

metals & mining

The magazine for the metals and mining industries

Issue 3|2009

SIEMENS
V A I 

Focus Topics:

**Long Products
Plant Modernization**



Increasing plant performance –
with integrated solutions

Next Generation in Plant Performance

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When investing in a new plant or modernization project, you expect the best performance – fast and reliable. As a unique solution provider, Siemens VAI maximizes results.

Interested in proof?

One of the most recent examples is the installation of a complete stainless steel plant from a single source – which has set new technological benchmarks. Integrated process know-how from Siemens VAI was decisive for this success. Want to maximize your plant performance? Contact us at: www.siemens-vai.com

Metals Technologies





Philip R. Morgan

Dear Readers,

When our company merged with Siemens VAI Metals Technologies in 2008, it was the ideal partnership. It brought together two great companies with a long tradition of service to the steel market and with product portfolios that fully complement one another. In particular, our high-speed reducing and sizing mills, operating in 54 new facilities worldwide, supplement the exceptional mill-stand design and technological expertise of Siemens VAI in bar, section and rail rolling. We now offer the complete spectrum of technologies and processes to roll any long-product shape or size in all grades of carbon, alloyed, super-alloyed and special steels. Our combined reference list exceeds 1,000 rod, bar, section and billet mills. In 2008, we acquired nearly 40% of all projects awarded in the long-rolling market on a worldwide basis. As a market leader, we are proud that Siemens VAI-supplied mills account for more than 30% of all long products rolled today on a tonnage basis.

We take seriously our reputation for service. Our greatly expanded access to the market, together with the local presence of Siemens worldwide, allows us to respond even faster to our customers' exacting expectations. For us, service not only means the rapid delivery of emergency spares, but, more importantly, the ability to keep our customers' mills humming smoothly and efficiently with the latest design solutions and system improvements.

Our workshops in the United States, China and India have considerably enhanced the in-house manufacturing capability of Siemens VAI. This is a critical factor to ensure the high-quality standards of our mill equipment and components. It also allows us to develop, test and optimize plant components and processes for the entire long-product portfolio.

Our customers will benefit from the merger with Siemens VAI. This means greater capability to provide everything from a single source – from engineering, manufacturing, equipment supply, installation and commissioning through life-cycle management. Our customers can expect faster rolling speeds, improved product tolerances, better metallurgical properties, greater flexibility and a wider product mix from their mills.

The integration with Siemens VAI augments the knowledge and experience of a large staff of seasoned specialists, magnifying our problem-solving expertise and our research and development capabilities. We will continue to uphold our reputation as a trendsetter in the long-product business.

Yours sincerely,

A handwritten signature in blue ink that reads "Philip R. Morgan". The signature is fluid and cursive, with a long, sweeping underline.

Philip R. Morgan
President and CEO

Morgan Construction Company – A Siemens VAI Business

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Siemens at Perumin

The Siemens product and solutions portfolio covering excavation up to beneficiation was presented to customers and visitors at Extemin 2009, which was held in the framework of the 29th Mining Convention Perumin from September 14 to 18, 2009. The Siemens booth focused on environmental care with displays on energy efficiency and water management as well as security systems.

The event was held at the Tescup Center in Arequipa, Peru. Organized by the Institute of Mining Engineers of Peru, Extemin is one of the largest and strategically most important mining fairs in Latin America. This year there were over 900 booths on 11,300 m² of exhibition area, which represents a 40% increase over the last Extemin. Experts from all over the world gathered to discuss new trends and activities in the sector. ■



29th Mining Convention Perumin at the Tescup Center in Arequipa, Peru



Hot Commissioning Achieved at Shagang Plate Mill



The first plate to roll off mill No. 2 at Shagang Wide Plate Mills Co. Ltd

On Thursday, September 24, four days ahead of contractual date, the first plate was rolled on 5.0-m Plate Mill No. 2 of Shagang Wide Plate Mills Co. Ltd. in Zhangjiagang, China. Full line operation is scheduled for the end of this year. Once it is up and fully running, the new line will allow operators at Shagang to increase production by 1.6 million tons per year.

Line No. 2, constructed over the course of 24 months, consists of a horizontal stand with edge, MULPIC[®] intensive cooling, a hot plate leveler and two shearing lines. The mill is a fully Siroll^{CIS} PM designed mill comprising mechanical, electrical and automation equipment. Plate mill No.1, which went into operation in January 2007, was also supplied by Siemens VAI. ■

Plant Start-ups (May 1 to September 30, 2009)

| Company | Country | Project |
|--|------------|---|
| Ahmsa | Mexico | FAC for Level 2 automation, including Dynacon Lomas, installed in two LD converters |
| Acciaierie Venete SpA | Italy | Hot commissioning of upgraded section mill with 150,000 t/a capacity and receipt of PAC |
| Acroni, d.o.o. | Slovenia | Start-up of upgraded 1x1 slab caster |
| ArcelorMittal Temirtau | Kazakhstan | FAC for bar & section mill with 400,000 t/a capacity |
| Dingsheng Hangzhou Aluminium Co Ltd | China | Start-up of 3 AGC/AFC systems for aluminum cold mills |
| Dneprovsky Iron & Steel Integrated Works | Ukraine | Start-up and FAC for upgraded 250-ton Ladle Furnace No. 1 |
| Gerdau Acominas SA | Brazil | Start-ups: 230-ton RH T-COB vacuum-degassing plant and new 1x2-strand slab caster |
| Habas Aliaga Iron and Steel Plant | Turkey | FAC rebar and bar mill with 1,185,000 t/a capacity |
| Isdemir Iron & Steel Works Co. | Turkey | FAC for hot-strip mill (E/A supply) |
| Jiangsu Shagang Group Co. Ltd. | China | Start-ups: 4 slab casters with 7 strands and new 5.0-m-wide plate mill (mech. & E/A supply) |
| Jiangyin Huaxi Iron & Steel Co., Ltd | China | Start-up of 160-ton twin-station RH T-COB plant and receipt of PAC |
| Lianyuan Iron and Steel Co., Ltd. | China | Start-up of dry-type dedusting and gas-recovery system for 210-ton LD converter |
| Maanshan Iron and Steel Co., Ltd. | China | Start-up of first Meros sinter-gas-cleaning plant in China with a capacity of 520,000 Nm ³ /h |
| Meishan Iron and Steel Co., Ltd. | China | FAC for dedusting system and gas-recovery system for 3x160-ton LD converters |
| Nippon Steel Corporation | Japan | Start-up of new 16 MVA main drive for plate mill |
| North China Aluminium Co Ltd | China | Start-up of 3 AGC/AFC systems for aluminum rolling |
| Novolipezk Metallurgical Combine (NLMK) | Russia | Start-ups: 160-ton LD converter with dedusting system and upgraded 1x 2-strand slab caster |
| OneSteel | Australia | Start-up of laying head and pinch-roll additions to wire-rod line and receipt of FAC |
| Pohang Iron & Steel Co, Ltd (Posco) | Korea | Start-ups: 280-ton RH T-COB plant and upgraded 1x2-strand slab caster |
| Rio Tinto Socatral | Cameroon | Start-up of AGC/AFC system for aluminum rolling |
| RWE Power AG | Germany | Start-up of manless operation of stockyard equipment comprising 4 stackers and 4 reclaimers at the open-pit mines in Hambach and Garzweiler |
| Salzgitter AG | Germany | Start-up and FAC for 210-ton ladle furnace and 210-ton VPL plant |
| Shougang Jingtang Iron and Steel Co., Ltd. | China | Start-ups: Plate Mill No. 2 (mech. & E/A supply) and continuous-annealing line (E/A supply); FAC for dedusting and gas-recovery systems for 3x300-ton LD converters |
| Suez Steel Co. | Egypt | Start-ups: upgraded finger-shaft EAF and upgraded 1x5-strand billet caster |
| Tangshan Guofeng Iron & Steel Co. Ltd | China | FAC for 110-ton twin-station VOD, FAC for Hot-Strip Mill No. 2 (E/A supply) |
| Tata Steel Ltd (Jamshedpur Works) | India | Start-up of upgraded "C" Blast Furnace with world's first Gimbal Top BF-charging system |
| Thep Viet Steel Co. Ltd. | Vietnam | FAC for bar mill with 450,000 t/a rolling capacity |
| Tianjin Iron & Steel Co. Ltd. | China | FAC for 800,000 t/a high-speed wire-rod mill |
| Usiminas Cubatao | Brazil | Start-up of bottom-stirring systems for 160-ton Converters No. 5 and No. 6 |
| voestalpine Stahl | Austria | Start-up of Converter No. 7, including new vessel and Vaicon CD Link Suspension System |
| Votorantim Siderurgia | Brazil | Start-up of 500,000 t/a high-speed wire-rod mill |
| Wuhan Iron and Steel Co., Ltd. | China | FAC for wet-type dedusting and gas-recovery system for 2x150-ton LD converters |
| Xinyu Iron & Steel Co., Ltd | China | FAC for hot-strip mill (E/A supply) |
| Zhangjiagang Hongfa Steelmaking Co. | China | Start-up and receipt of PACs for three ladle furnaces |
| Zhangjiagang Run Zhong Steel Co., Ltd. | China | Start-up of reducing-sizing mill addition to high-speed wire-rod mill |

AFC = Automatic Flatness Control, AGC = Automatic Gauge Control, E/A = Electrics & Automation, FAC = Final Acceptance Certificate, PAC = Provisional Acceptance Certificate, RH = Ruhrstahl Heraeus, T-COB = Technometal Combined Oxygen Blowing, SCR = Southwire Continuous Rod, VPL = Vakuumpflanzenlegierungsanlage

Customized modernization solutions maximize plant performance and savings

Reach for the Sky

Modernization means more than just the replacement of obsolete or non-available equipment and systems. Far more, plant modernizations can result in substantial improvements in production performance, product quality and operational costs with relatively low investments. As a dedicated partner to the metals industry, Siemens VAI has considerable experience in the supply and implementation of solutions that allow producers to get their plants in peak condition and to have them perform even better than what they were originally designed to do. With consideration to the current economic situation, a deferred-payment model is also introduced for the installation of technological packages with proven cost-saving benefits.



Customized modernization
solutions and advanced
technological packages for
every step of the iron and
steel production route

To be able to respond quickly to changing prices, market conditions and product demands, companies must continually improve their technological standards throughout the entire lifetime of a production facility. Therefore, modernization is a fundamental factor for producers to survive and even thrive in the current difficult market. Siemens VAI offers a complete range of upgrading solutions for each step of the iron and steel production chain. This includes assessment, consultancy and reengineering services, installation of the latest mechanical equipment and components, and the integration of sophisticated automation systems, process models and technological packages within existing plant configurations. The paramount targets of modernization are to increase plant availability, productivity and lifetime; expand the product range in regard to product formats and new steel grades; improve product quality in terms of compositional homogeneity, tolerances and mechanical properties; fully meet all environmental and safety regulations; and, of course, to decrease operational and maintenance expenses. In this cover story and throughout this issue of metals&mining, examples of modernization solutions and technological packages are presented in addition to benefits that can be reaped on the basis of actual plant examples.

A complete range of upgrading solutions is offered for each step of the iron and steel production chain.

Cokemaking

For the upgrading of coke-oven and the related by-product plants, the extensive experience and know-how of Siemens VAI Finland in this field helps producers meet the stricter operational and environmental requirements of today. Simetal^{CIS} Coke products are the basis for stable and disturbance-free cokemaking operations in addition to the production of coke that fully meets blast furnace requirements.

In the course of a project to expand the capacity of the existing cokemaking facilities of the Turkish steel producer Isdemir, Siemens VAI modernized the coke-oven by-product plant to cope with the increased quantities of generated coke-oven gas. The gas-treatment capacity was doubled to 140,000 Nm³/h, plant operations were considerably improved and all relevant process information can now be monitored from a central control room. A high degree of efficiency is now also achieved with respect to the removal of cokemaking by-products from the coke-oven plant (see metals&mining No. 1|2008).

Sintering

Sinter VAiron is an advanced process-optimization system for raw-material handling, stacking and reclaiming in the blending beds up to the preparation of sinter feed and dosing in the sinter plant. It is comprised of sophisticated tracking, diagnosis and control models that are bundled within an overall expert system. It is the basis for high-volume production of uniform-quality sinter at low operational costs (see metals&mining No. 1|2008).

Sinter VAiron incorporating an expert system is be-

- 1 The Gimbal Top blast furnace charging system prior to installation in the "C" Blast Furnace of Tata Steel Ltd, India
- 2 Fully optimized steel-making processes with advanced process models
- 3 View of a converter equipped with bottom-stirring elements
- 4 RCB nose panel for oxygen and carbon injection into EAF



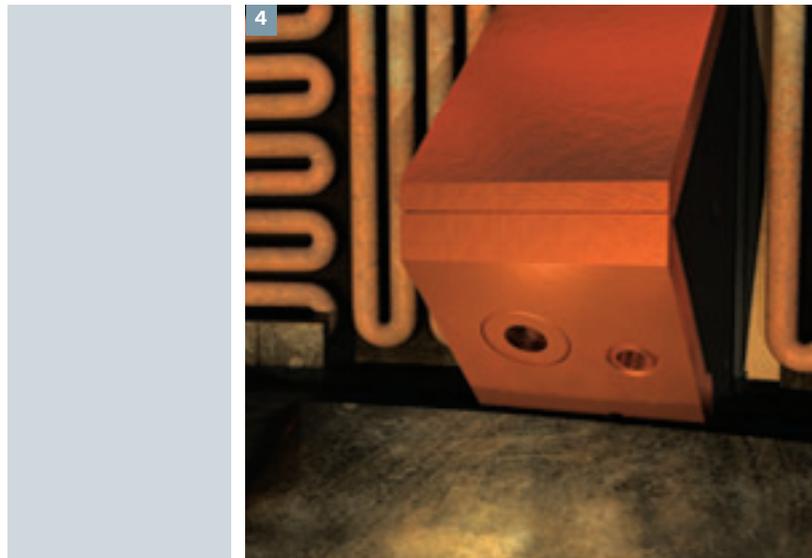
2

ing implemented on a 360-m² Chinese-made sinter machine at Nanjing Iron and Steel Co. Ltd. (NISCO). All major control packages and models are included. The system will fully optimize all sintering operations including the coke-consumption rate, and a systems-diagnostics tool is to be provided as well.

Blast furnace ironmaking

The VAiron automation and optimization package consists of a series of standardized process models that are grouped into mass and heat-balance models, special models and kinetic models. A closed-loop expert system provides fully automatic control of key operational parameters. The system is now in operation at nearly 100 blast furnaces worldwide with excellent results. In addition to achieving highly stable operational conditions, reducing agents are decreased by 5–10 kg/t hot metal. Other benefits include higher blast furnace productivity, uniform hot-metal quality and a reduction in the energy consumption of the hot-blast stoves.

