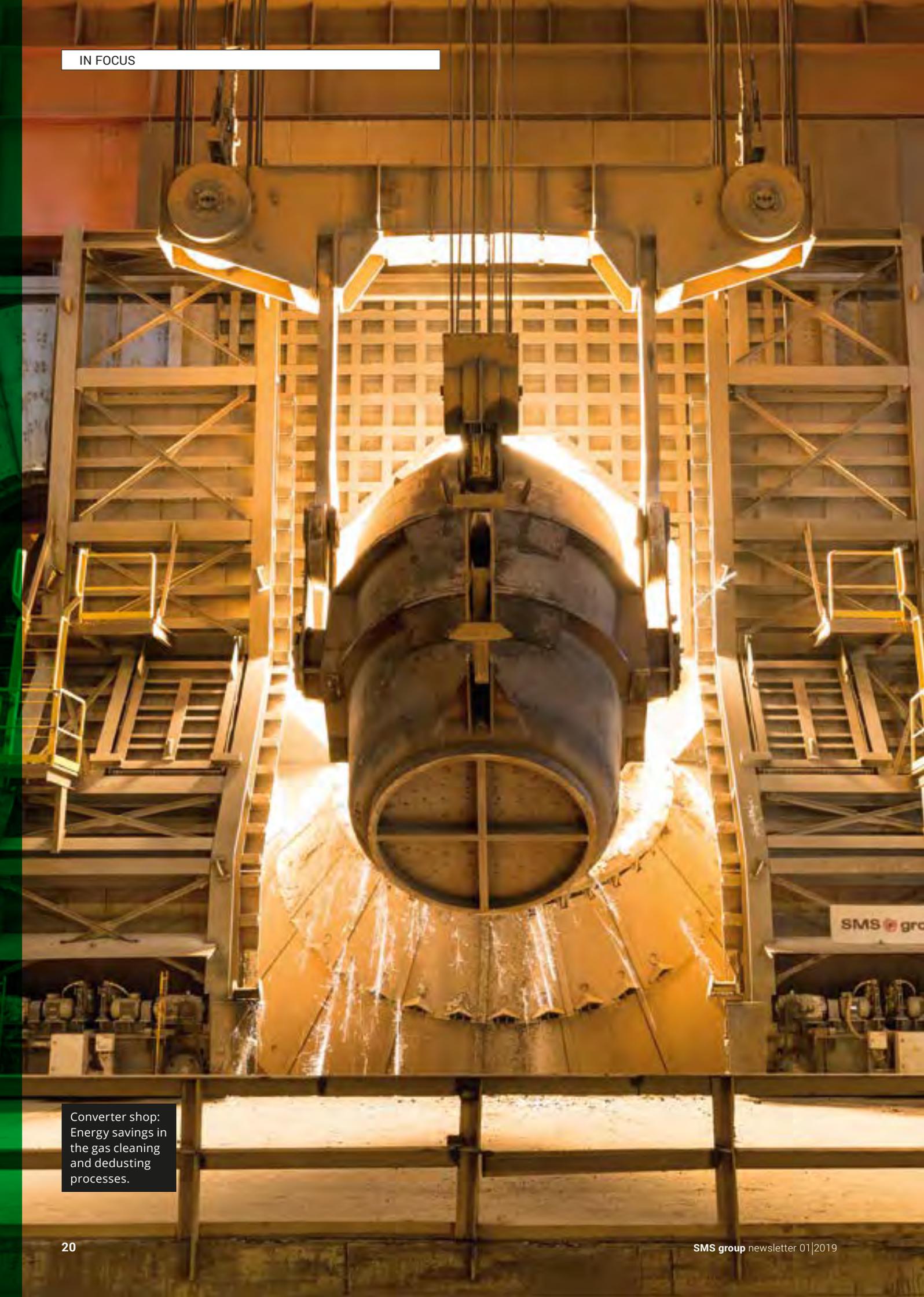
Even today, electricity consumption plays a key role in steel-making processes. Alongside the big “consumers”, such as the electric arc furnace, numerous small electricity consuming components make up the total electricity demand of a steelmaking plant.

Innovation

The Energy Demand Control module developed by SMS group sums up, predicts and visualizes the energy consumed by all plant units and components. The module uses this information to control the energy use in a smart way, helping operators to meet threshold values and comply with limitations. With the Eco Mode add-on, it is possible to reduce the energy demand during idle times yet further. Being an integrated module of X-Pact® Leading Automation, Energy Demand Control acquires all available consumption data. Complemented by intelligent forecasting, the module also supports the discontinuous processes taking place at the various production stages, for example, the converter ▶



X-Pact® FEOS
optimizes energy
consumption in the
EAF process.



Converter shop:
Energy savings in
the gas cleaning
and dedusting
processes.

process. A switch-off matrix adds to the energy savings by reducing the consumption by individual processes or switching them off completely – always in due consideration of the specifics of the respective process and clearly indicated to the operator.

Savings

The Energy Demand Control module, in concert with the Eco Mode add-on, actively supports the operator in reducing the number of electricity consuming units or switching them off completely whenever possible. Additionally, the system prevents the plant operator from exceeding the power demand limits stipulated in power purchase agreements and having to pay a penalty to the energy supplier for breach of contract.

- Equal distribution of the heats on all EAFs:
This operation mode leads to all EAFs being permanently held at operating temperature. Should one EAF fail, one of the remaining units will be able to take over immediately. This entails higher energy consumption, but rules out the risk of having to interrupt casting in the event of failure of one of the EAFs.
- Distribution of the heats on the minimum possible number of EAFs:
This mode saves energy, as only those furnaces required for the reduced CC capacity are being operated. Switching between both modes is uncomplicated. Therefore, in less critical situations, the operator may easily switch to the energy-saving variant. The Meltshop Pacer will automatically react when the casting machine goes back into operation.

X-Pact® MES 4.0 – Production planning under energy consumption aspects

The Meltshop Pacer software module calculates the optimal start and stop times of a heat in a steel plant along the EAF-LF-VD-CCM process route, taking into account current occupation and usage of the plants. Complex plant structures require powerful IT to calculate the optimal solution within the given time limits.

In situations in which the steelworks' capacity is not fully utilized, for example, during maintenance of a continuous casting machine, the operator may choose between two calculation variants:

Bottom line

X-Pact® Leading Automation is a modular and scalable system. The above presented modules can be used either as integral parts of a complete automation solution or as independent add-ons integrated into existing facilities. They interface with any conceivable communication formats.

This approach allows SMS group to achieve great savings with relatively modest investments. Products designed to achieve energy savings are expected to provide an ROI of less than two years. This can be easily achieved with the here presented modules. ♦

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X-Pact® MES 4.0 module.

WORLDWIDE

CONSTIR-MWS MODULATED WAVE STIRRING

Metallurgy A powerful tool to boost EMS performance and efficiency.



Electromagnetic stirrers (EMS) are a must for almost every continuous casting machine for long products. They improve steel quality and support a smooth, stable production process. However EMS are the single biggest consumer of electricity in a continuous caster production line. SMS Concast has addressed this issue with a small and smart tool: the modulated wave stirring (MWS) system. It radically reduces EMS electricity consumption by 30% and more.

Modulated wave stirring (MWS) shapes the electromagnetic field produced by an EMS. Based on advanced process analysis, it modulates the amplitude and frequency (AFM) of the current in the stirrer coils in such a way that the same stirring effect requires less energy input. The modulated wave requires less energy, hence power savings are achieved.

With the amplitude and frequency modulation (AFM) the conventional sinusoidal magnetic field is replaced by a multi-frequency magnetic field so that the liquid steel achieves greater turbulence (Figure 1). The temperature distribution thus getting more uniform, the result is a much more efficient electromagnetic stirring effect.

For the EMS current modulation a proprietary algorithm calculates how the conventional sinusoidal current input is to be adapted in its amplitude and frequency (AFM). The main variables for this calculation are steel grades, section size and specific operational inputs.

Figure 2 explains in more detail, how CONSTIR-MWS is integrated in the overall system. The frequency converter gets set as usual via the human machine interface (HMI) and the

Energy savings achieved with CONSTIR-MWS on seven installations

Considering that stirrers are often the largest power consumers on continuous casting machines, such power consumption savings are quite impressive and guarantee a very short return on investment (ROI) time. In this way CONSTIR-MWS represents an economical green technology add-on for any continuous casting machine.

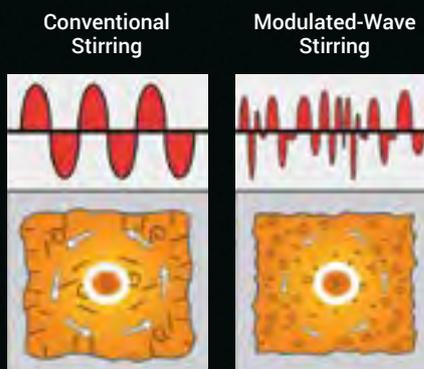
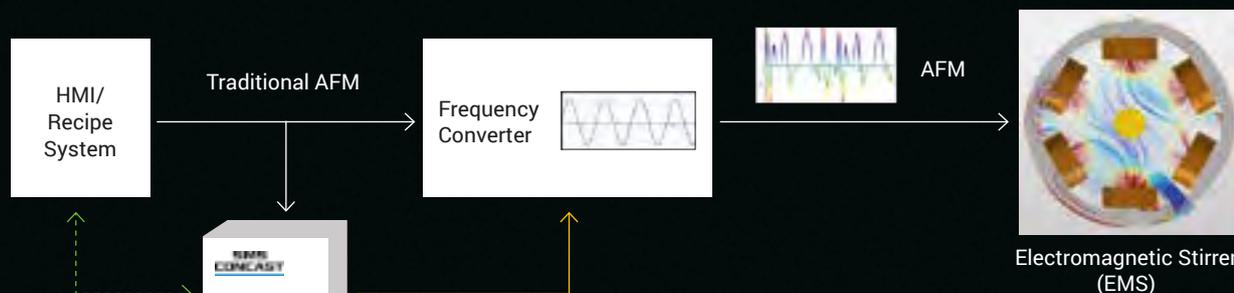


Figure 1: MWS significantly reduces the stirrer's energy consumption

Industrial application of CONSTIR-MWS stirring (Figure 2)



MWS = Modulated Wave Stirring
 HMI = Human Machine Interface
 AFM = Amplitude and Frequency Modulation

metallurgical recipe system. The CONSTIR-MWS controller generates the amplitude and frequency modulation (AFM) set point based on a special algorithm as explained above. These set points are then provided to the frequency converters which generate the modulation. Thus the original EMS system now performs a fast and reliable AFM operation to improve the stirrer efficiency with respect to performance and energy consumption.

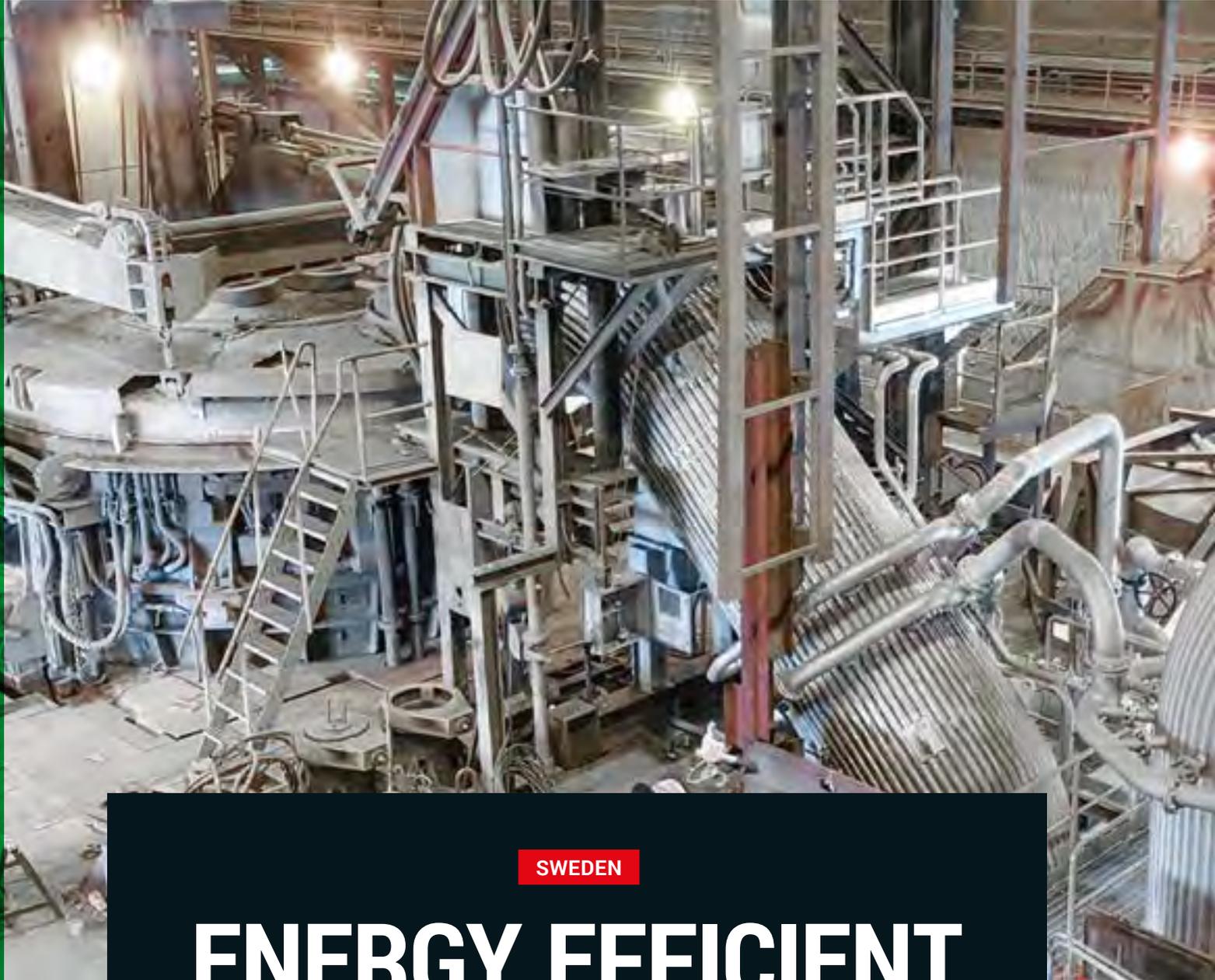
Also, the CONSTIR-MWS controller interfaces to the HMI and production recipe system and can be switched-on or switched-off in order to adapt to processed steel grades. As industrial application, CONSTIR-MWS can be retrofitted to any continuous caster using a Mold-, Strand- or Final-EMS,

35.4%

Average measured energy savings.

even when existing EMS units are already installed. No additional screens, buttons or mechanical equipment are needed, apart from the CONSTIR-MWS controller. Field application and trials have confirmed that on seven CONSTIR-MWS installations the average energy savings are at 35.4%. ♦

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SWEDEN

ENERGY EFFICIENT ENVIRONMENTAL TECHNOLOGY

Metallurgy Successful commissioning of modernized fumes treatment system at Uddeholm AB, Sweden.



Primary gas cooling system as modernized by SMS group at the electric arc furnace of Uddeholm.

- **Installing a cooler with bypass** prevents the formation of contaminants during scrap drying.
- **Dust content at the stack outlet** is 50 percent below the requested value.

SMS group has successfully commissioned the second modernization phase of the fumes treatment system of the electric arc furnace, and final acceptance (FAC) has already been granted.

In phase 1, SMS group had installed a new, more efficient filter system and replaced the canopy hood of the electric arc furnace with an SMS frustum hood. In this connection, the secondary gas line was also renewed, and an axial cyclone was installed as spark separator upstream of the new jet pulse filter. In phase 2, the primary gas line for direct exhausting of the hot fumes from the 60-ton electric arc furnace was renewed.

MUCH HIGHER FUMES VOLUME

The scope of supply of phase 2 consisted of a water-cooled fumes section, a gas cooler with bypass, and a radial-flow fan for pressure boosting. The hot fumes forming during the melting process are used to dry and preheat the scrap, and adhering ice is removed this way. The installation of a cooler with bypass maintains the entry temperature at the scrap pre-dryer at maximum 300°C, which prevents the formation of contaminants during scrap drying. The water-cooled components were optimized with regard to pressure losses and already prepared for the future use of an energy recovery system.

The modernization of the fumes treatment system yields quite a number of advantages. The new technology achieves a rise in fumes volume by 66 percent without increasing the energy consumption in comparison with the old system. The SMS frustum hood allows clearly more effective capturing and exhausting of the fumes during furnace charging and tapping. The dust content at the stack outlet is 50 percent below the requested value. The drying of the scrap guarantees safe operation of the furnace, and in the future it will be possible to recover energy by way of the extraction of hot water. ♦



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SWEDEN

HIGHLY EFFECTIVE

Metallurgy Scandinavia's largest producer of unalloyed and low-alloy flat steel has upgraded its converter shop in Luleå with SMS group technology. The aim of the project was to increase the yield of both converters and satisfy high environmental standards.



Swedish steel group SSAB is Scandinavia's largest producer of unalloyed and low-alloy flat steel. SSAB has production facilities in Luleå, Borlänge, Oxelösund, and Finspång.

SSAB operates an integrated steel plant at its Luleå site, including a converter shop with two BOF converters (1972: BOF 1, 1974: BOF 2). The converters, and the environmental technology in particular, needed to be renewed and/or upgraded. The contract for this was awarded to SMS group in 2014. The aim of the revamp was to increase the yield of both converters and satisfy the high environmental standards demanded.

In a converter shop, large amounts of process-related gas and dust are emitted along with the steel being produced. SMS group has the right technologies and components that can tackle the functional complexity at all times – in terms of both economy and ecology.

The purpose of the converter process is to significantly reduce the carbon content of the hot metal. The aim here is to achieve values of less than 0.1 percent by mass. To this end, substantial chemical transformations must take place. At the beginning of the process, for example, the melt of a 300-ton converter contains around 10 tons of carbon which must be reduced to around 100 kilograms. To bring about the necessary reduction, large amounts of technically pure oxygen are blown onto the melt. As a result, the undesired carbon escapes as CO and CO₂. The process gases associated with the production process are systematically collected and extracted.

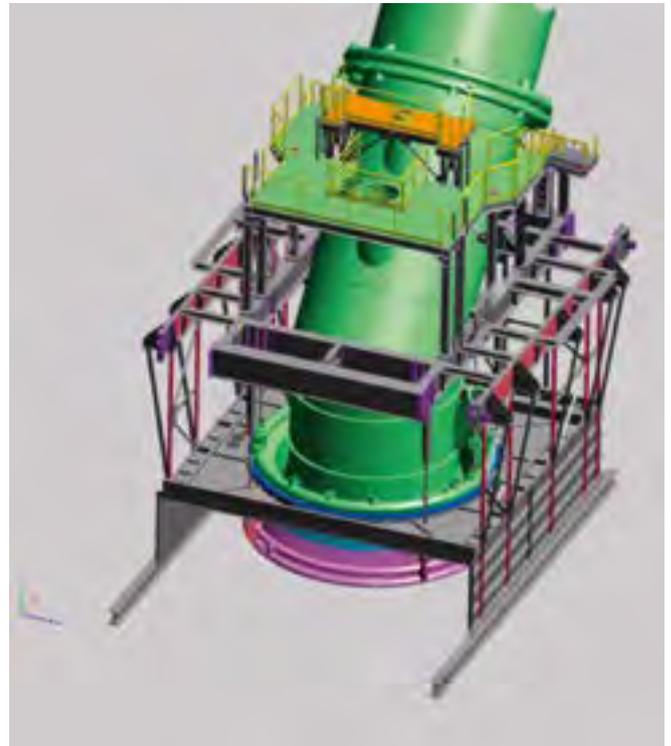
SMS GROUP SCOPE OF SUPPLY

Both converters, the cooling stacks and the inlet section of the scrubbing tower were replaced by SMS group in 2015.

SMS group's scope of supply included the engineering and manufacture of the complete converters and cooling stacks, including the dismantling and assembly of the component parts. The revamp was completed within the scheduled furnace shutdown period of 100 days. The converters and cooling stacks were replaced at the same time.

OPERATING PRINCIPLE OF THE SMS GROUP ADJUSTABLE SKIRT

Before melting, the SMS group adjustable skirt is hydraulically positioned over the converter opening. It provides an extensively air-tight seal on the opening. Process gases cannot escape into the atmosphere. At the same time it blocks the ingress of false air and prevents process gases from being completely burnt off and their internal energy being lost



Design of the adjustable skirt.

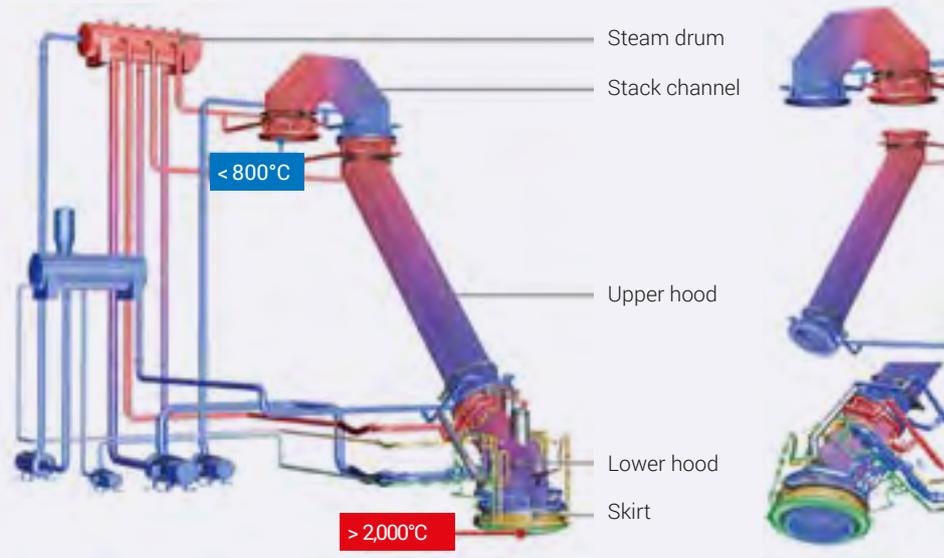
and unused. Instead, the chemical energy contained in the converter gas is available for recovery and re-use.

This is where SSAB relies on the design of the SMS group adjustable skirt, whereby the pressure inside the labyrinth seal is controlled in such a way that the intake of false air into the cooling stack is kept as low as possible. This has resulted in a substantial increase in the energy content of the process gas generated. The serviceability of the pressure measuring device has also been greatly enhanced thanks to the SMS group design.

The temperature of the gases collected at the converter mouth is around 1,700°C. For this reason, the SMS group adjustable skirt is equipped with highly effective water cooling systems and connected to recovery systems.

The precise coordination of the adjustable skirt and converter geometry means any interfering false air flows are avoided. This ensures an optimal flow development. A labyrinth seal is installed between the adjustable skirt and the converter hood for pressure control purposes. The converter hood has sealed openings for the oxygen and measuring lances.

Each converter has a tapping weight of 130 tons and an oxygen blowing rate of 320 Nm³/min. The resulting process gas containing CO is conducted into the cooling stack via the adjustable skirt using a suppressed combustion system. ▶



By comparison with a water cooling circuit, the generation of saturated steam means 15% less energy is consumed.

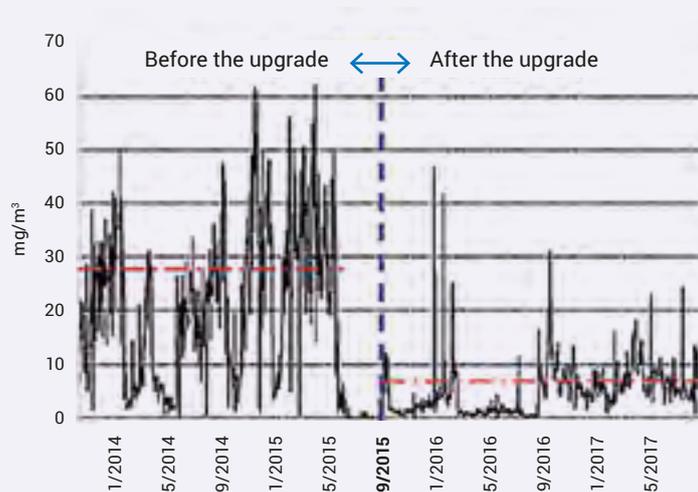
Production ramp-up of BOF 1 and BOF 2



First heat of BOF 1 on 14 September 2015.

Improvement in dust separation efficiency

This diagram clearly shows the improvement in the dust separation system. The pre-upgrade state is shown to the left of the blue separating line, with a mean value of $< 30 \text{ mg/m}^3$ dust in the process gas. The post-upgrade state is shown on the right, with a mean value of $< 10 \text{ mg/m}^3$ dust in the process gas.



The cooling stack, which operates in a water-steam circuit, cools the approx. 2,000°C hot process gas down to below 1,000°C and converts the heat released into steam. The cooling stack is operated at a pressure of between 1.5 and 3.3 MPa.

The steam produced is separated from the water-steam circuit in the steam drum and equalized with a steam accumulator so that a constant steam flow can be fed into the steam network of the plant. The CO process gas, which is created during the blowing process as a result of the suppressed combustion, is collected in a gas tank and re-used as a source of energy.

By replacing the cooling stacks, it was also possible to optimize the design of the adjustable skirt, the water recirculation system, and the scrubbing tower inlet section.

Revamp time schedule for SSAB

Order placement	9 May 2014
Delivery time	12 months
Start of shutdown	2 June 2015
Successful demonstration of target performance indicators	24 September 2015

To ensure the process gas can be collected as effectively as possible, the area between the converter outlet and the cooling stack inlet was sealed using an SMS group adjustable skirt.

The SMS group adjustable skirt with labyrinth seal prevents an excess of false air from being sucked into the cooling stack and also prevents the process gases containing CO from escaping.

OPTIMAL GAS RECOVERY

For optimal gas recovery it is important that precisely the same amount of gas is removed by extraction as the quantity of primary gas produced during the converter process. Consequently, the volumetric flow rate of gas extracted is regulated by a pressure measuring device inside the labyrinth seal. This type of control system and the effective seal provided by the adjustable skirt enable a high quality of process gas to be attained. A combustion factor λ that is significantly lower than 0.1 is achieved thanks to the adjustable skirt system developed and optimized by SMS group. By comparison: this value before the revamp was 0.2.

This is where the proven pressure measuring device, optimized by SMS group, is used. It is chosen such that, at a negative pressure in the labyrinth of approximately +/-0, only small quantities of false air can enter the cooling stack or process gas can escape.

The position selected means the pressure measuring device is additionally protected against the dust-laden process gas. This prevents blockages in the impulse lines on the pressure transmitters.

The cooling stack's water-steam circuit was analyzed and optimized as part of the revamp. It has resulted in the re-used circulation pumps working more effectively within their characteristic range. The cooling stacks operate under both forced and natural circulation. The water circulation in the cooling stacks is an important parameter for the effectiveness and durability of the components. SMS group fitted LaMont nozzles in the section of the cooling stack that is operated under forced circulation. Crucial influencing variables here are the line pressure loss and the heat input. Choosing the appropriate size of nozzles results in an even circulation of water.

Lower gas temperatures at the cooling stack outlet are the result. A water circulation stoppage, which can cause damage to the pipes, is thus prevented. The downcomers and risers were adapted in the natural circulation section to the new set-up.

The increased effectiveness of the new cooling stacks was confirmed during both the hot commissioning and the demonstration of the target performance indicators.

The cooling stack was welded with Thermanit in areas that are subject to considerable wear.

As soon as the converters and cooling stacks were replaced, both plants were ready for production and the planned ramp-up curve was significantly exceeded.

The new pressure control system maintains the negative pressure in the cooling stack at the precise setpoints selected. This means only small quantities of secondary air are sucked in at the cooling stack inlet. There was a substantial increase in the CO content of the process gases.

A direct comparison of the plant before and after the revamp showed that the portion of CO in the gas rose by an average of 10 percent point, from a previous level of around 60 vol.-%dry to a current level of > 70 vol.-%dry. The thermal value of the converter gas therefore increased by around 15 percent, resulting in primary energy source savings (natural gas).

Thanks to the lower supply of false air, the venturi throat functions within its optimum operating range, which in turn results in significant improvements in the dust separation system, as is shown in the diagram on the left. ♦

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ARGENTINA

EFFECTIVE ENVIRONMENTAL ENGINEERING

Metallurgy Ternium Argentina awards FAC for successful upgrade of gas cleaning plants.

Ternium Argentina, based in San Nicolas, Argentina, has awarded SMS group the Final Acceptance Certificate for the upgraded BOF gas cleaning plants at its San Nicolas works.

As part of a planned increase in the production capacity of the three 190-ton converters, the gas cleaning plants, installed in the 1970s, were upgraded to the state of the art and now provide far more efficient cleaning results. Offgas emissions have been reduced to below 25 mg/Nm³; the legal limit is 50 mg/Nm³.

Cesar Alejandro Parisi, Head of Plant Development Department for Hot Rolling Mill and Steelplant, Ternium Argentina: "This upgrade of our gas cleaning plants means we are ideally equipped to meet the environmental chal-

lenges of the future. The performance of SMS group's environmental technology comes up to and even exceeds our expectations."

For the revamp of the three scrubbers, SMS group supplied key components as well as two main induced-draft fans for gas cleaning. The venturi throat, developed by SMS group, features a new type of nozzle geometry and arrangement, which ensures extraction of a larger quantity of dust particles.