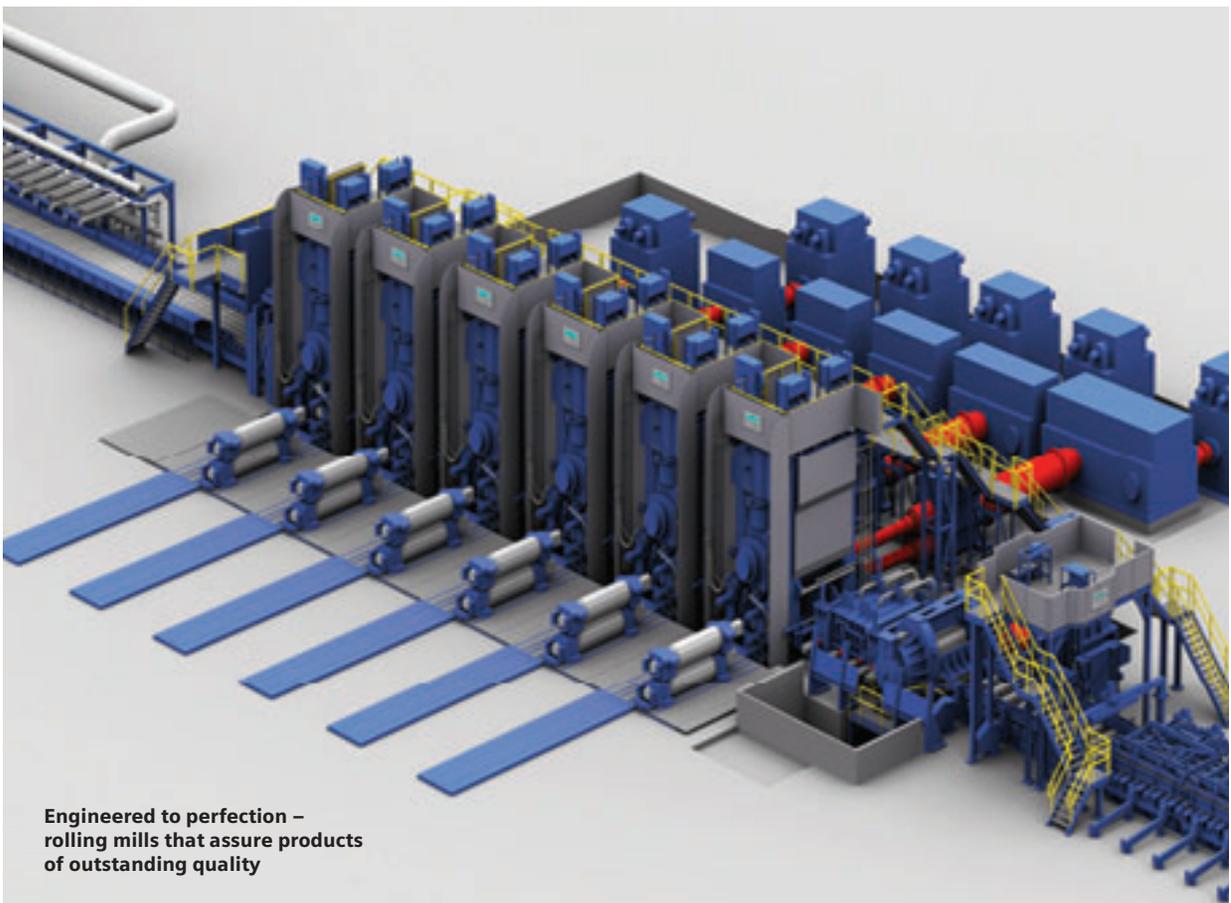
Flexible burden-distribution control offers decisive advantages in the blast furnace process. With the new Gimbal Top charging system from Siemens VAI, any burden profile can be generated by directing the charge to any point on the furnace stock line. Through the accurate and flexible positioning of raw materials onto the top surface of the blast furnace burden, a uniform gas flow and ideal smelting-reduction conditions are achieved. A further reduction in reducing agents is another important benefit. This innovative design has been put together as a technological package to unite the merits of Gimbal Top >>



CTCM No. 2 of
voestalpine Stahl,
Linz, Austria



COVER STORY >



Engineered to perfection –
rolling mills that assure products
of outstanding quality



1

1 State-of-the-art control-automation control pulpit at voestalpine Stahl, Austria

2 LiquiRob robot in operation on casting platform at Posco Gwang-yang Steelworks, Korea



2

>> equipment with an optimized blast furnace process control provided by the VAiron optimization models.

The world's first Gimbal Top installation in a blast furnace was started up on September 23, 2009, at Tata Steel Ltd simultaneously with the recommissioning of the relined and upgraded "C" Blast Furnace at the company's Jamshedpur Works in India.

Steelmaking

An entire suite of advanced process models under the generic term Steel Expert is available to optimize all steelmaking plants and operations. The process models are capable of simulating the entire production process and optimum production strategies are proposed. Set-point models determine the types and amount of addition materials for alloying, deoxidation, desulphurization, etc.

With the new Gimbal Top charging system from Siemens VAI, any burden profile can be generated.

Of the many technological packages available for both electric and oxygen steelmaking, only two are mentioned here. Bottom stirring of LD converters with inert gas leads to operational and metallurgical improvements. In particular, process kinetics is greatly improved.

The Foaming Slag Manager is a sensor-based technological package that records and analyzes struc-

ture-related noise during power-on operation of the electric arc furnace to determine the level of foaming slag in vessel. On the basis of this information, the consumption of carbon to generate foaming slab can be reduced by 20%–30%, coupled with a decrease in the specific electrical-energy consumption.

In separate articles in this and other issues of metals&mining, examples of modernization solutions, technological packages and automation upgrades for steelmaking plants are described in more detail.

Continuous casting

Advanced technological packages for all types of continuous casting machines are available from Siemens VAI to fully optimize the casting process and maximize production output, casting flexibility and product quality. These include solutions for automatic mold-level control, breakout prediction, hydraulic mold oscillation for better strand-surface quality, flexible slab-width and -thickness changes, improved and uniform cooling of variable slab widths, enhanced internal strand quality, optimum roller support, robotic operations for numerous tasks on the casting platform to maximize operator safety, connect&cast solutions for fast and trouble-free plant start-ups, online quality-tracking/control systems in addition to high-speed casting solutions for billet casters. For example, sticker-related breakouts are a major reason for high repair costs and production losses in slab casters. With the Mold Expert technological package, sticker-related breakouts can be reduced by up to 80%, as confirmed by the experience acquired in over 60 installations worldwide. >>

>> Hot-strip rolling

Under the generic term Siroll^{CIS}, the complete scope of rolling-mill equipment, components, utilities, drives and automation systems, as well as a full range of technological and service packages are available to meet the highest demands placed on rolling mills today. Technological packages and systems result in dramatic improvements with respect to thickness tolerances, strip flatness, surface quality, cleanliness and the uniformity of mechanical properties of the rolled-strip product. Other benefits achieved include stable and reproducible rolling conditions, chatter suppression, and reduced operational and maintenance costs. Individual production processes can be coupled, such as in-linked pickling and tandem rolling-mill configurations. Of paramount importance in the implementation of the foreseen modernization solutions is a minimum of disturbance to ongoing rolling operations. To ensure this, Siemens VAI performs simulated virtual rolling tests prior to delivery to confirm that all functions and applications will work properly and as designed.

As an example of a highly successful modernization project, Siemens VAI completely revamped the hot-strip rolling mill at Taiyuan Iron & Steel Co. (TISCO), a leading supplier of stainless, silicon and carbon steels in China. The primary targets were to increase the stainless steel output to 375,000 t/a, to enable the rolling of 1,250-mm-wide and 2.5-mm-thick stainless steel and to increase the overall rolling capacity to 1,350,000 t/a. Not only were these targets exceeded, the company is today a world-class producer of high-quality rolled products.

Plate rolling

Siemens VAI implemented an order from the Austrian plate producer voestalpine Grobblech GmbH to equip the 4.2-m heavy-plate rolling mill with new main-drive systems. The project included the delivery, installation and commissioning of new motors, the associated power-supply system and a control and visualization system. Two synchronous motors, each with a rated output of 7,200 kW and a surge-power output of 18,000 kW, were installed. The new main-drive system has twice the output of the previous DC drives. This is a decisive factor for the production of highly accurate finished-plate dimensions in terms of thickness, profile, width and flatness.

Cold rolling

The five-stand, tandem cold-rolling mill at Baosteel Group Corporation is one of the largest of its kind anywhere. It was originally built in the late 1980s and was part of the first expansion phase of flat-steel produc-



Roughing mill entry at the Arcelor Mittal Poland hot-strip mill

tion in Baoshan. Siemens was commissioned to upgrade the automation system with a particular focus on improving product quality and production output. The 15-year-old basic-automation system was replaced, including the operator pulpits, and the latest process-automation systems were installed. The out-of-date CPCs were substituted with state-of-the-art equipment. Furthermore, dynamic response and mass-flow-thickness control were improved through the digitization of drive-speed control. Finally, a new flatness-control system was implemented.

Following the restart of the upgraded mill, a total of 500,000 tons of cold-rolled strip were produced in



the first three months. An average output of more than 7,000 tons per day has been normal for the mill, with a maximum of 8,900 tons of cold strip rolled in a single day.

Long rolling

The two-strand rod mill of Wuhan was first started up in August 1996. The original design capacity was 700,000 t/a with 85% of the product mix being low-carbon and medium-carbon steel. To meet the ever-increasing market demand for higher value-added products and to increase mill efficiency for better cost control, Wuhan signed a contract with Morgan Con-

struction Company for mechanical modifications and Siemens for the electrical revamp at the end of 2003 to upgrade the existing rod mill. Morgan and Siemens carried out a comprehensive study of the process and the mill equipment. Modifications to all aspects of the equipment, mechanical, electrical and fluids were carried out.

The modernization included two elements: a mechanical revamp and electrical modernization to meet the customer's increased tonnage and process requirements.

After a detailed site investigation of the existing equipment, the automation concept and hardware >>

>> design was completed to achieve the requirements listed above.

Results and benefits of the mill modifications

The first coil was produced from the mill on April 24, 2006. The following achievements have been realized as a result of the mill modifications:

- Three months after start-up, the mill reached its design production rate of 160 t/h on 2-strand operation.
- The mill utilization increased by approximately 10% as the result of RSM technology.
- Material yield increased by 1.5%.
- Mill production exceeded the design capacity of 700,000 t/a immediately and a record high of 850,000 tons of production was achieved in 2007, whereby 250,000 tons were 5.5-mm coil for tire cord application.
- Utilization of the Morgan Enhanced Temperature Control System and modifications made to the Stelmor conveyor have resulted in excellent control of the cooling process, with finished product

properties greatly improved for high-value-added products such as PC strand, tire cord and cold heading steel.

In 2007, Wuhan became the largest tire-cord-quality coil producer and largest supplier to Bekaert in China as the result of good-quality steel and well-controlled rolling process after the mill modifications. In January 2008 alone, 19,453 tons of tire-cord steel was produced in this mill.

Deferred-payment option for technological packages

With consideration to the current economic situation, an innovative financing model is now available from Siemens VAI to assist metals producers that are “strapped for cash.” On the basis of a deferred-payment option, selected cost-saving technological packages can be installed in our customers’ plants at modest initial charges. These technological packages are characterized by their short payback period – typically within six months to a year – and payment is gauged to the savings achieved during on-

COVER STORY >

Interview

Erwin Unterauer, Siemens VAI sales manager, talks about the targets and benefits of technological packages, including a deferred-payment option offered by Siemens VAI. Excerpts:

What, in a nutshell, are technological packages?

Erwin Unterauer: Technological packages are a combination of mechanical, hydraulic, electrical and automation solutions that typically include sensor, measuring and analysis functions such as in mechatronic systems. Technological packages are designed to fulfill specific tasks and targets such as providing steel manufacturers with a greater capability to adapt their production to changing market conditions. That may be, for example, the need to supply different steel grades, different product dimensions, more exact tolerances, higher output, whatever. A typical target may also be to lower energy and material consumption and thus costs. Improving product quality is another key

objective of these packages. In most cases, maintenance work is also reduced.

Hasn't Siemens VAI always offered technological packages? Why is emphasis placed on technological packages now?

Erwin Unterauer: Our company has been supplying technological packages as part of the plants that we sell for more than 20 years now. However, in times of tight money, many producers are only allowed to invest in projects that have a return on investment within a year. The beauty of technological packages is that they offer measureable and calculable cost-saving results that pay for themselves within a short time. If a

going production. In this way, the money saved is the money earned for the investment.

This deferred-payment incentive and “welcome offer” has the intention of opening the door to a world of benefits for the iron- and steelmaking community, providing increased opportunities for companies to flourish and prosper, despite the current harsh and unpredictable economic climate. With fewer plants in operation, iron and steel producers may want to enhance the performance of the remaining production facilities in operation. When the demand for steel goes down, it is necessary to improve cost effectiveness. And when the economic upswing finally returns, producers will be ready on time.

The technological packages for which the deferred-payment option applies were chosen from across the entire iron and steel production route, beginning with the coke-oven batteries, sintering plant and blast furnace, through to the electric and oxygen steel-making plants up to hot- and cold-rolling and processing facilities. The impressive cost savings result from, for example, the lower specific coke, fuel and

energy consumption, reduced refractory wear, and less plant downtime, yield losses and product downgrades. Moreover, improved plant productivity, output and product quality accompany the cost-saving benefits derived from the installation of technological packages from Siemens VAI.

Decision makers are therefore invited to take advantage of this deferred-payment option through which the achieved cost savings pay off the investments in technological packages without incurring additional cash-flow obligations for a company. Steel and other metals producers are therefore offered an opportunity to get their plants in top form with minimum investments. ■

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www.technologicalpackages.com



The beauty of technological packages is that they offer measureable and calculable cost-saving results that pay for themselves.

producer still has a problem to finance the project, Siemens VAI is prepared to offer deferred payment for a selection of technological packages where a significant cost-saving potential exists. The money that a producer saves helps to pay for the costs of the purchased package. And when the market finally recovers, our customers have everything in place to derive the full benefits offered by this possibility.

Can technological packages from Siemens VAI be installed in machines and plants from other suppliers?

Erwin Unterauer: Of course. Our technological packages are designed in such a way that their application is virtually universal. They can be installed in most machines from other suppliers, even in those that were originally installed decades ago.

When should a producer consider installing technological packages?

Erwin Unterauer: The sooner, the better. In any case, before the market forces them to take steps to meet the increased demands.

COVER STORY >



Profile of the Siemens VAI long-rolling business

A Powerful Portfolio For Performance



Long products such as reinforcement bars and rods, wire, tubes, pipes, various sections and rails account for roughly 50% of all steel produced worldwide. They represent the “backbone products” in the industrialization and urbanization of a country and are widely used in the construction and machine-manufacturing industries as well as in infrastructure projects. Siemens VAI provides a comprehensive portfolio of solutions and services for long-rolling manufacturing that helps producers maximize plant performance and profit.

The Siemens VAI long-rolling business is headquartered in Worcester, Massachusetts (U.S.A.), and includes Morgan Construction Company (based in Worcester) and Siemens VAI Metals Technologies Srl in Marnate, Italy. These locations have over a century of long-rolling experience each. Company activities in this field focus on the design, manufacture and installation of equipment and processes for the production of both steel and non-ferrous rods, bars, sections (light, medium and heavy) and rails. Mill automation, process control, mill-management systems, spare parts, guides and specialized services are also provided. Solutions are available for the long rolling of all shapes and grades of carbon, alloy and special steels, in addition to super alloys. Endless rolling technology (ERT-EBROS®, licensed by JP Steel Plantech Co.) is also available from Siemens VAI to significantly reduce inter-billet time, increase mill utilization and production, and enable the production of rod coils with custom weights.

Bar and section rolling and sizing

Time-tested Red Ring stands from Siemens VAI have been installed in scores of long-rolling mills worldwide. They are characterized by their high rigidity, fully automatic operation, axial roll adjustment and automatic screw-down system – with adjustable under-load capability available. With the quick-disconnect features of the spindles and fluid utilities, the stands can be rapidly interchanged. These stands are available in vertical, horizontal, convertible and universal configurations to meet all market requirements.

A highly innovative solution for roughing and intermediate mills is two-high sliding stands. The rolling line is fixed, and the reversible sliding stands >>

>> are fully automated. Convertible stands provide an unlimited selection of products from a single mill layout, which is possible by means of simple push-button operation. Convertible stands allow either horizontal or vertical positioning and are mainly used in the intermediate and finishing trains.

Convertible stands provide an unlimited selection of products from a single mill layout.

A new generation of universal stands uses the Red Ring design for the rolling of medium to heavy structural shapes and rails. Conversion to conventional horizontal rolling is easily carried out, eliminating the need for additional horizontal stands.

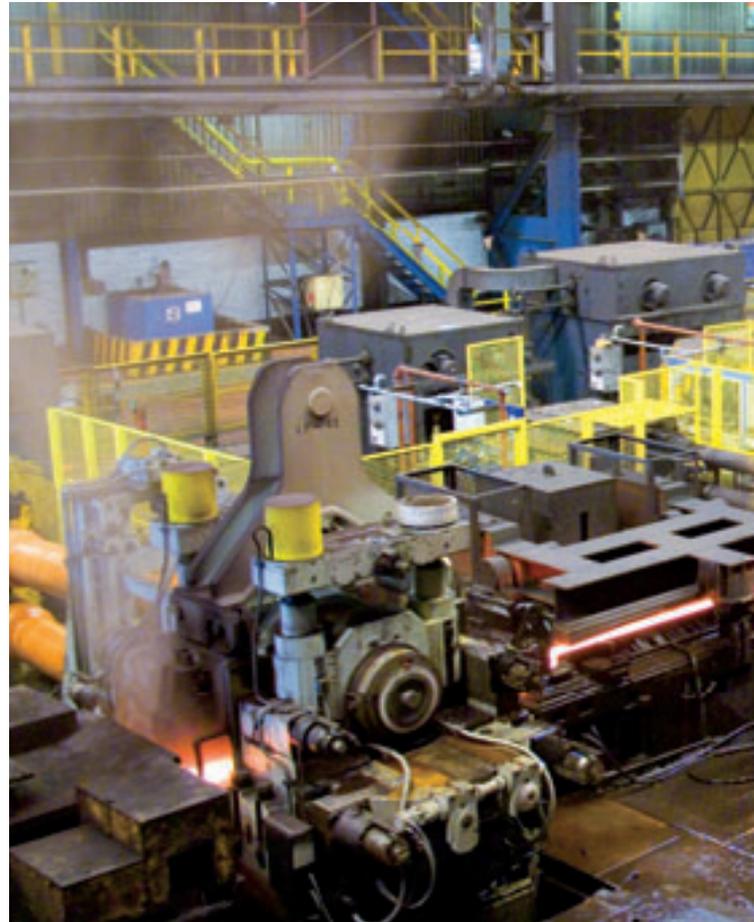
The flat-rolling block permits flexible rolling of medium/large flats with simple adjustment of roll gaps and grooveless rolling over a continuous range. It also allows size change within seconds and produces sharp edges and tight tolerances.

Bar-sizing systems from Siemens VAI include solutions featuring high-precision rolling coupled with process flexibility and equipment durability. Bar-sizing technologies offer the benefits of good surface finishing, close tolerances, improved metallurgical and mechanical properties, high load capacity for thermomechanical rolling as well as flexible operation. Single-family rolling minimizes roll and guide changes, and maximizes operational cost-efficiency. Free-sizing capability is especially beneficial for the rolling of small lots of bars within a relatively narrow range of sizes.

Rod rolling and sizing

The Vee No-Twist Mill (NTM) has been the key to success for high-speed rod mills worldwide for the past 25 years. Designed to roll grades ranging from carbon steels to tough-to-roll, heat-resistant alloys at speeds in excess of 120 m/s, NTMs feature housings with provisions for remote adjustments under load and can be equipped with facilities to monitor the condition of bearings. The latest innovation in this technology is the Modular NTM that incorporates a drive designed to disconnect unused stands from the mill when not needed, such as when rolling larger sizes.

This newly patented design from Siemens VAI provides advantages for maintenance, stand and guide setup, and size-change times. It also makes it possible to use the same rolling stands in any location from



Continuous universal mill at Corus Scunthorpe, U.K.

the pre-finishing mill through to the last stand of the Modular NTM, simplifying spares requirements.

The Vee Mini-Block is an innovative two- or four-stand mill expandable up to an eight-stand unit. It offers a host of benefits for rod and bar producers. In several installations, mini-block mills have increased productivity by as much as 50%.

The rod-reducing/sizing mill (RSM) can be installed after a conventional finishing block, thereby boosting mill productivity for small sizes by up to 60% and providing unsurpassed dimensional and metallurgical quality. The combination of advanced technologies allows very low temperature rolling to be performed, resulting in a more refined microstructure that can reduce or eliminate the need for additional processing steps for some products. Furthermore, the patented pass design enables true single-family rolling from the first stand after the rehear furnace to the last stand of the block ahead of the RSM. Used either with a conventional NTM or with the new Modular NTM, single-family rolling



Roughing and intermediate trains at Ferriera Valsabbia, Italy

significantly improves mill utilization and productivity, particularly when frequent size changes are needed.

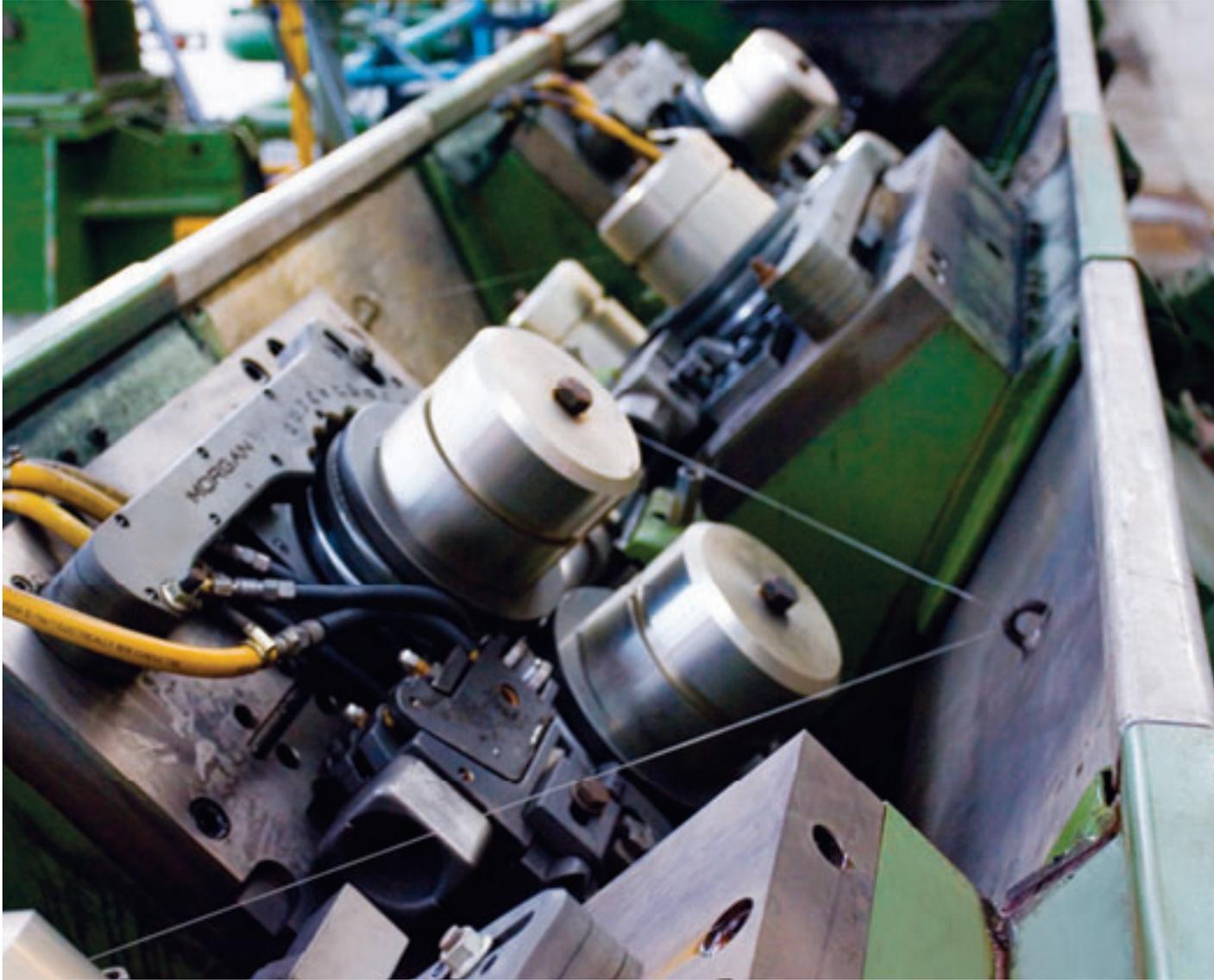
High-speed laying heads and pinch rolls

The laying head and pinch roll play a crucial role in the success of a high-speed rod mill. The equipment must be capable of high speeds with smooth operation, while simultaneously producing well-shaped rings correctly positioned on the conveyor. This calls for a precise mechanical system, accurate control and continuous monitoring. Siemens VAI pinch rolls and laying heads are engineered for sustained operation at high speeds and for highest flexibility to handle a large range of product sizes. The Siemens VAI laying head design with patented tail-end control helps improve the ring pattern on the conveyor for both small products at high speeds and for large products at lower speeds. It allows operators to increase production, improve yield and ensure consistent product quality.

Engineered for sustained operation at high speeds and for highest flexibility.

Stelmor controlled-cooling conveyor

The Stelmor cooling-conveyor system enables excellent metallurgical properties to be achieved during the controlled cooling process under a wide range of conditions. Forced-air cooling with high-capacity fans provides accelerated cooling rates and insulated covers enable retarded cooling. The system has the flexibility to create other combinations of natural and hybrid cooling. This enhances mill capability to produce a wide spectrum of plain carbon and alloy steels as well as stainless steel and other specialty grades, resulting in improved as-rolled rod properties. The traditional Optiflex system or the new patented Optimesh system assures excellent >>



No-twist mill at Tata Iron & Steel Co. Ltd., India

>> cooling uniformity in the fast cooling mode, advantageous for downstream processing.

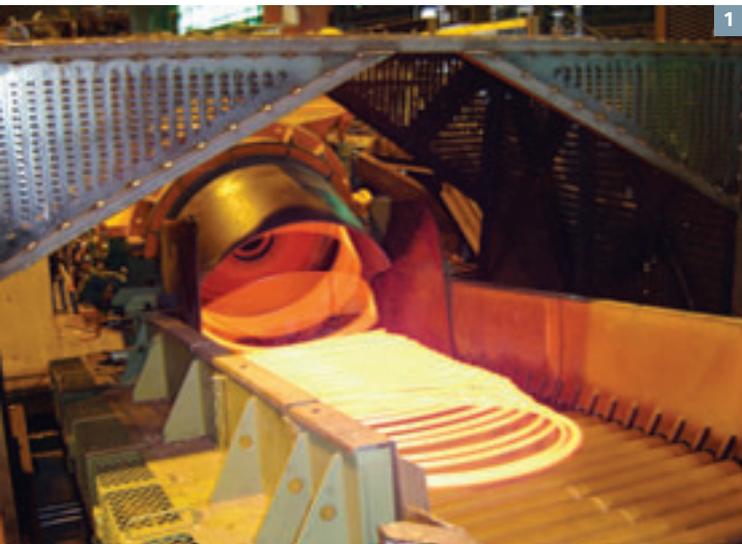
Ring distributor, coil handling and compactors

The patented ring distributor from Siemens VAI collects rings high in the reform tub using a rotating blade for optimal placement in the tub. This assures that the coils have very good payoff characteristics, which reduces tangles in wire-drawing operations. This system creates a denser coil package, helping with shipping and storing space while further reducing costs. Horizontal hook and vertical-pallet coil-handling systems are supported by a specialized mechatronic system that provides automated coil transport, customized coil distribution, and storage

that can maximize cooling time and product throughput. The versatile design of coil compactors in either horizontal or vertical configurations are available for binding with wire or strap and are designed for high reliability and low maintenance.

Bar-in-coil outlets

The Siemens VAI pouring reels, or Garrett coilers, enable the production of bar products in coiled form, typically for bar sizes from approximately 10–60 mm. Designed for a low foundation depth, these feature interchangeable entry spouts to accommodate a wide product-size range, and multiple pinch rolls to assist the bar into the tub and control tail ends.



1 High-speed laying head with tail-end control at Nucor Steel, Nebraska, U.S.A.

2 Bundling and tying area at Union Iron & Steel, U.A.E.



The bar-in-coil system allows ideal metallurgical and scale characteristics to be achieved.

The coiling line can be supplied with a new coil-handling system or interfaced with an existing vertical pallet or horizontal hook system. In addition to its ability to form well-shaped coils with excellent surface quality, the bar-in-coil system allows ideal metallurgical and scale characteristics to be achieved. Blowing stations and insulated tunnels are available for versatility in metallurgical processing, from slow to accelerated cooling.

Bar-spooling outlets provide twist-free coiling of bars with diameters up to 32 mm, resulting in very compact coils. This not only benefits transportation and storage operations, it also makes the decoiling operation easier.

Bar cooling and finishing

To increase the rolling rate of small-size rebars, Siemens VAI offers high-speed bar-delivery systems such as the Rotary Entry System (RES). RES comprises a pair of rotating drums for each strand, with a guide pipe in each quadrant of a drum that indexes the bar after it is braked by the high-speed pinch rolls located before the cooling bed. Full mechanical-component standardization of the cooling beds ensures high equipment availability and performance. For special applications, the cooling beds are provided with slow cooling using insulated covers, or forced cooling with water-spray systems or water tanks.

From cutting to length, counting and bundling, the entire system promotes a smooth final production process. Automated counting of all types and sizes of bars moving from the cooling bed to the bundling station assures accurate and complete order fulfillment.

Cutting, straighteners, stackers and pre-cambering

Application of a high-speed shear eliminates oversized front and tail ends, reduces wear and impact stress on downstream equipment, automatically trims the uncooled product and can increase product yield. Siemens VAI designs flying- and static-type hot and cold shears equipped with a clutch and brake or direct drive to produce precise end products. Whether pendulum, rotary, crank, or convertible, they can crop, divide, emergency chop and sample. When end deformation is critical, abrasive and metallic disc saws equipped with automated dust-removal systems are available.