The scope of supply also included the measuring technology for the venturi scrubber and the whole gas cleaning plant, including the cooling stack, as well as the supervision of the erection work and commissioning. ♦



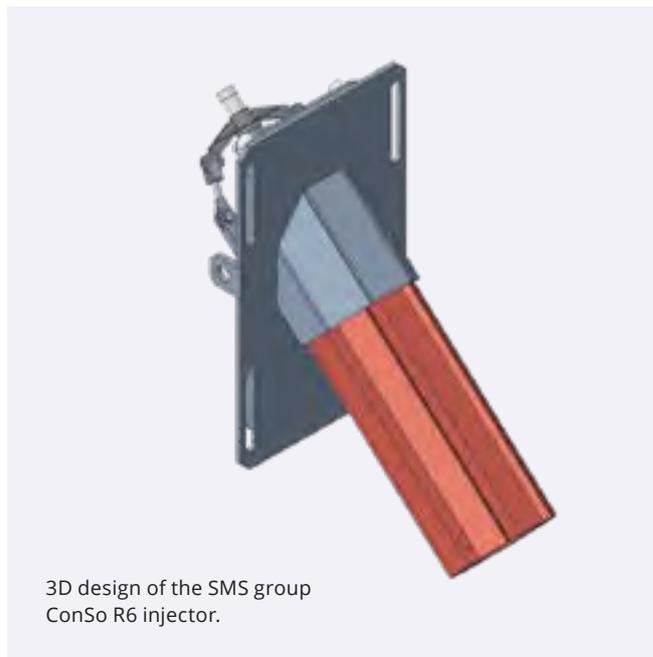
The venturi throat from SMS group helps to reduce emissions significantly.



Dr. Dirk Timmermann
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Design study with computational fluid dynamics (CFD).



3D design of the SMS group ConSo R6 injector.

CHINA

ELECTRIC ARC FURNACE WITH INJECTOR TECHNOLOGY

Metallurgy Nanjing Iron and Steel to receive new ConSo R6 injectors for an electric arc furnace. The aim is to reduce the volume of hot metal by adding scrap to the charge.

Nanjing Iron and Steel Co., Ltd., China, has placed an order with SMS group to supply new SMS group ConSo R6 injectors for the electric arc furnace No. 3 in Luhe, Nanjing. Erection and commissioning of the equipment are scheduled for 2019.

The main goal of the upgrade is to cope with the future reduction of hot metal by replacing it with scrap in the charge. For this purpose, efficient injector technology is required. Furthermore, the upgrade will reduce operating costs and increase productivity.

The injector design was developed using computational fluid dynamics (CFD). The new lightweight construction, 10 percent lighter than the previous version, is particularly easy to maintain.

The SMS group ConSo R6 water-cooled copper boxes in monoblock design are not susceptible to cracking and effectively prevent water leakage. The integrated flashback

detection system allows continuous monitoring of the ConSo R6 injector. The injector, which can be operated in burner or oxygen injector mode, additionally provides for automatic management of the melting profiles, ensuring excellent efficiency.

The SMS group scope of supply includes three ConSo R6 injectors, water-cooled copper boxes, the respective valve stations, an integrated flashback detection system as well as supervision of the erection and commissioning activities. ♦



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Electric arc furnace built by SMS group in operation.

AUSTRIA

HIGH-TECH STAINLESS STEEL PLANT

Metallurgy voestalpine orders main melting area components for new stainless steel plant in Kapfenberg.

- **Innovative technologies** of the new stainless steel plant will set new energy efficiency and environmental protection standards.
- **The order for SMS group** comprises a 55-ton electric arc furnace, a 60-ton vacuum converter, three ladle furnaces, two vacuum degassers, one vacuum oxygen degasser, one ladle refining station and all associated electrical and automation systems.

voestalpine BÖHLER Edelstahl, a subsidiary of the international technology and capital goods group voestalpine and located in Kapfenberg, Austria, has placed an order with SMS group to supply an electric arc furnace, an AOD converter and secondary metallurgical facilities for the construction of a high-tech stainless steel plant which will set new standards in energy efficiency, environment protection as well as innovative automation of the production processes. The new stainless steel plant is intended to replace the existing plant of voestalpine BÖHLER Edelstahl GmbH & Co KG at the Kapfenberg location and will produce 205,000 tons of high-performance steels per year for application in the aerospace and automotive industries as well as for the oil and gas sector.

On a site of approximately 50,000 square meters, the globally most advanced plant for the production of stainless steel will be established within the next three years. Hot commissioning is scheduled to take place in the middle of 2021.

The steel plant concept unites cost-efficient process solutions with optimized process sequences and high plant availability. The plant engineering will feature a high degree of automation and digitalization in all production steps.

FURNACE POWERED BY RENEWABLE ENERGY

The centerpiece of the plant will be a 55-ton electric arc furnace (EAF) able to melt high-purity scrap and alloys into liquid steel on the basis of electrical power that is completely generated by renewable energy sources. In addition, the exhaust heat generated during the process will be used to dry the ultra-pure scrap in a separate plant before it is fed to the electric arc furnace.

The 60-ton vacuum converter will combine the classical AOD process for medium carbon contents with decarburization and degassing under vacuum for steel grades having low and ultra-low contents of carbon and nitrogen.

The ladle metallurgical sector of the production line will be equipped to meet all future requirements in steel refining. It will comprise three ladle furnaces, two VD systems for ▶



3D representation of the high-tech stainless steel plant from SMS group for voestalpine BÖHLER Edelstahl.

steel degassing, which means in the first place to reduce undesired hydrogen contents and to obtain lowest possible sulfur content (< 10 ppm), a VOD system for vacuum refining of stainless steel grades as well as a ladle treatment station for the analytic conditioning and homogenizing of steel melts. The VD systems will be used for the vacuum treatment of high-temperature resistant steels respectively tool steels, while the VOD system serves for the refinement of stainless steel grades, preferably of ferritic steels with low carbon content.

In terms of energy efficiency and environment protection, too, the new stainless steel plant will set new benchmarks. Closed cooling water circuits and heat recovery systems will minimize emissions and the consumption of resources. Forward-looking air purification systems will meet the most stringent environmental requirements.

SUPPLY SCOPE TO INCLUDE ELECTRICAL AND AUTOMATION SYSTEMS

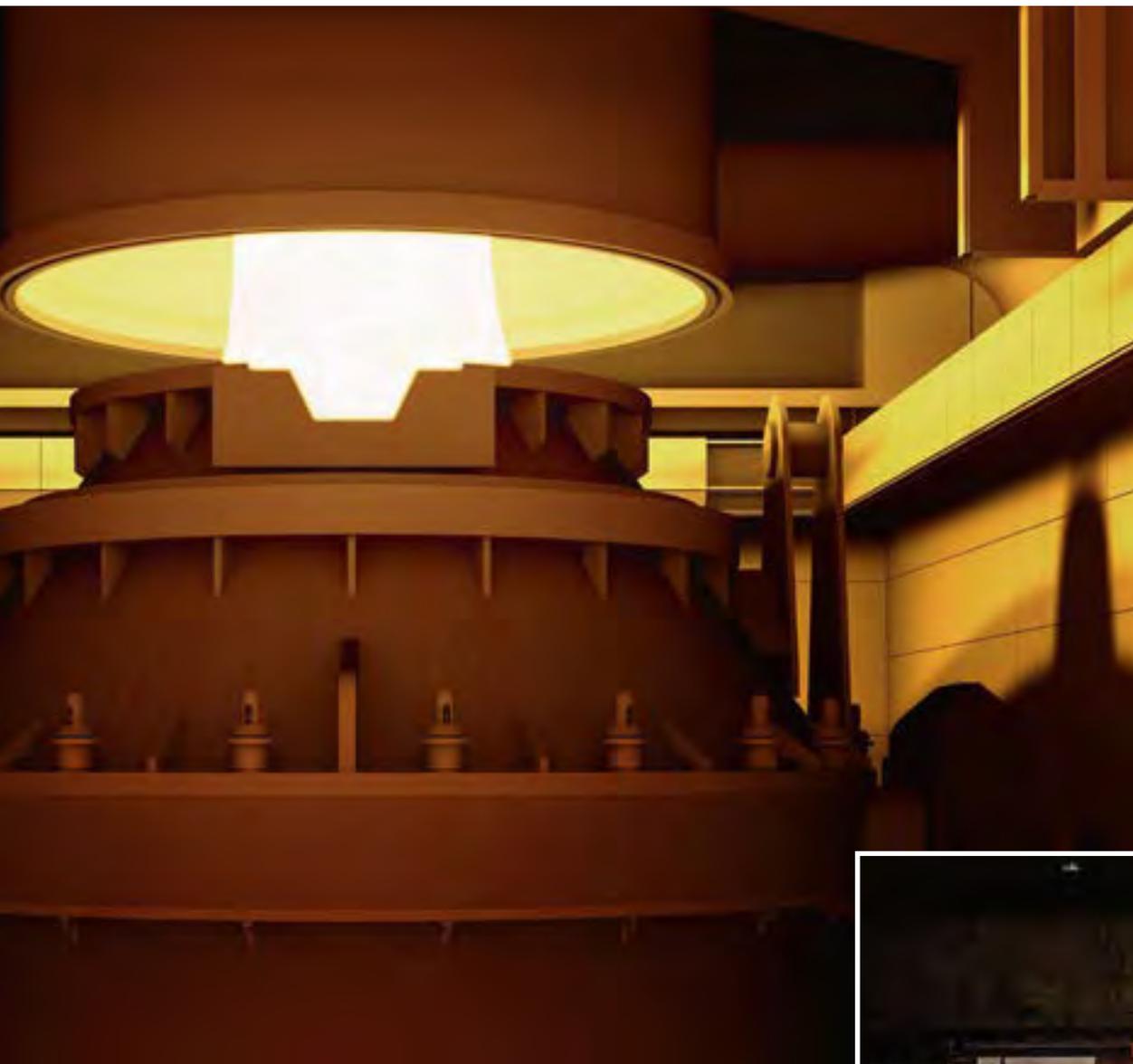
All components of the stainless steel plant will be equipped with X-Pact® electrical and automation systems. The X-Pact® MES 4.0 production planning system and the innovative

X-Pact® Process Guidance (PGS) will lay the foundation for digitalization of the most-advanced stainless steel plant worldwide.

The manufacturing execution system X-Pact® MES 4.0 is the holistic, modular solution for planning and control of the entire metallurgical process chain and of all production facilities. Based on planning modules, it considers the interaction of all factors relevant for decision, such as plant condition, product quality and energy consumption, i.e. horizontal networking takes place. Reporting is completely web-based and provides detailed data analyses.

For all facilities within the plant, the automation concept X-Pact® Process Guidance will merge process-oriented operation of the different automation levels in a uniform look and feel. The modular design will provide a basis for reporting, tracking, material management and for metallurgical models. New sensors can be added respectively available





Left: 3D presentation of a vacuum converter.

Below: voestalpine BÖHLER Edelstahl will start production at the Kapfenberg site in the middle of 2021.



data be transferred shortly. All components of the stainless steel plant will be monitored in a central control station.

SMS group will furthermore supply the technological equipment for the Kapfenberg training center where the complete plant complex will be digitally visualized for training purposes.

The supply scope of SMS group includes basic and detail engineering, mechatronic plant technology, supervision of erection on site and commissioning of the above mentioned components. To make sure transition of production from the existing to the new stainless steel plant will be accomplished smoothly, it is planned to train the customer's staff on site and in the test center of SMS group in Germany. ♦

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GERMANY

EFFICIENT GEAR UNITS

Flat Rolling Mills Requirements on gear units are satisfied by SMS group with customized designing and high quality standards in gear manufacture.



The gearwheels of SMS group are known for their very high reliability and efficiency. All gear sets have been constructed according to the advanced gear design. In this case, the tooth and flank profiles are calculated and improved individually ensuring an even load distribution across the entire tooth flank. Therefore, the maximum transmissible torque is around 30 percent higher than that of a standard toothing.

ECOGEAR UNITS OF SMS GROUP

Comprehensive know-how from SMS group in the field of drive technology and manufacturing capacities in its own workshops provide customized and efficient drive solutions. Particularly the competences in the manufacture of large-diameter spur gears allow the implementation of large gear ratios with few gear steps. It is thus often possible to save a ratio stage when multistage gears are employed. For example, if a three-stage gear unit is constructively converted into a two-stage unit, this leads to a power loss reduction by approx. 34 percent. Due to lower power dissipation of the gear unit, the cooling capacity of the lubricating oil unit may also be correspondingly lower. The result is energy savings on gear and lubricating oil unit. Apart from this, less lube oil is required, allowing a correspondingly smaller design of the oil unit. A reduction of the gear stages also offers the advantage that fewer toothing components and thus also fewer antifriction bearings are needed. The number of possible spare parts is thus minimized.

The advanced gear design with an even load distribution across the tooth flank causes the contact temperature in the tooth mesh to be approx. 20 percent lower than that of a standard toothing. As a result, the seizure resistance of the toothing is increased and the load on the lubricating oil is reduced boosting the service life of the lube oil.

LOW-VIBRATION GEAR UNITS

Gear units operating at high speeds tend towards vibrations. The new low-vibration gear units from SMS group have already been tried and tested in cold rolling mills en-



Michael Legge
checking the
multistage spur/
pinion gear unit.

sure that the surface quality of the rolled strips is significantly higher. In addition, the low-vibration gear units offer the advantage that noise emissions from the plant are considerably lower. To accomplish this, the toothing is designed such that the overlap and contact ratios are within a defined range. Here, various load conditions of the gear unit are considered which may occur during operation later on.

Individually tailored to the respective needs, the gear units from SMS group can be equipped with different measuring sensors. For example, acceleration sensors for monitoring toothing and antifriction bearings, temperature sensors for bearing temperature monitoring as well as flow and

pressure sensors for lubrication monitoring can be provided. In addition to the pure hardware, SMS group also supplies comprehensive software for evaluation and documentation of the measured values. Besides pure condition monitoring of the gear unit, also extensive digitalization possibilities are therefore feasible within the respective plant. ♦



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Open heat insulation hood in front followed by closed heat insulation hoods.



INDONESIA

OPERATING WITH GOOD RESULTS

Hot Rolling Mills The HI_{BOX}-system is a new, highly efficient solution SMS group is offering for heat insulation hoods in hot strip mills. The innovative design boosts effectiveness, improves rolling conditions in the finishing mill and reduces maintenance costs.

The equipment of a state-of-the-art high-performance hot strip mill includes heat insulation hoods. They are positioned between roughing stand and finishing mill to prevent temperature loss of the transfer bar in order to keep strip temperature at an optimum level for processing in the finishing mill.

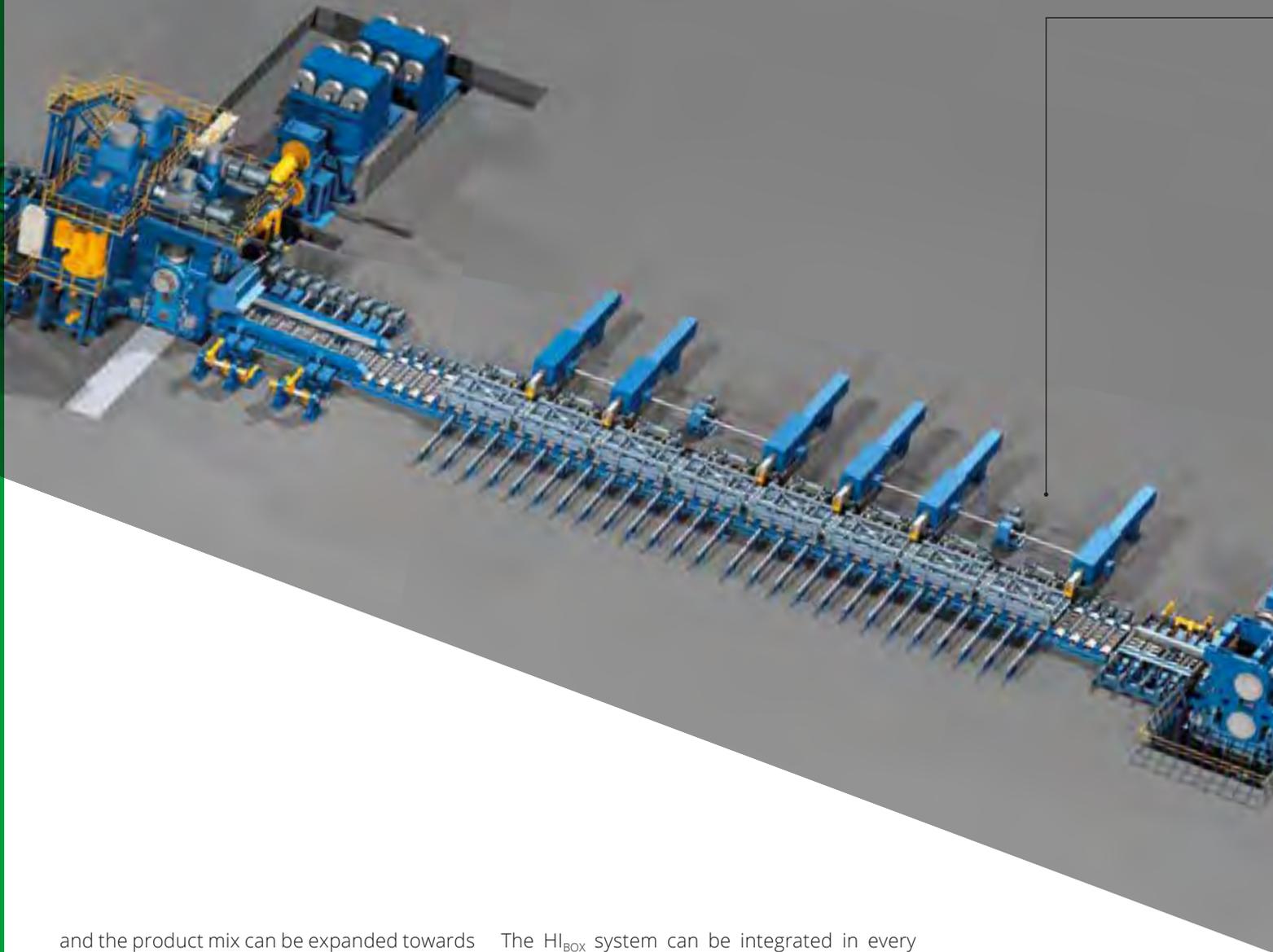
Heat insulation hoods must be resistant to high temperature fluctuations. These are due to the fact that the hot strip underneath the insulation hoods is running discontinuously as a consequence of the respective process. The temperature variations caused by radiation are enormous and expose the equipment to high stress by thermal tension. Conventional heat insulation hoods are susceptible to wear reducing the insulating efficiency. To keep operation safe despite the adverse conditions,

maintenance and servicing require labor-intensive effort, which has a detrimental impact on operating costs.

SMS group has dedicated to the challenge, developed and already tried and tested a new, efficient system.

HEAT LOSS REDUCED BY 50 PERCENT

The new HI_{BOX} heat insulation hood system of SMS group is installed above the connecting roller table between roughing stand and finishing mill and cuts the heat loss over the entire transfer bar length between strip head and tail by up to 50 percent depending on the boundary conditions, which clearly reduces temperature speed-up in the finishing mill. In addition, the rolling process is more stable ▶



and the product mix can be expanded towards smaller final- thickness products and/or higher-strength grades. The HI_{BOX} system hence boosts the productive efficiency of the hot strip mill.

HI_{BOX} hoods are arranged above the feed roller table as hinged elements. They are mounted on an assembly plate and allow for individual replacement in case of damage.

Each HI_{BOX} hood consists of several HI_{BOX} modules. This design permits individual HI_{BOX} modules to be replaced within the scope of maintenance and greatly simplifies module inspection and maintenance.

A single HI_{BOX} module is composed of several steel plate boxes (HI_{BOX}) of manageable size, each thereof filled with insulating material. The HI_{BOX} gave its name to the system and is the basic component thereof. The completely modular design concept offers the benefit of greater resistance to load and wear occurring in the process.

The HI_{BOX} system can be integrated in every hot strip mill. Being the smallest unit of this system, the HI_{BOX} can be installed respectively retrofitted in all existing heat insulation hood setups. This means the new HI_{BOX} system developed by SMS group will increase the efficiency and life cycle of existing heat insulation hoods, too.

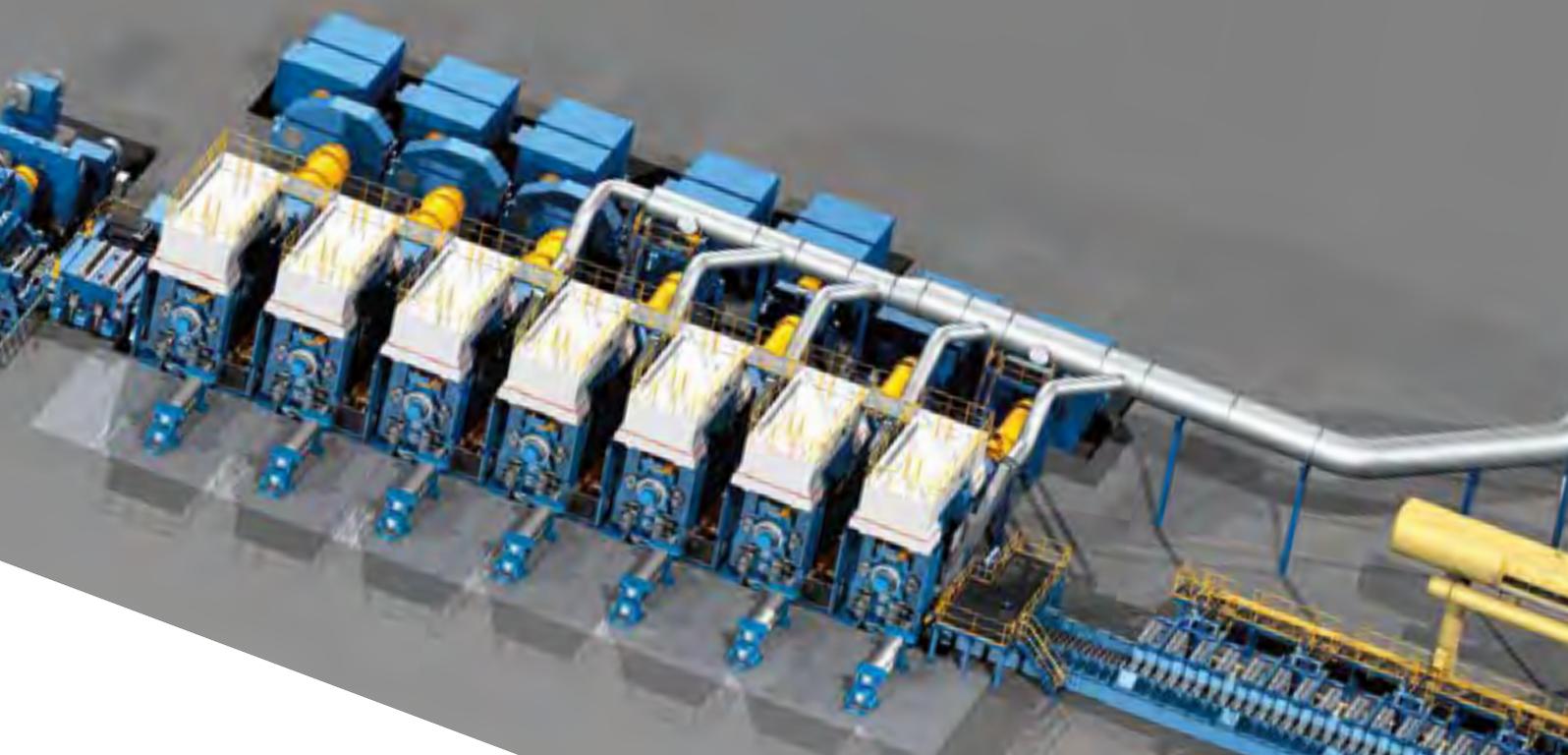
PILOT INSTALLATIONS

In the meantime, several tests have provided evidence of the HI_{BOX} system attaining a manifold longer service life than conventional heat insulation hoods do. This additionally opens up the opportunity to provide the HI_{BOX} with thinner membrane plates than used for conventional heat insulation hoods thus ensuring targeted optimization of the insulating efficiency. Experience from the HI_{BOX} pilot installation showed a lifetime triple that of the installed conventional heat insulation hoods. The HI_{BOX}



SUITED FOR RETROFITTING

Heat insulation hood with conventional elements (left and right) and with HI_{BOX} modules designed by SMS group (middle).



cassette can be recycled or reused a second time after turning.

Pilot tests of the HI_{BOX} system performed by SMS group in numerous hot strip mills of different capacities revealed remarkable results. The first high-performance hot strip mill to be completely equipped with HI_{BOX}-system heat insulation hoods is the new hot strip mill at PT Krakatau Steel in Indonesia, which is being established by SMS group. This new hot strip mill is designed for a maximum strip width of 1,650 millimeters and an annual capacity of 1.5 mil-

lion tons in the first construction stage with the option to later increase production to four million tons. In addition to other innovative rolling technologies from SMS group, it is the efficient HI_{BOX} heat insulation hood system in particular that will make the hot strip mill of PT Krakatau Steel rank among the most advanced plants of this kind in the world. ♦

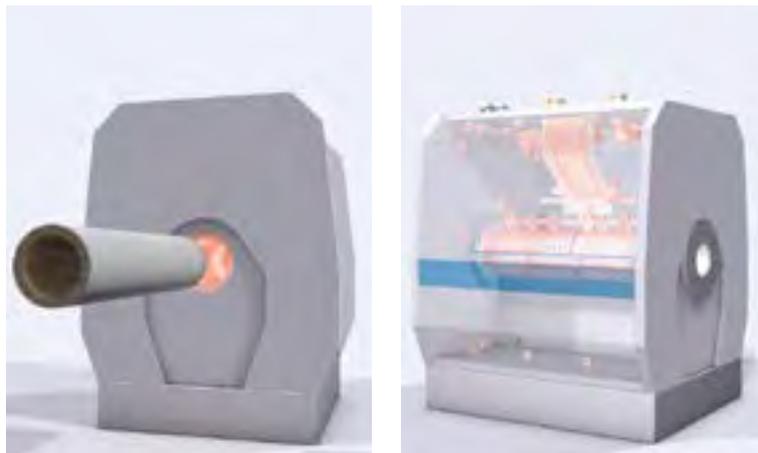


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WORLDWIDE

HALVING THERMAL LOSSES

New Dimension With the Elo-ICE (Inductor Concept Efficiency) system of SMS Elotherm up to ten percent energy and costs can be saved before forming when heating systems for steel are employed.



The energy needed for heating the material to forming temperature (1,100 to 1,250 degrees Celsius) and for heat treatment exceeds the energy demand of the rolling and forging machines themselves in many companies significantly. It is thus worthwhile to optimize the entire process as regards the demand of energy in such a way that on the one hand operation takes place from one heat source as much as possible and cooling and reheating processes are avoided to the greatest possible extent and on the other hand heat losses in the heating plant are kept as small as possible.

Particularly for steel, thermal radiation to the environment and the refractory lining plays an important role when

temperatures prevail of more than 600 degrees Celsius. The heat flux transferred towards the plant depends on the emission coefficients of steel and wall surfaces and follows a non-linear radiation law. Approximately one square meter of steel with a temperature of 1,200 degrees Celsius thus radiates a power of about 200 kilowatts (equivalent to the power of a large passenger car) to the environment at room temperature. About 80 kilowatts are radiated to a refractory wall with a temperature of 1,000 degrees Celsius.

For billet and bar heating inductor coils are normally cast with refractory concrete to ensure that mechanical and thermal protection of the coil is provided. The result is a

monolithically cast hollow cylinder made of concrete with embedded and only electrically isolated copper winding. But the protective effect decreases due to aging and infiltrations (scale). Besides, refractory concrete is only suboptimal material with regard to thermal insulation. Owing to the directly embedded water-cooled copper winding in the refractory concrete, a very effective cooling is generated for the lining which on the other hand results in a relatively low lining temperature and thus in high thermal losses.

ELO-ICE SYSTEM AS NEW DEVELOPMENT

In developing the Elo-ICE system the engineers of SMS Elotherm were faced with the challenge to keep the temperature difference between steel and the lining as low as possible to make sure that the heat flux and thus the thermal loss of heat towards the water-cooled inductor coil is minimized. Apart from that, it is necessary to minimize the wall thickness of the lining and thus the distance between the inductor coil and the material to be heated such that the electromagnetic efficiency of the inductive heat transfer is as high as possible.

This could be implemented by a hybrid refractory composite system acting as radiation protection. The system is composed of new materials still revealing extremely high levels of strengths even when delicate shapes are employed.

In cooperation with partners SMS Elotherm succeeded in developing an inductor lining achieving similar strengths as pre-cast molding than a conventionally cast lining, however, with reduced wall thickness.

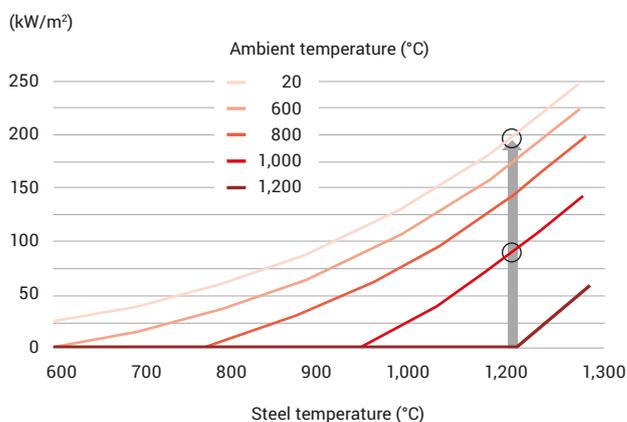
Tests proved that thermal losses in the high-temperature range could be reduced by more than 50 percent which means that up to approx. 10 percent of energy of the whole plant can be saved (in relation to the energy which prevails in steel at forming temperature).

BENEFITS FOR USERS

Compared to a conventionally cast lining the newly developed Elo-ICE system only reveals nearly half the thermal losses. Taking into account an electrical efficiency of 60 percent and 6,000 operating hours annually, up to 100,000 Euro per year can be saved for forge heating plants (depending on the steel cross-section and for an assumed electricity price of 0.1 €/kWh). As a result, ROI periods of less than a year are possible.

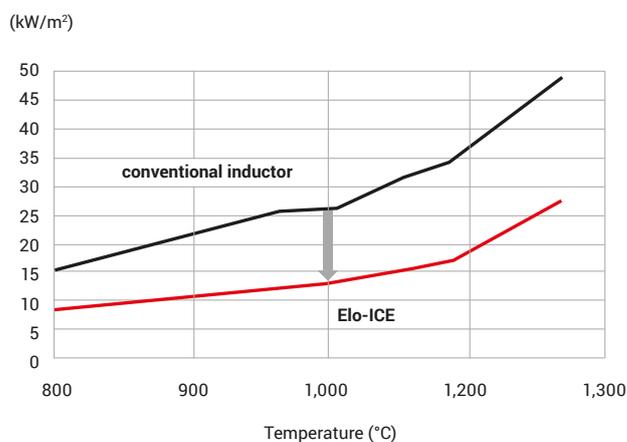
This saving is also not independent from the throughput since thermal losses always occur as soon as steel is heated to forming temperature.

Energy radiated from steel to the environment



Comparison heat loss conventional inductor and Elo-ICE inductor

Test with steel D = 40 mm



The energy-saving Elo-ICE system also impresses by the fact that maintenance and repair of the inductor can be carried out significantly easier and quicker since any time-consuming and arduous demolition work and thus also damage to the inductor copper coil can be avoided. ♦

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WORLDWIDE

LOW ENERGY CONSUMPTION AND MINIMAL EMISSIONS

Long Products Energy-efficient production of long products
with Continuous Mill Technology.

- **Energy-efficient CMT® minimill** for producing rebars.
- **Direct link** of rolling mill to melt shop ensures short distances. Rolling takes place without time lag by utilizing casting heat.
- **Endless production** of approx. 23 hours possible.

The worldwide steel industry is seeking strategies for compact and efficient production units predominantly utilizing local resource and distribution markets. This development originates from the requirement of a sustainable, energy efficient and cost-optimized steel production process. To meet this market demand SMS group developed the CMT® Continuous Mill Technology process.

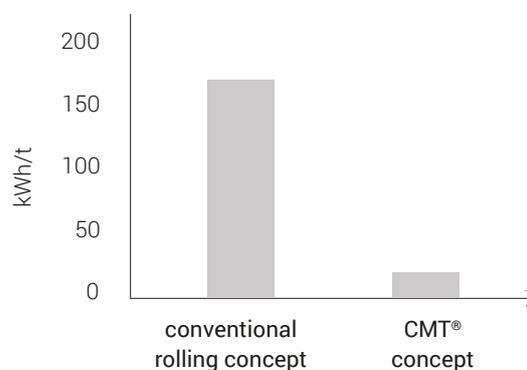
DIRECT LINK BETWEEN CONTINUOUS CASTER AND ROLLING MILL

Aim of the CMT® process is to combine billet continuous casting directly with the rolling process. Hence, energy consumption and yield losses can be reduced significantly compared to conventional discontinuous processes. To maximize these and other benefits of directly linked casting and rolling

CUSTOMER BENEFITS FROM CMT® MINIMILLS

- Compact design reduces size of land
- Less construction area minimizes cost for foundations, steel structures
- Inline transport between CCM® and rolling mill of billets enables a reduction of crane capacities and lighter steel structure
- Saves up to 20% CAPEX compared to a conventional minimill
- Energy savings, minimal energy consumption through induction heating before rolling
- Higher yield no scale formation and minimized crop ends
- "Endless" billets or welding of billets
- Reduced personnel requirement due to direct billet feed
- Lower operational costs
- Saves production costs of up to 20 Euro/ton

Energy demand for billet reheating



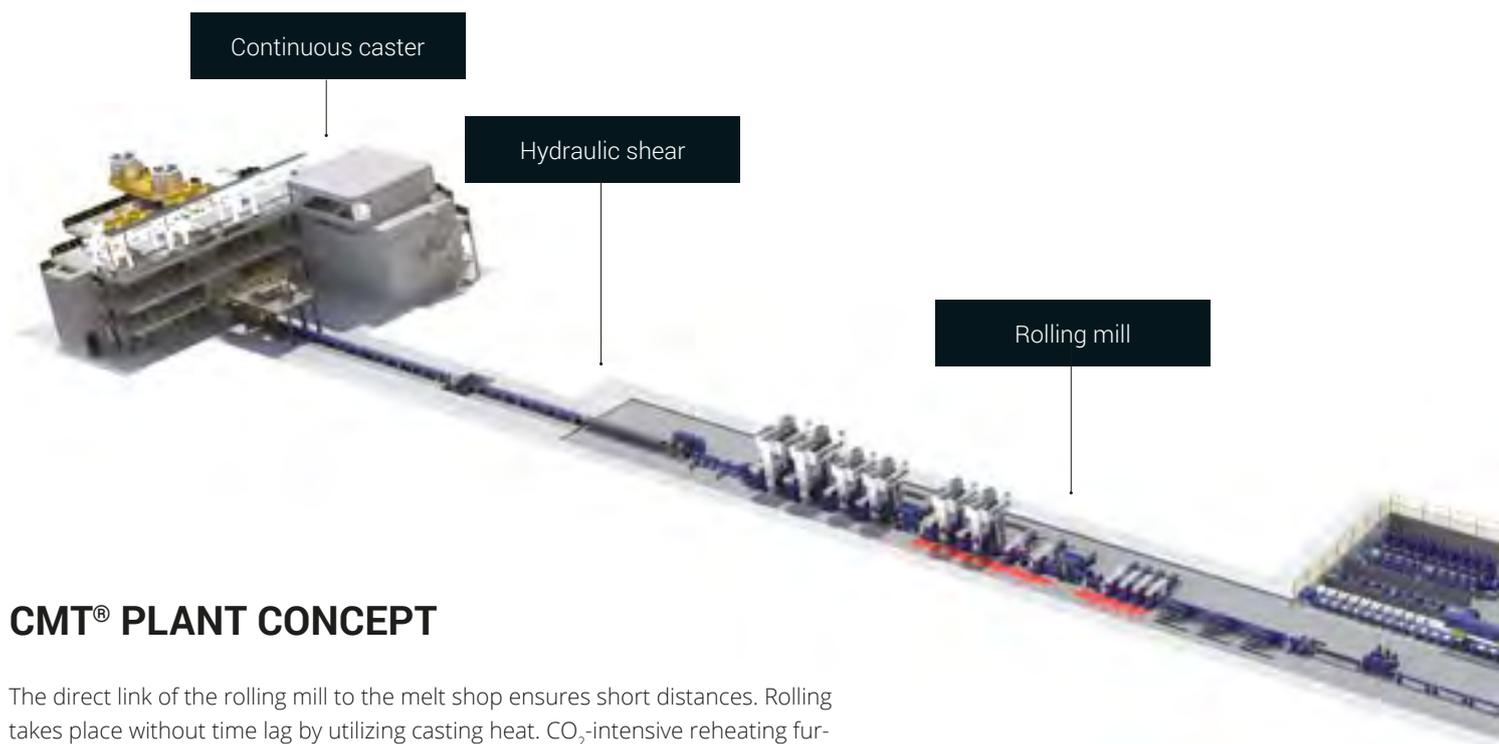
the casting machine is casting on one strand only with speeds as high as the required entry speed of the rolling mill, hence allowing a real endless production of the plant with uninterrupted sequences of approx. 23 hours.

The casting and rolling process steps have a significant potential to reduce the energy requirement. The highest potential is clearly to be found in the reduction of the energy demand required for reheating of cold billets from ambient to rolling temperature. The CMT® process allows, depending on parameters like cast steel grades and billet section, to immediately heat up and roll the hot billet without or with very low energy demand. By applying the direct casting and rolling concept more than 90% of the energy required for reheating of the billets is saved when compared to a conventional production concept with reheating furnace.

CMT® HAS BROUGHT FORWARD THE BASIC MINIMILL CONCEPT AN IMPORTANT STEP

The development of the CMT® started with the CMT®300 solution, rated for an annual production of 300,000 tons of structural steel.

At the base of this concept there is a melt shop with a productivity of 50 tons/hour, and a single-strand billet continuous caster producing 130 x 130 millimeter billets. The cast product is fed endlessly into the rolling mill at a speed of approx. 6 meters per minute. By using the INVEX mold technology it is possible to achieve the required casting speeds ensuring the quality of the cast product at the same time. Consequently, traditional reheating furnaces can be dispensed with. The elimination of a complete heating step results in a significant reduction of both energy costs and environmental impact. ▶



CMT® PLANT CONCEPT

The direct link of the rolling mill to the melt shop ensures short distances. Rolling takes place without time lag by utilizing casting heat. CO₂-intensive reheating furnaces can be dispensed with. Instead of an oil- or gas-heated furnace an inductive heating system is employed. In this way, the billets are not heated but only the temperature profile is compensated. The inductive heater offers a perfect setting of the operating temperature for the rolling mill according to the billet speed. This solution requires considerably lower investment costs.

Additionally, bar head and tail cutting is no longer necessary thanks to endless production and the chances of process interruptions caused by the threading of cut-to-length billets is reduced to a great extent. These two effects increase the yield of the rolling process significantly so that more finished weight can be produced with the same charge weight.

Higher production rates can be attained by increasing the casting speed up to 7 m/min or by increasing the cast section to 150 x 150 millimeters and beyond.

The CMT®500 concept is rated for 500,000 tons per year, with an hourly productivity of 75 tons while casting 165 x 165 millimeter endless billets. For further increasing the productivity to 100 tons/hour the cast section can be increased to 190 x 190 millimeters or to a "mini-slab" format of i.e. 165 x 220 millimeters, achieving a production of 700,000 tons per year.

For production capacities in excess of 1 million tons per year, SMS group offers the CMT®1000 concept. In this case, liquid steel is cast on a CCM equipped with two or more strands. The billets produced are continuously fed into the rolling mill without interim storage where they are heated up

to rolling temperature by means of an induction heating system in front of the first mill stand. In this way, production can be performed in semi-endless mode.

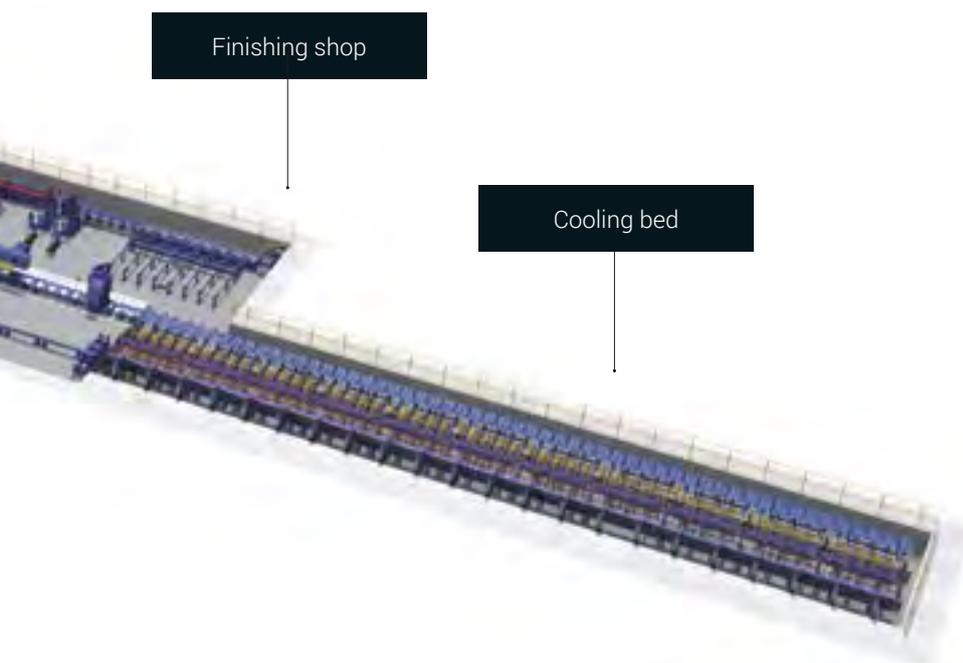
IN USE WORLDWIDE

This concept has been adopted in various steel plants since 2011; recently in the new minimill ordered by Moon Iron and Steel Company (MISCO) in Oman. Our customer Tung Ho Steel Corp. in Taiwan has already ordered and successfully commissioned two plants in succession implementing this technology. Depending on the end product characteristics, the installation of a billet welding machine allows the production of tailor-made product bundles in dimensions and weight. In a combined casting and rolling process, casting speed must be synchronized with rolling speed to ensure a continuous material flow throughout the plant.

The casting speed is not freely adaptable when free runner nozzles are used. Since the mold level is controlled by the withdrawal speed of the strand or the casting speed an open casting technique of the CMT® process cannot be employed.

Comparison of different CMT® concepts

	No. of strands	Format [mm ²]	Productivity [t/h]	Productivity [t/y]	Casting speed [m/min]
CMT®300:	1	130 x 130	50	300,000	~ 6
CMT®500:	1	165 x 165	75	500,000	~ 6
CMT®700:	1	190 x 190	100	700,000	~ 6



The mold level in the CMT® process is instead controlled by a conventional stopper or a tundish slide gate. The continuous caster operates in submerged casting mode, using a submerged entry shroud (SES) and mold lubricating powder. The design of the slide gate, SES and the refractory materials used allows long casting sequences in endless mode.

In steady state, the temperature of the strand entering the rolling mill ranges between 1,150°C (in the center) and 1,050°C (on the surface), and therefore is suitable for direct rolling without additional temperature adaptations. An induction heater is placed in front of the rolling mill to possibly reheat the billets which have cooled down below rolling temperature. The inductive heating system also serves for heating cold billets. Besides, it is used for calibrating the rolling mill or is employed at the beginning of a casting-rolling sequence.

FULLY-CONTINUOUS ROLLING MILL

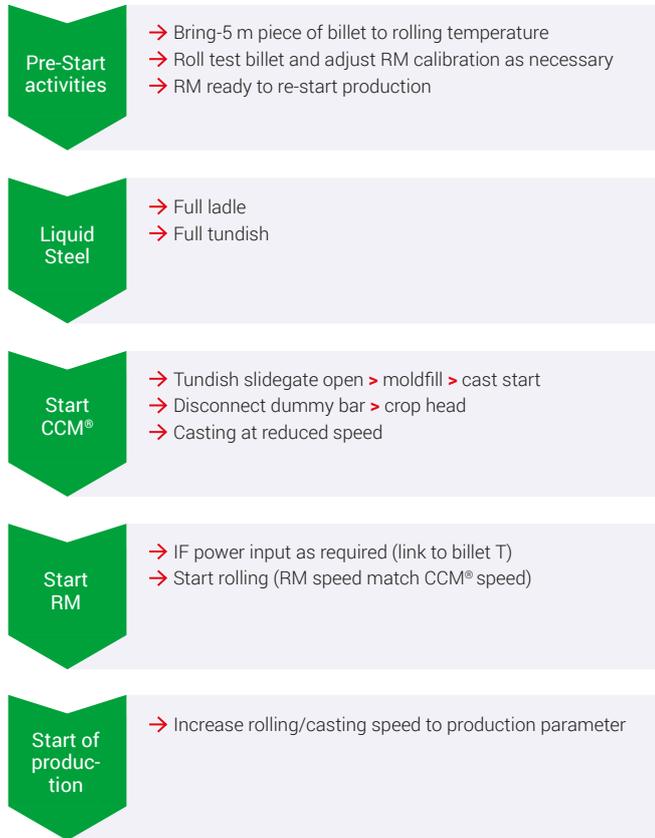
In normal casting and rolling mode the cast strand will run endlessly into the rolling mill. Only in case of emergency, a hydraulic shear, placed between caster and mill, will cut the

billet separating the two plant areas. The rolling mill is designed for direct hot charging of the cast billets. The fully-continuous mill is equipped with HL housingless type stands arranged in horizontal and vertical configuration. Mechanical properties of the final product are improved thanks to the thermoprocessing systems installed on the rolling line. The mill is also equipped with the industry-leading SMS group (HSD®) High-Speed Delivery system for safe and reliable delivery of bars on the cooling bed. Behind the cooling bed the rolled stock is transported to the finishing area where it is fully automatically cut to length, bundled and loaded.

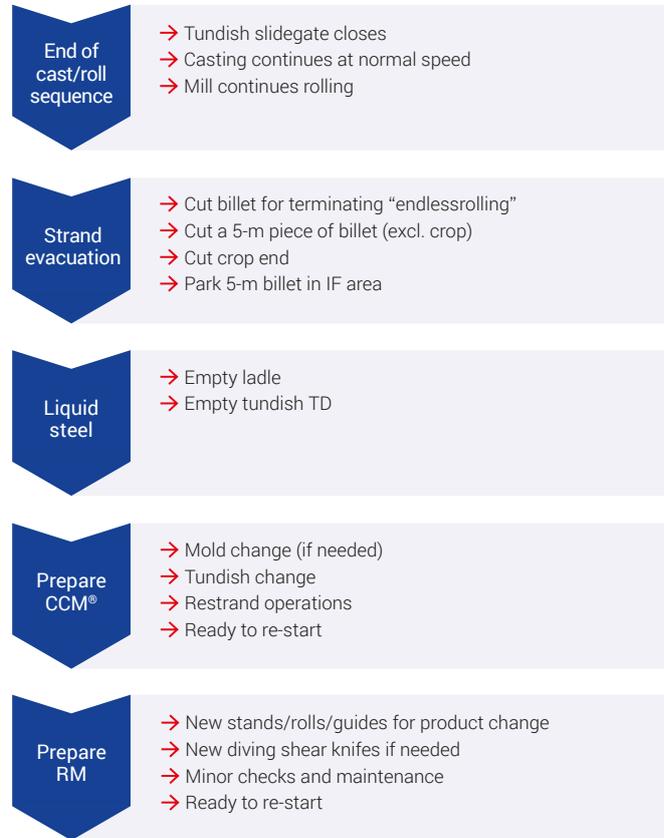
COMPLETE ELECTRICAL AND AUTOMATION PACKAGE

The heart of the CMT® plant is the automation package X-Pact® covering Level 1 equipment, Level 2 process and Level 3 production controls which were specifically designed to meet the demanding production challenges resulting from specific operating needs combined with ▶

Standard startup sequence



Standard shutdown sequence



Sequences for normal startup and shutdown procedures

the latest safety requirements. In addition to seamlessly integrating itself with the mechanical equipment to assure high levels of productivity and efficiency, the CMT® automation also allows to easily and quickly adapt the production mix to varying market demands. Here, the operator is supported by an integrated plant-wide production planning, by functions for scheduled ordering and by material plant tracking. The production concept of the CMT® plant requires cross-functional Level 1 plant control. In addition to assuring a stable and high-speed production on individual machines, it guarantees a coordinated flow of the material across all plant areas.

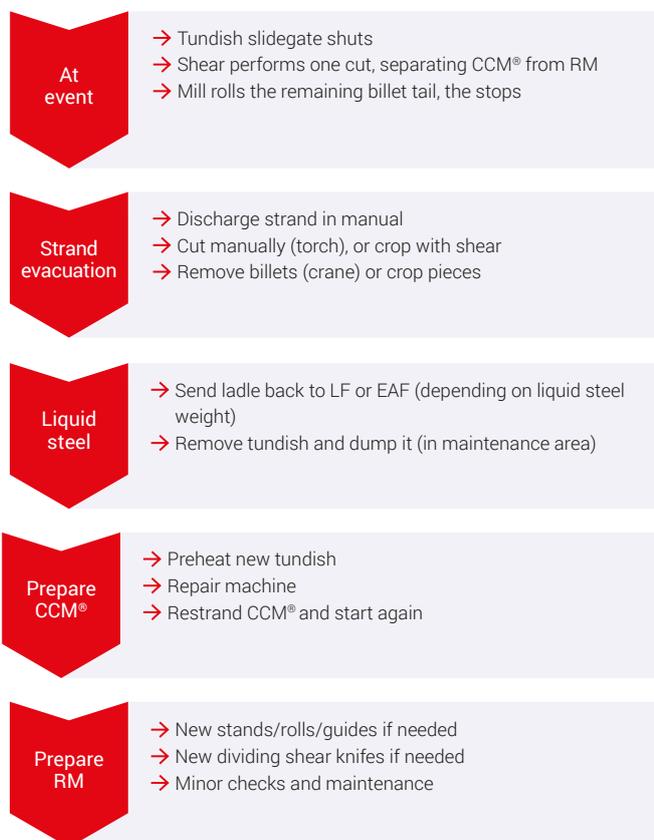
To face the challenges of the CMT® technology, SMS group developed a specific control solution in addition to implementing individual automations for high-speed casting and rolling to mutually coordinate the speed of both caster and rolling mill ensuring a perfect continuity of the material flow under all possible conditions. All this requires

the development of a meticulously planned plant control to guarantee both the correct speed coordination and the minimization of production losses during the normal startup and shutdown sequences. The Level 2 automation specifically developed for the CMT® plant by SMS group takes full advantage of the process continuity between caster and rolling mill offering an unprecedented level of seamless integration of process control across all plant areas starting from the scrap yard up to the end product.

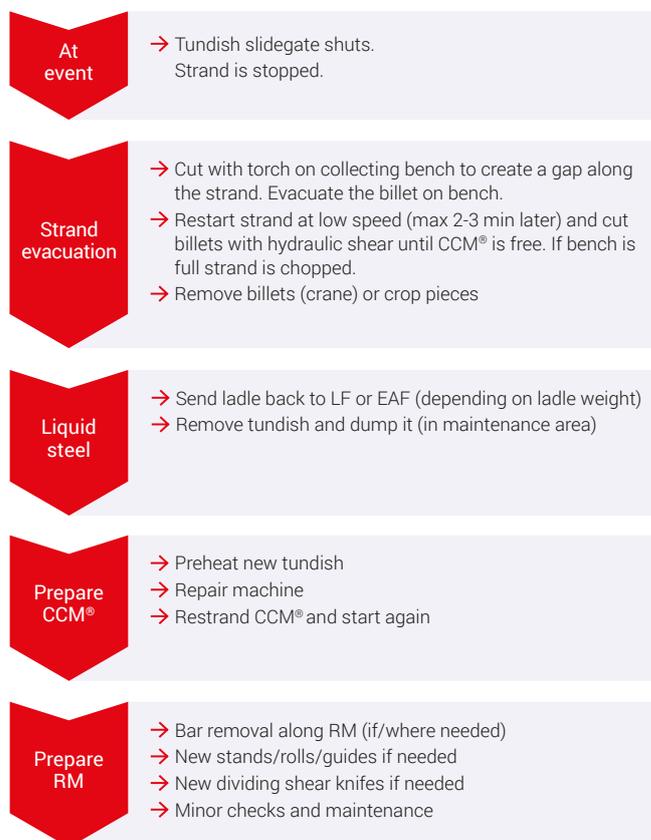
The process coordination of the CMT® Level 2 automation supports the technologists by means of special tools in a central material database, allowing them to design the melting, refining, casting and rolling process in detail. This working approach enables us to handle the whole procedure as an overall process and thus reflects the philosophy of the plant. For production control, Level 3 functionality offers the operator full support for a plant-wide production planning, scheduling and material tracking in the plant.

To be able to properly react to emergency situations, a specific inter-area equipment control additionally implements different shutdown strategies depending on the origin of the problem which are designed to assure maximum safety and easy resumption of production.

Break-out/overflow at CCM®



Cobble or power failure at RM



Sequences for emergency shutdown procedures

CONCLUSION

The CMT® technology, when compared to a traditional minimill of the same output, offers an efficient plant concept with an estimated saving of approx. 20 Euro/ton in transformation cost towards a conventional link between continuous caster and rolling mill. In addition to a reduction of the initial investment costs, this also allows to reduce the running costs which may result in a cost advantage of 10 to 25%. ♦

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BELGIUM

EXPANSION OF MELTING CAPACITY

Forging Technology Hertwich to supply multi-chamber melting furnace to Hydro Extrusion Lichtervelde NV.

- **The furnace concept utilizes the energy content of organic contaminations reducing the operating costs significantly.**
- **Minimal emissions contribute to a safe and eco-friendly furnace operation.**

Hertwich Engineering, a subsidiary of SMS group, has received an order from Hydro Extrusion Lichtervelde NV for the supply of an Ecomelt-PS200 multi-chamber melting furnace including a skimming machine. The plant with a melting capacity of 60,000 tons per year will be installed in the casthouse in Ghlin, Belgium. Commissioning is scheduled for the first half of 2019.

By the acquisition of Sapa, Hydro has considerably expanded the scope, presence and innovative competitive edge of its extrusion division. As a globally leading extrusion plant, Hydro currently supplies more than 30,000 local and global customers in more than 40 countries around the world. In Belgium the company employs around 850 people in their extrusion facilities in Raeren and Lichtervelde and in the aluminium casthouse in Ghlin.

Hydro will increase the recycling capacity in Ghlin by 60,000 tons per year by adding a new Ecomelt-PS200 multi-chamber melting furnace from Hertwich Engineering. With this investment Hydro responds to the growing importance of scrap recycling, both manufacturing and turn-

around scrap, within the extrusion industry. With aluminium starting to be intensively used in construction, transportation, industrial and other applications about five decades ago, we now see a corresponding rise in the amount of turnaround scrap. The aluminium industry benefits from this trend by an approx. 95 percent reduction of the energy demand in aluminium production. Hertwich Engineering, which has reached a worldwide leading position with their Ecomelt melting technology, can achieve even higher energy savings using suitable scrap.

The Ecomelt PS furnace to be installed in Ghlin is especially designed for medium to heavily contaminated scrap. The casthouse requires a broad spectrum of different types of scrap: vehicle license plates, wires, machining chips, cables, lithographic sheet, profiles, UBC, spray cans and others - partially loose in bulk, partially shredded, partially briquetted or packetized. The degree of contamination ranges from "clean" all the way up to heavily contaminated with paint and lacquers, rubber and plastic parts, oils, greases, etc. Furthermore, even solid scrap, such as sows, T-bars or ingot stacks are charged.

With this type of furnace the scrap flows through a vertically arranged preheat shaft, which is filled from above. The hot gases flow through the charged material in the shaft from bottom to top while the organic compounds are completely removed. The resulting pyrolysis gases are fed into the main chamber to support the gas heating.



Hertwich Ecomelt PS Furnace.

30,000 CUSTOMERS

By the acquisition of Sapa, Hydro has considerably expanded the scope, presence and innovative competitive edge of its extrusion division. As a globally leading extrusion plant, Hydro currently supplies more than 30,000 local and global customers in more than 40 countries around the world. In Belgium, the company employs around 850 people in their extrusion facilities in Raeren and Lichtervelde and in the aluminium casthouse in Ghlin.

At the bottom end of the preheating shaft the de-coated and preheated material is immersed in the flowing bath and is immediately melted. The melt flow between the furnace chambers is generated by electro-magnetic liquid metal pumps.

The resulting pyrolysis gas volume when melting heavily contaminated scrap naturally reduces the demand for heating gas more than when melting relatively clean scrap. The energy consumption of this furnace type is between 300 and 550 kWh/ton, depending on the condition of the scrap. The remaining slag (dross) from the melting process is concentrated on the bath surface and must be removed. For this, Hertwich supplies a rail-guided skimming machine for safe, careful and fast cleaning of the furnace.

Due to this furnace concept, the energy content of the organic contamination is used efficiently, whereby operating costs are reduced markedly. Furthermore, the minimum emissions (NO_x, VOC, CO, dioxins, no salt addition) contribute to a safe and environmentally friendly furnace operation – an aspect that has a high priority within the entire Hydro group. ♦



Further information
www.hertwich.com

WORLDWIDE

UTILIZING ENERGY POTENTIALS

Forging Technology Energy-efficient drives for radial forging machines, type SMX.

In recent times, the demand of energy for machines and equipment plays an increasingly important role. For many years, the prices for energy have been gradually rising and in many countries the environmental requirements are increasingly tightened. To keep pace with the global market with regard to ecology and economics, SMS group has been continually working to improve the energy efficiency of individual machines and complete installations for many years. By increasing the efficiency operating costs of the customers and CO₂ emissions at the same time can be reduced.

In the course of increasing the efficiency of forming machines, tests have been performed on a radial forging machine of the SMX type. In particular, various machine parameters were recorded and analyzed online while forging tubes, bars and stepped shafts. Some measures for increasing efficiency could be derived and evaluated from the analysis. The greatest savings potential was ascertained on the drive side of the forging machine. SMS specialists from the Technology, Electrics and Hydraulics Departments have further investigated the measures with the greatest potential for energy saving. In this way, an overall consideration of the measures to be

implemented could be made. The simulation and calculation results in the drive section provided many informative answers to important parameters such as pressure ratios, natural frequencies and energy losses.

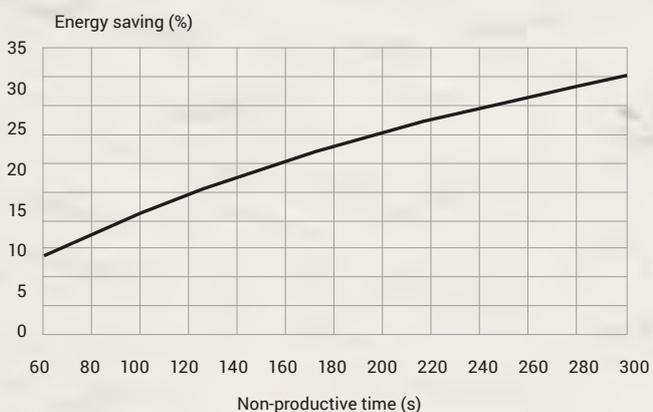
IMPROVED DRIVE STRATEGY

With state-of-the-art hydraulic components and a new improved drive strategy the energy demand can be reduced during forging and above all during non-productive times. Downtimes are affected by internal plant processes and are unavoidable. In this case, the transport of ingots from the furnace to the forging machine plays an important role. Tests have shown that non-productive times from ingot to ingot are between 91 and 265 seconds. Thanks to a new optimized drive strategy, energy savings from 13 to 28 percent can be realized (see diagram). SMS group continually concentrates on issues for energy saving on radial forging machines and is confident to be able to further optimize the efficiency. ♦

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Energy saving through new drive



OPTIMUM PRODUCT QUALITY

Products such as shafts, axes or tubes and materials such as steels, nickel-based or titanium alloys: Hydraulic radial forging machines type SMX of SMS group accomplish the most varied shaping tasks of the highest possible quality. Quick changeover times and high efficiencies exceeding the values of open-die forging by a factor of three to four additionally ensure an optimal productivity. The results are also convincing: Forgings of particular homogeneity and surface quality.