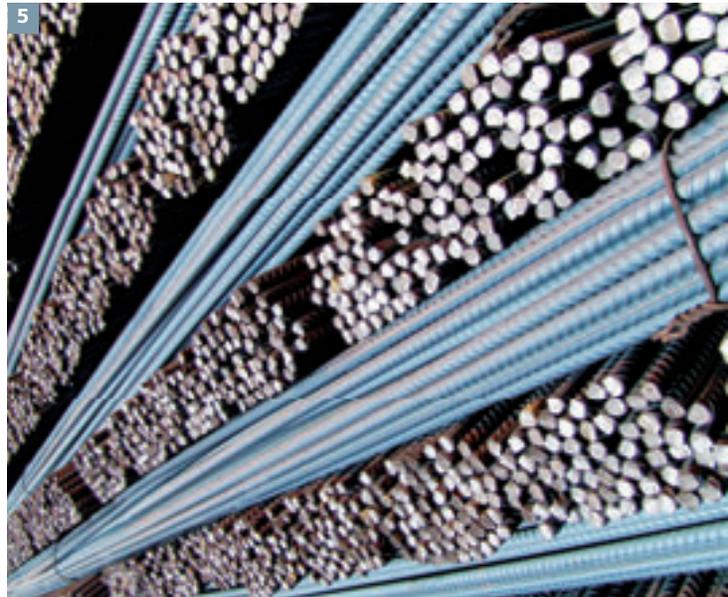
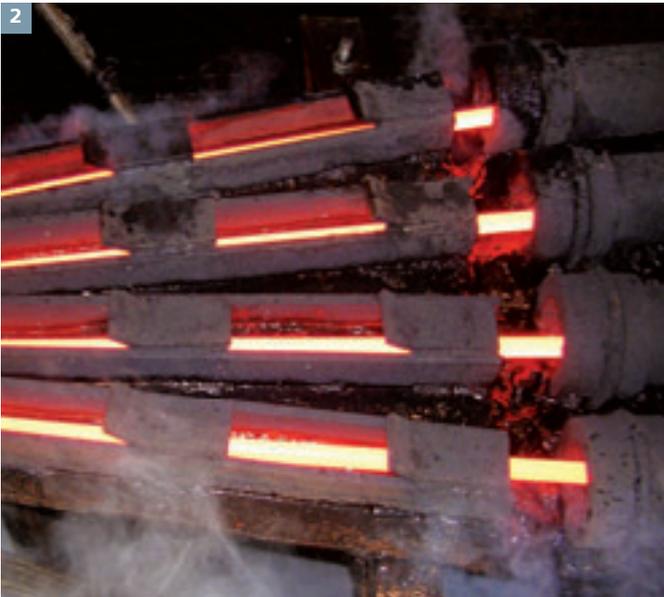
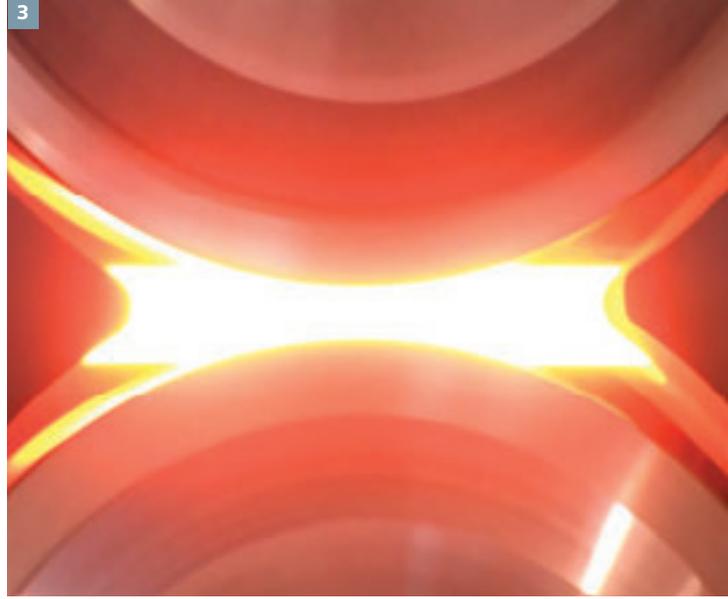
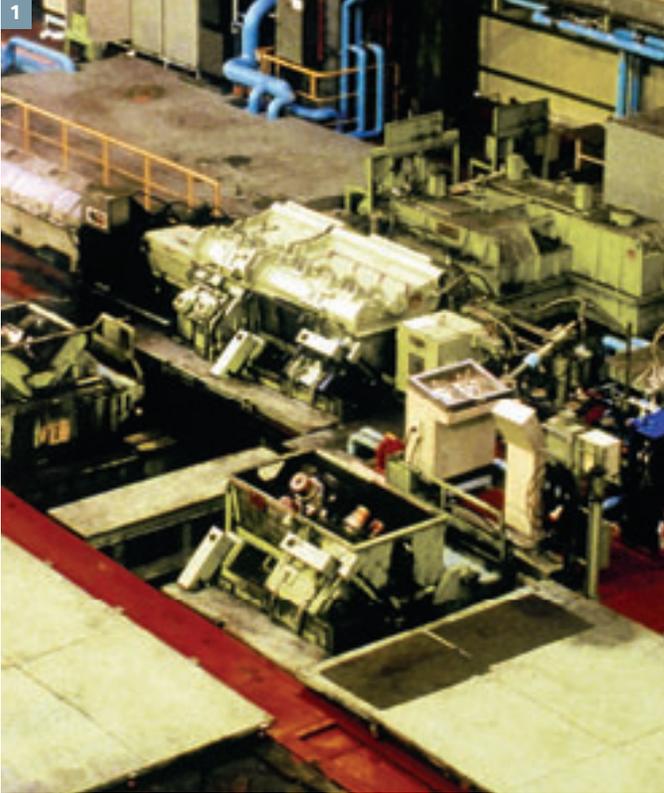
Multi-strand in-line bar straighteners equipped with independently adjustable rollers and quick cassette change assure close straightness tolerances. Stackers suited to handling straight and reverse layers are available for all types of sections.

Pre-cambering devices are specifically designed for rails at the entrance of the cooling bank. Pre-camber geometries are calculated as a function of various rail parameters and cooling models.

In-line thermal processing

Well-proven water-cooling systems from Siemens VAI can substantially enhance mill operations, from >>

COVER STORY >



- 1 Rod-reducing/sizing mill, POSCO (Pohang Iron & Steel Co.), Korea
- 2 Slit rolling at Habas Aliaga, Turkey
- 3 Well-engineered mills for precision rolling
- 4 High-speed cooling bed with rotary entry system (RES) at Tata Iron & Steel Co. Ltd., India
- 5 Stacked bundles of rebars ready for dispatch, United Steel Industrial Company, Kuwait

>> improved utilization to better product quality. Available cooling elements include the popular split-nozzle design to ensure excellent alignment for high-speed rolling and easy cleaning and checking for clearance in the pass line. Water-cooling boxes are available in several lengths and arrangements depending on cooling needs, and are available as traversing units to enable very fast nozzle-size changes.

Water-quenching systems efficiently cool ribbed products in straight lengths or in coil form to meet virtually any specification for quenched and tempered rebar. The systems increase yield strength and can eliminate expensive post-rolling treatment, such as cold drawing and stretching.

The Morgan Enhanced Temperature Control System (METCS) monitors and controls the stock temperature to ensure that the correct mechanical and metallurgical properties are obtained accurately and consistently throughout the process. By monitoring product speed and temperature, along with cooling-water pressures and temperatures, the system provides real-time feedback for closed-loop control of cooling zones, from the furnace exit to the laying head or cooling bed.

Metallurgical processing flexibility is becoming increasingly important for specialty steel and cold-heading-quality producers. Thermomechanical Rolling (TMR) refines the product microstructure so that it has superior as-rolled mechanical and metallurgical properties. This eliminates or significantly reduces subsequent downstream processes that decrease the conversion costs for specialty grades. Siemens VAI offers an engineered combination of components designed for high rolling loads together with a well-engineered mill layout with sufficient cooling capacity and metallurgical support services. This makes thermomechanical rolling at low temperatures a practical production process.

Metallurgical processing flexibility is becoming increasingly important for specialty steel and cold-heading-quality producers.

Mill automation, process control and mechatronics

A state-of-the-art rolling mill requires more than just first-class components. It necessitates a profound understanding of the interrelated processes

to create a customized solution that meets all production and quality needs. A full array of integrated automation systems from Siemens VAI, complemented by mechatronic packages, assure reliable mill functionality, flexibility and ease of use. This is the basis for automated control of roll-stand changes, roll parting and drive systems, direct interface to the mill-control system, integrated tension control, an easy-to-navigate HMI interface for plant operators, and full local and remote-control options. It also includes mill management, supervisory and control systems as well as self-learning process models for the reproducible manufacture of steel products of defined quality. Application of MES (Manufacturing Execution System) solutions enables optimized production planning with a minimum number of rejects.

A state-of-the-art rolling mill requires a thorough understanding of the interrelated processes.

Rounding things off

Siemens VAI services for long rolling help to keep producer's facilities up and running with a well-designed service concept that also includes around-the-clock plant monitoring. Dedicated specialists respond quickly and follow up until problems are resolved. A worldwide network of warehouses and sales offices provides access to the most critical spare parts, typically within a day. Service support also extends to the installation of the latest equipment designs, automation modules and media systems to ensure optimal mill performance. Highly competitive solutions for any guiding requirements are also provided.

The completely integrated product, system and support portfolio from Siemens VAI provides verifiable results for optimized mill performance and product quality. From high-speed production and the fastest product-changeover time to precise microstructure qualities, Siemens VAI offers the right solution for all long-rolling requirements. ■

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Belt conveyors have proven to be the most efficient and cost-effective method of moving bulk solids in mining operations. Regardless of the distance, the volume or the type of terrain, thanks to detailed planning with state-of-the-art simulation tools, Siemens provides its customers with a solution that saves money over the entire life cycle. High-quality components and Siemens involvement from start to finish ensure the best solution possible. After commissioning, Siemens also offers trend-setting maintenance plans to protect the investment over the long term.

The belt is one of the most expensive items for a conveying system to transport bulk material. Depending on capacity, length and the topography, a conveyor belt can easily make up 30% or even more of the investment costs of a conveyor system. In recent years, system designs have become more complicated with increased distances between the axes on long-distance belt conveyors, higher belt speeds, and more challenging routes with horizontal and vertical curves. Despite the high initial investment costs, in day-to-day operations, and especially in the face of increasing energy prices, no other transportation medium comes close to the cost effectiveness of belt conveyors for transporting large amounts of bulk material over long distances.

To ensure that belt conveyors maintain their cost effectiveness well into the future, a robust design is needed that allows for high levels of plant availability, high productivity, low training costs and a long service life. Further considerations include a low-wear design to extend service intervals and reduce the costs associated with spare parts and operation. The answer is Simine^{CIS} CON, the collective name for Siemens drive-system solutions for conveyors, which includes mechanical and electrical solutions for outstanding overall conveyor performance with both fixed-speed and variable-speed drives. Automation control is also part of the package.

Leaving nothing to chance

Only a good design can ensure system longevity. This begins with determining the optimal width of the belt, depending on conveyor inclination, the weight and size of the bulk material and the speed. The dimensioning in accordance with DIN 22101 is the basis for the planning of a belt conveyor.

But this is only the first step in the design process. >>



Innovative bulk-material handling solutions from Siemens

Simulation Protects Investment





Especially for complex belt conveyors, simulation performed ahead of time ensures reliable operation

>> All conveyors designed by Siemens – whether for use in an open-pit mine or for a complex stockyard or for long-distance conveyors uphill or downhill – are further analyzed and optimized using computer simulation. In the case of more complex installations, the simulation also serves as a basis to predict dynamic behavior. With the methods of operational research, decision-making duties are given to the dispatcher to recommend optimized scenarios. The control system is also able to take over automation tasks via an on-line service. A further goal of the simulation includes the de-bottlenecking of complex stockyards. Especially for complex belt conveyors – those which operate at a positive or negative incline or with vertical and horizontal curves – simulation performed ahead of time ensures reliable operation.

Using fully developed and realistic dynamic simulation models, the drive configuration of the belt drives is tested so that all start and stop periods are mastered. Special attention is paid to safety-relevant operating conditions, such as conveyor performance during emergency stops, unacceptable conditions for the drives, gears and belt, sufficient braking power and whether safety considerations are adequately assessed.

Altogether, simulation enables all possible operating scenarios to be considered and is therefore an important method for designing innovative belt conveying systems in a short period of time. This greatly minimizes the chance of unpleasant surprises during real operation of the conveyor. Throughout the planning phase, all variables are

tested in the simulation, which results in an optimal design.

Siemens experts use the simulation as the basis for basic and detailed engineering. In the framework of detailed engineering, the exact components as defined in the simulation are added to the bill of material. The highly innovative simulation model is used to optimize system design, which ensures functional capability, reduces capital expenditures and contributes to energy-efficient operation. During the operation phase, the simulation model supports the decision-making process of the operator in critical situations by providing information about different scenarios.

Siemens' approach as general contractor, taking over responsibility for the entire project from planning and design to commissioning, reduces complexity by having fewer interfaces and provides a consistently integrated technological solution from one source. In contrast to classic OEMs, Siemens uses only equipment – such as converters, motors, gears, drives, automation systems, switchgear and transformers – that is designed and produced by Siemens. All other components, such as drums, rolls, belts and steel structures, are procured in the market. Even after commissioning, Siemens service teams ensure plant availability and maintenance for longevity. ■

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Customized modernization solutions for Simine^{CIS} Mill GD

Fit for the Future

Siemens is continually working on the development of innovative modernization solutions for Simine^{CIS} Mill GD (gearless drives) to ensure the longest possible life cycle and availability for this key component of mining operations. The introduction of the newly available Sinamics control for the cycloconverter will be the cornerstone of various modernization projects worldwide.

Usually the grinding mills are the “bottleneck” of a mine, so reliability and availability of the mills are of paramount importance. With more than 30 years’ experience in design, planning and building of reliable gearless drives for mining operations and more than 35 installed mills, Siemens has developed modernization packages to improve the life cycle and availability of the installed Simine^{CIS} Mill GD.

With the application of innovations and new ideas, the Simine^{CIS} Mill GD standard for gearless drives has been continually improved over the past decades in terms of higher availability, productivity and efficiency. These innovations, including significant and rapid advancements in the area of electronics and computer technologies that have impacted the control technology employed in Simine^{CIS} Mill GD, will be made available for existing systems with modernization packages. The Siemens modernization concept for Simine^{CIS} Mill GD makes it easy to modernize the mill step by step, as new and old systems can be operated in tandem. This enables investments to be stretched out over time.

Thanks to the extremely rigid, reliable and robust design of motor and transformer and an optimally designed modernization package for the drive system, further significant savings for the modernization investment can be achieved due to the reuse of motor and transformer.

Selection of a suitable modernization strategy

Special emphasis should be placed on selection of a suitable modernization strategy. One important goal

is to identify obsolete parts of the mill with significant problems based on the availability of essential spare parts. Optimization of mill downtime is the next essential aspect of every modernization. Using a step-by-step process, it can be implemented over several standard downtimes of the mill as follows: first, replacement of the automation and visualization system; second, replacement of the technological drive control

Thanks to the newly installed equipment from Siemens, it is now possible to control the gearless ore mills more flexibly.

system; and, finally, replacement of the power section of the cycloconverter. Furthermore, the following will optimize downtime: pretested components and a final system test, use of standard packages with minimal delta engineering, and reuse of existing I/Os to avoid rewiring, or as an alternative, adapter plugs for reuse of Simatic S5 plugs on new ET200 systems (installation of new I/O cards but no need for rewiring).

Modernization of the technological drive-control system

In older Simine^{CIS} Mill GD installations, the existing drive systems, analog or early digital closed-loop control systems such as Simadyn C/D are the weakest link in the control chain. If these systems are replaced with

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Modernized gearless drive mills at Codelco's Chuquicamata copper mine in Chile

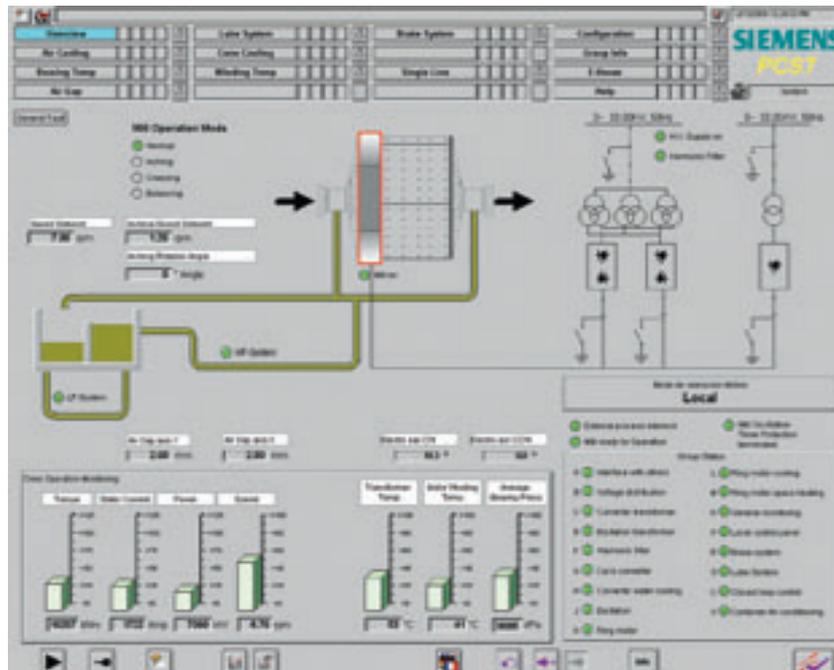


Fig. 1: Main PCS7 overview screen of the Grinding Mill system

>> modern digital closed-loop control systems, greater precision, better resolution of actual values and greater chronological control constancy are achieved. A complete new control cubicle for the cycloconverter based on the new Sinamics drive family is now available and ready to replace the old Simadyn-based control cubicle. Besides the optimized switchover due to the 1:1 compatibility with the remaining power section of the cycloconverter, the new Simatics solution leads to improved diagnostic and maintenance possibilities thanks to a standardized engineering and diagnostic interface for the complete Sinamic drives family.