WORLDWIDE

NEW DRIVE CONCEPTS

Forging Technology The drive technology employed offers great potentials to machine builders and plant operators when operating energy-intensive machines more efficiently.

Rising electricity costs are forcing machine builders and plant operators to find solutions how energy-intensive machines can be operated more efficiently and can produce more economically. The new drive concept used here offers great potentials. The electro-hydrostatic drive concept developed by SMS group for forming machines such as ring rolling, hydraulic presses and slab shears demonstrates how higher productivity with minimized power consumption and at the same time simplified and cost-effective installation brings competitive advantages.

Radial-axial ring rolling machines

Apart from the main roller drives, there are up to nine position- or force-controlled axes used in parallel during the ring rolling process. Traditionally, these axes are constructed as cylinder units with control valves and supplied by a central hydraulic system.

Together with Moog GmbH, an innovative drive concept was developed based on the electro-hydrostatic pump unit (EPU). This unit consists of a radial piston pump with adjustable displacement volume, featuring a maximum operating pressure of 350 bar and providing a servomotor screwed on by an adapter flange. As module system, the EPU units are scalable to a delivery volume from 85 up to 450 liters per minute. The pump drive unit has been optimized for four-quadrant operation using a variable-speed drive. The selected drive concept is based on a speed-regulated pump drive with a double-acting cylinder. ▶

Slab shears

For a slab shear with a force of 14,000 kilonewton (kN), a similar drive concept has been realized together with Bosch Rexroth. The challenge has been to achieve a particularly high number of cycles of five cuts per minute in a cutting time of six seconds each.

In a conventional system the necessary peak performance, which results thereof, leads to an above-average number of pumps and accumulators in the central pump station which would cause both high investment and operating costs. When employing the direct drive concept, the investment costs continue to be high due to a more expensive drive design on the one hand, but are compensated on the other hand by an optimized drive performance (reduced losses) and through the omission of components such as valves and accumulators. Operating costs are reduced significantly which results in a more cost-effective operation in the long term.

For the slab shear a compact drive unit was provided with six variable-speed pumps (one electric motor with two pumps each) for each cutting cylinder. The unit is equipped with all necessary oil-conditioning units and it is optimally placed immediately next to the cylinder.



3D overview image of machine series RAW ecompact.

Ring blank presses

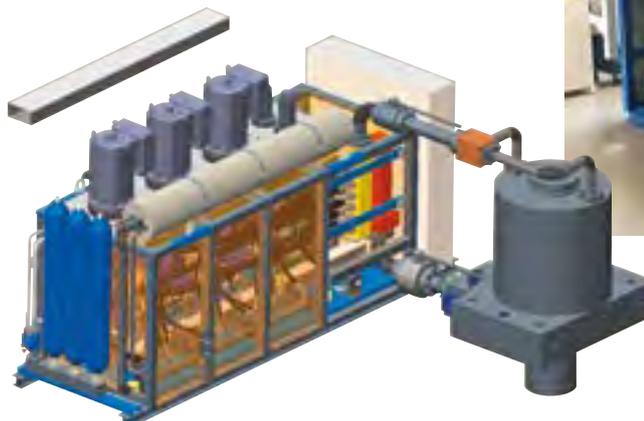
For ring blank presses with very large forming strokes very high rapid traverse speeds of up to 500 millimeters per seconds are required. To achieve this, the DvP drive concept (variable-speed pump drives) was extended with the surface changeover principle.

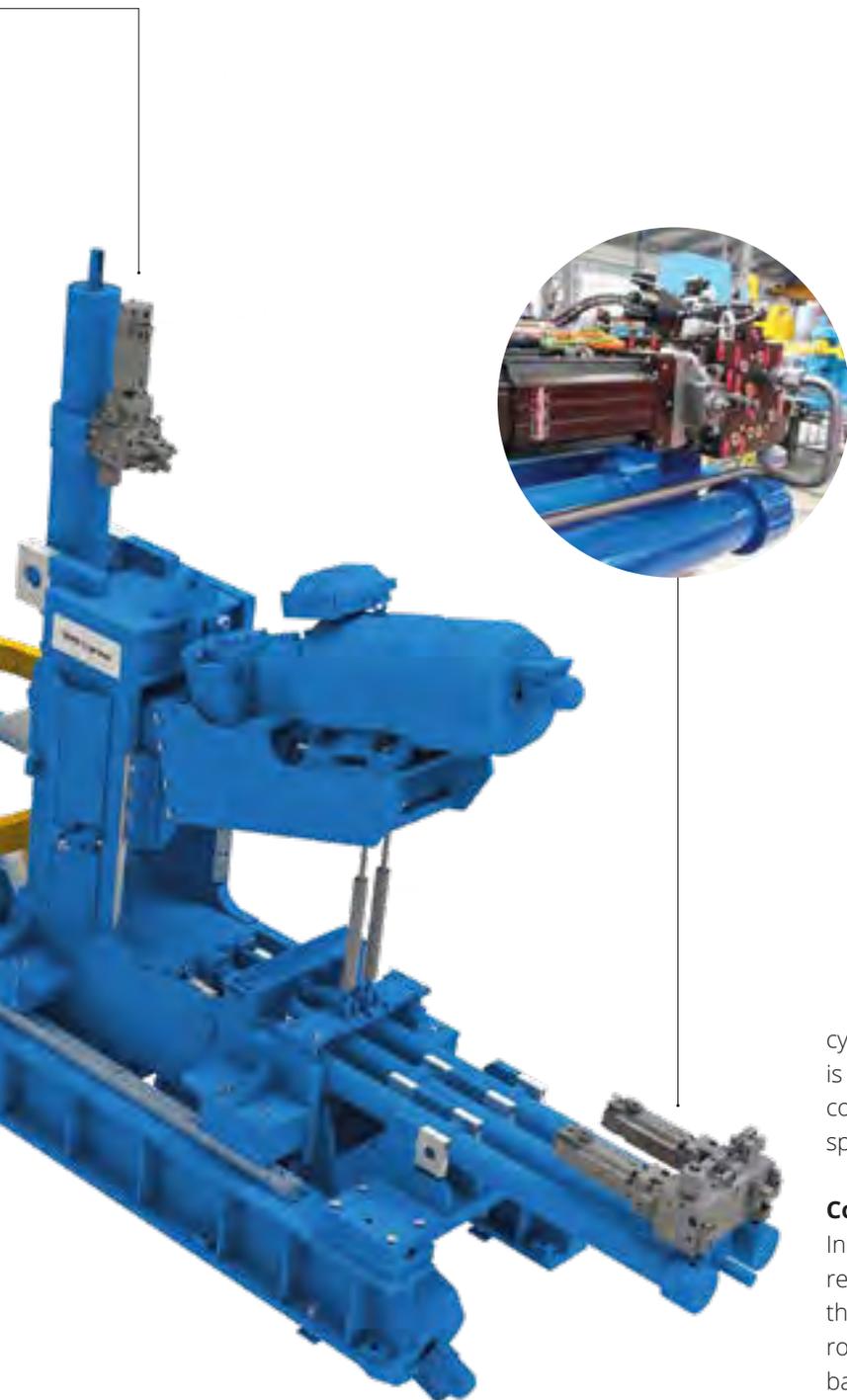
The new drive concept CLH (Closed-Loop Hydraulics) is an innovation in hydraulic press construction. The principle is based on variable-speed piston pumps operating in the closed oil circulation system in four-quadrant mode. The speed is controlled precisely and highly dynamically via water-cooled servomotors. By means of additional auxiliary



... and during production.

3D model of drive unit (left) with cutting cylinder (right) ...





BENEFITS OF ELECTRO-HYDRO-STATIC COMPACT DRIVES

- Basic machine construction remains unchanged
- Installed capacity of approx. 60 percent of standard hydraulic system
- Reduced oil volume in the machine (factor 1:10)
- Reduced noise level and no standstill losses through "power on demand"
- Omission of hydraulic room → lower foundation requirements
- Considerably reduced piping expenses → easier assembly
- Reduced number of components → less maintenance
- Trial operation possible prior to delivery
- Safety: Thanks to state-of-the-art converter techniques with SS1 (Safe Stop 1), STO (Safe Torque Off) and SLS (Safely Limited Speed) an implementation of the Machine Directive is easier than with a conventional hydraulic system.

cylinders the pendulum capacity of the differential cylinders is taken up. Therefore, the oil tank can be omitted almost completely. Surface changeover between rapid and working speed enables a ratio of up to 1:10 of the cylinder speed.

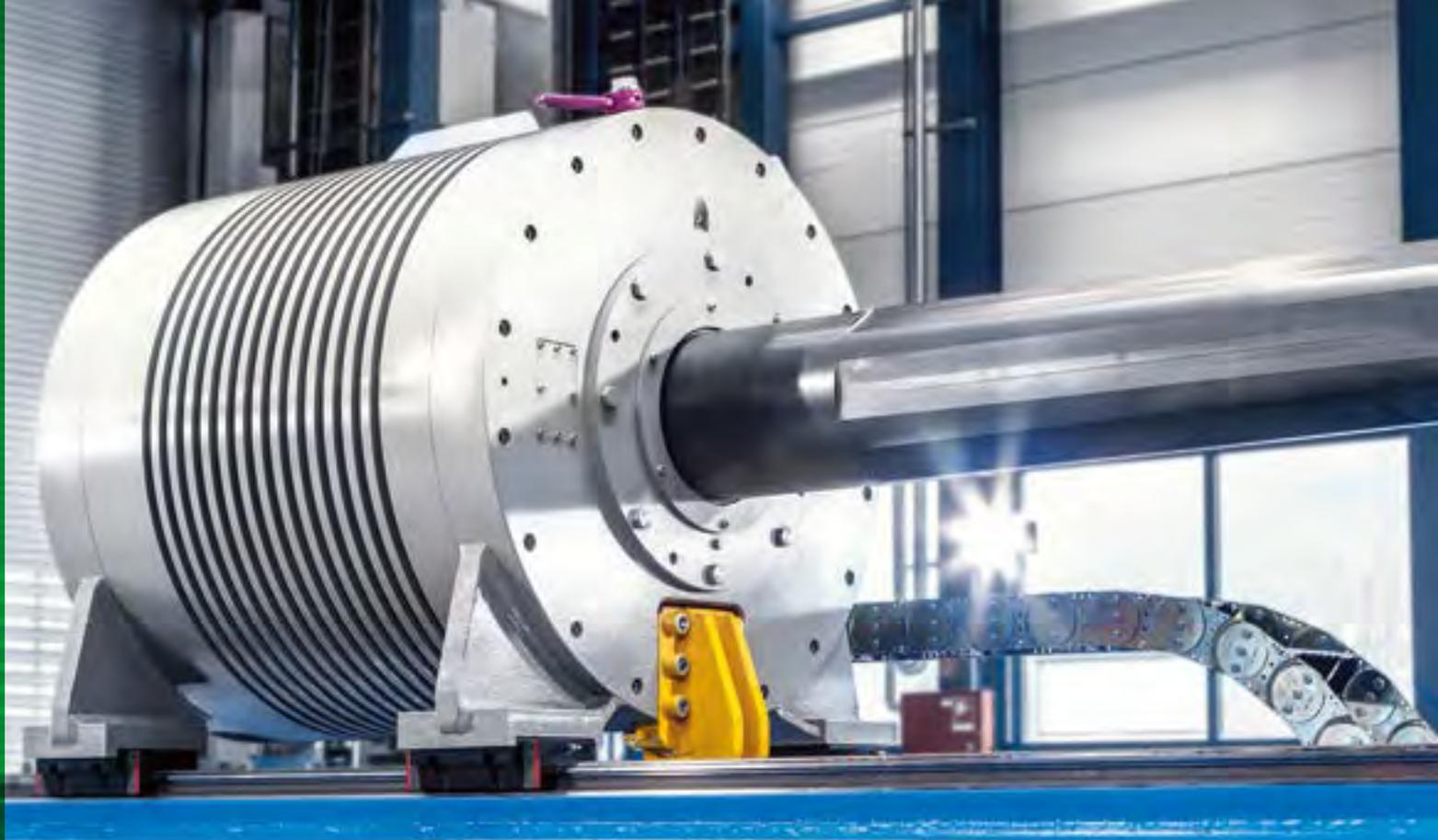
Compact drives with benefits

Initial experiences with electro-hydrostatic compact drives revealed an excellent controllability (position and force) of the axes. Due to the small number of components, a highly robust system is attained which is not susceptible to disturbances. By reducing the energy demand by about 70 percent and with reduced noise emissions of approx. 30 percent the machine is eco-friendly and thus conforms to the Ecoplants concept of SMS group. ◆



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Compact edge-scrap coiler.

BELARUS

INNOVATION: DIRECT DRIVE FOR AN EDGE SCRAP COILER

Electrical and Automation Systems
Highly efficient, compact, mechatronic solution.

- **For application in the mechanical engineering sector** an energy efficient, low-noise and extremely maintenance-friendly machine has been developed.
- **The innovative direct drive** allows the machine to achieve a total efficiency of 98 percent.

Most of the drive systems in use today feature force-ventilated asynchronous motors, gear units and mechanical brakes. However, this causes several disadvantages: The systems comprise numerous components needing much space for installation, have low energy efficiency and require high maintenance effort.

For the edge scrap coiler at customer MMPZ-Group in Miory, Republic of Belarus, SMS group has developed a mechatronic drive solution overcoming all of these drawbacks.

TAKING A STEP FURTHER

Similar to the eccentric presses built by SMS group, permanently activated synchronous engines respectively torque motors are used here. A torque motor has high torques at low revolution rates allowing operation without gear unit. This is possible due to a large number of motor pole pairs ensured by high-performance permanent magnets that are installed on the rotor. Torque motors have reached industrial maturity long ago, which is proven by the fact that this type of drive has been standard in the field of machine tools for years and has been used in a wide variety of applications whether for ship engines or drives for the basic materials industry.

For application in the mechanical engineering sector, SMS group has gone even further and integrated all “electrically active parts” in the mechanical structure required anyway. In doing so, a highly efficient, compact, mechatronic engine was created that reduced the footprint of the coiler to half the size needed by the conventional solution.

This application provides the advantage that the existing coiler mandrel bearings can also be used as motor bearings. For that purpose, the magnet-equipped rotor is mounted directly on the coiler mandrel shaft. The motor stator, consisting of laminated core and copper winding, is installed between the existing coiler end shields.

The result is a compact and energy-efficient engine that is very easy to maintain:

- no gearwheels
- no gear unit lubrication
- no external cooling
- no mechanical brake
- significantly fewer bearings.

In addition to the ecological aspect, i.e. avoiding any gear oil and reducing the noise level to approx. 70 dBA (compared to more than 85 dBA in the past), this drive concept comes with a particularly high effectiveness resulting from the abandonment of lossy converting stages and from saving ancillary equipment in the drive system. What's more, the physical/electro-technical principle of a permanently excited synchronous motor makes it operate essentially more efficient than an asynchronous motor.

The innovative direct drive developed by SMS group allows the machine to achieve a total efficiency of 98 percent. In the design phase already, attention was paid to easy coiler maintenance and convenient repair in case of defects. Maintenance was reduced to lubricating two roller bearings. Another advantage showed during the tests: The control behavior of the direct drive was much better than that of an asynchronous motor drive version. So, the new solution has become path-breaking for further applications and offers the customers of SMS group numerous benefits in terms of little maintenance effort, of energy efficiency and environment protection of their plants. ♦



The new video film provides an overview of the advantages of the innovative drive solution.

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Quality



Industrie 4.0



Production



Efficiency



PERFORMANCE MODULES

Improving competitiveness with affordable investments.

SMS group is continuously developing a multitude of solutions to substantially improve the competitiveness of plants at moderate investment costs. These technologies, components, automation solutions or services are classified as Performance Modules. Each individual module helps customers improve the performance of their plants in one or several dimensions and hence achieve a competitive edge in a tough mar-

ket environment. This means the modules will not only increase plant productivity and product quality, but also reduce operating costs and permit new, high-margin products to be introduced. ♦

 **Contact**
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Continuous casting plants

E-CO Energy Collector

Performance Checkbox



Challenges

- Energy recovery on the continuous caster

Solution

- Heat exchanger installed above hot slabs recovering heat in the slab discharge area with the aim of generating steam for further use in the process or conversion into electrical energy

Technical advantages

- Suitable for all plants involving surfaces with $T > 750^{\circ}\text{C}$
- Fully automated control system
- Simple maintenance-free and modular design, extendable
- No interference with the production
- Batch and continuous operation possible

Efficiency

- Reduction of emissions
1,000 t/year CO_2 savings
- Reduction of energy costs
45 – 70 $\text{kW}_{\text{therm}}/\text{m}^2$ slab →
10 – 20 €/t of steam

Example: For a roller table 15 meters in length and a slab 2,000 mm in width, 1 ton of steam per hour is generated



Electric arc furnace

CONDOOR®

Performance Checkbox



Challenges

- Conventional slag door practice requires regular risky manned operation (scrap pushing, sill cleaning)
- Improving furnace sealing for process and OPEX benefits

Solution

- Two-axis automatic slag door

Technical advantages

- 800-millimeter pushing stroke with 24-ton pushing force
- Automatic cycle integrated in melting profile for de-slagging control

Productivity

- 0.25 to 0.50 percent higher scrap-to-liquid yield
- Power-off time reduction

Efficiency

- 5 to 10 percent less electrodes consumption
- 1.5 percent less electricity consumption
- 10 percent less carbon injection



Electric and converter steelplants

X-Pact® Gas Cleaning Assist
Optimum control of
the extraction process

Performance Checkbox



Challenges

- Effective and homogeneous extraction at all suction points

Solution

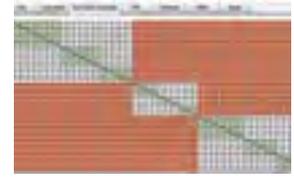
- Dynamic damper controlling to reach maximum extraction at each extraction point

Technical advantages

- Maximum suction power with minimum energy consumption
- Reacts flexible to every process step
- No additional measurement
- Easy to extend for new plant configurations
- Energy saving thanks to controlled induced draft fans/dampers

Efficiency

- Maximum suction power
- Energy saving up to 25 percent



Processing lines

Production optimization models
Optimization of coil sequence

Performance Checkbox



Challenges

- Different materials and strip dimensions require different process settings

Solution

- Optimization of coil sequence
- Calculation and control of smart transition parameters

Technical advantages

- Prevention of transition areas not satisfying quality demands
- Prevention of transition strips
- Higher output and hence higher yield due to intelligent production planning and process models
- Lower energy consumption due to optimized production sequence
- Easy and optimized production planning

Productivity

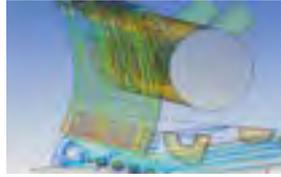
- Yield increase up to 30 percent

Efficiency

- Up to 20 percent lower energy consumption

Industrie 4.0

- Connecting all influencing factors with superordinated optimization



Hot strip mill / CSP® plant

Convection roll cooling (CRC)

Performance Checkbox



Challenges

- Conventional work-roll spray cooling systems are operating at 12 bars with ~10,000 l/min per stand
- Operational costs for energy and spare parts (nozzles and valves)

Solution

- Work roll cooling based on forced convection principle

Technical advantages

- Higher cooling capacity compared to conventional spray cooling
- Reduction of required pump energy
- Precise guiding of water

Efficiency

- Up to 80 percent savings in energy use (pumps)
- Up to € 1 million/year lower energy costs (for HSM)
- Reduction of water consumption

Quality

- Reduction of water on strip

Large-diameter pipe plants /
Spiral pipe plants

PERFECT arc® Digital welding source

Performance Checkbox



Challenges

- Increased requirements with respect to weld seams and greater cost pressure on pipe manufacturers

Solution

- Digital welding process for spiral pipes as well as for longitudinally seam welded pipes suitable for both arc and submerged arc welding
- Precise control of power supply during ignition, welding and stopping

Technical advantages

- Fully digitalized current source instead of thyristor current sources
- Result: "Perfect arc" that reacts quickly and can be controlled precisely at any time
- Electric efficiency > 90 percent with uniform load on network

Productivity

- 50 percent faster with tack-welding
- 20 percent faster with submerged arc welding

Efficiency

- 30 percent less energy consumption compared to conventional welding techniques
- Use of a fully digitalized current source instead of thyristor current

During the opening ceremony, the staff of Weber Metals seized the opportunity to take a group picture.



U.S.A.

NEW DIMENSION FOR THE FUTURE OF FORGING

Grand opening ceremony of the world's largest pull-down die forging press supplied by SMS group at Weber Metals in California.



On October 23, 2018, OTTO FUCHS Group celebrated the grand opening of its new 60k pull-down die forging press at the location of its U.S. subsidiary Weber Metals in Paramount, California. It is the largest single investment in the company's over 100-year history. Numerous guests from industry, economy and politics attended the opening ceremony. Completely set up by SMS group, the new press, with a force of 54,000 metric tons, is the worldwide strongest and most advanced hydraulic pull-down die forging press in pit-mounted design.

"The new forging press from SMS group is our flagship and will ensure the competitiveness and also the technological leadership of OTTO FUCHS for the next 30 years," says Klaus Welschof, Head of Aerospace Division, OTTO FUCHS KG.

In the course of the event, visitors had the opportunity to experience the dimensions and the unique power of the press. The high-ranking representatives from economy and politics as well as those from customer OTTO FUCHS and Weber Metals were equally impressed and excited. In total, SMS group used about 9,000 tons of steel to build the plant, which is more than once used for the Eiffel Tower.

SMS group was responsible for the mechanical equipment, electrical and automation systems, hydraulic equipment as well as the complete erection of the plant including commissioning. Forging of first reference pieces was also part of the supply scope. The forging results were impressive right from the beginning, confirming the success of the partnership-based cooperation and meticulous planning coordination between Weber Metals and SMS group.

"The SMS slogan of being the Leading Partner in the World of Metals has definitely proved to be true. For the construction of this press, we had to make our choice from several partners and decided in favor of SMS because they came with a vast range of know-how which perfectly complemented that of our company. SMS complied with our wishes, and jointly we have built something really great," says Dr.-Ing. Hinrich Mählmann, personally liable partner of OTTO FUCHS KG.

Anyone standing in front of the press during the opening ceremony could hardly imagine the routes the giant steel parts had gone. The huge components had mainly been manufactured in Europe and Asia and then been shipped to the U.S.A. according to excellent logistical schedules. In particular, the items concerned are 34 cast and forged parts with weights between 100 and 330 tons installed in the ▶



The world's largest pull-down die forging press is operating at Weber Metals, Paramount, California.



One of the first parts forged on the 60k press.



Film on the grand opening at Weber Metals.

Forging manipulator at work.



press. Also, the earth and installation work, and the auxiliary assembly aids specifically designed for this project, were record-breaking.

SIZE IS NOT AN END IN ITSELF

The pull-down die forging press, also named 60k press as it can exert a force of 60,000 short tons (U.S.), will serve Weber Metals to make products for the aerospace industry from forged aluminium and titanium. Forgings of these high-performance materials are used in the fuselage, the wings, and the engines. The size of the plant is not an end in itself nor does it serve the pursuit of world records, but follows a clear future-oriented strategy: The new pull-down die forging press opens up completely new perspectives to designers and manufacturers in the aerospace industry for larger, weight-optimized, but also structure-optimized components that offer increased safety at less weight. In the future, such parts will allow for the design of aircrafts featuring higher transport capacities, improved safety and minimized fuel consumption. These new, larger and lighter components are the key to future mobility. What's more, thanks to its enormous forging power the plant can shape even new high-strength and ultra-high-strength materials. Companies able to offer such semis will find markets that could not be served so far, which means clear competitive advantages and added value. SMS group supports customers in tapping this potential by providing plant solutions and tailored technology and thus helps the customer, like OTTO FUCHS in this case, establish in promising markets.

NOT ONLY STRONG; BUT HIGHLY PRECISE

The hydraulic pull-down die forging press has a force of 60,000 short tons (U.S.) and a die clamping area of 6,000 by 3,000 millimeters. The working stroke is 2,000 millimeters. The press is designed for hot and cold forming. An essential feature of the press is its balancing system with latest valve technology and highly sensitive electronics being perfectly harmonized and interacting. The result is extremely high precision in the forging operation. ◆

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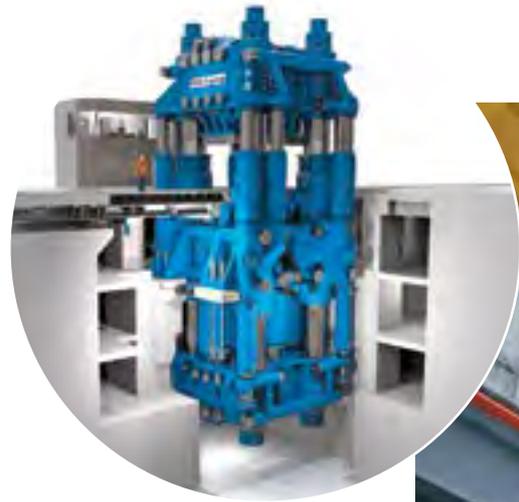


Illustration of the pull-down die forging press with a force of 540 MN (60,000 short tons) supplied by SMS group.



Ceremonial presentation of the new 60k pull-down die forging press at Weber Metals in Paramount, California.





Operating staff at the pull-down die forging press.

During the grand opening, the use of virtual and augmented reality technologies for training purposes was demonstrated to small groups accompanied by lectures on latest trends and topics around the subject of digitalization.

GERMANY

NEW WAYS OF LEARNING

Grand opening of Digital Classroom.



In December 2018, the SMS TECademy opened the doors to its new training classroom in Mönchengladbach. The inaugural address was held by Prof. Dr.-Ing. Katja Windt, Member of the Managing Board of SMS group, followed by key handover to Jochen Burg, Manager Business Unit Technical Service, and Karsten Weiß, Head of SMS TECademy. The guests participating in the opening ceremony had the opportunity to gain a first impression of the trendsetting techniques and methods applied in the SMS TECademy training courses.

SMS TECademy offers its customers a new and uniquely interactive way of learning using the digital classroom. By using virtual and augmented reality applications, training participants will benefit from a higher learning effect as for example complex maintenance work can be experienced with a high immersion factor. The simulated environment looks and feels to some degree like the real workplace. Trainings at the virtual model will not disturb the real plant production schedule and can take place at any time. Furthermore, training participants can practice without crash and damage risks. Explore, learn and apply – the SMS TECademy makes it possible. ♦



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Customers from all over Germany accepted the invitation and came to Mönchengladbach to try and test the new training technologies.

GERMANY

KEMPER ORDERS LOGISTICS SYSTEMS FROM AMOVA

For the new Works III, AMOVA will supply logistics systems based on a logistics study. The overall concept was developed by a project group from KEMPER in cooperation with AMOVA.

Gebr. Kemper GmbH + Co. KG has awarded to AMOVA GmbH, a subsidiary of SMS group, an order worth several million euros. For the second construction stage of the new Works III in Olpe, which is to accommodate the finishing line, AMOVA will supply logistics systems including warehouse management system (WMS), a driverless transport system with pre-storage area, turnstiles, an intermediate storage area, a binding and packaging system as well as a high-bay store for pallets. With the aid of a logistics study, AMOVA could accompany already the first step of the implementation. The project focused on the material flow of starting and finished material, packaging tasks for a variety of final products as well as on the storage of starting, finished and packaging material. Particular attention was paid to identifying optimization approaches taking into account economic aspects such as return on investment (ROI).

Gebr. Kemper GmbH + Co. KG is a more than 150-year-old, family-managed company for gunmetal castings and building technology as well as copper and copper-alloy

rolled products domiciled in Olpe, Germany. 780 employees of totally almost 1,000 worldwide are working at the Olpe location. The rolling mill will be expanded by Works III. This is the place for tailoring copper strips with thicknesses between 0.1 and three millimeters to be used in many consumer goods.

AIR CARGO TERMINALS AND CONTAINER STORES

AMOVA GmbH located in Netphen, Germany, also known under the names SMS Logistiksysteme or SIEMAG Transplan from history, has been a specialist in satisfying logistic demands in the metallurgical and rolling mill industry for more than 60 years. The portfolio further includes fully automated solutions meeting the most diverse requirements with respect to packaging for internal and external transportation.

AMOVA has been successful in translating the knowledge of these demands into other industrial sectors. In cooperation with its partner UNITECHNIK, located in Wiehl, Germany, AMOVA supplies fully automated air cargo terminals under the brand name ACUNIS. In 2017, Africa's largest air cargo terminal was opened in Ethiopia. Erection and commissioning of the follow-up facility in Kenya started in May 2018.

Another field AMOVA has become a specialist in is high-bay stores for containers. Sea containers are carried to fully automated high-bay stores where they are kept in space- and time-saving arrangement until repackaging or reloading (by ship, rail or road). ♦



AMOVA's business is customer-specific storage, transport and packaging solutions.

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 **Further information**
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For its additively manufactured 3D spray head SMS group has won the German Design Award 2019 in the category "Industry".

GERMANY

SMS GROUP RECEIVED GERMAN DESIGN AWARD 2019

Additively manufactured 3D spray head for forging plants wins design award in the category "Industry".

For its spray head used to cool dies in forging presses, SMS group has received the German Design Award 2019 in the category "Industry". Every year, the German Design Council organizes the German Design Award honoring innovative products and projects, their producers and designers.

Axel Roßbach, Research and Development Extrusion and Forging Presses of SMS group: "Through the use of 3D printing and by employing a function-optimized construction the spray head is a milestone innovation in the design of plant and machine components. The shape of the component is optimally designed to its designated function using state-of-the-art computer systems." The machine component is significantly lighter, features flow-optimized channels and cools the dies specifically and as required in each individual case. What is more, SMS group itself is planning to enter the market as provider of comprehensive solutions for this manufacturing method. Only recently, a pilot plant for industrial-scale production of special metal pow-

der has been successfully commissioned. The powder forms the basis for Additive Manufacturing and its grade is decisive for the quality of 3D printing.