Modernization of the automation and visualization systems

For the migration of the automation system the Simine^{CIS} Mill GD standard software for automation and drives will be the basis for all mills. Thus the old automation systems, mainly Sinamic S5 as PLC and Coros as visualization system, will be replaced

Modernization can be implemented during a standard downtime for a necessary liner exchange

with Sinamic S7 and PCS7. The modernization of the automation system will lead to a significantly improved visualization and message system and thus advanced possibilities for fault diagnostics.

Reuse of the main equipment and service contracting

Siemens delivered the first gearless drive motor for mills in 1972. It is still in operation. Recently, a motor from the early 1980s was disassembled and rebuilt at a new mine in Australia. This shows that there is no need to replace the motor and transformer, thanks to the optimized designed-migration package for the drive system, which leads to significant savings for the necessary modernization budget.

The standard service contract for Simine^{CIS} Mill GD drives is the right choice to ensure the highest possible reliability and availability for the remaining equipment as well as the newly modernized equipment. Especially for remaining equipment such as the motor, a service concept with preventive maintenance is essential for ensuring highest reliability and availability over the coming decades. In addition, modernization add-ons like a high-speed data recorder and a newly available remote diagnostic feature ensure the best possible and fastest

support from highly qualified engineers from the Metals & Mining Support Center in Germany. This applies equally to remote mines.

Modernization of gearless drive mills at Codelco

Codelco (Corporación Nacional del Cobre de Chile) owns around one-fifth of all the copper deposits in the world and operates several mines in Chile. Currently eight gearless drives are in operation at mines in Chuquicamata, El Teniente and Andina. Siemens has a long tradition of continual support of the largest copper producer in the world with modernization solutions. Since the first modernization of a gearless drive mill in 1992, Siemens has successfully performed several modernizations, mainly for the electrical portion of the mill (automation and control of the cycloconverter). Siemens also recently modernized several Simine^{CIS} Mill gearless drives at Codelco.

The first such modernization was performed in Codelco's Chuquicamata mine in 2007. The largest open-pit mine, with an annual production of around 600,000 metric tons of copper, Chuquicamata is located 1,650 km north of Santiago de Chile at 2,870 meters above sea level. Thanks to the newly installed equipment from Siemens, it is now possible to control the gearless ore mills more flexibly. A new line of controllers based on the Simatic S7 PLC and Simadyn D (32-bit) automation modules ensures optimum acceleration and braking as well as precise stopping of the mills. In the newly available creep mode, the mills can be positioned without time-consuming test runs. As a result of the new modes, mill operation can be adapted to different material characteristics. In addition, the new closed-loop control system will make operation highly energy efficient. The local conversion work took less than ten days.

In the wake of the successful implementation in Chuquicamata, Codelco placed further modernization orders based on the highly adaptable and proven Simine^{CIS} Mill modernization solutions. Just one year ago a gearless drive mill at the El Teniente mine was modernized. Once again, a downtime of less than ten days was needed to install the new equipment. This shows that the modernization can be implemented during standard downtime for a necessary liner exchange – no need for additional downtime for the modernization. Currently a modernization for a gearless drive of the mill at the Andina mine is in progress. ■

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Electrical equipment for shaft-winding installations in Chinese hard-coal mines

A Success Story From the Far East

The performance of the shaft-winding system is a crucial factor affecting the efficiency of a mine because the shaft is the bottleneck. This is why coal-mine operating companies are increasing the power and efficiency of the hoisting equipment and thus the winding capacity. To date, Siemens has delivered more than 900 mine winders worldwide.

MINING >



From the 1900s to the 1930s, DC motor-generator sets represented the state of the development of large hoisting equipment. Since then, Siemens has played a key role as the technical development leader of the automation control and drive system. From the 1980s when Siemens entered the market in China to the present, the total number of installed winders is more than 80 and there are nearly 10 new winders per year.

Siemens is one of the few suppliers in the world that offers all four different drive and converter combinations for shaft-winding installations. They are distinguished by the design of their motors (integrated or conventional) and by the type of converter used (cycloconverters or voltage-source DC link converters). The integrated machine consists of a synchronous motor with a rotor built into the friction drum. This model has proven its value in many mines for over 30 years and is mainly used when space in machine rooms is restricted and when a uniform, symmetrical loading of the whole installation is required. In a conventional winder, the motor is flanged onto the side of the rope drum. The result is that the bearings are subjected to more one-sided stress.

Innovative DC link converters

For the converters, the selection criteria are somewhat more complex, depending not only on the existing power supply networks and ambient conditions but also on the investment costs. If maximum performance is required with low investment costs, the cycloconverter is usually the first choice. Thanks to its method of air cooling, it adapts itself to any ambient conditions because it is not always an easy matter to install a water circuit in every mine.

Siemens is now expanding its range of high-performance variable-speed drives with the Sinamics SM 150

It is possible to operate the winder fully automatically and to monitor the movements in a control center.

DC link converter. The water-cooled multi-level converter supplies highly dynamic, regenerative synchronous motors with approximately 4–27 MVA of power. Its high output frequency – compared to previous cycloconverter solutions – enables a high motor speed

and ensures high reliability while causing fewer disturbances in the power supply. The converter uses IGCT (Integrated Gate Commutated Thyristor) power semiconductors both in the line-side active front end (AFE) and in the inverter on the motor end. In this technology, power semiconductors and the associated control system are integrated in a single unit. Low switching losses increase the total efficiency of the drive.

Technological control systems for shaft-winding tasks

Adaptations to the conditions in the shaft are possible with the appropriate technological control systems. They are built in such a way that they meet the applicable mining safety requirements and, at the same time, obtain maximum performance and efficiency for the mine. They control the entire winding cycle as reliably as possible. If irregularities occur, the safety brake is triggered immediately. The technological control systems are based on the worldwide standards of the Simatic S7 world, with continuous safety monitoring and interlocking circuits in two channels. Siemens is equipping all the winders with the Simatic S7-400 winder control system and Profibus DP communication. It can be configured quickly and easily and provides a high level of dynamic response and precision for complex control tasks. All movements in the shaft can be displayed on a visualization screen. It is possible to operate the winder fully automatically with all the loading and unloading functions and to monitor the movements in a control center.

Advanced technology in Chinese mines

With the advanced technology and production, Siemens China is offering the most optimized solutions including the standard and non-standard system of drive and winder technology control. Based on the actual requirements of each customer, Siemens systems reach the maximum production capacity to improve productivity and to reduce the cost of investment, operation and maintenance.

To facilitate domestic service, Siemens China set up business service centers in major cities including Beijing, Taiyuan, Zhengzhou, Hefei and Jinan. There are more than 30 experts in China who are responsible for sales, technical support, commissioning, training and after-sales service. They not only provide 24/7 online support; they are ready for on-site services at all times, and maintain the equipment regularly to make sure the winder is running in the best condition.

The Yankuang Group Corp. Ltd. with an annual hoisting capacity of more than 40 million tons, is one of China's leading coal producers. Because of the increasing demand in the country, Yankuang is currently >>



MINING >



Mine-winder installation at Hattorf, Germany

>> developing the Zhaolou and Wanfu mines in the Juye mining area. The coal reserves there have been estimated at more than 200 millions tons. For the Zhaolou mine, Siemens supplied the electrical equipment for two high-performance production winders in the main shaft and for the double-cage winder in the service shaft. The two production winders have a synchronous motor with a power of 4.0 MW and Simover ML2 type DC link converters. The cage machine is also equipped with an identical 4.0-MW drive. This allows the machine also to run in heavy-load operation without ballast in the counter cage.

In addition, the use of three identical drive systems simplifies the stocking of spare parts. The low-voltage energy supply and the automation engineering, including the safety systems, completes the supplied equipment.

The new drive system in Tunliu is characterized by its high efficiency and low maintenance costs.

The Shanxi province to the west of Beijing is a center for Chinese coal production. The Lu'an Mining Group operates several mines in Shanxi. At Tunliu mine, Siemens installed two winders with synchronous motors, each with a power of 4.0 MW and Simovert ML2 type DC link converters. The new drive system in Tunliu is characterized by its high efficiency and low maintenance costs. The supplied equipment also includes the energy distribution and automation engineering, as well as the safety systems. The production shaft of the Liuzhuang mine, north of Hefei in Anhui province, has an annual mining capacity of around eight million tons of coal. For the coal mine, Siemens supplied two six-rope winders with a diameter of 4,650 mm; these winders have integrated motors. The compact construction allows the two winders to be installed next to each other on one floor in the winder tower. The two winders have a power of 5.5 MW each and are fed by Simovert D type 12-pulse cycloconverters. Two operator consoles with a visualization system are provided for control and monitoring. The supplied equipment also includes high-voltage transformers, low-voltage switchgear and motor fans. For this project, Siemens was also responsible for the engineering, installation supervision and commissioning.

The operator control and monitoring includes a highly sophisticated visualization system.

Located in the province of Shandong in eastern China, the Shandong Yuncheng Coal Mine is set to produce 2.4 million tons of coal per year. The mine has one production shaft and one service shaft. The mine is scheduled to start production in spring 2010. For the new winders, Siemens is supplying the drives, the automation equipment including a safety system, and the braking systems. Each of the winders will be fitted with a 3.5-MW synchronous motor. For the power supply, DC link voltage converters of the type Sinamics SM150, each with an output of 10 MVA, will be used. Simatic S7-400 programmable logic controllers will form the brain of the automation system.

The Shandong Luneng Group is the leading supplier of electrical energy in Shandong province, which has approximately 93 million inhabitants. The company is involved in development of the Jinje coal mining region in the west of the province. In the future, 2.4 million tons of coal per year will be hoisted in the

Goutun mine. Siemens supplied and installed the electrical equipment for the two winders of the mine. The production shaft is fitted with a synchronous motor with an output of 4.2 MW, and the service shaft is provided with a motor output amounting to 1.3 MW. Medium-voltage Sinamics SM150 converters feed the motors with power while a special winder controller ensures safe and precision positioning of the cages. The mine winders are equipped with an effective and highly available drive solution. The operator control and monitoring includes a highly sophisticated visualization system. Siemens also supplied transformers, medium and low-voltage switchgear and the hydraulic brake system. ■



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The unique advantages of the selective waste-gas recirculation system from Siemens VAI offers a host of environmental and operational benefits

A Logical Solution

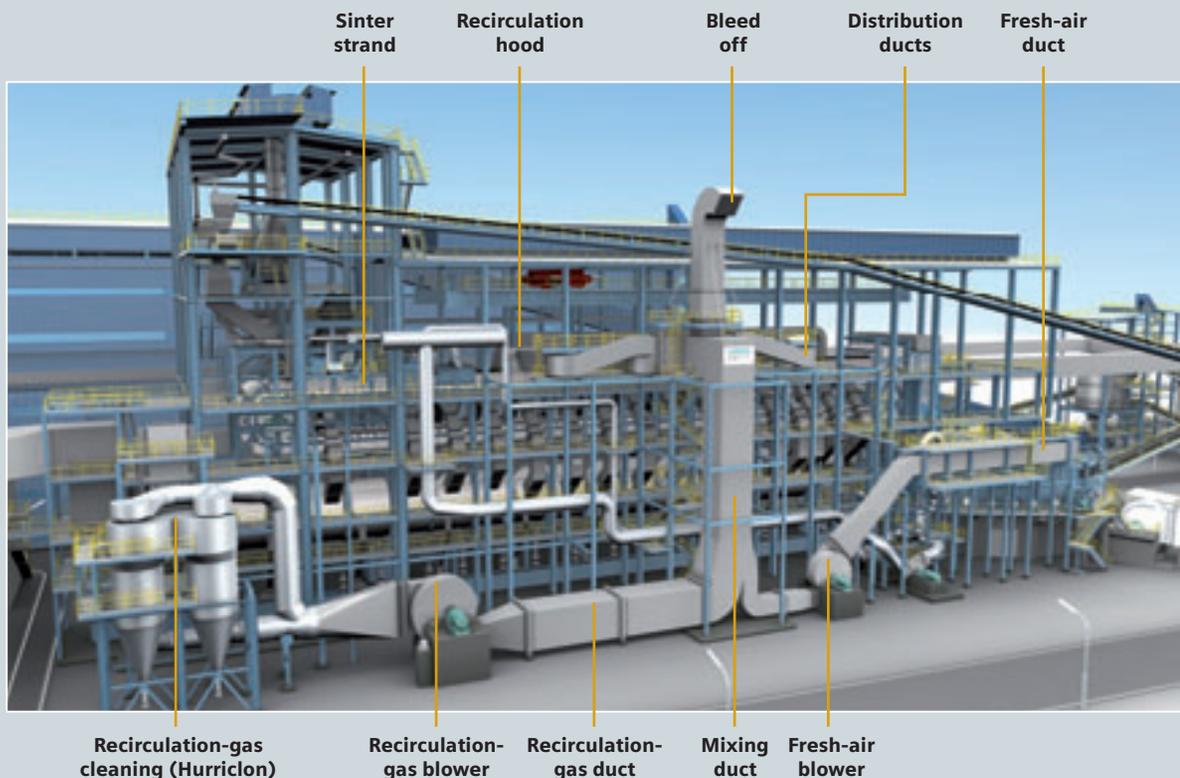
Siemens VAI offers a unique selective waste-gas recirculation system that allows sinter producers to flexibly exhaust the off-gas from selected wind boxes depending on environmental and operational considerations. With off-gas recirculation to the sinter strand, it is possible to expand sintering capacity without increasing the quantity of off-gas emitted to the environment. This process also reduces the consumption of solid fuels required to combust the sinter mix by using the latent heat of the recycled off-gas and additional post-combustion effects.

Traditional sinter waste-gas recirculation systems offer only limited flexibility for producers because a portion of the total volume from all of the wind boxes is recycled to the process. This type of system is not capable of separately exhausting wind boxes with higher emission concentrations. A “golden opportunity” is thereby lost to maximize potential environmental benefits through the application of sinter waste-gas recycling technology.

Logical and effective

In the selective waste-gas recirculation system from Siemens VAI, the gas flow for recirculation purposes is taken only from selected wind boxes with relatively high concentrations of certain gases, dusts and pollutants such as dioxins, furans and heavy metals. Depending on the composition of the sinter mix and other operational factors, the preferred section along the sinter strand for off-gas extraction may vary. Most

Main equipment of the selective waste-gas recirculation system



emission values reach their peak or are at high levels in the burn-through zone of the sinter bed where the exhaust-gas temperature shows a steep incline. Accordingly, the wind boxes are usually selected for waste-gas recycling where the burn-through zone is near the bottom of the sinter bed, typically located in the latter section of the sinter-strand length. The off-gas flow from the individual wind boxes is directed either to the stack or recycled to the sinter strand. In this way, an optimized gas recirculation can be assured with respect to operational requirements and maximized recycling of dusts and pollutants back to the sinter strand. It is this unique aspect of the Siemens VAI solution that distinguishes this process from all other off-gas recirculation systems.

Environmental benefits

As a direct result of the recirculation of sinter waste gas to the sinter strand, the specific concentrations of dusts, combustion products, SO_x, NO_x, VOCs and heavy metals eventually released to the environment through the stack are notably reduced. Sulfur dioxide (SO₂) contained in the recirculated waste gas is largely trapped during its passage through the sinter bed – the higher the basicity of the sinter, the more SO₂ that is bound in the sinter bed.

The concentration of harmful volatile organic compounds (e.g., dioxins and furans) – resulting from volatile organic material present in the coke breeze and oily mill scale – gradually increases along the sinter strand towards the burn-through point. The compounds peak just before they reach this point and are then destroyed by the prevailing high temperatures. When they enter the sinter bed via recirculated gas, they are effectively destroyed as they pass through the flame front. The levels in the partial flow to the stack are thus drastically reduced.

The consumption of coke breeze for combusting the sinter mix is reduced by up to 10% due to the recirculation of hot waste gas augmented with hot off-air from the cooler for oxygen repletion purposes. This also reduces sinter cooler dust emissions. CO, which is formed during the sintering process, comprises approximately 1–2% of the recirculated gas. It is post-combusted in the burning zone of the sinter bed, saving additional solid fuels and reducing CO₂ emissions.