Markus Hüllen, Vice President 3D Competence Center of SMS group: "As Leading Partner in the World of Metals our objective is to offer our customers complete Additive Manufacturing plants supplied on a turnkey basis including all process steps, i.e. with reproducible top quality for series production. Our customers will receive modular, scalable solutions tailored to their individual requirements. With our world-spanning service and support network we are also able to accompany our customers on their way into the world of Additive Manufacturing." ♦



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ITALY

FAST TRACK REPAIR SERVICES

Thanks to the very close cooperation between Acciaieria Arvedi and Paul Wurth, the repaired blast furnace at the Trieste plant resumed regular hot metal production after only 34 days of furnace stop.



Controlled salamander tapping at the beginning of the repair activities.

After a hearth condition assessment which identified some spots in critical state, Acciaieria Arvedi awarded Paul Wurth an order for an urgent repair at No. 3 Blast Furnace at their Trieste works in Italy.

Paul Wurth's scope of services covered engineering and execution of the salamander tapping, engineering for hearth lining replenishment, supply of carbon based material and site jobs supervision. The preparation work commenced immediately after the agreement on 9th of May, so that salamander tapping operations could be started on May 29th already.

NO OFF-THE-SHELF SOLUTIONS

Despite the organizational complexity and appearance of some additional, unforeseen activities during the repair works, regular hot metal could be tapped from BF 3 again on Sunday the 1st of July, after a furnace stop of only 34 days. This was in line with the originally scheduled shutdown duration. This record time was achieved thanks to a very proactive cooperation between the customer and Paul Wurth teams from Italy and Germany which, in particular, ensured an ultra-short delivery time for the refractory material supplied.

The new refractory configuration selected by Paul Wurth was a tailor-made combination of a silicon carbide-based unshaped material as hot face lining and a monolithic carbon block in the taphole area surrounded by small carbon bricks, all suitably shaped to ensure a proper connection with the remaining carbon lining.

The customer expressed full satisfaction for the good job executed and sent the following written appreciation to Paul Wurth: "The joint effort and the high level of cooperation achieved between the Arvedi and the Paul Wurth teams greatly contributed to the proper execution of the planned activities in full compliance with the projected deadline." This event is a further example of the professional service that Paul Wurth can offer to its customers even in the most particular situations calling for unconventional solutions.

Salamander tapping and hearth lining replenishment executed by Paul Wurth satisfy customer's expectations – Certificate of Appreciation issued! ♦



New coke dry quenching plant at Tata Steel, Jamshedpur, India.

INDIA

ECO-FRIENDLY DRY QUENCHING SYSTEM

First Paul Wurth coke dry quenching plant in operation.

The first hot coke was charged into the CDQ No. 11 coke dry quenching unit at Tata Steel's integrated steel plant in Jamshedpur, state of Jharkhand, in India, in spring 2018.

The corresponding contract had been signed in March 2015, when Tata Steel, Ltd. awarded this order to Paul Wurth in the frame of a consortium set-up with Larsen & Toubro as construction partner. Paul Wurth's part was the engineering, supply of technological equipment, training and supervision of erection and commissioning for two new coke dry quenching (CDQ) systems. While the biggest part of the supply and the overall project management was handled by Paul Wurth, the Japan-based joint venture Paul Wurth IHI provided the key technological items and the related expertise.

After the successful heating-up phase, activities proceeded smoothly and the first quenching operation on coke

coming from coke oven battery (COB) No.11 took place according to schedule. The second CDQ system is to handle coke from COB10 and will be put into operation shortly. The hot coke throughput capacity will be 2 x 100 tons per hour. At both CDQ systems, the volume of the main chamber is 500 cubic meters while the pre-chamber capacity is 300 cubic meters.

This is Paul Wurth's first reference of a coke dry quenching plant, featuring the most recent technologies in coke quenching. ♦



Further information
www.paulwurth.com

RUSSIA

COAL STAMP-CHARGING TECHNOLOGY

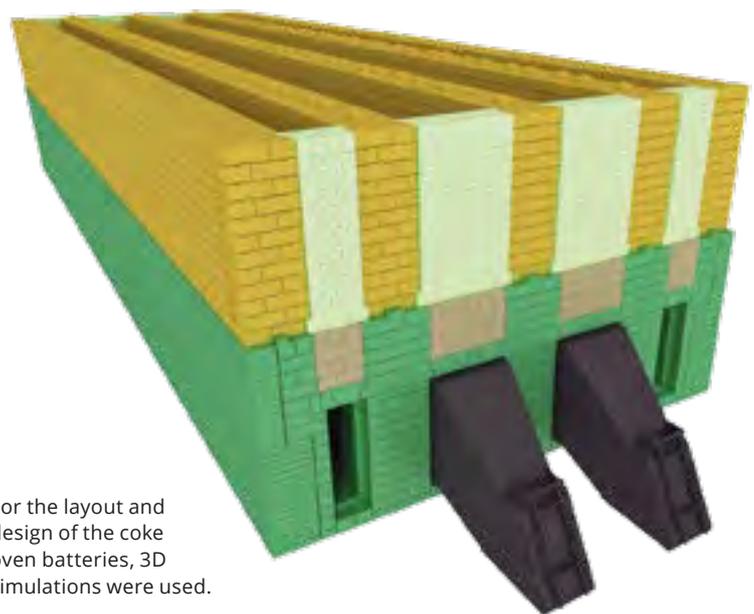
Stamp-charged coke oven batteries allow cheaper raw materials to be used while achieving the required coke quality.

Severstal and Paul Wurth have recently signed a contract for the construction of a new coke making complex at Severstal's integrated steel works in Cherepovets in the northwest of Russia. Core parts of the new complex are two brand new stamp-charged coke batteries, for which Paul Wurth had executed the "Project Documentation", an extended version of basic engineering, in the months before. Now, Severstal confirmed its trust in Paul Wurth by placing this consecutive order which covers so-called "Working Documentation", the Russian version of detail engineering, and "Supplies Procurement", i.e. the supply of Paul Wurth key equipment necessary for guaranteeing the general performance of the new plant, as well as the "Designer's Supervision" to be provided during the erection works.

MODERN COKE MAKING SOLUTIONS

Along with the two coke oven batteries ("Block 1" and "Block 2"), Paul Wurth's technologies and engineering solutions for the new coke making complex will be applied in the three new coke dry quenching systems, in a complete set of coke oven machines, in ancillary equipment for coal preparation and coke handling as well as in the tar decanting plant. Paul Wurth's hardware supplies will include critical and patented equipment and systems such as the coke oven doors, refractories, machines and the SOPRECO® system for single oven pressure control.

The two batteries (2 x 56 coke ovens of 6.25 meters height) are designed for a total production of 1.4 million tons of coke. They will be of the stamp-charging type and integrate state-of-



For the layout and design of the coke oven batteries, 3D simulations were used.

the-art Paul Wurth coke making technology such as the innovative smokeless charging system.

In a recent statement, Vadim Germanov, the Director of Severstal's division "Rossiyskaya Stal", mentioned that "This will be the first Russian coke batteries with a new promising technology, the coal stamp-charging process, allowing us (Severstal) to use cheaper raw material while maintaining the coke quality. Furthermore, we apply strict criteria for protecting the environment, even as early as at the design stage; therefore the contract includes the relevant technological solutions."

The new complex is slated to be commissioned by September 2021. ♦



Further information
www.paulwurth.com

JSW Steel Ltd. ordered a 5(6)-strand high-speed billet caster from SMS Concast for 165-millimeter square billets.

INDIA

NEW ORDER FROM JINDAL GROUP

JSW orders high-speed billet caster from SMS Concast.

JSW Steel Ltd. in Toranagallu, India, belonging to Jindal Group, has awarded SMS Concast, a company of SMS group, an order covering a 5(6)-strand high-speed billet caster. This project is part of a bigger expansion plan, and the main objective is an increase in productivity.

The existing steel plant consists of a 160-ton electric arc furnace, ladle furnace, billet caster and rolling mill and shall increase the annual produc-

tion to 1,500,000 tons of steel after installation of the new billet caster. The caster will be designed for fast casting of square billets with an edge length of 165 millimeters.

The configuration of the new caster from SMS Concast will allow the use of spares in both plants. This is a big feature to cut operating costs (OPEX).

Furthermore, latest technology will be applied to reach the specified productivity and OPEX tar-

gets. Special products are the low-maintenance oscillation drive CONDRIVE and the advanced INVEX® mold technology.

The CONDRIVE mold oscillation combines the advantages of hydraulic and mechanical drives in one. Due to the innovative torque drive, the amplitude, frequency and oscillation profile can be adjusted online and independently. Thus, it grants full functionality, however without the hydraulic system drawbacks in terms of maintenance and piping. In this context, CONDRIVE is one part of the innovative maintenance concept with a view to reduced spare parts inventory.

Regarding productivity, the SMS Concast-developed INVEX® mold allows for very high strand throughputs in the range of 790 kg/min. The special tube geometry and enhanced water cooling features allow an efficient heat transfer and thus a more uniform solidification at the faces and in the corner areas, thus enabling higher casting speeds.

“Considering the very good performance of the existing SMS Concast equipment, its advanced technology and reduced OPEX, we have decided to go for another cooperation in order to implement our expansion plan,” says Purushottam Prasad from JSW Steel Ltd. ♦



RH plant in operation.

Further order for SMS Mevac

JSW Steel Ltd. to be supplied 160-ton RH-TOP vacuum degasser.

SMS Mevac has secured an order from JSW Steel Ltd. to install a 160-ton RH degasser at their plant in Vijayanagar, Karnataka, India. This RH unit will be the second one supplied by SMS Mevac for Steel Melting Shop No.1, which makes three in total provided by the company for the Vijayanagar site.

The RH package consists of a RH-TOP degassing unit with a single treatment station, built in partnership with SMS India Pvt. Limited. The RH-TOP vacuum degasser will be of the

rocker-type vessel design with the vacuum vessel mounted in a moving platform at one end of a pair of rocker arms. At the other end of the rocker arms there is a counter-weight system which is raised and lowered by a hydraulic cylinder.

Increase of plant availability

Two ladle transfer cars will be provided to reduce handling time and improve unit availability, which would otherwise be limited due to the available space in the shop. The unit will be installed with an SMS Mevac multi-function TOP lance combining oxygen blowing and an oxyfuel burner for vessel heating in one unit. The degasser will be supplied complete with an extensive alloy addition system and equipped with the latest Level 2

process control models. The scope of supply for SMS Mevac comprises all technological parts, including the vacuum pump, vacuum lock, ferrosilicon vacuum bunker, TOP lance system and automatic sampling facilities. SMS India will supply all large fabrications including the vacuum vessels, hot off-takes, hydraulic systems and other ancillary equipment. The unit will be designed for making a wide variety of grades including high-silicon steels. ♦



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Further information

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Vizag Steel now produces rounds of 410 and 450 millimeters in diameter in addition to 200 millimeters square blooms on the new continuous casting machine supplied by SMS Concast.

INDIA

PRODUCT RANGE EXPANDED

Vizag Steel has successfully commissioned the continuous casting machine from SMS Concast for round blooms and square billets.

RINL's (Rashtriya Ispat Nigam Ltd.) Visakhapatnam Steel Plant (VSP) has successfully commissioned the new continuous casting machine in Visakhapatnam, India, which was supplied by SMS Concast, a company of SMS group.

With a casting radius of twelve meters, the five-strand continuous casting machine has a rated capacity of one million tons per year, covering a wide range of steel grades from simple carbon grades to grades for ball bearing and seamless tube applications as well as railway wheels.

The new continuous casting machine is enlarging the product range of Vizag Steel by introducing round bloom sections of 410 and 450 millimeters in diameter in addition to the 200 millimeters square sections. The smoothly commissioned casting machine encompasses all technological features required to produce steel grades for highest quality demands, including a submerged pouring system with electro-mechanical stopper flow control system, hydraulic mold oscillation, mold and final electromagnetic stirrers as well as a product marking system.

The state-of-the-art Level 1 and Level 2 automation systems ensure efficient operation of the continuous casting machine with minimized personnel requirements, while controlling and monitoring all required process parameters

“Thanks to the very successful cooperation with SMS Concast, we now operate a continuous casting machine of the latest technology specifically designed to meet our high quality standards.”

P.C. Mohapatra, Director (Projects) at Vizag Steel

and capturing all key product data for digital production and quality tracking.

With this new state-of-the-art equipment, Vizag Steel will be able to further strengthen its position in the Special Bar Quality (SBQ) market. ♦



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GERMANY

AURUBIS ORDERS NEW PEIRCE-SMITH CONVERTERS

Hamburg-based Aurubis AG is to take delivery of new Peirce-Smith converters, which will be supplied by SMS group and used to produce blister copper, an important stage in the copper production process. The converters will be installed at the company's headquarters in Hamburg. They are scheduled to be put into operation in fall 2019. The converters measure 15 x 38 feet. Aurubis AG is installing the new converters in order to strengthen and consolidate its global position as an integrated copper group and the world's largest copper recycler. The new converter design already takes future optimization into account to allow for more efficient production processes. SMS group has been commissioned with the engineering, delivery, and installation of the converters.

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INDIA

SMS MEVAC RECEIVES ORDER

Supply of second
350-ton RH-TOP vacuum
degasser to JSW Steel Ltd.

SMS Mevac has secured an additional order from JSW Steel Ltd. to install a second 350-ton RH degasser at their plant in Dolvi, Maharashtra, India. The order will add additional vacuum degassing capacity to the No. 2 BOF shop which is currently being built by SMS group. The second RH package consists of a single-station RH-TOP degassing unit, built in partnership with SMS India Pvt. Limited.

ROCKER-TYPE LADLE LIFTING

The RH-TOP vacuum degasser will be of the latest rocker-type design with the steel ladle being raised up to the vacuum vessel for treatment using a hydraulic counterweight system. Two ladle transfer cars will be provided to reduce handling time and allow inter-bay transfer of the treated ladles. The unit will be installed with an SMS Mevac multifunction TOP lance combining oxygen blowing and an oxygen-fuel burner for vessel heating. The degasser will be supplied complete with an extensive alloy addition system and equipped with the latest Level 2 process control models.

SMS Mevac is going to supply all technological parts, including the vacuum pump, vacuum lock, TOP lance system and automatic sampling facilities. SMS India will supply all large fabrications including the vacuum vessels, hot offtakes, hydraulic systems and other ancillary equipment. ♦

 **Mark Whitehead**
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CHINA

SUPERLATIVES IN CUTTING-EDGE TECHNOLOGY

New flat steel complex in Shandong has started production.



The production complex at the Chinese east coast.

5,000

employees are currently working at the Rizhao production site.

- **SMS group** supplied the complete production complex to Shandong Iron & Steel Group Rizhao Co., Ltd. (SDIS). The portfolio at this location mainly comprises strip grades for the automotive industry.
- **A special feature** of this state-of-the-art complex is the use of the cross-process quality management system Product Quality Analyzer (PQA®) which documents, monitors and ensures the whole production process at Shandong Iron & Steel.

The starting signal was given in autumn 2017 by the high-performance hot strip mill, followed by a combined pickling line-tandem cold mill in February 2018. The first one of the two annealing lines was commissioned on March 14, 2018, with the hot-dip galvanizing line to follow on May 3, 2018. The second annealing line produced its first strip on September 5, 2018. SMS group's scope of supply was rounded off by a complex comprising a continuous caster and a Steckel/plate mill, the order for which was placed in spring 2017.

Shandong Iron & Steel Group Rizhao uses the new equipment to focus production on strip grades for the automotive industry. To reliably meet the particularly high requirements of this trade, SMS group implemented its innovative Product Quality Analyzer (PQA®), a quality management system covering all production processes from steelmaking up to the final galvanized strip. This makes the new complex at SDIS rank among the most advanced flat steel production facilities worldwide. ◆

 **Christian Sobotka**
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Office building of Shandong Iron & Steel Group Rizhao.



1.2 mm

is the minimum thickness of the strips produced at this location, the maximum is

25.4 mm



Heat insulation hoods reduce heat losses of the transfer bar.



Two roughing mill stands efficiently reduce the rolling stock to transfer bar thickness.

HIGH-PERFORMANCE HOT STRIP MILL

The high-performance hot strip mill has a maximum annual capacity of 4.8 million tons and produces strip with widths of up to 1,900 millimeters and thicknesses of between 1.2 and 25.4 millimeters. Key installations include a slab sizing press, a two-high reversing roughing stand, a four-high reversing roughing stand with edger, a heat insulation box system between the roughing and finishing mills, a crop shear, seven finishing stands, a laminar strip cooling section and three downcoilers.

This plant configuration affords SDIS a high degree of production flexibility. ▶

4,800,000

tons is the annual capacity of the high-performance hot strip mill.



The seven-stand finishing mill rolls the transfer bar down to final thickness. All mill stands feature CVC®plus.



The high-performance hot strip mill is equipped with three downcoilers.



XIANGRUI MENG,
DIRECTOR, HOT STRIP ROLLING
DEPARTMENT DIRECTOR,
SHANDONG IRON & STEEL GROUP RIZHAO.

INTERVIEW

HIGH-PRECISION AUTOMOTIVE SHEETS

Mr. Meng, what kind of products are you presently producing on your high-performance hot strip mill?

This production line mainly produces some high-quality products. Currently, our main market is automobile sheets.

Are you satisfied with the equipment from SMS group?

We are very satisfied with SMS group. On the one hand the team is very dedicated and on the other the equipment you provided has perfect precision.

How do you judge the ramp-up curve since you started production on the hot strip mill?

The ramp-up curve has perfectly met our expectation. We are very satisfied with it.

What do you expect from the Product Quality Analyzer (PQA®) in the future?

PQA® should be very helpful to our production line in the future. Currently, we are collecting data to prepare a more accurate analysis of product performance. In the years to come, PQA® will have significant influence on our production. ◆ ▶

Pickling tanks in the turbulence pickling line.

1.8 mm

is the minimum thickness of the starting stock processed in the PL-TCM, while the maximum is

6.0 mm

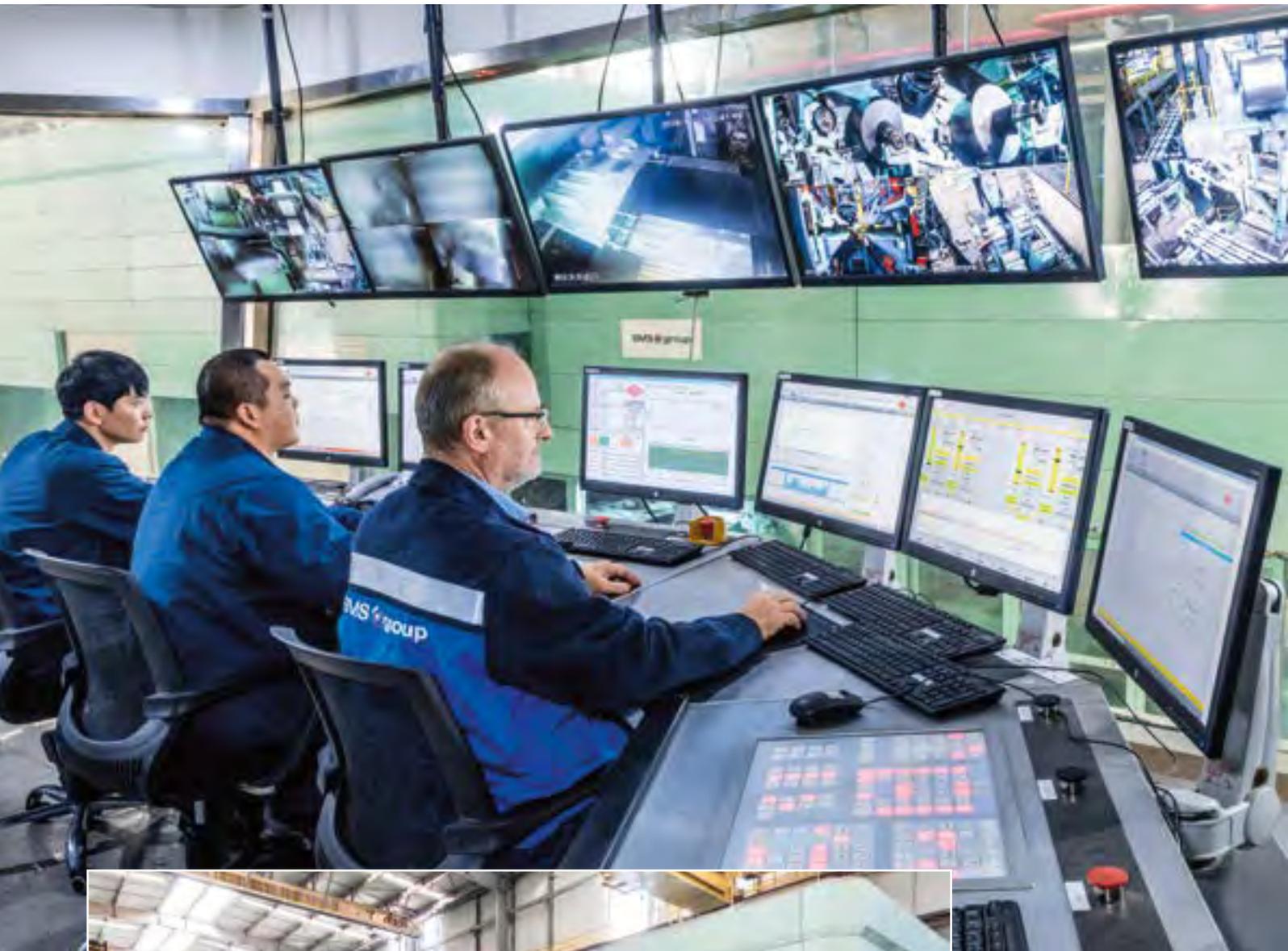
2,000,000

tons is the annual capacity of the pickling line-tandem cold mill (PL-TCM).

COMBINED PICKLING LINE-TANDEM COLD MILL FOR A VAST ARRAY OF PRODUCTS

A large proportion of the hot strip is processed in the pickling line-tandem cold mill (PL-TCM) to create high-quality cold strip. In the tandem cold mill, the first strip was rolled on January 30, 2018. Shortly thereafter, on February 19, 2018, hot strip was pickled and rolled in a combined process for the very first time.

The PL-TCM has an annual capacity of two million tons and processes strip that is between 900 and 1,880 millimeters wide and has final thicknesses ranging from 0.3 to 2.5 millimeters, using starting material with a thickness of between 1.8 and 6.0 millimeters. ▶



Tandem mill main control station. X-Pact® electrical and automation systems ensure transparent and harmoniously meshing process sequences and hence maximum operational reliability.

Five-stand tandem cold mill with connecting area to the pickling line.



LIJUN HE, DEPUTY DIRECTOR,
COLD ROLLING DEPARTMENT, SHANDONG
IRON & STEEL GROUP RIZHAO.

INTERVIEW

PQA[®] SYSTEM OPTIMIZES PRODUCT QUALITY

Mr. He, what kind of products do you make in the pickling line-tandem cold mill (PL-TCM)?

We mainly produce cold rolled strip. Our annual output is two million tons.

How satisfied are you with SMS group as your supplier?

SMS group has comprehensive technical and process know-how. We are very satisfied with the cooperation. In addition, SMS group has provided not only the mechanical equipment, but also the electrical and automation systems, which was a great advantage for us.

The scope of supply also included the PQA[®] system. What do you expect from the Product Quality Analyzer?

The PQA[®] system helps us produce high-quality products and supports us in further optimizing the product quality. It can collect all kinds of quality parameters in the whole production process from steelmaking down to the final cold rolled products. These quality parameters may be measured values, data from specific production situations and even complex standards. All these data can be used as an important basis for our quality evaluation and optimization.

Was SMS group's Plug & Work concept helpful for Shandong Iron & Steel Group Rizhao?

SMS group completed all automation integration work before the installation of the equipment. Thus, we could test and optimize the whole system in advance. With Plug & Work we were also able to simulate the production process and train the operators at the same time.

How would you characterize the cooperation between SMS group and your company?

Our cooperation was very good. The SMS group team has highly professional technical know-how and wide-ranging experience in site work and commissioning activities. We greatly benefitted from working with them.

SMS group also provides customized technical service. Do you think that after-sales service would be an option for your mill?

Yes, absolutely. From the beginning of the construction activities, our cooperation with SMS group has been extremely effective. During the project execution, SMS group was always there to support us when we needed help. And we are still getting this great support in a most timely manner when we have a problem, even after we issued the FAC. ◆ ▶

2,000,000

tons of cold strip are processed in two annealing lines and one hot-dip galvanizing line to create high-quality end products for the automotive industry.

1,000 MPa

The two annealing lines.

is the maximum strip tensile strength of some high-strength steel grades.

TWO ANNEALING LINES AND ONE HOT-DIP GALVANIZING LINE FOR AUTOMOTIVE GRADES

The cold strip produced is refined in two annealing lines and one hot-dip galvanizing line to create high-quality end products. A special feature of the lines are the powerful Drever radiant tube furnaces. Among other things, they are equipped with an ultra-fast cooling system permitting extremely high cooling rates to be achieved and thus the production of high-strength grades for the automotive industry. To prepare the strip for the annealing process, a multi-stage cleaning zone is integrated in each line entry section. To prevent any coating imperfections resulting from selective oxidation of alloying elements, the furnace in the hot-dip galvanizing line features ProBO_x® pre-oxidation technology. Further, the hot-dip galvanizing line includes a FOEN air knife system to precisely meet the required layer thickness and thereby satisfy the extremely high surface quality demands of the automotive industry.

The annealing lines are designed for an annual capacity of 950,000 respectively 650,000 tons of steel strip. A further portion of 400,000 tons of steel strip per year can be heat-treated and provided with a zinc layer in the hot-dip galvanizing line. The totally two million tons of surface-finished cold strip comes in widths of between 900 and 1,850 millimeters and final thicknesses from 0.3 to 2.5 millimeters. The portfolio comprises material grades CQ, DQ, DDQ, EDDQ, SEDDQ, BH, HSLA, HSS, DP, TRIP, with tensile strengths of up to 1,000 megapascals being achievable.



The ProBO_x® technology allows for flawless zinc coating of high-alloy high-strength steel grades.

ELECTRICAL AND AUTOMATION SYSTEMS

In the combined pickling line-tandem cold mill and the strip processing lines at SDIS, SMS group's holistic X-Pact® electrical and automation system makes sure that all components of the individual plants are well-matched and interact in harmony: from energy supply and distribution, through drive systems and instrumentation, up to continuous automation. The comprehensive process know-how in modular X-Pact® automation packages ensures both the overall capacity of all plants and the high quality of all end products.

The Plug & Work concept developed by SMS group provided valuable time savings already in the run-up to erection and commissioning of the plant. New automation systems were set up, tested, and pre-optimized as a complex unit in SMS group's test fields long before on-site erection work had started. What's more, the customer's staff was trained in a virtual production process and learned how to operate and master the plant and its functions.

Operators in the control station during ongoing production.





The PQA® system stands for consistent documentation.

PQA® - PRODUCT QUALITY ANALYZER

The PQA® system monitors, documents and safeguards the whole production process and product quality through to the finished cold strip. For this purpose, all relevant production data are recorded and analyzed continuously. By means of instructions based on a set of stored rules, the quality of the coils is assessed semi-automatically, and they are released or blocked accordingly. In addition, operators get specific instructions by the system during the production process, early indicating any process irregularities and showing effective countermeasures. As a result, operators are able to intervene before the actual problem comes into existence. Troubles in the production process as well as resulting massive quality losses and downtimes can be reduced significantly. In the long run, this means an increase in output accompanied by a reduction of quality costs. To sum up, PQA® brings SDIS essential benefits like the immediate identification and elimination of quality issues, high process stability combined with increased output as well as higher acceptance by end customers, as the whole process is fully documented.



Thanks to early system instructions, the operators are able to intervene before a problem comes into effect.



JINGUANG YANG,
VICE GENERAL MANAGER, SHANDONG
IRON & STEEL GROUP RIZHAO.

INTERVIEW

RELIABLE SUCCESS WITH A TRUSTED PARTNER

Mr. Yang, what is the main market for selling your products?

Currently, we mainly supply our products to high-end market customers in China. In addition, we have exported already about 350,000 tons to Southeast Asia, Japan and to the Middle East this year. The overall market situation is very well.

How satisfied are you with the plants supplied by SMS group?

Generally, we are very satisfied with the cooperation between our company and SMS group, especially with the 2050 Hot Strip Mill for which we already issued the FAC to SMS group. We have achieved great success with this project, and with all the new production lines we currently have much progress. Therefore, we can say we are very satisfied with SMS group.

How important is it for you that SMS group, as a systems supplier, supplies all mechanical, electrical and automation systems from one source?

SMS group is worldwide a well-known supplier. To make the right decision for equipment, including the electrical and automation systems, was very important for us. It is basically significant for the production operation and the product quality which should meet our expectations. Thus, I could say, SMS group is very important for us.

Are you planning further joint projects?

SMS group should be our strategic cooperation partner. We will have some further project planning and new projects. We hope that both of us will keep up close coordination and communication to create even better conditions for the new projects in the future.

Would you recommend SMS group to other customers?

I surely will. In fact, we have already recommended SMS group to some of our partners and our customers.

So, is it your opinion, too, that SMS group is the Leading Partner in the World of Metals?

I totally agree with this slogan, and hope that SMS group can keep holding that position. ◆



Final step in the manufacturing process: painting the new gear unit for Novelis Nachterstedt.

GERMANY

THE IMPOSSIBLE MADE POSSIBLE

New gear unit for Novelis Nachterstedt within just 12 weeks.

Being the Leading Partner in the World of Metals to SMS group means supporting the customers at the best of its efforts, especially in emergencies. On January 21, 2018, a gear unit damage stopped operation of the aluminium cold mill stand of customer Novelis at Nachterstedt, Germany. The damage survey revealed that the gearwheel on the output shaft had broken and severely damaged the gear unit housing. Further operation was out of the question, and there was the hazard of a production stop of the single-stand mill for a longer period, with one of the reasons being that spares for the broken wheels were not available.