Operational benefits

The sinter output in existing plants can be increased by up to approximately 30% without an increase in the quantity of off-gas emitted to the environment with the installation of a selective waste-gas recirculation system. Existing downstream off-gas treatment equip-



Selective waste-gas recirculation system under construction at Dragon Steel, Taiwan

ment does not have to be modified. Alternatively, the specific off-gas volume in new sinter plants can be lowered by roughly 40% with selective waste-gas recirculation. This means that downstream waste-gas-treatment facilities (collecting mains, fan, waste-gas cleaning, stack diameter and height) can be dimensioned smaller with the associated investment and operational-cost savings. Occasional concerns that there might be a loss in productivity and sinter quality as a result of the physical (e.g., dust, temperature, viscosity) and chemical (oxygen content) properties of the recycled gas can be overcome with the installation of a recirculation gas blower with sufficient suction pressure.

Industrial applications

A selective waste-gas recirculation system was first implemented by voestalpine Stahl and Siemens VAI at the steelworks of the former company in Linz, Austria. The specific amounts of dust and pollutants, including SO₂, NO_x, PCDD/PCDF, heavy metals, alkalines and chlorides, were considerably reduced in comparison with previous sinter-plant operations (see *metals&mining* Nr. 2|2008 for quantified results). Siemens VAI is currently installing a larger-scale waste-gas recirculation system at the Taiwanese steel producer Dragon Steel Corporation, which is expected to go into operation in late 2009. ■

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Blast furnace rebuilds at Corus, U.K. and CSN, Brazil

In Record Time

The blast furnace business sector of Siemens VAI has been a leading supplier of blast furnaces for more than 100 years. Supply includes the related engineering, technology, equipment and systems. Around 185 new blast furnace projects in addition to many more rebuilds have been implemented to date. In the following, two blast furnace rebuild projects are outlined – one was completed within a year and the other had an outage time of just 98 days. The project targets were fully met without compromising safety or quality.

The end of a blast furnace campaign is an ideal time to consider implementing improvements, equipment and system replacements – even complete rebuilds – to meet the stricter demands with respect to performance, fuel consumption, hot-metal quality, reliability, environmental aspects, safety and, of course, costs. All related work, including relining activities, must be done rapidly and professionally to minimize production loss.

At Corus Port Talbot an entire blast furnace rebuild program, from enquiry to blow-in, was completed in less than 12 months. In a rebuild project at CSN, the 24-month program was designed to limit the outage time to 98 days. This underlines the importance of plant-building know-how, precise product coordination and the application of modular design and construction techniques.

Corus Port Talbot No. 5 Blast Furnace rebuild

Two blast furnaces (No. 4 and No. 5) are in operation at the Corus Port Talbot site in the U.K. The No. 4 Blast Furnace has an inner volume of 2,491 m³ and a daily output of approximately 5,000 tons. It features a modern tower-type structure following a rebuild carried out by Siemens VAI in 1992. The No. 5 Blast Furnace,

with an inner volume of 1,984 m³, was of the original Lintel design, although it had been repeatedly rebuilt since it was commissioned in the late 1950s.

Following an incident in November 2001 that resulted in severe damage to Blast Furnace No. 5, the furnace had to be completely rebuilt. Corus required that the process of replacing the furnace had to be carried out as quickly and efficiently as possible, with the aim of minimizing the unexpected loss in production. In order to keep engineering time and costs as low as possible, it was decided that the furnace should be rebuilt with a design similar to the No. 4 furnace, as the drawings and specifications were already available.

Corus selected Siemens VAI as its partner in an ambitious project to jointly reconstruct and commission the new furnace. The required equipment and materials were manufactured, delivered and installed, and the blast furnace was completely rebuilt and started up in less than 12 months following the commencement of this challenging project. The original Lintel design was replaced with a free-standing tower design and the daily output could be increased by more than 30%. With the use of advanced refractory materials, such as super-micropore carbon and improved design features, the blast furnace campaign life is expected to exceed 15 years. >>

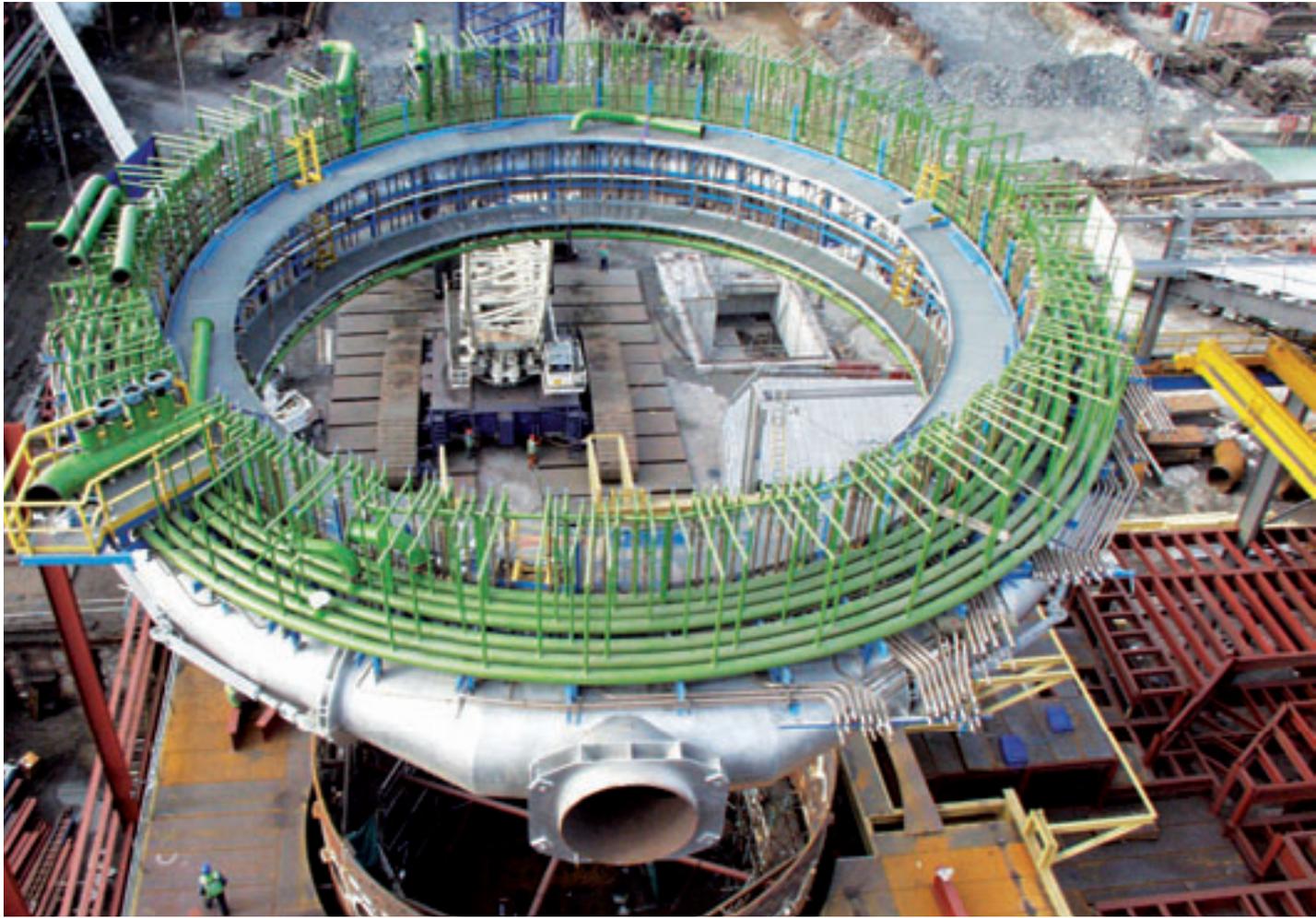
Comparison of furnace parameters before and after rebuild of Port Talbot BF No. 5

| Parameter | Before rebuild | After rebuild |
|--------------------------------|--|---|
| Inner volume (m ³) | 1,984 | 2,491 |
| Furnace production (t/day) | 3,500 | 4,570 average, 5,470 max. |
| Number of tuyeres | 24 | 30 |
| Furnace cooling | | |
| Hearth | Spray cooling | Spray cooling |
| Bosh | Copper cooling plates | Copper cooling plates |
| Gas-cleaning plant | Three-vessel conditioning tower, annular-gap scrubber and demister | Combined conditioning tower and Davy cone annular-gap scrubber with external demister |



Application of modular construction techniques dramatically shortened rebuilding time of the No. 5 Blast Furnace at Corus Port Talbot

IRONMAKING >



Preassembled
bustle main



Rebuilt No. 5
Blast Furnace at Corus
Port Talbot

>> **CSN No. 3 Blast Furnace rebuild**

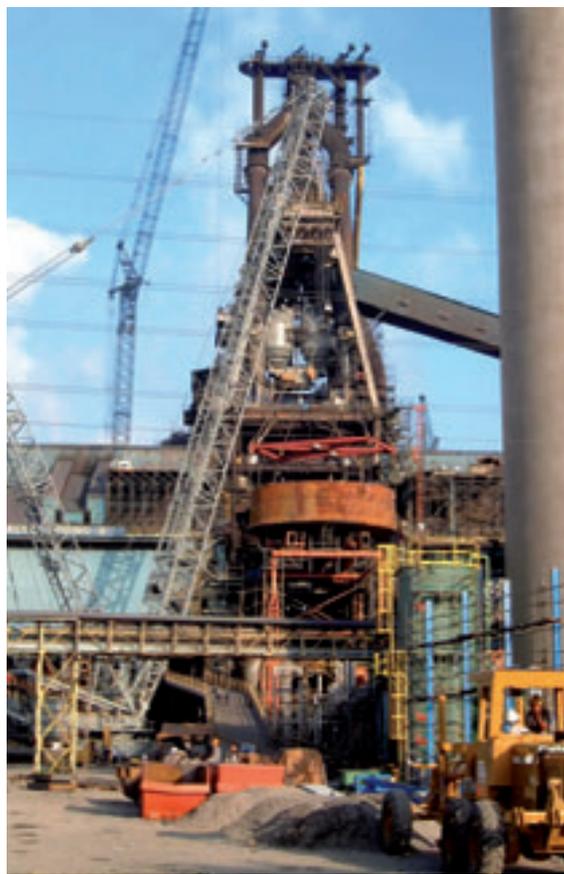
The No. 3 Blast Furnace of CSN (Companhia Siderúrgica Nacional) is in operation in Volta Redonda, Brazil. It was originally designed by Nippon Steel and commissioned in the mid-1970s, with a subsequent rebuild in 1986 and relined in 1996. In 2001, the furnace had reached the end of its campaign life. With the aim to increase capacity, boost productivity and to achieve a new campaign life of 20 years, Siemens VAI was appointed to enhance the design of the furnace. The rebuild project was executed on a turnkey basis by a consortium of companies lead by Siemens VAI. The key responsibilities included project management, engineering, equipment supply, civil works, testing, commissioning, start-up and operational assistance.

The existing hot-blast stoves could be reused. A new bustle main and tuyere stocks were installed. The furnace hearth was newly designed and outfitted with micropore carbon refractory bricks and a ceramic cup to ensure a longer operating campaign. Additionally, the furnace hearth was deepened to minimize erosion. The existing cast-house floor was furnished with new iron and slag troughs. The fume-extraction system was modified for higher efficiency. The gas-cleaning plant was equipped with a new three-cone gas-cleaning system with an external demister. Mechanical equipment in the stockhouse had to be refurbished and repaired. Finally, the previous electrics and control systems were upgraded to the latest standards.

During the construction period, up to 1,800 people worked on day shift and 800 on night shift throughout the rebuild period with no serious accidents. This allowed the construction phase to be completed in a record time for a large furnace rebuild in Brazil. An average daily production of 9,400 ton/day was achieved after only 15 days of operation.

Factors for success

Decisive for the rapid completion of the above rebuilds was the application of modular building techniques. Both projects were highly successful and the project targets were met. These remarkable achievements are



Rebuilding of Blast Furnace No. 3 at CSN, Brazil

also attributable to the excellent communication and coordination throughout the project, strict project management, dedicated partnership and teamwork as well as the employment of lean manufacturing methods. This ensured that the delivery time of key components to the site could be kept to a minimum, allowing production and profitable operations to start as quickly as possible. ■

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Comparison of furnace parameters before and after rebuild of CSN BF No. 3

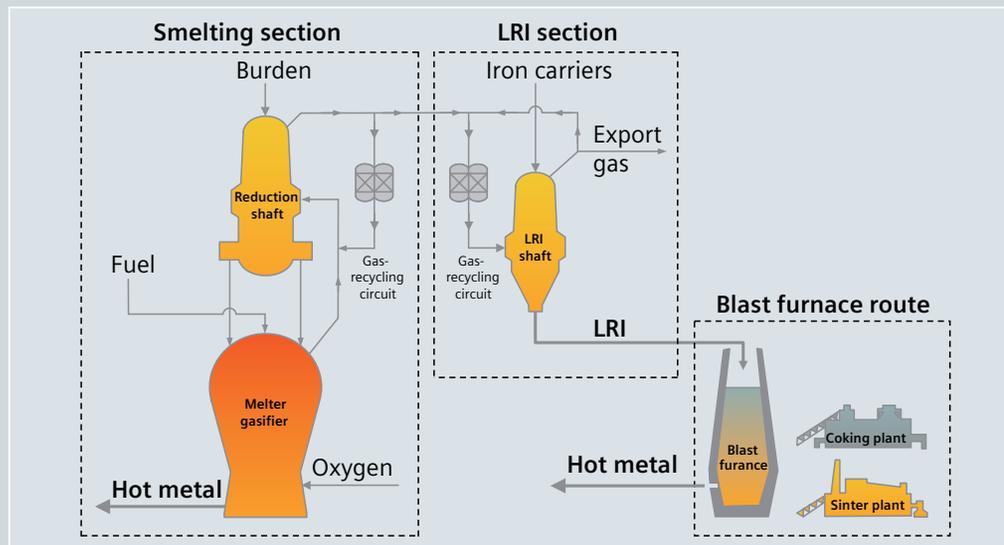
| Parameter | Before rebuild | After rebuild |
|----------------------------|--|--|
| Inner volume | 3,815 m ³ | 4,247 m ³ |
| Furnace production (t/day) | 8,700 | 9,400 average, 11,000 max. |
| Coke rate (kg/t hot metal) | 340 | 320 |
| Number of tuyeres | 34 | 38 |
| Furnace cooling | | |
| Hearth | Spray cooling | Spray cooling |
| Bosh | Plate cooling | Copper-stave cooling |
| Gas-cleaning plant | Two-stage Venturi scrubber with septum valve | 3-cone annular-gap scrubber with external demister |

A new Corex process variant offers exciting perspectives for blast furnace operators

Corex LRI – A Whole New Ball Game

Steel manufacturers are regularly confronted with challenges in a dynamic market where even short- and mid-term fluctuations can have a dramatic impact on production and profit. Flexible and cost-effective solutions are therefore required at each step of the iron and steel production route to remain competitive and successful. This article outlines a completely new application of Corex ironmaking technology referred to as Corex LRI (low-reduced iron). It allows existing blast furnace operators to benefit from the well-known economical and ecological advantages offered by Corex.

Flow sheet of the Corex LRI process route



IRONMAKING >

The gradual and inevitable depletion of raw materials leads not only to price increases, it also means supply bottlenecks. This is true for coking coal and also for natural gas where limited supplies are increasingly being required to meet public demands for power generation, heating and fertilizer production, etc. Additionally, environmental care, which is not just limited to the reduction of greenhouse-gas emissions, has become a major economical driving factor. Ever-stricter emission regulations require operators to revise existing production routes or even terminate processes that are not compliant with environmental demands. Technical solu-

tions are called for that enable steelmakers to better meet these challenges.

Partial recycling of export gas to the Corex process

The traditional Corex process is based on the smelting reduction of lump ores and/or pellets directly using coal instead of coke. The exclusive use of oxygen for coal gasification creates a valuable export gas that is ideally suited for the generation of electrical energy as applied at Jindal South West Steel (JSW Steel) in India, Posco Pohang Works in Korea and at Baosteel in China.