SMS group immediately set to work, and a little later was able to present the customer a gradual approach to solve the problem, i.e. installing a universal shaft between motor and gear unit for fast production restart. Simultaneously, SMS group worked full speed on the design and supply of a new gear unit.

A few days later, SMS group was able to present to Novelis an offer covering the supply of a new gear unit with in just twelve weeks. This extremely short delivery period was possible due to the fact that blanks for pinions and wheels were stored in SMS group's Hilchenbach workshop.

In addition, such bearings only were selected that the manufacturers had in stock.

At the end of January already, the design of the main gear unit was completed and manufacture was started in the Hilchenbach workshop. In mid-February, SMS group supplied a universal shaft with very large deflection angle and installed it between motor and mill pinion gear unit to ensure, at least, restricted operation of the mill stand until completion of the new gear unit.

Manufacture of the totally 30-ton gear unit with double-helical and case-hardened wheels took a time of eleven weeks. The gear unit left the Hilchenbach workshop on April 30, 2018 according to schedule. In the middle of May, the Nachterstedt plant was shut down to install the gear unit, and the aluminium cold mill stand could resume production shortly thereafter. ♦



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Further information
www.sms-group.com/expertise/drive-technology

RUSSIA

MMK RELIES ON SOLUTION FOR QUALITY MANAGEMENT

Industrie 4.0 system from SMS group for quality assurance at integrated steel plant in Magnitogorsk.

Magnitogorsk Iron & Steel Works (MMK), Russia, has placed an order with MET/Con, an SMS group company, for the implementation of the quality management system PQA® (Product Quality Analyzer). Together, MMK, SMS group and MET/Con intend to set a milestone with this project and show how the location's performance and quality levels can be improved thanks to total process and production transparency.

MMK produces around 10 million tons per year of quality steel at its site in Magnitogorsk; this steel is used in the construction and automobile industries, for example, and

for pipeline and mechanical engineering. As part of a company-wide Industrie 4.0 initiative, MMK will implement the new PQA® quality management system in order to further improve quality levels across all processes in Magnitogorsk, as well as stabilize production processes, improve on-time delivery performance, and thus improve its competitive position.

The PQA® system is a holistic IT solution that operates on know-how based expert rules. Among other things, the advanced software and database solution from QuinLogic GmbH in Aachen, also an SMS group company, is to be used. This approach has been successfully implemented in the past at selected flat steel and long product manufacturers with a wide range of downstream processing stages.

The PQA® system conducts an online analysis of process, production, and quality data from steel production, through casting and rolling, right down to surface finishing and refining. The PQA® expert rules, which can be freely configured and fed with specific know-how, take into account customer and order-specific information in the quality assessment process or when the material is approved for further processing.

The modular software structure comprises a Logic-Designer for flexible rule adaptation, a quality assessment module, and a web-based reporting system. The centerpiece of the quality management system is the DataCorrelator software module, which also covers current topics such as big data analyses and artificial intelligence (AI). Various intelligent mathematical evaluation methods, including pattern recognition options, identify and indicate correlations that can be directly used for process optimization. ♦



The PQA® quality management system from MET/Con provides for an improved level of quality, stable production processes, enhanced on-time delivery performance and ensures competitiveness.



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The new exit-side concept includes the cutting-edge Rotary Inspect offline inspection station permitting the fast and especially ergonomic inspection of strip top and bottom sides.



The tandem cold mill of PAO Severstal will be provided with new exit-side equipment.

RUSSIA

PRODUCING COLD STRIP IN MAXIMUM WIDTH

PAO Severstal again relies on the modernization expertise of SMS group.

In April 2018, PAO Severstal has contracted SMS group to modernize the exit section of the tandem cold mill "2100" at its Cherepovets plant in northwest Russia. In the forefront, there is the target of full utilization of the maximum possible strip width of 1,850 millimeters. The supply scope will mainly comprise a new tension reel featuring a motor coupling of about nine meters length connected to a new electrical gear (AC motor and converter), in order to coil the strip under high tension. In addition, there will be two coil cars guided on one common running rail serving for coil transportation to the inspection station respectively to the coil storage which will be arranged in a neighboring shop. Further, an offline inspection station of the Rotary Inspect type will be supplied for ergonomic and fast inspection of the finished strip.

The modernization will be carried out during a scheduled downtime of only 23 days. Commissioning of the tandem cold mill with the new exit-side installations is scheduled to take place in summer 2019.

In 2016 already, SMS group comprehensively modernized the tandem cold mill "2100" of PAO Severstal and completely exchanged the entry section and the four mill stands. In addition, rolling technologies and electrical and automation systems were lifted up to the latest technological level through the use of X-Pact®. By these measures, the rolling mill "2100" was very well prepared to satisfy the increasing material requirements of PAO Severstal's customers, especially regarding high-grade carbon steels, high-strength steels and micro-alloyed silicon steels. ♦

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VIETNAM

PERFECTLY SET FOR FUTURE REQUIREMENTS

MY VIET INDUSTRIES grants FAC for push-pull pickling line and Compact Cold Mill.

Vietnamese cold strip producer MY VIET INDUSTRIES Co. Ltd. has granted Esmech Equipment Pvt. Ltd., a company of SMS group, the final acceptance for the supplied push-pull pickling line and the CCM® Compact Cold Mill.

MY VIET had put the push-pull pickling line and the twin-stand cold rolling mill into operation in May 2018. In July 2018, after six weeks of hot commissioning and performance optimization, Esmech Equipment Pvt. Ltd. received the Final Acceptance Certificate.

MY VIET INDUSTRIES Co. Ltd. is a reputed supplier of coated steel products for the construction industry. The new cold strip mill in the Hung Yen Province, south of Hanoi was added to an existing works as a backward integration in order to provide the existing facilities with the required cold rolled strip and to supply the additionally produced strip to the Vietnamese industry. The mill will produce approximately 400,000 tons per year of low carbon strip in widths of up to 1,250 millimeters and final thicknesses down to 0.15 millimeters for numerous construction and industrial applications.

SET FOR FUTURE CUSTOMER REQUIREMENTS

The push-pull pickling line, which is of the turbulent pickling design, comprises a double entry section and four pickling tanks completely made of granite. The design allows for high process speeds and safe and eco-friendly processes. The pickling line can process strips with widths in the range from 600 up to 1,250 millimeters and thicknesses of up to 4 millimeters. The process speed can be varied between 15 and 120 meters per minute.

The CCM® is equipped with high-tech components manufactured at the German workshops of SMS group. The components include the well-proven CVC®plus (Continuously Variable Crown) roll shifting technology and roll bending devices, which ensure premium rolling results and high production efficiency. The mill also features automatic flatness control, modern actuators, an interactive roll pass calculation module and Level-2 automation. All this makes MY VIET INDUSTRIES Co. Ltd. perfectly set not only for current but also for future customer requirements. ♦



Top: The CCM® of MY VIET INDUSTRIES Co. Ltd. delivers premium rolling results.

Left: The pickling tanks of the push-pull pickling line are completely made of granite.

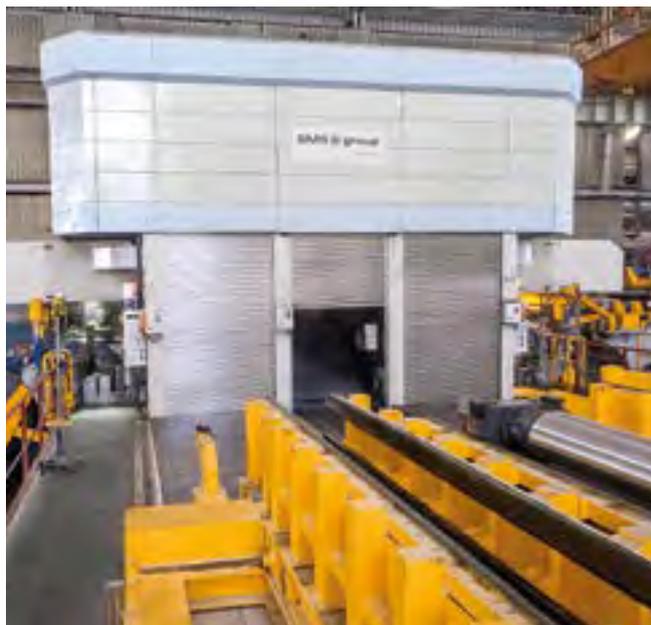


Torsten Seeger

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On June 5, 2018, the first coil was successfully rolled on ISL's new CCM® in Karachi.



ISL emerges as biggest cold roller in Pakistan after starting the second CCM®.

PAKISTAN

ADDITIONAL COLD STRIP CAPACITY OF 450,000 TONS PER YEAR

Pakistan's second CCM® at ISL successfully put on stream.

Only 14 months after order intake, SMS group has put the new Compact Cold Mill (CCM®) at International Steels Limited (ISL) in Karachi into operation. The Pakistani cold strip producer is now operating the second CCM® supplied by SMS group.

The new CCM® is a twin-stand reversing cold mill, completely supplied by SMS group including the X-Pact® electrical and automation systems and the media plants. During the order placing, ISL attached importance to SMS group supplying the entire mechatronic systems from a single source in order to ensure trouble-free coaction of mechanical equipment and automation system. The short commissioning time proves this strategy right.

Quality components like the complete mill stands, drive trains and media systems from German manufacturing ensure the quality of the strips rolled. CVC®plus roll shifting

technology and two X-Shape flatness measurement rolls as important components of the X-Shape flatness measurement and control system complete the technological components.

The new CCM® increases ISL's production significantly. With the commissioning of the second cold rolling mill, ISL's rolling capacity has increased to approx. one million tons per year, depending on the product mix, thus making the company the largest producer of cold rolled and galvanized products in Pakistan. The new mill is designed to roll strips with a maximum width of 1,250 millimeters down to a final thickness of 0.15 millimeters. ♦



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VIETNAM

TOP PERFORMANCE FROM THE START

Hoa Sen Group is now operating the third CCM® Compact Cold Mill.

On October 1st, 2018 and thereby 13 months after the order coming into effect, SMS group has successfully put Hoa Sen Group's Compact Cold Mill (CCM®) at the new Nhon Hoi facility in southern Vietnam into operation. The first coil being rolled on the twin-stand reversing cold mill was 1,212 millimeters wide and was reduced to the final thickness of 0.94 millimeters in two passes. So that the minimal final gauge of 0.11 millimeters already was below the target values, defined in the technical specifications.

FLEXIBLE ROLLING PROCESS

In the course of further commissioning mill performance will be optimized with regard to the target parameters. Among others, strip widths up to 1,250 millimeters, rolling speeds up to 1,400 meters per minute and an annual capacity of 350,000 tons of cold strip are comprised.

Hoa Sen Group is already operating the fourth cold rolling mill, supplied by Esmech Equipment Pvt. Ltd., a SMS group company located in India. The CCM® was delivered completely including the auxiliary plants. It is provided with the latest generation X-Pact® electrical and automation system. The strip quality determining mechanical core components, like the CVC®plus roll shifting technology, which is well established on the market and ensures a very large setting range, comes from the German fabrication of SMS group. The first-class technological equipment allows the mill reacting very flexibly during the rolling process and reliably achieving the required product quality. For that purpose the proven X-Shape flatness measurement and control system from German manufacture makes also an important contribution. ♦



Since October 1, 2018, Hoa Sen Group has been operating the third CCM® from SMS group.

 **Torsten Seeger**
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INTERVIEW

MARKET ON THE MOVE

In September 2018, Steel Group of India hosted the “Bangladesh Steel 2018” conference in Chittagong, Bangladesh. One of the participants in the event was SMS group.

The company supported the conference as gold sponsor with some representatives delivering papers. The event attracted more than 250 participants, a strong resonance indicating a lively local market.

SMS group presented one lecture each of its business units long and flat products. Sudeepa Majumder, Senior General Manager Sales Long Products Plants at SMS India Pvt. Ltd., read a paper entitled “Optimal capacity solutions in long products plants” referring to the focus topics of modern manufacturing concepts and long products technologies.

Torsten Seeger, Project Director Business Unit Flat Rolling Mills at SMS group, also attended the event as a speaker and describes his impressions of the “Bangladesh Steel 2018” in the interview below.

Mr. Seeger, you have already implemented several cold rolling mills for different customers in Bangladesh. How do you rate the market potential?

Bangladesh has very young inhabitants and, together with Pakistan and some other countries in South East Asia belongs to the emerging markets with growing steel consumption per capita. There is a rising demand for a systematic expansion of the local manufacturing capacities in order to become more independent from steel import. As a machine and metallurgical plant supplier, SMS group offers these developing markets reliable and strongly demanded plant technology meeting their individual needs.

What are the characteristics of this needs-based plant technology?

In the field of cold rolling mills, we record the strongest demand for reversing lines. The title of our paper was: “Cold rolling mills by SMS group – flexible plant concepts tailored to the demand of emerging markets”. Our portfolio includes reversing cold mills in single-stand design or two-stand compact cold mills. An interesting offer to our customers in emerging markets is the option to start cold strip production with a single-stand



At the conference, Torsten Seeger, Project Director of SMS group, presented a paper on market-oriented cold rolling technology.

mill and expand it later on. We have already implemented such projects for International Steels Ltd. (ISL) in Pakistan and for KYCR in Bangladesh with good results. As these are examples of the region they were of course of particular interest. Needs-based plant technology also refers to the plant design that we optimized in terms of CAPEX and OPEX and proved by operating results of reference plants.

Which of the characteristics are to be mentioned in particular?

Reversing cold mills (RCM) in single- or two-stand design operate in discontinuous mode contrary to a combined pickling line/tandem mill, for example. A great advantage of the RCM is its flexibility in production planning. Setup times, however, may adversely affect yield. In the cold rolling process, we are talking of the strip being threaded into and out of the roll gap. Depending on the intended application, SMS group offers its customers two technological variants to support the threading and unthreading procedure. These are on the one hand the Yield Optimizer and on the other the Total Roll Gap Control (TRC®) both compensating the drawbacks involved in the batch mode and improving yield significantly. The effectiveness of TRC® is higher, but this more complex system also poses greater demands on automation. By the way, both systems can be retrofitted in existing plants.

What is your knowledge from the conference?

For some years now, we have been successful in supplying to developing markets reliable, high-quality and adaptable plant technology that is flexible to grow along with our customers' requirements. This applies to both plant capacity and rolled product quality. We ensure very short erection and commissioning times and thus an early return on investment. Not least for these reasons, we are the market leader in the field of Compact Cold Mills (CCM®). ♦

 **Torsten Seeger**
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SLOVENIA

IMPOL GROUP SLOVENIA AWARDS FINAL ACCEPTANCE

40-year-old cold rolling mill with higher performance
after revamp to the latest state of the art.



Treadplate
production on the
aluminium cold
rolling mill
revamped by
SMS group.

After successful modernization of the 40-year-old aluminium cold rolling mill by SMS group at the Slovenska Bistrica facility, the Slovenian aluminium producer Impol Group Slovenia has awarded the final acceptance to SMS group. The previously performed acceptance tests had proven that the rolled products are now fulfilling even stricter quality criteria.

With this upgrade, Impol Group Slovenia has invested in the future viability of the facility and has brought about significant improvements of the cold rolling mill's capability. The strip width and thickness range was enlarged and the maximum coil weight increased. By new setting and control systems, strip quality was improved, particularly with respect to closer thickness and flatness tolerances. A new strip blow-off system minimizes oil residues and provides a homogeneous strip surface.

The comprehensive upgrade and extension measures comprised technological control systems and measurement instrumentation, entry and exit side equipment of the rolling mill, coil logistics, media plants as well as accompanying modifications of the foundations. SMS group managed to integrate the new components and units in the limited space available of the existing mill.

Thanks to these measures, Impol Group Slovenia is operating an all-around renewed aluminium cold rolling mill that fulfills current market requirements and is well prepared to meet future challenges. ♦



Rüdiger Roger Wiechmann

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A double ironing roll supports the precise coiling of aluminium strip.

CHINA

HIGHLY PRODUCTIVE PLANT FOR STRIPS OF EXCELLENT QUALITY

The Chinese aluminium producer Henan Mingtai has granted acceptance of the new aluminium cold mill at its Gongyi site.

On October 18, 2018, the Chinese aluminium producer Henan Mingtai Al. Co., Ltd. has granted the Final Acceptance Certificate for the new aluminium cold rolling mill established at the Gongyi location. Henan Mingtai is very satisfied with the plant since regular operation could be started soon after a short and efficient commissioning and ramp-up phase. The six-high cold rolling mill with CVC®plus (Continuously Variable Crown) rolls a wide range of materials and alloys up to a maximum strip width of 2,650 millimeters. The portfolio includes, for example, sophisticated material grades and qualities for automotive body application.

Henan Mingtai now owns a high-yield mill producing strips of excellent quality and featuring the most advanced rolling technology, with core components, including CVC®plus technology for roll shifting and the new inductive and particularly energy-efficient roll barrel heating system, made in Germany by SMS group. ♦



Klaus Siebert
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1

The quality of the coating also depends on the quality of the paint. The paint kitchen cares for optimum viscosity and temperature.



CHINA

HIGHLY PRECISE COATING

On behalf of Henan Zhongfu Industrial Co., Ltd. a color coating line for thin aluminium strips to produce can material has been established in China - complete including all mechanical, process-technological and thermal equipment plus electrical and automation systems.

Color coating lines from SMS group allow for high-quality coating of aluminium strip suited for direct processing to final products. Precise coatings with excellent surface quality and resource-saving as well as energy efficient operation are the characteristics of these color coating lines. The material Henan Zhongfu is producing on its new line is mainly for can ends. This involves the highest demands in terms of food industry certification. Depending on the type of beverage, most different paints have to be applied with an accuracy of one thousandth of a millimeter. The line was designed for the flexible use of solvent- as well as water-based paints for a wide product portfolio. A further outstanding feature is its ability to coat ultra-thin strip at high speeds. The line is equipped with all necessary machines and devices and has numerous components ensuring a further increase in material quality. From mechanical equipment to electrical and automation systems, all were supplied by SMS group from one source. ◆

**Contact**strip.processing@sms-group.com

2

A heated, vertical roll coater is integrated in the exit section allowing a layer of wax to be applied to the strip as an option.



3

COATER DECKS

The coating is applied by two back-up roll coaters. Two coater decks are integrated for coating the strip top side. This makes Henan Zhongfu benefit from a very flexible solution enabling fast coating changes. The strip bottom side is coated by one coater deck since generally the same coating solution is used here. Provided with three rolls each and various adjustment options, the coater decks ensure extremely precise coating results.

4

Entry and exit loopers are positioned side by side in compact arrangement and serve to bridge standstills in the entry or exit section or for inspection purposes.



5

The tension leveler optimizes strip flatness for the coating process. The machine is perfectly adjusted to the respective material and its dimensions by the automation system.



6

Everything in the line is geared to maximum surface quality. That is why the strip treatment process starts with thorough alkaline pre-cleaning and rinsing. Prior to coating, a second cleaning process takes place in the main cleaning section. There, the layer of oxide is removed by means of alkaline and acid solutions, and the surface is activated for coating.



7

A preparatory chemical is applied in the chemcoater.



8

FLOATATION OVEN

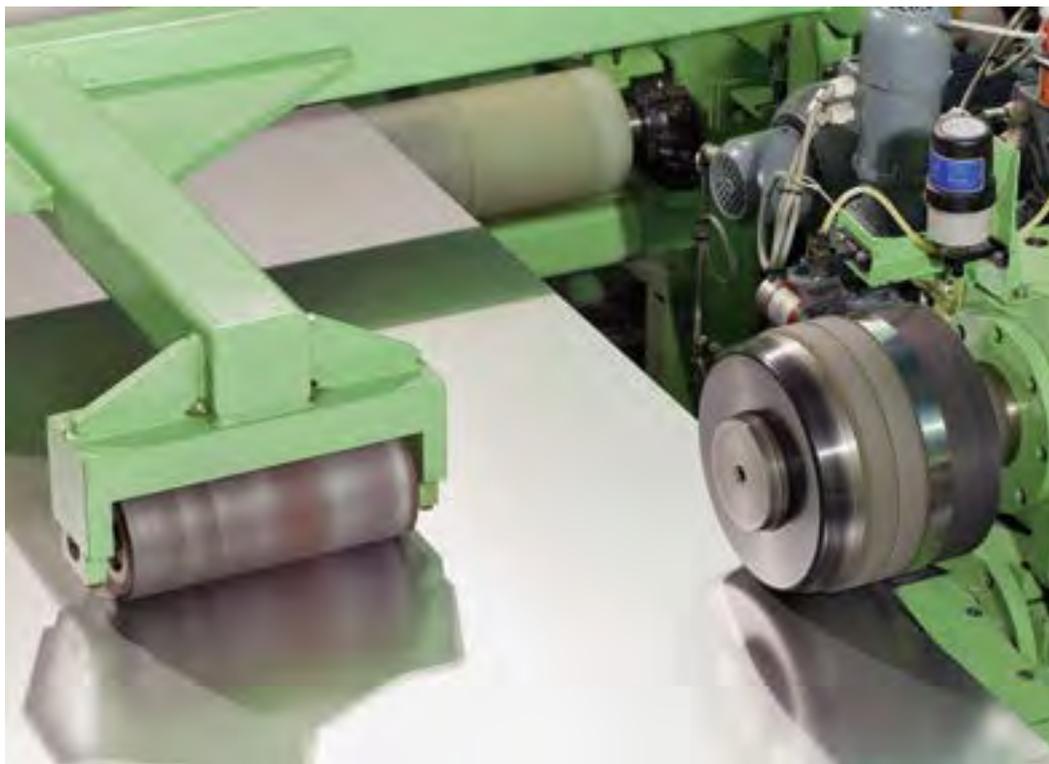
Another highlight of the line is the floatation oven with downstream cooling section. Over a length of more than 100 meters the strip is kept floating, dried and cooled.



9

Cleaning the solvent-containing exhaust air by the regenerative thermal oxidizer is a prime example of recovering energy in a highly efficient and cost-effective way. To this end, post-combustion of the extracted solvents takes place in a three-chamber system with catalyst blocks. Hot air is fed to the drying oven through a heat exchanger with the result that once this process has been initiated the oven operates in autothermal mode without feeding additional energy, provided however, the solvent content of the paint is high enough.

The new line will enable FUXIN to trim and recoil 150,000 tons per year of stainless steel cold strip.



TAIWAN

FUXIN ORDERS STRIP TRIMMING LINE

150,000 tons of processed stainless steel strip for the Chinese industry.

FUXIN (Fujian Fuxin Special Steel Co., Ltd.; an entity of Formosa Plastics Group, Taiwan) has selected SMS group to supply a trimming line for stainless steel strip. The line is to be erected in the Fujian province of China and scheduled to start production in 2020. It will enable FUXIN to process 150,000 tons of cold strip annually. The material will mainly be used for applications in the home appliances, elevator or construction industries.

SMS group is going to supply the complete engineering of the line, electrical and automation systems as well as the mechanical equipment. Also included in the scope of supply is the supervision of erection and commissioning. The line serves for trimming of the strip edges to the desired width. The edge scrap will be cut

into pieces via a scrap chopper. This process is followed by a visual inspection. Besides trimming, another main purpose of the line is to uncoil and rewind the coils.

The line will process strips up to 1,350 millimeters wide and between 0.2 and 3.0 millimeters thick. The maximum process speed will be 200 meters per minute. The product range will comprise stainless steel of the 200, 300 and 400 series. ♦



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BELGIUM

HIGH-PERFORMANCE PRODUCTION PLANT INCREASES DEGREE OF AUTOMATION

Aperam orders annealing and pickling line for stainless steel cold strip.



The powerful furnace from Drever International will be designed for the resource-saving and efficient processing of cold strip.



The pickling section will allow for a good pickling result at low consumptions and high speeds and include electrolytic sections, a turbulence pickling section as well as a rinsing area with oscillating brushes.

Aperam Stainless Belgium has contracted SMS group to supply an annealing and pickling line for stainless steel cold strip to its site in the Belgian city of Genk. Production start is scheduled for 2020. With this investment in state-of-the-art and future-oriented plant technology, Aperam will enlarge its product range by material grades for the most demanding applications and improve lead time and flexibility to meet the market demand. It will further increase efficiency and cost competitiveness of its plants and continuously enhance the impacts on health, safety and environment.

The line will stand out due to its high degree of automation and resource-saving processes and will be equipped, in addition to a horizontal Drever annealing furnace and a multi-stage pickling section, with a four-high skin-pass mill stand and a side trimmer. The new annealing and pickling line will be the fourth one SMS group is going to install at Aperam's Genk site.

Besides mechanical equipment, process technology, furnace technology, electrical and automation systems, the scope of supply will also include technical support during installation and commissioning. The line will process both austenitic and ferritic grades. ♦



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To enhance the spreading of electric vehicles it is indispensable to expand the infrastructure by numerous charging stations.

WORLDWIDE

BENEFITTING FROM THE TREND TO E-MOBILITY

To produce electric vehicles and related charging stations, electric steel is indispensable. SMS group offers technologies allowing conventional integrated steelworks to produce high-quality electric strip.



Many car makers and countries have been announcing not to produce or register any vehicles equipped with combustion engines in the near future. All around the globe, sales figures of electric vehicles keep growing. Electric steel, which is also called silicon steel, is absolutely essential to be able to provide the necessary electrical drive systems and an adequate infrastructure with a closely knit network of charging stations. Studies show that the demand for electrically driven industrial motors, cooling units and further small and large electrical applications is on the rise, with the applications often being networked.

Due to its advantageous electromagnetic properties, electric strip is a key material for efficient motors, generators and transformers. Even though the production route is very complex as compared to conventional steel grades, SMS group offers technologies allowing conventional integrated steelworks to produce high-quality silicon strip. This will enable steel producers to benefit from the e-mobility trend, the growing demand for electric strip and the price rise involved.

DIFFERENT ELECTRIC STRIP GRADES WITH MANIFOLD APPLICATIONS

As a rule, electric strip is subdivided into non-grain-oriented (NGO) and grain-oriented (GO) grades.

In non-grain-oriented electric strip, the orientation of the ferritic grains is irregular, and the material has isotropic magnetic properties. A distinction is generally made between two qualities of non-grain-oriented electric steel strip. In the case of semi-finished material for laminated core motors, the final annealing treatment is accomplished by the engine producer directly at the final product subsequent to the punching process. The fully finished material (NGO-ff) is annealed and coated already in the works of the electric strip producer. Depending on the electrical properties, the material is further categorized into two groups: material with low and material with high silicon content. Non-grain-

oriented electric strip is used in rotating machines with alternating field orientation. Since electric motors and generators determine the performance of a vehicle, a machine or any other electrical system, high-quality material is much sought after. Automotive manufacturers, in particular, are looking for high-performance materials to increase the capability of their vehicles.

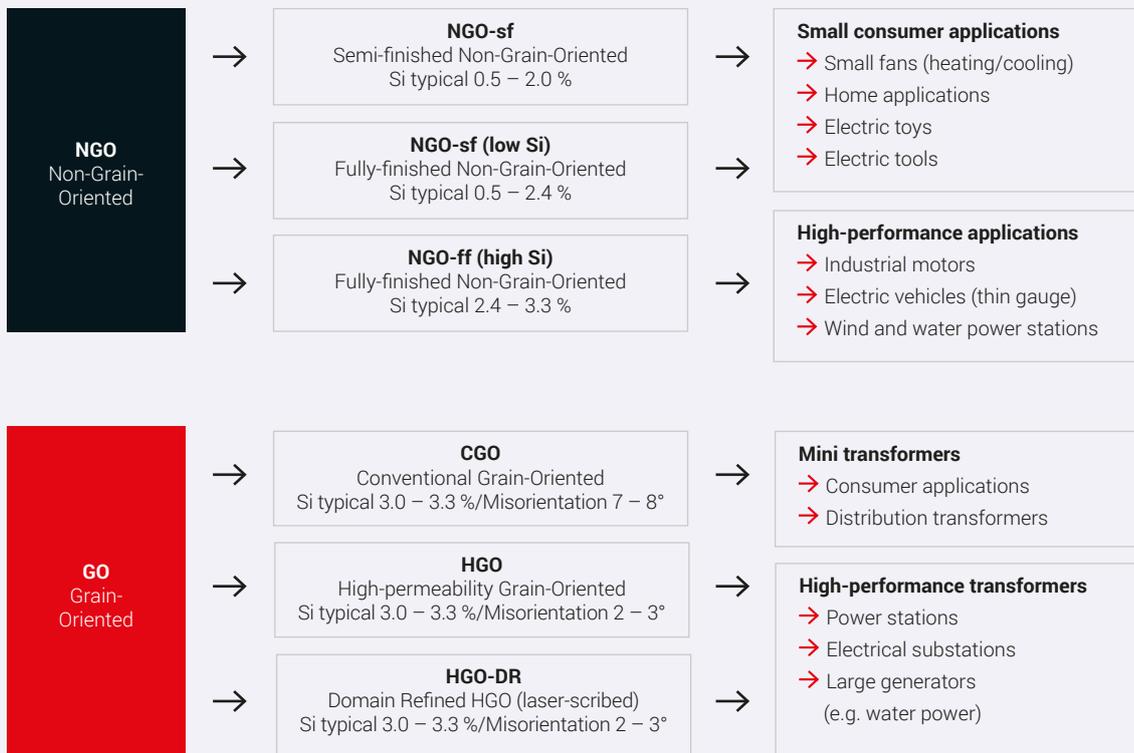
In grain-oriented strip the grains are aligned in the direction of cold rolling. According to the degree of orientation, grain-oriented strip is again divided into material with conventional and high permeability. Highly permeable materials can also be supplied with "domain refining", a laser-scribed area refinement to further reduce losses due to re-magnetization. To ensure the efficient transmission and distribution of energy, grain-oriented strip is used for static applications, for example in transformers or rectifiers which, due to the rising production of electricity worldwide, will lead to an increase in demand.

FROM HOT STRIP TO HIGH-QUALITY ELECTRIC STRIP

Hot strip provided for the production of electric strip must meet specific requirements, for example a defined content of silicon and other alloying elements and the appropriate strip dimensions. If producers can make hot strip with such properties themselves or purchase it, then they will be able to produce silicon strip on the downstream plants described below. If not so, the experts of SMS group offer to compile an analysis for the optimization of the upstream processes.

The simplest way to get to electric strip is the production of semi-finished, non-grain-oriented electric strip on a pickling line/tandem cold mill, batch annealing furnace and skin-pass mill. Since the high silicon content produces silicon sludge during the pickling process, a suitable system for desludging should be available, but can also be integrated into an existing line. On the basis of such production equipment it is comparatively simple to produce fully finished ►

Classification of electric strip grades and pertaining main applications.

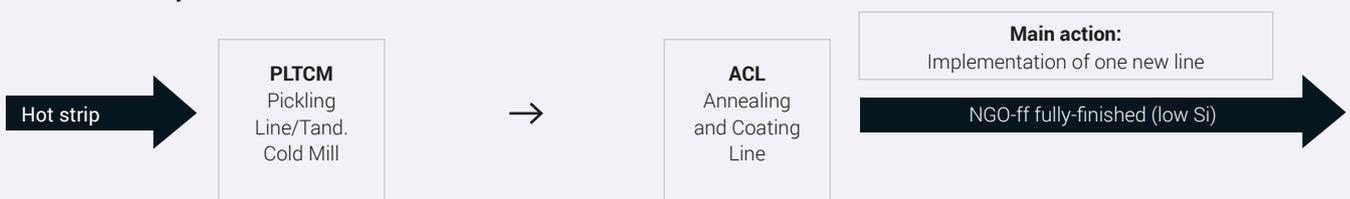


Production of non-grain-oriented electric strip in three stages of implementation.

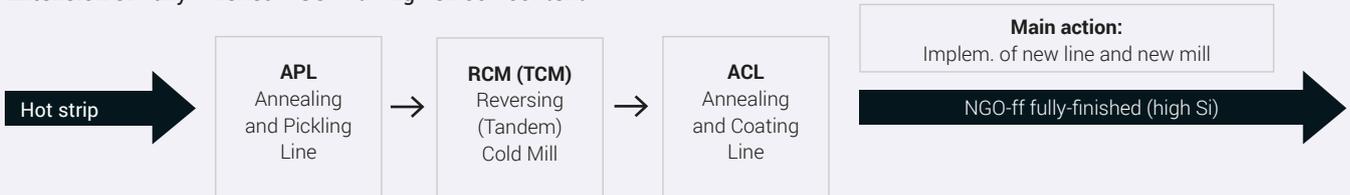
Extension 1: Semi-finished NGO



Extension 2: Fully-finished NGO with lower silicon content



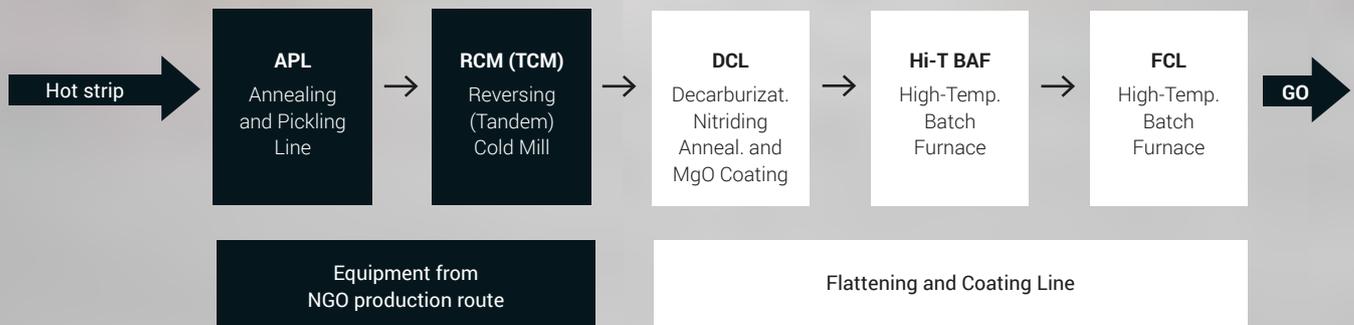
Extension 3: Fully-finished NGO with high silicon content





Production route of grain-oriented electric strip using hot strip as starting material.

Extension: High-permeable grain-oriented silicon steel strip



SMS group supplied to Shougang seven lines for the production of electric strip: two annealing and pickling lines, three decarburizing and coating lines and two flattening and coating lines.

material with low silicon content as well. The equipment to be added is an annealing and a coating line to change the internal structure and provide the strip surface with an insulating layer. The next step toward fully finished material with high silicon content is to integrate an annealing and pickling line plus a cold rolling mill. Because of the high silicon content, the hot strip material must be annealed before it is pickled and cold rolled. Usually, reversing mill stands are used for cold rolling, but it is also possible to do with a continuous tandem mill.

The production route of grain-oriented electric strip starts with annealing and descaling of hot strip in a special annealing and pickling line. This is followed by cold rolling, primary recrystallization, including decarburizing, nitriding and coating with magnesium oxide, and secondary recrystallization to generate the desired final structure orientation and material purity. The decarburizing and coating line also serves to perform nitration. For the secondary recrystallization process special high-temperature batch annealing furnaces are needed. Thermal flattening and final coating complete the treatment.

PROCESS KNOW-HOW AND SPECIAL EQUIPMENT FOR ELECTRIC STRIP

SMS group, in cooperation with MET/Con, provides a broad range of process support for the production of electric strip. The service covers metallurgical aspects as well as layout planning plus assistance in commissioning and plant operation. The MET/Con experts have a wealth of experience and complete parameter sets to offer and helped Anshan Steel, China, just to mention one company, to produce highly permeable electric strip on its existing and old plants within a short time.

All of the plant equipment is tailored to meet the special requirements of electric strip, as for example the adapted turbulence pickling system. A specific tank shape and appropriate equipment in the circulation system allow for the

removal of silicon oxide sludge to be accomplished largely automated. Heating the coil and the strip edges supports reliable strip guidance and prevents the fairly brittle electric strip from being damaged or from cracking. Special roll coaters are installed since the coating has a decisive impact on quality.

Drever International, a subsidiary of SMS group, supplies furnaces for the thermal treatment of all grades of electric strip. These furnaces feature special designs tailored to the relevant requirements of the electric strip.

Since SMS group supplies the X-Pact® electrical and automation systems, too, all treatment steps are smoothly integrated into the electrical and automation systems of the lines. A Plug & Work integration test considerably reduces the period required for commissioning. Best evidence of that powerful combination provides the seven treatment lines at Shougang Qian'an that started operation with a steep ramp-up curve. ◆



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SOUTH KOREA

HSD[®] SUCCESS STORY TO BE CONTINUED

Upgraded rolling mill at Daehan Sinpyeong with new quenching line and HSD[®] technology.

From left: Tae-Heon Kim, Production Manager, Daehan Steel; Young gi Lee, Plant Manager, Daehan Steel; David Maurizio, Area Sales Manager, SMS group S.p.A.; Jong-An Park, Senior Managing Director, Daehan Steel; Meoung-Jong Jeon, Vice President, SMS group GmbH Korea Branch.



South Korean Daehan Steel Co. Ltd. has placed an order with SMS group for a bar mill modernization. This new order further strengthens the longstanding cooperation between SMS group and Daehan Steel.

The rolling mill in Daehan's Sinpyeong works located in the Busan area is designed to produce 130 tons per hour of rebar in diameters from 16 to 32 millimeters up to grade SD 500.

The modernization project will comprise the replacement of the existing quenching line with a new one designed with latest technology from SMS group, including systems for precise pressure control and exact setting of the water flow rates. In addition, two dividing shears with associated pinch rolls and a bar braking system will be supplied, as well as a HSD[®] (High Speed Delivery) line that will be integrated into the existing

cooling bed. With this new HSD® system, Daehan will be able to feed bars onto the cooling bed via rotating channels, which are precisely synchronized with the soft bar braking unit, the cooling bed cycle movement and the bar position monitoring system. Furthermore, the bars can be cut to all product sizes at any speed. The shears cut bars in diameters up to 32 millimeters. Due to the dedicated control system, the shears provide very tight cutting tolerances even at maximum speed. The newly supplied equipment will be fully integrated by way of an automation package from SMS group.

EXTENDED PRODUCT RANGE

The main objective of the modernization is to reduce the ferro-alloys content in the billets, which will result in a substantial cost reduction. The upgrade is also aimed at increasing the product range. With the new SMS group equipment Daehan will be able to add 13 millimeter rebar to the size range and produce new steel grades up to SD600.

This latest reference underpins SMS group's modernization expertise and strengthens the longstanding partnership with Daehan. ♦

REDUCED PRODUCTION COSTS

Daehan upgrades the existing VCC® mill in Pyeongtaek with billet welder and VCC® line to produce coils weighing up to five tons.

Daehan Steel Co., Ltd., South Korea, awarded SMS group an order to modernize the existing VCC® (Vertical Compact Coiler) of its rolling mill in the Pyeongtaek plant close to Seoul.

The plant produces 450,000 tons per year of compact coils in diameters from 10 to 25 millimeters which are internally processed in the own cut-and-bend facilities or exported to the Far East market. The modernization project includes the installation of a new welder at the furnace exit side of the existing rolling mill. The welder will be used to join billets of 130 x 130 or 150 x 150 millimeters to generate an endless feedstock that will be rolled on the existing mill to produce a tailor-made coil weight of up to five tons.

The intermediate rolling mill line will be also modified by relocating the existing crop shear used for head stock cutting, while a new dividing shear will cut the endless bar and hence define the coil weight. A modification of the water quench system is planned as well to fulfill the requirements of the new process.

The existing VCC® system will be upgraded to handle the new coil weight of up to five tons. To this end, the two coilers will be replaced and the downstream coil handling system adapted accordingly. The VCC® line produces compact coils that are directly coiled in vertical position. The plant operator can therefore eliminate the need for turning manipulators and, at the same time, reduce the process cycle time as all coils are formed in the final position. The coils can be stored immediately after coiling has been completed and the coils have cooled down. Reduced handling also minimizes the overall risk of damaging the coil surface. SMS group, with deep knowledge of the existing plant, will minimize the modifications at the existing equipment to reduce the shutdown time of the plant needed for erection.

The main target of the modernization is the production of heavier coils in order to reduce the downtimes in the cut-and-bend facilities and thus to bring down production costs.

Daehan Steel placed the second order in a row with SMS group, trusting in SMS group's modernization expertise and strengthening the long-term partnership between both companies.

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The new rolling mill is to be designed to reach a maximum overall capacity of approx. 300,000 tons per year.

CAMEROON

FIRST COMBINED ROLLING MILL IN AFRICA

Prometal Aciérie orders hot rolling mill to widen production.

Prometal Aciérie, Cameroon, Africa, has awarded SMS group the order to supply a new hot rolling mill for rebars, sections and wire rod. The new rolling mill will be designed for the production of straight rebars, angles, channels, flats, squares, beams and wire rod coils, enabling Prometal to expand its product portfolio, covering as much as possible of the product mix for long steel products. With this investment, long steel producer Prometal Aciérie, based in Douala, Cameroon, is going to install the first combined rolling mill in the African region.

The rolling mill will be designed for a maximum overall capacity of approx. 300,000 tons per year. Starting with 130 millimeter square billets, which will be heated up in a 60 ton-per-hour modern pusher-type furnace, the mill will be able to produce rebars from 8 to 32 millimeters, sections such as 100-millimeter beams and channels, and smooth

rounds in coil from 5.5 to 12 millimeters. The state-of-the-art HSD® (High Speed Delivery System) allows reaching the full production capacity for the complete size range, increasing the material yield. The high speed finishing block will produce quality wire rod coils at minimized operational costs. Moreover, the rolling mill will be controlled by a Level 2 automation system provided by SMS group.

The combined mill, supplied by SMS group and scheduled to be commissioned in December 2019, will become the new reference benchmark in terms of high technology, quality, efficiency and low operational costs in Africa. ♦



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SOUTH KOREA

WIRE ROD MILL TO BE COMPLETELY MODERNIZED

New pouring reel for special steel in South Korea will increase quality, process, and plant efficiency.

Pohang Iron and Steel Company (POSCO), the fifth largest steel producer in the world and largest in Korea, has awarded SMS group an order to modernize the existing wire rod mill at its Pohang works.

The plant presently produces 540,000 tons per year of wire rod and bar-in-coils for automotive applications in the diameter range from 14 up to 42 millimeters with the coils weighing up to two tons.

The target of the modernization includes the replacement of several equipment items throughout the mill (existing descaler and additional one in the rolling mill), a new cropping shear, a shiftable water cooling line, pouring reels with walking beam conveyor, cooling fans and hoods assuring in-line treatment of coils.

The project is aimed at widening the diameter range of coiled round products up to 55 millimeters and at rising the rolling speed of smaller products to 22 meters per second. The mechanical areas will be connected by a scratch-free conveying system that, combined with the automation package supplied by SMS group, will grant POSCO a quality improvement on the rolled surface of the bars and a better coil shape and formation. Further implementations are the off-line simulation process with CCT® (Controlled Cooling Technology) and quick changing system of the water cooling line in less than five minutes to grant better plant efficiency. These features will enable POSCO to even better supply the automotive and special steels market.

This latest modernization project further underlines SMS group's expertise and its position as a leading supplier of rolling mills for quality steels in all size ranges. ♦

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Bornay produces precision tubes for the automotive sector, among others.

SPAIN

BORNAY RELIES ON HIGH-PRECISION TUBE WELDING LINE

Spanish welded steel tube specialist Bornay S.L. has ordered an HF (High Frequency) tube welding line, type RD 40, from SMS group for its Alicante works. SMS group is the single-source supplier of all technical equipment from strip preparation to the cut-off-saw.

The new machine will produce round tubes having diameters from 10 to 40 millimeters and wall thicknesses from 0.75 to 4.5 millimeters, as well as squares in dimensions from 10 x 10 millimeters to 30 x 30 millimeters and rectangulars in dimensions from 20 x 10 millimeters to 40 x 20 millimeters; with wall thicknesses ranging between 1.00 and 4.00 millimeters.

The tube welding line to be commissioned in the first quarter of 2020 will achieve a production speed of maximum 120 meters per minute. Here, Bornay can produce high-quality tubes with round, square and rectangular cross-sections. They can be used, among others, as precision tubes for the automotive sector, but also for metallic furniture or in the agricultural sector.

"Our requirements with regard to the new tube welding line were very high since we produce tubes for mechanical applications that require a high level of precision in their finishing. The engineers from SMS group have designed a plant meeting our needs," says Juan Bornay, Managing Director, Bornay S.L. ♦

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The previous three-high roughing stand was replaced by a six-stand continuous roughing mill with compact stands.



SMS group has installed a new walking beam furnace and related entry and exit equipment.

SPAIN

EFFICIENT ROLLING PROCESS

SIDENOR issues FAC after fast and successful completion of modernization.

Following the successful commissioning of the upgraded bar mill at its Basauri location, Spanish steel company SIDENOR ACEROS ESPECIALES, S.L. has issued the Final Acceptance Certificate to SMS group.

The upgrade was aimed at ensuring more effective rolling operations, increasing the initial pass section, raising rolling speeds and improving the material properties. SMS group's scope of supply included all process facilities, the automation system, and the entire erection and commissioning.

SIDENOR ACEROS ESPECIALES, S.L.

At its Basauri works, SIDENOR produces round bars in the 29 to 100-millimeter-diameter range from high-grade carbon steels, low and high-alloy quality steels and tool steels, roller bearing steels and stainless grades used in the automotive industry, in the oil and gas industry, and in the machine and plant engineering sector.

SCOPE OF THE UPGRADE

As part of the upgrade the existing three-high roughing stand was replaced with a six-stand continuous roughing mill with compact stands (CS) in V-H arrangement. What's more, a new flying crop shear and two additional compact stands in an H/V arrangement were installed upstream of the current 11-stand continuous finishing mill. A further flying shear, which was installed in the exit section of the bar mill, enables SIDENOR to cut not only larger cross-sections in future, but also smaller sections at speeds of up to ten meters per second. Static, multi-strand entry and exit guides, and in some cases roller entry guides, are used to guide the rolling stock.

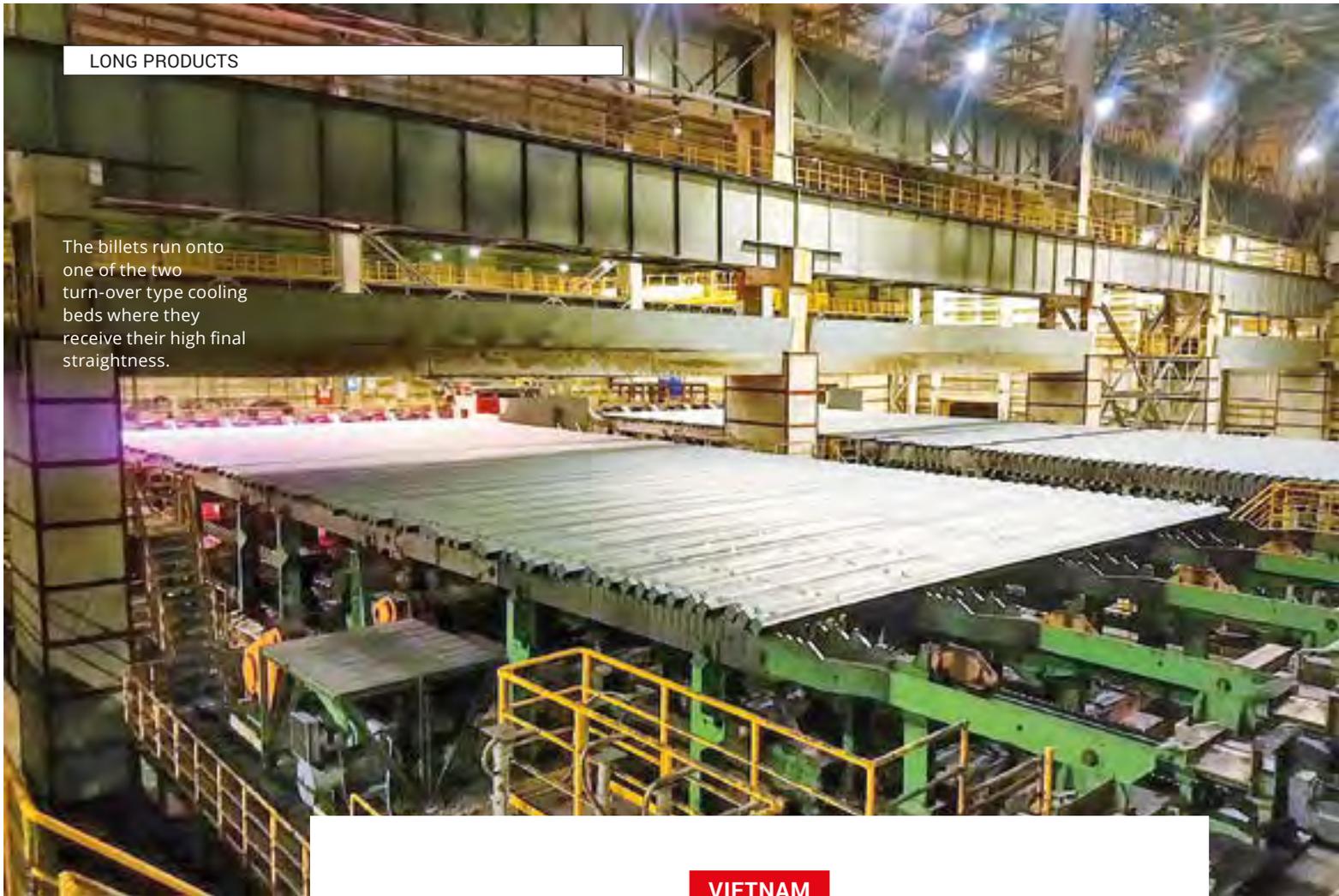
The scope of the upgrade also included the installation of a completely new walking beam furnace and related entry and exit equipment, which will allow for higher capacity levels in future thanks to its modular design. The exit side of the furnace is equipped with a high-pressure water descal-

ing unit. The furnace is also equipped with the advanced SMSPrometheus® Level 2 automation system, which is ideal for setting the heating parameters according to the wide range of steel grades to be rolled. The use of SMS Zero-Flame burners will also minimize pollutant emissions into the atmosphere in future.

This latest reference further underlines SMS group's upgrade expertise and its position as a leading supplier of rolling mills for quality steels in all size ranges. The order was completed on time within a very short delivery period. ♦

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The billets run onto one of the two turn-over type cooling beds where they receive their high final straightness.



VIETNAM

WORLD'S MOST ADVANCED BILLET MILL

Semi-continuous billet mill at Formosa in full operation.

The new semi-continuous billet mill supplied by SMS group to Formosa Ha Tinh Steel Corporation in the Ha Tinh province, Vietnam, has commenced full commercial production. Formosa issued the Final Acceptance Certificate to SMS group as early as in the summer of 2018. Jimmy Chen, Head of Long Product Rolling Mills at Formosa, states: "SMS group convinced us with its outstanding number of reference mills and the best technological concept. Our new mill is considered the newest and most modern billet mill in the world with latest design compact breakdown mill stand and ultra-rigid CS stands

of the latest generation. The CS stands are just the perfect solution for the finishing of large-size billets due to its rigidity and sturdy design."

The new billet mill is designed for a capacity of one million tons per year of special steel grades in the first phase and up to 2 million tons per year in a second expansion. It is producing 160 and 180 millimeter square billets from blooms of 260 x 300 millimeters and 360 x 450 millimeters in size.

The blooms, reheated up to 1,250 degrees Celsius, are descaled by means of high-pressure water. The reversible 2-high blooming mill



PERFECT SOLUTION FOR THE REQUIREMENTS

- SMS group convinced Formosa Ha Tinh Steel Corporation with the best technological concept for the construction of the world's most modern billet rolling mill.
- In the first construction phase, the plant has an annual capacity of one million tons of billets in special steel grades.
- The employed four-crank shear contributes to a high plant utilization and low production costs.

stand is equipped with sideguard manipulators and hook-type tilters on the entry and exit side. The state-of-the-art stand design includes a hydraulic unjamming device, roll force measurement, ultra-rigid hydraulically activated keeper plates and roll shifting, to mention but the main highlights. All functions are fully automatic and roll change is performed in less than 25 minutes.

Provision has been made for a four-sided flame scarfing machine to be installed after the blooming mill. Before entering the continuous mill, the head of the leader pass can be cut off by means of a 10,000 kN bloom shear and the leader section is tilted through 45 degrees with the bar turner. The four-stand continuous mill is of H/V (horizontal/vertical) design. All stands are of CS design.

HIGH PLANT UTILIZATION

A key feature of the mill is the 3,800 kN four-crank shear designed to cut billets of up to 180 millimeters square into lengths of 10 or 12 meters and essential in safeguarding high utilization and low production costs. Also the head and tail ends are cut. As the lifetime of the shear blade is much longer than in saw-type cutting, the specific cutting costs are approx. 10 times lower. At the same time, utilization of the mill is much higher.

All billets are cooled on two turn-over type cooling beds where they receive their final high straightness. Each billet is marked with a stamped number and weighed separately at the end of the cooling bed. Both, billet ID and weight are reported to the Level 2 system which forms the basis of a well-organized storage system and production planning for the downstream mills.

The loading area of the mill boasts four loading beds. Via three of the loading beds, the billets can be sent directly to the storage bays of the downstream rolling mills. Alternatively, they are sent to an intermediate storage area where they cool down to below 50 degree Celsius so that they can be processed through the fully automatic inspection and grinding line which was also supplied by SMS group.

SMS group also supplied the complete electrical and automation package, including complete Level 1 and Level 2 automation. ♦



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The Železiarne Podbrezová project team after contract signing at SMS group in Mönchengladbach.



SLOVAKIA

MODERNIZATION OF PUSH-BENCH PLANT

Reduced future effort for maintenance and repair in tube production.

Železiarne Podbrezová has placed an order with SMS group covering the upgrade of its existing push-bench plant in Podbrezová, Slovakia. On this push bench, Železiarne Podbrezová produces seamless tubes in the diameter range from 0.5 to 5.5 inches. The modernization order covers two new racks with drive pinions and a new rack guide bed for the push bench as well as 14 new stands for the stretch reducing mill.

The new racks, which have a special gearing, will be supplied in merely three partial lengths (instead of the existing five ones) and with the connecting elements in an even better and stronger version. The rack guide bed will be of robust and single-part design in its cross-section. All individual rack guiding elements are to be supplied in maximum possible lengths so that four elements only will be needed to cover the overall length. As a consequence, the forces and torques in the rack guide bed can be perfectly absorbed and hence significantly reduce the effort for maintenance and repair. The new stands for the stretch reducing mill will be designed for the use of hard metal rolls that can absorb higher rolling forces and permit greater pass diameters to be cut. ♦

“Since we had good experience with SMS group in the past, we again decided to have the modernization carried out by SMS.”

Milan Srnka, Technical Director
at Železiarne Podbrezová



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JAPAN

HIGH OUTPUT OF PREMIUM THREADS

JFE Chita orders second premium threading machine.

SMS group has received a new order from JFE Steel Corporation, Chita works, Chukyo Industrial Zone, Japan, for a premium threading machine.

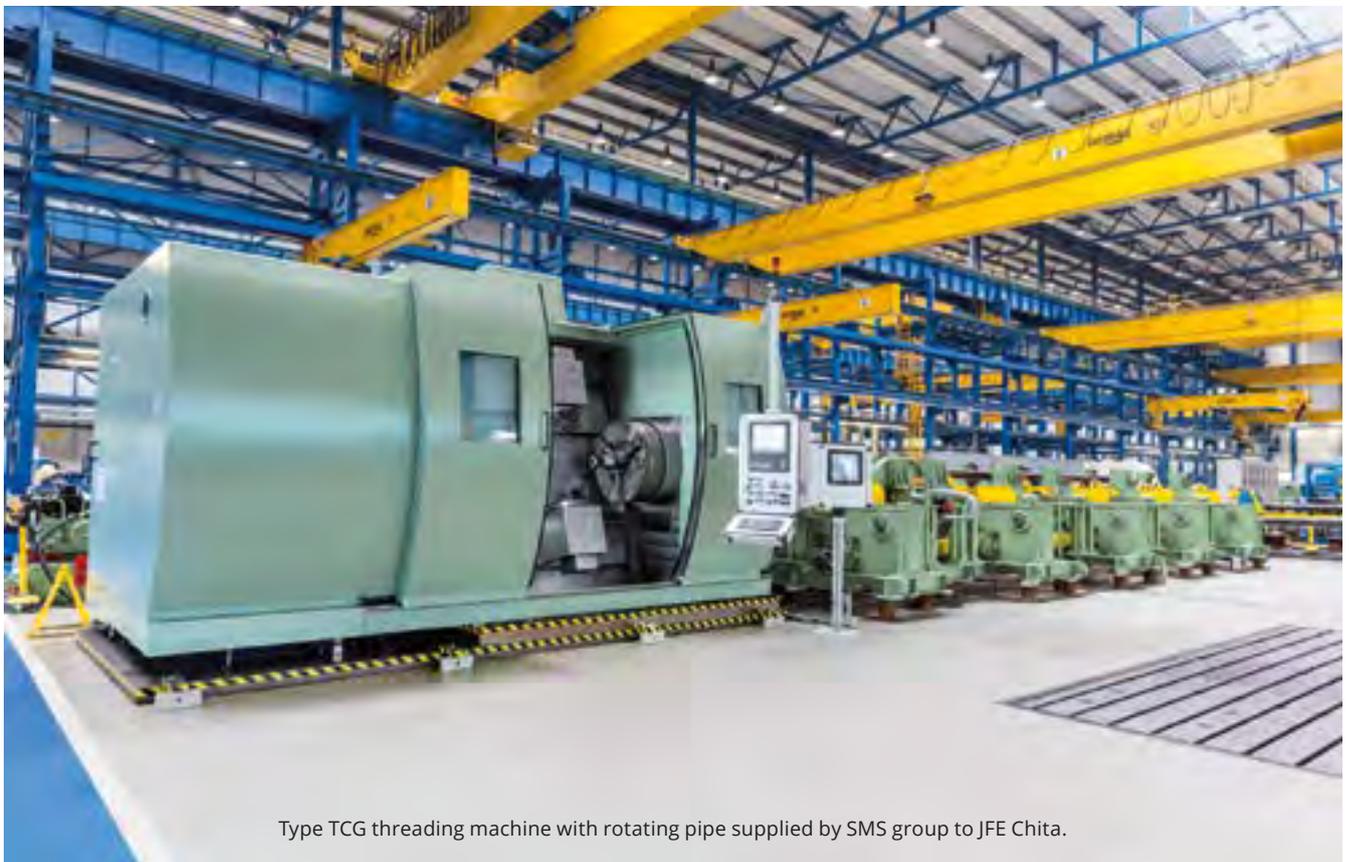
This new machine, which will be JFE's second threading machine from SMS group, will enable the producer of premium threads to expand its production capacities.

The threading machine of type TCG 43/4 is able to thread pipes in the diameter range from 139.7 to 406.4 millimeters with wall thicknesses from 7.0 to 50.8 millimeters and lengths of up to 15 meters.

The machine operates according to the "stationary tool – rotating pipe" principle. With this method it can cut standardized inside and outside threads as well as all premium threads.

Thanks to latest FMEA (failure mode and effects analysis) technology and temperature control, the machine has an outstanding stability and produces threads of highest quality. The powerful drive achieves excellent acceleration and deceleration rates, resulting in a high output of premium threads and of high performance chromium grades. The pipe threads comply with the production standards for all API 5CT steel grades, JFE grades and other international standards. ◆

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Type TCG threading machine with rotating pipe supplied by SMS group to JFE Chita.



**MT 5000 ECCENTRIC
FORGING PRESS**

with MEERtorque® servo drive
for Musashi Europe.

GERMANY

FULLY AUTOMATIC FORGING PRESS

SMS group to supply 5,000-ton MT 5000 eccentric press to Musashi Europe.