Another possibility to utilize the export gas is partial recycling back to the process to fulfill its pri-

mary metallurgical purpose of ironmaking. In Corex variants with the partial recycling of export gas, CO₂ is removed from the gas stream, thereby enriching the CO and H₂ concentrations. This gas is then effectively reused for ore reduction in the reduction shaft. This enables a more efficient Corex

Gas recycling is an important step towards achieving notable fuel savings.

plant operation with a decreased energy demand on the melter gasifier that lowers the consumption of coal and oxygen accordingly.

The remaining diminished quantity of export gas with a lower heating value can still be used to generate electricity. An advantage of this process variant is that



ArcelorMittal South Africa is the first industrial producer to take advantage of a combined Corex plant and downstream Corex-gas-based direct-reduction plant to maximize gas utilization for ironmaking

gas recycling can be flexibly and steplessly regulated by the operator to either minimize carbon consumption or maximize the quantity of export gas, depending on the requirements of the steelworks.

Use of Corex export gas to generate additional DRI

Already in 1996, the steel producer Saldanha Steel, now a company of ArcelorMittal, recognized that export gas can be used to separately produce DRI (direct-reduced iron). The traditional Corex process was augmented with a gas-preparation plant and a downstream Corex-gas-based direction-reduction shaft. In this process combination a single melter gasifier pro-

vides the process gas needed to efficiently operate the Corex reduction shaft and a second reduction shaft to produce additional DRI as a supplementary product to the hot metal tapped from the melter gasifier.

Boosting blast furnace performance with Corex LRI

Siemens VAI has developed a new concept for the application of Corex technology within existing steelworks, referred to as Corex LRI. Similar to the Saldanha Steel concept described above, top gas from the Corex reduction shaft is used for the additional reduction of ore in a second shaft. However, only “semi-reduced” sponge iron with a relatively low degree of metallization in the range of 50% is produced. This LRI is directly charged into the blast furnace, thereby substituting sinter, pellets or lump ore (see Figure). Due to the higher total iron content of LRI compared to conventional iron carriers, this results in a lower blast

LRI allows blast furnace operators to take advantage of the proven economical and ecological benefits offered by Corex technology.

furnace coke consumption at the same hot-metal output or, alternatively, the blast furnace output can be increased at a constant coke rate. The blast furnace can therefore partly claim the same proven economic and environmental advantages offered by Corex technology, which does not require sinter and only a minimum of coke.

Get the ball rolling

For these reasons, the integration of the Corex LRI concept represents a highly attractive option for improved production performance, particularly within an existing integrated steelworks. An on-site evaluation of existing operational conditions, parameters and facilities serves as the basis for the preparation of a study to determine the potential advantages that the Corex LRI concept offers iron- and steelmakers. ■

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AOD converter replacement at ThyssenKrupp Nirosta, Germany

Three Weeks And Running

STEELMAKING >



Charging of new AOD converter at ThyssenKrupp Nirosta, Krefeld, Germany

Following 32 years of reliable and excellent production operations, two of the stainless steelmaking converters of the German producer ThyssenKrupp Nirosta had reached the end of their service life. Siemens VAI was selected as the partner for a highly challenging project that involved replacing the stationary AOD converters with new exchangeable AOD converters. An incredibly short time period of only three weeks was all that was required for the replacement and restart of the new stainless steelmaking facilities.

With its stainless steel production and processing facilities, ThyssenKrupp Nirosta is one of the leading stainless steel producers in the world. For the converter replacement project in Krefeld, ThyssenKrupp Nirosta, a company of ThyssenKrupp AG, had very clear and precise objectives. The older facilities were to be replaced with new low-maintenance converters and auxiliary equipment. Overall safety and environmental conditions also needed to be improved by installing converter doghouses. Installation work had to be carried out under very severe space restriction in an operating plant with only minimum disturbance to ongoing production. Finally, during the hot-commissioning phase, production had to be ramped up to design capacity within just days. These were tall orders to be met ...

Siemens VAI was awarded the project in April 2007. The work comprised the complete dismantling of the

Installation work had to be carried out in an operating plant with only minimum disturbance to ongoing production.

existing vessels down to their foundations, installation of two new horse-shoe-type trunnion rings with tilting drives for the exchange-vessel system, and replacement of the newly designed converters, including related components. Additional activities involved civil works and the supply of equipment such as charging bins, process-gas regulation stations, new waste-gas hoods, converter exchange and trans-

fer cars, two converter preheaters, one jib crane, a wrecking stand with tilting device as well as converter relining. Some of the existing equipment and interfaces with the new equipment had to be adapted. The main control desk and the Level 1 automation system were also modified to meet the new converter requirements. The electrical equipment was renewed or upgraded as required.

Fast, efficient – and successful!

All on-site work for the two converter replacements was completed within only three weeks during an operational standstill in the spring of 2009. This impressive accomplishment can be attributed to the application of proven and reliable equipment and technology, meticulous project planning during the engineering and on-site installation phases, and, in particular, to the combined efforts and excellent cooperation between the start-up teams from ThyssenKrupp Nirosta and Siemens VAI.

Production of the first heat following converter replacement took place on April 1, 2009. The second converter was started up only days later on April 7, 2009. The environmental situation within the plant was substantially improved with the construction of dog-houses enclosing the AOD vessels.

All on-site work for the two converter replacements was completed within only three weeks.

Production capacity of the Converter Nos. 1 and 2 exceeded their nominal output already within only six and three days of the respective converter start-ups. The entire project was successfully implemented within the foreseen time schedule. Following the fulfillment of the guaranteed performance figures, ThyssenKrupp Nirosta issued the Final Acceptance Certificate for the entire installation in May 2009, just five weeks after the start of hot commissioning. ■



1 Members of the ThyssenKrupp Nirosta and Siemens VAI project teams

2 Vaicon Quick converter suspension system – a robust, reliable and simple solution for the quick exchange of AOD converters



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A new horizontal sub lance for LD (BOF) converters makes steel measurements and sampling more efficient, cheaper and safer

There's Always Room For Improvement

Although steelmaking today is highly automated and efficient, it is still possible to get things done even better. A horizontal sub lance system recently introduced by Siemens VAI offers a number of important advantages for producers in comparison with manual or vertical-sub lance measurements and for the sampling of liquid steel in a converter.

STEELMAKING >



Successful test campaign of the horizontal sub lance at ArcelorMittal Eisenhüttenstadt GmbH, Germany (July 2009)

The new sub lance manipulator from Siemens VAI automatically carries out required temperature, oxygen and carbon measurements, and also takes steel samples from a tilted LD (BOF) vessel. Characterized by its highly robust construction, it can be mounted on the doghouse door or on a mobile heat-protected car. A specially designed lance equipped with a probe is inserted approximately 5 m into the converter to perform the necessary work. The lance features an innovative, gas-cooling system that does not require water. If space is limited in front of the converter, the whole assembly can be swiveled into the measuring position by means of an electro-mechani-

cal cylinder. Personnel safety is greatly increased due to the fact that only the probe has to be attached and removed manually.

A series of tests performed under industrial conditions at ArcelorMittal in Eisenhüttenstadt, Germany, showed that all measurement and sampling procedures could be carried out quickly, systematically and cost-efficiently. Since its debut at Eisenhüttenstadt, additional orders for the horizontal sub lance system have been received from Novolipetsk Steel (NLMK), Russia (one unit), and SAIL Bhilai Steel Plant, India (three units). ■

Main Benefits

Compared to manual work:

- Dramatic improvement in personnel safety
- Standardized, fast and reproducible steel measurements and sampling
- Better sample quality

Compared to a vertical sub lance:

- Considerably lower investment costs
- Major reduction in probe costs
- Greatly increased system availability (100%)
- Easy system handling and easy lance-unit exchange
- Easy postinstallation

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Application of a new simulation tool to optimize production and logistics

Osiris – To Know for Sure

Because of the complex nature of production systems, the use of simulation techniques in many industrial segments has become an indispensable tool to better understand and optimize production processes. In the following, a new simulation tool named Osiris is introduced, which helps steel producers to save investment and operational expenses.

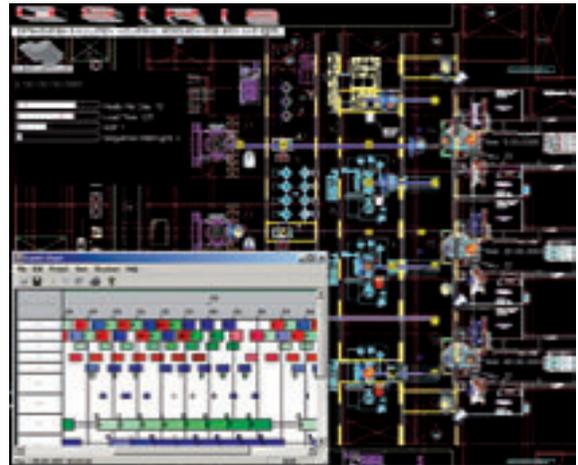
A discrete-event simulation tool named Osiris (Optimization, Simulation and Industrial Research for Iron & Steel) was developed by Siemens VAI in 2009. It is comprised of a simulation library dedicated to the metals industry and is operated using Plant Simulation, the material-flow simulation tool from Siemens.

Osiris was recently applied in a project in the Middle East to investigate the influence of the product mix on overall production performance in a steel mill. Various factors and parameters were taken into consideration by the software tool including transportation (cranes and transfer cars), material-flow data, the buffer capacity for heats in progress and other variables that had an impact on production. Prior to the application of simulation techniques, the customer contemplated installing additional buffer capacity to better coordinate the material flow between the steelmaking units and the continuous casting machine. The model, however, proposed a marginal reduction in the tap-to-tap time with consideration to the rated capacity of the electric arc furnace (EAF) transformer. Together with a production-mix optimization and a calculation of the optimum number of heats to be cast in sequence, a throughput improvement could be achieved with a simultaneous cost reduction.

“Simulation provided the answer for the right sequencing of the production process and helped the customer save expenses.”

Hans-Joerg Klappf, Senior Project Manager

Osiris was additionally applied to provide support during the project-execution phase for the revamp of a continuous casting machine at the Kaluga EAF melt-



Simulation of steel mill production and logistics

shop in Vorsino, Kaluzhskaya Oblast, Russia, as well as to optimize plant layout and production-planning scheduling at Nizhny Tagil Iron & Steel Works (NTMK), also in Russia.

Siemens VAI intends to gradually extend the Osiris simulation library to eventually cover the entire iron and steel production chain in future projects. ■

Main Benefits

- Investment savings
- Higher plant productivity
- Ideal utilization of resources (materials, equipment, personnel)
- Optimized production planning and scheduling
- Identification and elimination of bottlenecks
- Improved material flow
- Reduced inventories

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Modernization of the process-optimization system
at Salzgitter Flachstahl GmbH, Germany

Striving for Perfection

Modernization of Level 2 automation systems requires the integration of engineering, hardware and process models within the given automation environment with minimum disturbance to ongoing production operations. Siemens VAI installed and started up a new process-optimization system for the LD (BOF) steelmaking and secondary metallurgical facilities at Salzgitter Flachstahl GmbH. It is based on fail-safe hardware and features flexible and extendable software. In addition to greater system availability and improved data security, easy adaption of the software to changing production conditions is possible.

STEELMAKING >



View of LD (BOF)
steel shop, Salzgitter
Flachstahl GmbH*

*Compliments of Salzgitter
Flachstahl GmbH

Salzgitter Flachstahl GmbH is the largest steel subsidiary of the German-based Salzgitter Group. In March 2006, Salzgitter Flachstahl placed an order with Siemens VAI for the modernization of the information system of three LD (BOF) converters in addition to the scrap-yard area. The project was completed at the end of 2007. In September 2007, Salzgitter Flachstahl placed a further automation order with Siemens VAI for the installation of an information system for the entire secondary metallurgical section comprising two twin-stand ladle furnaces, a single-stand ladle furnace and three vacuum-degassing stands. This project was completed in April 2009. The features and highlights of both projects are outlined in the following.

Process-optimization systems

Expertly designed tracking modules and process models are a prerequisite for optimized production.

Process tracking and the generation of setpoints is based on predefined production practices and treatment schemes, as well as on the results of different process models that are activated depending on the current treatment phase. The calculated material quantities are divided into portions according to the addition schemes as defined by the production practices.

As the basis for assuring that a wide range of production requirements are satisfied, Siemens VAI installed its well-known Process Explorer system at Salzgitter Flachstahl. The system, an intuitive user interface based on Microsoft.NET Framework, makes the individual steel-production steps highly visible and reportable for the plant operator. Access to a particular plant unit and application functionality is controlled by role-based security mechanisms.

KISS ... and run!

The newly developed train and scrap-yard management system under the name of “KISS” – a German acronym for Konverter InformationSystem und Schrottverwaltung – performs cost-optimized scrap calculations in addition to ordering and tracking functions for the various scrap mixes as required by the production program. The focus and features of this Level 2 automation system for oxygen converters include a cost-optimized charge calculation, the reliable and easily maintainable control of the blowing schemes as well as improvements in the reliability and consistency of process data. The recently enhanced SteelExpert process models cover the entire production process, starting from the ordering of scrap up until alloying during tapping. The purpose of the model package is to calculate the quantity of charging materials and the volume of oxygen to be blown to produce a heat that conforms with the production schedule and steel-grade order. On the basis of off-gas measurements, the Dynacon model (see *metals&mining* No. 2|2009, pages 38–39) provides online process control for blow-end prediction and automatic blow stop to achieve the targeted carbon content. As requested by Salzgitter Flachstahl, different operational strategies were incorporated into the process models to take into account varying hot-metal/scrap ratios. This allows the producer to respond flexibly to hot-metal or scrap availability as well as to fluctuating scrap prices.

Secondary metallurgy information system (SMIS)

The installed Level 2 automation system for the secondary metallurgical sector completely controls all production steps from the end of steel tapping to the continuous casting section. All relevant actions and processes, such as heating, cooling, addition of slag materials, deoxidation, alloying, wire feeding, degassing and stirring are covered by the SteelExpert process model to ensure that the targeted quality values are met. For different production steps different target values can be defined. For example, it is possible to portion the charging of alloys to meet metallurgical requirements by applying the standard melting practice (SMP). The Level 2 system not only satisfies the temperature and compositional targets, it is also able to determine the cleanliness of the steel after deoxidation. In order to support a disturbance-free continuous casting process, a special calcium process model was developed that ensures the calcium content remains within defined minimum and maximum values. The duration of vacuum degassing can be automatically extended if the process model determines that the reactions have not yet reached the target values.



Automation control pulpit of secondary metallurgical section (Compliments of Salzgitter Flachstahl GmbH)

Hardware

The installed hardware and system software consists of six servers – two production servers and one development server for each of the two projects. These are equipped with an OpenVMS operating system and cluster technology. It also incorporates a hot-standby concept. An Oracle database with real application cluster is used for the production servers. The separate storage area is equipped with redundant data disks featuring online disk mirroring (SAN on two storage nodes).

Results and improvements

With the successful implementation of the two automation projects at Salzgitter Flachstahl, a number of operational improvements could be achieved. These included:

- Reduced raw-material costs due to scrap-cost optimization
- Implementation of a selectable converter strategy based on, for example, cost optimization or hot metal/scrap availability
- Easily configurable steel melting and treatment practices
- High degree of system functionality that can be expanded as required

Dr. Andreas Berghöfer, Steel Plant Manager of Salzgitter Flachstahl, described the successful automation projects as follows: “The project implementation phase was characterized by the excellent cooperation between our company and Siemens VAI. The profitability of the installed automation systems could be proved within a short time, particularly with consideration to the new scrap-operation mode.” ■

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Producers can derive a host of benefits from caster upgrades at relatively low costs

The Price Is Right

With relatively low expenditures for upgrading, it is possible to dramatically improve caster performance and product quality. Siemens VAI is not only one of the world's leading suppliers of new continuous casting machines, it can also refer to an impressive number of caster upgrades. During the past 40 years up until the end of August 2009, the company has modernized a total of 187 slab casters (279 strands), 138 billet casters (592 strands), 25 bloom casters (120 strands) and 14 beam-blank casters (44 strands). Altogether, Siemens VAI has performed approximately 75% of all major revamping projects worldwide. The four caster projects described in the following show examples of benefits that were derived with the installation of the latest technological solutions.