Musashi Europe has placed an order with SMS group for the delivery of a 5,000-ton eccentric forging press, type MT 5000, for its plant in Bockenau, Germany. Commissioning of the new MT 5000 closed-die forging press is scheduled for Q4 2019. The new forging press will enable Musashi Europe to produce large rotationally-symmetric forgings for passenger cars and truck applications in a highly efficient production process. With the new eccentric forging press, which features a MEERtorque® servo drive, forging is precise, reliable and fully automatic.

The MT 5000 is one of the latest generation of eccentric presses from SMS group. The eccentric shaft and the flywheel are directly driven by dynamic torque motors. This type of drive separates the pure ram motion from the forging energy supply, and combines the advantages of servo presses with those of presses featuring a flywheel and conventional clutch-brake combination. This means the forging process is both highly energy-efficient and resource-friendly. The energy generated during the deceleration phase can be used for the re-acceleration of the flywheel.

Thanks to the reduced number of mechanical components, Musashi Europe benefits from considerably lower maintenance and inspection costs. What's more, sections of the MT press casing can be easily opened to offer the best possible access. Furthermore, the utilities are supplied via a central energy column, which also provides particularly maintenance-friendly access.

The construction of the robust, FEM-optimized press housing is based on the proven split tie-rod design. Extremely large press windows offer perfect automation capability and allow for easier changes of the die and holder. To enable individual dies to be replaced, the MT 5000 is equipped with a die change arm, which is fitted to the press housing. The integrated die spraying system cleans, cools and dries the dies in precise doses, to achieve maximum forging quality and increase the service life of the dies. ◆



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AUSTRIA

ALUMINIUM PROFILES FOR THE AUTOMOBILES OF THE FUTURE

Thöni orders 55-MN aluminium extrusion press line.

Thöni group, headquartered in Telfs, Austria, has placed an order with SMS group covering a press line for the extrusion of aluminium. The line includes a 55-MN front-loading extrusion press to process billets that have a maximum diameter of 12 inches (304,8 millimeters) and a maximum length of 1,600 millimeters. This extrusion press is already the fifth one SMS is going to install for Thöni. The extrusion press line is to be established in a new works at the recently developed location at Pfaffenhofen and will produce profiles of aluminium and aluminium alloys for application in the automotive and other markets.

To satisfy its demanding customer base, Thöni group has invested in most advanced extrusion press technology. Billet heating will be done in a patented induction furnace, a combination of induction furnaces from IAS, a sub-

siary of SMS group, and a gas-fired furnace from Extrutech GmbH. Aluminium bars will be stored in a warehouse, then heated to approx. 480 degrees Celsius in an inline furnace, sawed to a maximum length of 1,600 millimeters and transported to the billet loader.

The 55-MN front-loading extrusion press will be built to SMS group's latest design and be equipped with the highly precise linear guidance system for all moving main components, servo drive technology for all auxiliary functions as well as the proven EcoDraulic concept to reduce energy consumption. In addition, the press will have a modular process control system, part of which will be CADEX/3 (Computer Aided Direct Extrusion) for isothermal and isobaric extruding. The MIDIS (Management Information Diagnostic Indication System) technology package will allow for



Thöni's future works at Pfaffenhofen where the extrusion press from SMS group will be installed.

“From the end of 2019, the new line will produce about 8,000 tons per year of high-quality aluminium profiles for the European automotive industry. Through subsequent processing we will refine these products ready for installation.”

Helmut Thöni, CEO and shareholder of Thöni group

the administration of all product-relevant data. An IBA measuring and analyzing system integrated into the control system will provide the opportunity of remote diagnosis.

Directly downstream the extrusion press, an advanced runout will be installed by OMAV, another company SMS group is holding a stake in. Two high-performance cooling systems using spray water and air will cool the extruded profiles from an outlet temperature of about 520 degrees Celsius down to approx. 100 degrees Celsius. A special challenge here is to adapt the cooling rates to the product extruded in order to prevent profile warping. All cooling parameters will be recorded and managed by MIDIS. This makes sure identical material properties such as strengths can be reproduced in follow-up orders - a must for the automotive industry. Double puller, flying saw, stretcher,

final cutting saw and an automation system complete the runout area.

“With this state-of-the-art extrusion press line from SMS group we are setting the course for the growing demand for aluminium components. We have devised the new works for possible expansion by further extrusion press lines right from the start,” says Helmut Thöni.

Commissioning is scheduled to take place in summer 2019. Extrusion of the first billet is planned for July 15, 2019. ♦



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SERBIA

OPTIMIZATION OF PRODUCTION

Upgrade and modernization of finishing mill automation at HBIS group, Serbia, by SMS group S.p.A.

After the successful refurbishment of the roughing mill including vertical edger, executed by SMS group S.p.A. for HBIS group in Smederevo, Serbia, with mill disassembly and refurbishment, foundation demolition and reconstruction and mill re-assembly, in a single shutdown of 40 days, fully respecting the tight schedule, it's time to take up a new challenge.

On June 1, 2018, SMS group S.p.A., a subsidiary of SMS group, was awarded a contract for the finishing mill automation modernization, with the completion of the project expected in 12 months only.

Main scope of the project

The scope of supply of SMS group will include the installation of a new X-Pact® process and basic automation including technological control systems in the existing hot strip mill without any mechanical modification.

The plant will operate through a new dedicated X-Pact® Vision HMI system and the necessary main local control desks. Also, the network infrastructure to assure fast and safe data exchange and reliable communication will be included in the modernization of the automation system.

General concept of the finishing mill automation modernization

The battery limits of automation revamping extend from finishing mill entry side, including the crop shear, up to finishing mill exit side and concern mainly the following:

- Replacement of existing mill automation by new SMS group X-Pact® Level-1 and Level-2 including remote I/O implementation

- Installation of a new cooling section X-Pact® Level-2 system
- Replacement of existing crop shear automation by new SMS group X-Pact® Level 1 including remote I/O implementation

System architecture will include:

- New SMS group X-Pact® Level-2 process models on a physical-mathematical basis:
 - Pass Schedule Calculation (PSC®) model for finishing mill setup calculation
 - Profile, Contour and Flatness Control (PCFC®) model for profile and flatness
 - Cooling Section Control (CSC®) model for optimized utilization of the cooling section

The new Level-2 system provides setups to the new Level-1 system and is an integral part of SMS group's holistic approach to hot mill automation systems. By means of its sophisticated adaptation procedures it is a self-learning system. It comprises setup calculation, data collection, adaptation intelligence and reporting.

- New SMS group Level-1 basic automation system including technological control systems
- Replacement of existing HMI systems by new SMS group X-Pact® Vision HMI considering the Level-1 and Level-2 HMI screens to form a common HMI basis
- Interfacing of existing and remaining plant areas, controls and measuring gauges

2017
Roughing Mill and
Vertical Edger



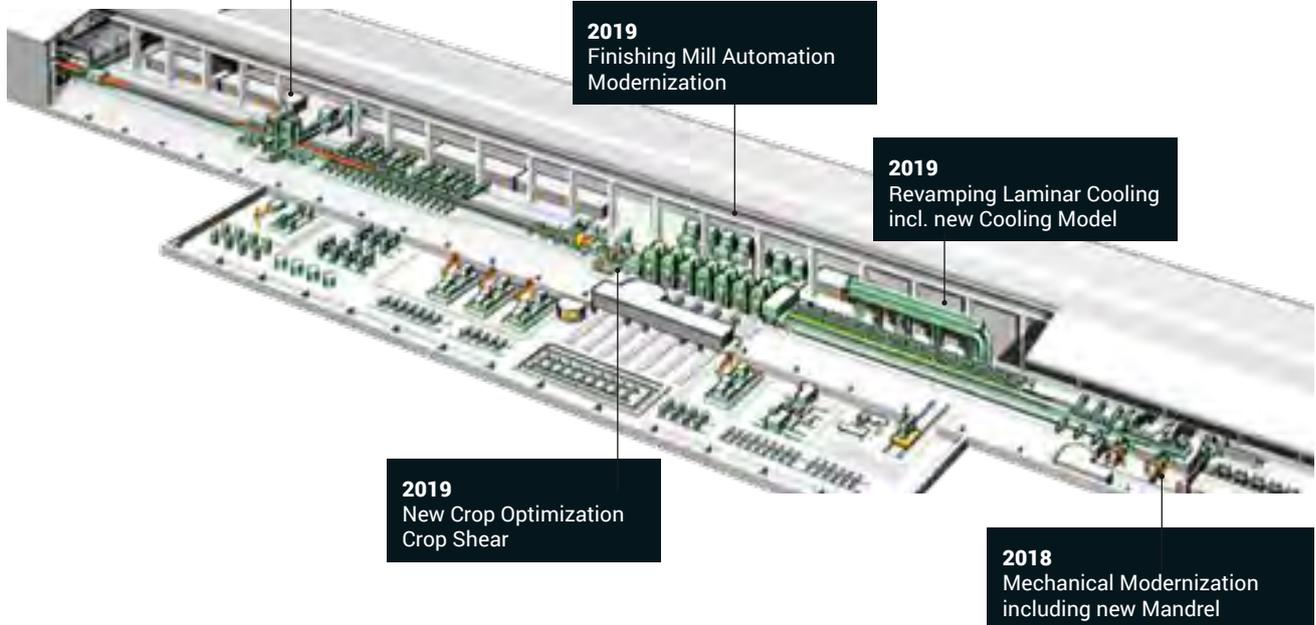
Typical control desk by SMS group.

2019
Finishing Mill Automation
Modernization

2019
Revamping Laminar Cooling
incl. new Cooling Model

2019
New Crop Optimization
Crop Shear

2018
Mechanical Modernization
including new Mandrel



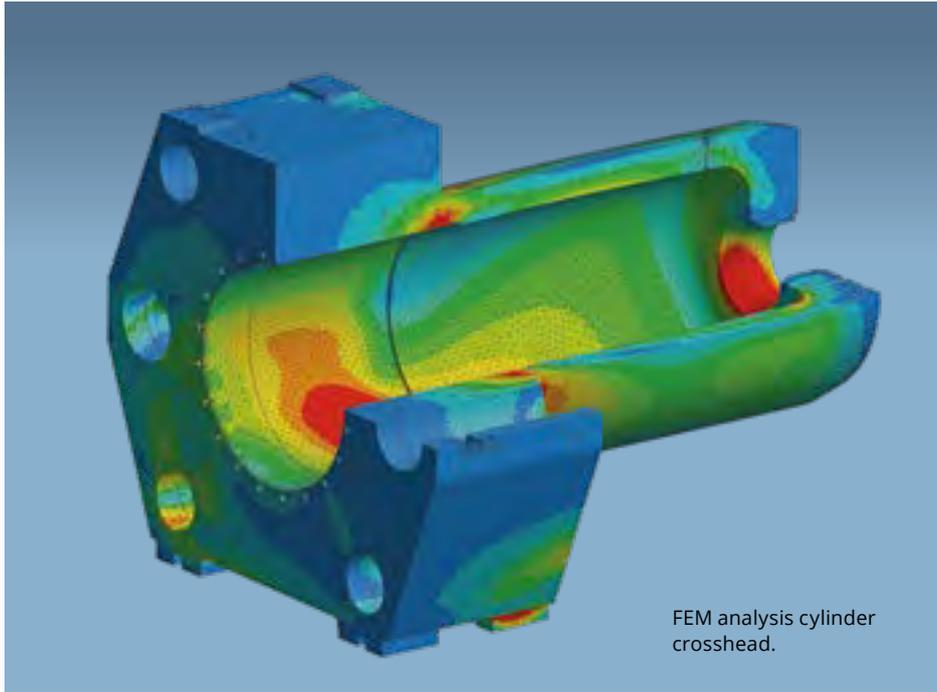
The SMS group concept foresees to install new remote I/O boxes equipped with intelligent terminals (ETHERCAT or PROFIBUS) close to the existing junction boxes in the field area. The new remote I/O boxes including the required cables to/from the control room will be erected prior to the shutdown during maintenance shifts.

During the shutdown, the new remote I/Os will be connected to the terminals in the existing junction boxes. This will eliminate, after several years of operation, the existing old, worn-out interconnecting cabling between junction boxes and the control room.

Finally, SMS group will perform a comprehensive process simulation test in order to ensure smooth mill start-up after the mill outage in spring of 2019. ♦

MAIN GOALS OF THE MODERNIZATION PROJECT

- Improvement of product characteristics
- Increase of production and productivity
- Reduction of production cost
- Integration of new process technologies
- New X-Pact® finishing mill automation system



GERMANY

HIGH-END COMPONENTS IN USE

20-MN extrusion press successfully upgraded by STEP-G at Bitterfeld location.

For many years, ST Extruded Products Group (STEP-G) has been relying on the Technical Service of SMS group when it comes to plant modernizations. This is also the case with the most recently performed upgrade of the 20-MN extrusion press at the Bitterfeld location. At the end of 2017, SMS group supplied a newly forged cylinder crosshead including pre-controlled filler valve and side cylinder for the 20-MN extrusion press. Service experts from SMS supported STEP-G during assembly and startup. The project could be implemented as planned and the press could be handed over to production at an even earlier date.

"We coordinate the construction for modernization measures always in close cooperation with our customers from the outset. By doing so, we are able to manufacture an optimal component exactly tailored to the needs of the customer. We attach top priority to smooth project implementation and intensive exchange," explains Nils Brämswig, Project Manager Modernizations and Maintenance Services Hydraulic Presses at SMS group.

For late 2018, the erection of four new columns had been additionally planned. The geometry of the columns is designed to improve the force distribution within the press frame and thus attain a long service life at the same time.

The Bitterfeld works were founded in 1915. On its 20-MN and 50-MN extrusion presses, the plant today produces aluminium profiles for its customers of the most diverse industries such as the automotive industry, mechanical engineering or the construction sector. With its own casthouse, the extrusion of specially alloyed standard and large profiles as well as sophisticated further processing STEP-G offers its customers a great potential for the production of customer-specific profiles. ♦



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GERMANY

UPGRADING THE CONTROL SYSTEM IN ONLY TWO WEEKS

New future-proof plant engineering for Deutsche Giessdraht.

In the course of the renewal of cathode shaft furnace and burner zones including burner control system on the wire rod plant at Deutsche Giessdraht GmbH in Emmerich, Germany, the customer and the Technical Service experts of SMS group involved had good reason to be pleased. The upgrading of the burner control to the Siemens S7-1500 F control system including modernized visualization took place in August 2018 within two weeks. The new control and regulation system now complies with current regulations and standards.

The modernization of the plant comprised the upgrade of the control system, the renewal of the gas control line and the gas supply to the furnace plus assisting the certification process of the existing burner. The next step will be to replace the cathode shaft furnace in 2019.

“The cooperation with the Technical Service of SMS group was excellent. Right from the onset of the project we had an open and trustworthy relationship between all persons involved and felt well advised,” concludes Dr. Stefan Schneider, Managing Director of Deutsche Giessdraht.

The order of the upgrade, at first the control system, and then the replacement of the cathode shaft furnace following

a successful examination provides the customer with the certainty that downtimes can be minimized and thus production outages can be reduced.

Günter Gesche, Project Manager at SMS group, explains: “We were able to offer the entire all-round carefree package to the customer – from making an inventory up to certification, erection, commissioning and assistance during production start.”

In the last ten years, SMS group has successfully built 15 such cathode shaft furnaces. ♦

DEUTSCHE GISSDRAHT GMBH

Deutsche Giessdraht GmbH is a subsidiary of AURUBIS AG, Hamburg, the largest European copper producer. For more than 40 years, Deutsche Giessdraht in Emmerich on the Rhine, has been producing high-grade copper wire rod based on selected grade A cathodes.



Project team members after scheduled upgrade of control system.



Gas supply line with new control and shutoff assemblies.



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SMS group service experts have developed a detailed conversion concept.

BRAZIL

EFFICIENT MODERNIZATIONS

SMS group Metalurgia do Brasil advises companies on modernization projects and the planning of plant rebuilds. Higher productivity and reliability as well as reduced maintenance effort are the most common objectives of such projects.

PROJECT 1**CONVERSION CONCEPT
FOR ARCELORMITTAL
TUBARÃO**

For ArcelorMittal Tubarão, a project has been developed to convert the existing continuous casting machine No. 3 to a new cartridge-type mold design in order to reduce maintenance time and increase mold reliability.

Continuous casting plant No. 3 at ArcelorMittal Tubarão in Brazil, in operation since 2007, was originally built by a Japanese plant manufacturer. Maintenance of the plant had always been very time-consuming. SMS group Metalurgia do Brasil Ltda., a company of SMS group, has consulted ArcelorMittal Tubarão and proposed products and services that will reduce the maintenance effort and improve the productivity of the plant. The main focus of the proposed concepts is the conversion of the mold cartridge. It involves the installation of an intermediate backup plate between the water jacket and the copper plate. First, the conversion was performed on the broad faces.

As a first phase of the project, the water jacket had to be reverse engineered because the customer had no detailed drawings of the plant. The new cartridge design provides ArcelorMittal Tubarão the following advantages:

- Reduction of the time needed for mold maintenance.
- More flexibility in copper plate repair, resulting in less transport and coating costs.
- Cost reduction as a result of the new water jackets.

The second project phase, for which SMS group Brazil has already received the order, will comprise the implementation of the new mold cartridge design on the narrow faces and some small modifications to the foot roll material and design, to the lubrication system and to the copper plates. The caster is scheduled to go back into operation in early 2019. ♦

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Close to the customer: Technical Service in Brazil ensures short response times.

PROJECT 2**MANDREL MODERNIZATION**

At the end of 2017, Companhia Siderurgica Nacional (CSN), Brazil, has placed an order with SMS group Metalurgia do Brasil Ltda., a company of SMS group, to modernize a mandrel in its hot strip mill (HSM). In this mill, CSN operates three obsolete coilers dating back to the 1970s. With a current campaign of 1.3 million tons each mandrel, the expectation was to increase productivity to 2.0 million tons. This was the first time CSN had an HSM mandrel repaired outside the own workshop. Until then, these repairs were made internally. The modernization concept was geared to an increase in performance and to preventing damage to the equipment.

The equipment suffered from a couple of breaks in the mandrel body due to vibration of the segments as a consequence of wear between these two parts. SMS group proposed to install a projecting spring device putting an end to gaps originated by wear. The aim was to eliminate vibration in the mandrel segments and thus to increase the life cycle and reduce the number of maintenance downtimes.

Meanwhile, CSN has started operation with the modernized mandrel at its Volta Redonda production site in the state of Rio de Janeiro with good results. ♦

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HERE YOU CAN
FIND ALL 2019
TRAINING TOPICS
AND DATES

In addition to standardized specialized training courses, SMS TECademy experts also design customized training on demand which is particularly adapted to the needs of the customers while the training venue can be freely selected.

WORLDWIDE

ACQUIRING NEW KNOWLEDGE

Annual program 2019 for
specialized training courses.

The annual program of SMS TECademy 2019 is now available. Here, you can choose from many training dates on selected topics in the areas of technology, maintenance/servicing and plant engineering.

The learning success is also supported by using the innovative Virtual Reality (VR) technique. Karsten Weiß, Head of SMS TECademy at SMS group, explains why: "Thanks to AR/VR techniques, our training participants experience a computer-aided enhancement of the perception of reality. This enables training courses to be structured or organized much more efficiently. Contents from 3D plant drawings can be derived and provided with appropriate kinematics. With this technique, the hands are "free" and could be used e.g. for assembly purposes which makes our training courses even more interactive."

SMS TECademy trainers are experts in their fields and can provide the right answers to the questions of the participants. During all training procedures the practical relevance and the applicability of the contents are the main focus.

E-learning opportunities provide maximum possible flexibility. Regardless of whether interactively via live transmission of a training course via webcam (webinar) or by means of autonomous learning of the contents in the form of video series (webucation) – time and place are determined by the participant! ♦



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ASIA

NEW STEEL GRADE OF HIGHEST QUALITY

The new steel grade TRIP600-TH of an Asian steel producer unites convincing qualities and resource-saving special properties.

CONSULTANCY SERVICES

Since 2013, SMS group's subsidiary MET/Con has been offering professional consultancy services for all steelmaking sectors along the entire process chain, in particular in the area of demanding multi-phase steels, from high strength through higher strength to highest strength grades. With their wealth of know-how, the engineers of MET/Con support steelmakers in the field of production plants including combined pickling line-tandem cold mills, continuous annealing lines and hot-dip galvanizing lines.

At an Asian steel producer, experts of MET/Con developed a new material featuring a superior combination of properties.

In the course of acceptance tests for defined multi-phase steels at an Asian steelmaker, the engineers of MET/Con developed a new steel that, with this combination of properties, has not been available so far. It unites the high strength of a TRIP steel (TRansformation Induced Plasticity) with the elongation-at-fracture values of an IF steel (Interstitial Free), a result that could be achieved through an innovative cooling strategy made possible by the excellent equipment from SMS group. This way a steel grade with outstanding properties called TRIP600-TH was created at the continuous annealing line. Such a grade by other steelmakers is neither specified in European Standards (EN 10338/EN 10346) nor in VDA Standard (239-100). The market offers steel grade TRIP600, however with clearly lower elongations at fracture and strain hardening coefficient at a minimum tensile strength of 590 MPa.

NEW GENERATION

Thanks to its exceptional elongation at fracture (+40 percent) and an excellent strain hardening coefficient (+20 percent) referred to existing specifications, customers in the automotive industry and their suppliers, steel service centers, the commercial vehicles sector and not least profile manufacturers are offered a steel grade opening up completely new opportunities.

In addition to the tensile-test standard parameters, the presented high-ductility TRIP steel TRIP600-TH features special properties such as guaranteed hole expansion according to ISO 16630 for forming operations free from edge cracks or guaranteed bending angles to VDA 238-100. With its guaranteed tensile strength and elongation at fracture the product stands for a new generation of AHSS (Advanced High Strength Steel) also known as third generation of steel grades.

The very small parameter differences of the steel strip along and across its rolling direction demonstrate another important and resource-saving special property and that is material quasi-isotropy. Boards, for example, may be cut from the strip irrespective of the rolling direction (transversal, longitudinal or at angles to the rolling direction) and thus contribute to minimize waste. ◆



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GERMANY

LEADING

ALUMINIUM 2018 with focus on digitalization.

“Leading Partner Talks” were the platform for aluminium producers and SMS group to report on successful projects.

POINT OF CONTACT IN HALL 9: THE BOOTH OF SMS GROUP

PARTNER



SMS group

Augmented reality applications support training and lead to a higher learning effect.

Industrie 4.0 and digitalization were the main topics of SMS group at the trade show.

Electronic parts catalogue eDoc is just one example of the potential of digitalization.

DIGITAL SERVICE

ADDITIVE MANUFACTURING

For three days in October, the exhibition ALUMINIUM 2018 has again made Düsseldorf the center of the aluminium industry. SMS group introduced itself as the Leading Partner of the trade and presented the potential Industrie 4.0 and digitalization offer to the industry.

CUSTOMERS REPORT ON JOINT SUCCESSES

A highlight of the show was the Leading Partner Talks, an opportunity for aluminium producers together with their contact persons at SMS group to report on successful projects. For example, Christian Schwarz from Höfer Metall Technik, Germany, together with Hansjörg Hoppe and Ben Zander from SMS group looked back on the HybrEx® success story at HTM where the first one of the particularly energy-efficient HybrEx® extrusion presses had been commissioned in 2014. In the meantime, the Technical Service of SMS group has taken over maintenance of said HybrEx® and of another producer's extrusion press. Christian Schwarz: "The Technical Service of SMS group is very important to us. Among other things, our employees benefit from the transfer of technology. We are very satisfied with the support of SMS group." In a discussion with Norbert Doblhofer from Hertwich Engineering, Dr. Feras Allan from Emirates Global Aluminium talked about the development of EGA and the experience made with homogenizing furnaces that had nearly all been supplied by the Austrian subsidiary of SMS group. Dr. Markus Schober from HAI (Hammerer Aluminium Industries) also referred to a common project with Hertwich: "Hertwich was the right partner to implement the project within the specified period. Everything was in time and within budget and turned out to be an



"Hertwich was the right partner to realize the project within the set period of time. Everything was in time and within the budget and an overall success."

Dr. Markus Schober, Managing Director, HAI – Hammerer Aluminium Industries, Austria



"100 percent of our continuous homogenizers and 10 of our 12 batch homogenizers were provided by Hertwich. All facilities are running perfectly."

Dr. Feras Allan, Senior Vice President Product and Casting Operations, Emirates Global Aluminium, United Arab Emirates

overall success." Finally, the CEO of Alcomet, Huseyin Yorucu, talked with Michael Schäfer from SMS group on the new cold rolling mill and the HybrEx® extrusion press that will soon be put on stream in Bulgaria.

FOCUS ON DIGITALIZATION

In terms of content, the show of SMS group fully dedicated to the topic of digitalization. One of the exhibits was the X-Shape flatness measuring roll with closed roll surface, precise flatness measurement and optical signal transmission. The roll is a key element of advanced measuring and control technology ensuring top product quality of cold-rolled aluminium strip. Other exhibits such as the active chatter device or the automatic billet surface inspection of Hertwich Engineering also focused on the issue of product quality. ▶



Automatic billet surface inspection from Hertwich Engineering.



3D-printed components can be installed in aluminium plants, too.

On occasion of the exhibition, the Belgian company E-Max extended the service contract for maintenance of its extrusion presses.



The X-Shape flatness measuring roll is a core element of measuring and control technology in cold rolling processes.



#MAGAZINE

Impressions of the trade fair show and the Leading Partner Talks are available here





“The Technical Service of SMS group is very important to us. Among other things, our employees benefit from the transfer of technology. We are very satisfied with the support of SMS group.”

Christian Schwarz, Managing Director, Höfer Metall Technik, Germany



“From the kick-off meetings to the signing of the contract, we were very impressed how well prepared and experienced SMS group was. We are very satisfied with the partnership.”

Huseyin Yorucu, CEO, Alcomet, Bulgaria

The way process data can be used for quality assurance within the whole aluminium plant was illustrated by the PQA® (Product Quality Analyzer) system. It collects all relevant production and process data, continuously analyzes same on the basis of defined rules, provides instructions for action whenever it identifies inadequate material quality and rates products after each process step whether they are suited for the next stage and for reaching the desired final quality.

SMS group also showed the potential of digitalization for technical service using the example of the electronic parts catalog eDoc. This cloud solution allows for simple identification of the parts integrated in a plant and for adding additional information such as operating instructions. Time-consuming searching for necessary information is a thing of the past. A further benefit is that identical parts can be identified and shown across all works and plant areas, which immediately leads to a reduction in stock-keeping and increases plant profitability.

DISCUSSIONS ON PROJECTS AND THE SERVICE CONCEPT FOR EXTRUSION PRESSES

In addition to presenting these topics, the exhibition was used as a platform for many project discussions and the exchange of professional knowledge. Numerous customers enquired about the service concept for extrusion presses paying special attention to quality, productivity and product safety.

On occasion of the exhibition, the Belgian company E-Max Profiles extended a comprehensive service contract covering the two light-metal extrusion presses supplied by

SMS group, one press with a force of 25 MN and the other with 35 MN. “The market for aluminium profiles is extremely competitive. SMS group is an important strategic partner to us to ensure high availability and productivity of our plants in the long term,” says Dimitri Fotij, CEO of E-Max. Ben Zander from the Technical Service of SMS group supplements this statements: “It is of great importance to us to be in close communication with our customers, as this is the only way for both parties to benefit from the cooperation and to ensure constant advancement. All measures to be carried out are coordinated with a view to production planning and then jointly implemented.” ♦



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Foto: MCI/Thomas Ecke

The delegation of the Japanese Forging Association JFA at the SMS group exhibition stand.

GERMANY

CLOSED-DIE FORGING INDUSTRY

About 600 trade visitors at first EUROFORGE conFair interchanging with closed-die forging experts at SMS group exhibition stand.

From November 13 to 15, 2018, the first EUROFORGE conFAIR took place in Berlin. The trade fair was hosted by the European Umbrella Association of the National Forging Associations in Europe who welcomed 55 participating companies and about 600 trade visitors from 35 countries. On the accompanying conference SMS group reported in its presentation "Forging line concepts for producing chassis components made of aluminium" on current developments for the closed-die forging industry. During talks with our closed-die forging experts at our SMS group exhibition stand the visitors could inform themselves further on this and many other topics.

Based on an Augmented Reality (AR) application, the trade visitors were able to look at the exemplary operation of a completely animated three-dimensional closed-die forging line.

Another highlight for the SMS group team was the visit of a delegation of 25 persons from the Japanese Forging Association JFA. "For the further development of our business in Japan the support of the Japanese Forging Association is very important. It was an excellent opportunity for us to establish personal contacts and to talk about future potentials of the Japanese forging market," Klaus Merkens, Head of Sales Forging Plants Division, stated with satisfaction. ◆

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PREVIEW

IN OUR NEXT NEWSLETTER ISSUE ...

... you will learn more about our trade fair appearance at the METEC 2019.

The METEC is the world's most important trade fair for metallurgy, steelmaking and steel processing. SMS group is one of approx. 2,000 exhibitors presented in Düsseldorf at the METEC and its sister exhibitions THERMPROCESS, GIFA and NEWCAST from **June 25 to 29, 2019**. At the last fair four years ago, more than 78,000 trade visitors from more than 120 countries attended the four exhibitions. SMS group presents its appearance under the motto "Leading Partner in the World of Metals" offering solutions and visions for the digital future of the steel industry.



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The information provided in this magazine contains a general description of the performance characteristics of the products concerned. The actual products may not always have the characteristics described and, in particular, these may change as a result of further developments of the products. The provision of this information is not intended to have, and will not have, legal effect. An obligation to deliver products having particular characteristics shall only exist if expressly agreed in the terms of the contract.

METEC 2019

DÜSSELDORF, JUNE 25 - 29

LEADING PARTNER IN THE WORLD OF METALS

In June 2019, Düsseldorf will be once again the heart of our industry. We cordially invite you to Metec trade fair and to visit us at our booth for a personal exchange of ideas and to experience our answers for the future.

At Metec 2019, SMS group will turn the spotlight on the topics of digitalization and Industrie 4.0. Come to our booth in hall 5 and learn all about our vision of the "Learning steel plant".

Be our guest and discover the bright world of metals!

Read more on our website:
www.sms-group.com/metec



Follow us on



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