Beginning in the early 1990s, there was a notable rise in the number of inquiries for caster modernizations. Ever-increasing demands were placed on caster operators to boost output and productivity, improve the internal and surface quality of cast products, extend the range of steel grades and dimensions that could be cast with the same machine, and, of course, to reduce operational costs to remain competitive. To help steel producers meet these challenges, Siemens VAI introduced a modularly designed machine concept that was complimented by a series of innovative and advanced technological packages. This allows caster parts, components and sections to be easily replaced with new equipment, and dramatically enhances overall caster performance, capability and reliability.

“Grade A” slab-caster performance at Arconi

In the spring of 2009, Siemens completed a major upgrading project on an over 20-year-old, single-strand slab caster at the steelworks of the Slovenian producer Arconi, d.o.o. With the goal to improve productivity, product quality, and the range of steel grades and product dimensions that can be cast, the machine head and strand-guiding system were replaced and outfitted with state-of-the-art technological packages, systems and equipment.

The previous mold was substituted with a Smart Mold that, in combination with DynaWidth technology, allows the mold narrow sides to be hydraulically shifted to flexibly cast strands of different widths. Smart Segments installed in the bow and straightening and horizontal caster zones enable fast slab-thickness changes to be carried out. I-Star Rollers (intermediately supported trans-axle rollers) provide ideal strand-shell support throughout the entire strand-guiding system. Other technological packages are at work to enable automatic and precise mold-level control (Levcon), enhanced strand-break-out protection (MoldExpert) and on-line adjustment of the mold-oscillation parameters (DynaFlex). Highest internal



Upgraded slab caster at Arconi, Slovenia

strand homogeneity is made possible with DynaGap Soft Reduction technology. Finally, an integrated quality-management system serves the basis for the consistent production of superb-quality slabs.

All on-site construction activities were completed within a tight time frame of only 38 days. This kept production downtime to a minimum. Thanks to the application of connect&cast solutions, a quick and trouble-free caster start-up was possible. All casting equipment and systems functioned as designed beginning with the first heat. The Arconi slab caster is now capable of casting approximately 515,000 tons of steel per year comprising medium- to high-carbon, peritectic, structural, micro-alloyed, stainless steel (series 300 and 400) and Si grades in thicknesses between 200 mm and 250 mm and at widths from 800 mm to 2,120 mm.

“Through the modernization of our continuous slab-casting machine we have acquired one of the >>

Additional examples of slab-caster modernization and replacement projects

| | |
|------------------------------------|--|
| SSAB Tunnpå, Luleå works, Sweden | Upgrade of machine head with DynaFlex and DynaWidth in 14 days |
| ArcelorMittal Fos-sur-Mer, France | Conversion from curved to straight mold in 9 days |
| ArcelorMittal, U.S.A. | Conversion from curved to straight mold in 7 days |
| Outokumpu Stainless Avesta, Sweden | Replacement of the entire machine head in 14 days |
| Outokumpu Stainless Avesta, Sweden | New straightener installed in 16 days |
| ArcelorMittal Fos-sur-Mer, France | New bow and straightener segments installed in 4 days |
| voestalpine Stahl, Austria | DynaGap Soft Reduction upgrade during maintenance outage |
| voestalpine Stahl, Austria | Upgrade to 355-mm-casting thickness in 5 days |
| ArcelorMittal Genk, Belgium | Caster replacement in 21 days |



Preassembled piping system for Hadeed billet caster, Saudi Arabia

>> most advanced machines of its kind in the world. This increases our production potential,” said Emil Subelj, Deputy Steel Plant Manager of Acroni.

400% more billets at Hadeed

When the Steel Melt Shop No. 1 was completed for the Saudi Arabian steel producer Hadeed (Saudi Iron & Steel Company) in 1982, production capacity of the three 6-strand billet casters was designed for 850,000 tons per year. (Actual production following plant start-up was at more than 1.0 million tons.) Following the first plant upgrade in 1992, the capacity was expanded to 2,000,000 tons. A second revamp carried out in 2001 on one of the 6-strand machines focused on increasing the casting speed. This was accom-

Following completion of the upgrading activities, total billet output could be escalated to more than 3.2 million t/a.

plished by installing a high-pressure secondary cooling system and DynaFlex hydraulic oscillation. The same upgrading measures were performed on a second machine in 2006, which boosted the annual casting output at Hadeed to more than 3.0 million tons in 2007. The third billet caster was upgraded in the first half of 2008. To keep caster downtime to a minimum,

the entire machine head was preinstalled by Siemens VAI in the manufacturer’s workshop. Furthermore, the complete control circuit of the secondary cooling system, including booster pumps, was fully assembled, pre-piped and tested in the workshop. The pre-assembled equipment was shipped to the site and only had to be connected together. Following completion of the upgrading activities on the third billet caster, total billet output at Hadeed could be escalated to more than 3.2 million tons per year – nearly 400% more than the original design capacity!

Beaming with success at SDI

With the goal of expanding productivity and improving the quality of their cast products, the American steel producer SDI (Steel Dynamics Inc.), located in Fort Wayne, Indiana, commissioned Siemens VAI to upgrade their bloom/beam-blank caster.

The project scope included the supply of new equipment such as tundishes with a greater capacity, modification of tundish cars, a new bloom section, DiaMold mold tubes with a new mold taper and the extension of the strand-containment system. The straightening section of the caster was modified to improve internal strand quality and the cooling system was adapted. A fourth strand and a new casting section were also installed to enable the production of rail blooms with a cross section of 320x250 mm.

The new equipment was assembled and tested during regular maintenance periods without interrupting ongoing operations. Commissioning was completed during a six-day shutdown period. Following the upgrade, a faster casting speed of the beam-blank profiles was possible, which enabled the caster throughput to be increased from 163 tons to more than 254 tons per hour. Flange bulging of the beam-blank sections was reduced by nearly 50%. The project was highly successful and the productivity and quality targets were fully met.

The bullet caster at Severstal

Severstal, located in Cherepovets, Russia, is one of the country’s leading steel producers and counts among the top steel manufacturers in the world. With the target of increasing the casting speed and thus the output of their 6-strand billet caster, Siemens VAI was requested to make equipment modifications and carry out a series of tests on one of the strands together with Severstal.

The mechanical mold oscillator was replaced with a DynaFlex hydraulic oscillator. This reduced vibrations and oscillation deviations that occurred at higher casting speeds with the old system. DynaFlex allows the mold-oscillation parameters (stroke and os-



cillation frequency) to be adjusted online in accordance with casting requirements. The strand-containment system and secondary-cooling system were also modified for higher-speed casting.

The casting tests were performed in July 2007 on a 100-mm-square billet. A constant casting speed of up to 7.4 m/min. was achieved – more than one meter faster than previously. On the basis of the successful high-speed-casting demonstrations with excellent operational and quality results, Severstal commissioned Siemens VAI to carry out the same modifica-

tions on the remaining five strands. Electrical equipment and the Level 1 automation system were also modified. Start-up of the upgraded billet caster took place in June 2008.

Concluding remarks

Outdated caster equipment and systems are no longer capable of meeting the ever-increasing demands of the market today. To derive the maximum potential from an existing machine, as well as to optimize investment outlays, a careful evaluation of all design, production and quality aspects by a reputable engineering company is a wise decision. On the basis of the immense experience that Siemens VAI has acquired from the modernization of hundreds of continuous casting machines worldwide, producers are advised of the best possible solution to improve their casting operations with consideration to product requirements and the market potential. ■



Upgraded billet caster at Severstal, Russia

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Start-up of a vertical slab caster at Baosteel, China

Standing Tall

Conventional slab casters can cast just about any steel grade in a steelmaker's recipe book. But to cast complex metal concoctions with, for example, up to 80% alloying elements comprising nickel, chromium, manganese, molybdenum and aluminum, a vertical caster is the safer choice. In order to apply continuous casting practices to reduce costs, improve yield and produce new steel grades, Baosteel commissioned Siemens VAI to install one of the most challenging casters ever built in China at their Shanghai-based Special Steel Branch.

The casting of a broad range of highly critical alloyed steel grades is extremely difficult in a conventional bow-type caster. This is because these types of materials are exceptionally rigid and also sensitive to cracking, meaning that they cannot easily be bent from the vertical to the horizontal direction in the bending and straightening zones of a caster. In order to assure fulfillment of the strictest quality demands for their broad and highly specialized product mix comprising high- and ultra-high-alloyed carbon, special and stainless steels, Baosteel decided to install a new single-strand vertical slab caster with a nominal casting capacity of around 270,000 tons per year.

For this challenging project, Siemens VAI provided basic and detail engineering and also supplied the main caster components, special equipment and sys-

tems such as the mold, electromagnetic stirring device, torch-cutting machine, electrics and automation. The caster was designed with a vertical height of 40 m and a metallurgical length of 13.6 m. Slabs can be cast in thicknesses of 150 mm and 200 mm and at widths between 600 mm and 1,300 mm. A wide array of sophisticated technological packages was installed to assure reliable plant operations and highest slab quality. Smart Segments combined with the DynaGap Soft Reduction technology package enable dynamic soft reduction to be carried out to optimize internal strand quality. The installed Level 2 quality-control system is another key factor for the production of highest-quality slabs at Baosteel. "Dry casting," made possible by employing internally peripherally cooled rollers, is applied in most of the strand segments to

Interview

Olaf Schwarze, head of the Siemens VAI project team, spoke with Dr. Lawrence Gould about the challenging aspects of this unique project.



This was the first vertical slab caster that Siemens VAI had supplied in over 30 years. Why then did Baosteel come to Siemens VAI to do this project?

Olaf Schwarze: First of all, the outstanding reputation of Siemens VAI in the field of continuous casting is without question. Our customers know that we will do the job that has to be done. With respect to this project, I think that a key reason why we got the con-

tract was because during the entire negotiation phase we were completely open and honest about what was technically possible and what was not. We made a number of alternative technical solutions to address the specific needs and requirements of the caster. This, I feel, certainly created a strong sense of trust and confidence in our proposed technical solutions.

What was the main challenge that had to be met on site in the implementation of this project?

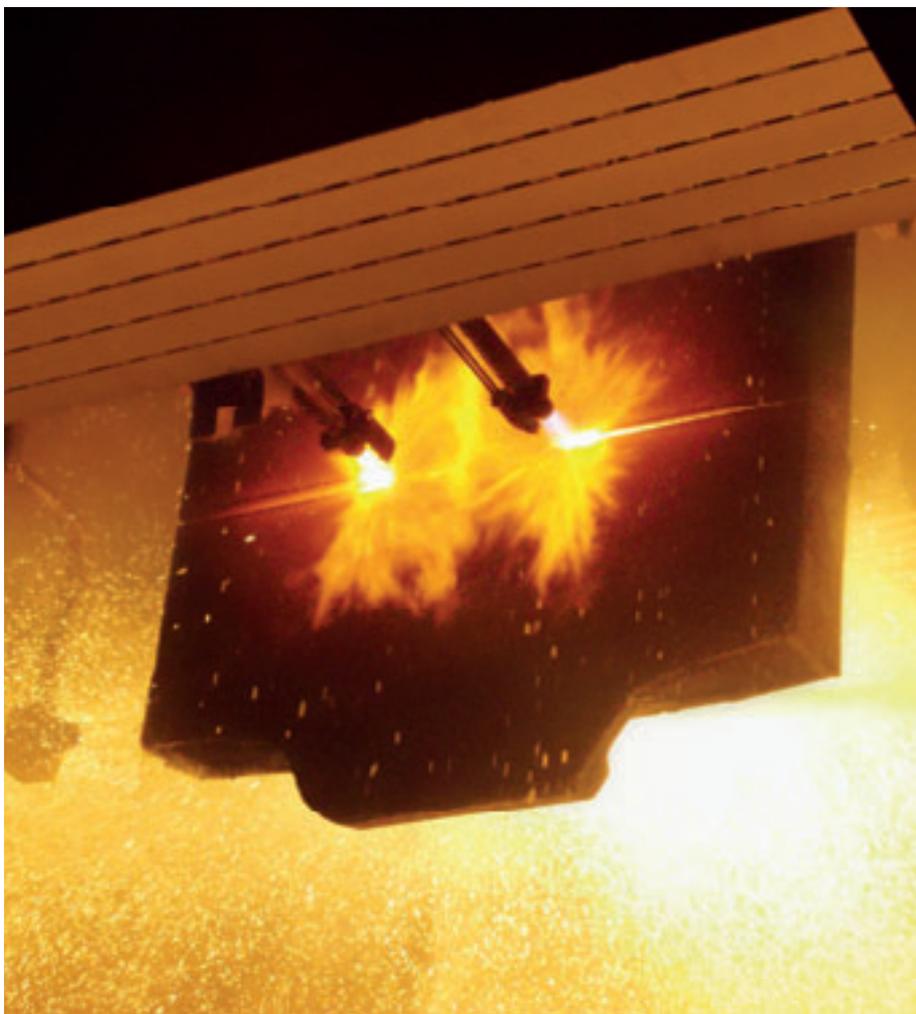
Olaf Schwarze: Gravity. In a vertical caster that is 40 m tall everything has to be fixed and secure. Under no circumstances can the strand or the cut slabs fall down, which would be a disaster. The entire strand up until cutting is suspended vertically and must be adequately supported. Liquid steel and water follow the force of gravity and engineering solutions have to take this into account.

prevent strand overcooling as well as to increase strand-cooling flexibility to meet the specific cooling requirements of currently cast and future steel grades.

As this was a prototype machine, a number of special design features were required. This included a new secondary-cooling-water deflection system to completely remove water from the caster area and keep the casting pit dry. An innovative segment-exchange system was developed to enable strand-segment replacements in the horizontal direction. During slab cutting, a newly developed withdrawal unit firmly clamps the vertically suspended slabs and then transports them through the casting pit. By means of specially designed caster run-out equipment, which is unique in the world, the cut slabs are tilted in the casting pit and lifted to the ground floor for their subsequent removal to the slab yard or cooling-pit area.

Successful start-up and commissioning

The slab caster was successfully started up in early 2009. All equipment and systems functioned as designed right from the first heat. Hot commissioning was completed within only two months of effective caster operations and the Final Acceptance Certificate was received on April 30, 2009. With the new caster, Baosteel is now able to substitute a portion of their existing ingot-casting operations. Furthermore, this future-oriented casting machine also allows new and novel steel grades to be developed and continuously cast in an efficient and cost-effective manner. ■



Vertical caster in operation at Baosteel Special Steel Branch, China

Weren't you concerned that some major problems would arise that couldn't be seen in advance?

Olaf Schwarze: No. And I didn't lose any sleep either. Your question is fully justified because this was a completely new plant design. But the honest answer is that I had such a capable and experienced team that if they couldn't do it, then nobody in the world could do it.

Could you describe the feeling and emotions of the working personnel when the first slab was cast?

Olaf Schwarze: It was an indescribable and tense atmosphere that prevailed right before the first cast. The most exciting moments were when the first ladle arrived at the casting platform. Would the theoretical and unproven solutions work the way they were planned? Yes, they did! Apart from some minor initial strand deformation, all of the machine equipment and automation systems functioned as designed.

Do you see a lot of sales potential for vertical slab casters in China or elsewhere?

Olaf Schwarze: You have to consider the fact that normally a vertical slab caster incurs higher investment costs and has a lower productivity than a conventional bow-type caster. But for certain niche markets, a vertical slab caster is certainly the better solution in terms of product quality and castability of high-alloyed steel grades. This is ultimately the customer's decision. In fact, we have recently received several inquiries for vertical casters, underlining the interest in this technology.

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ROLLING >



Start of industrial endless strip production at the Arvedi ESP line, Italy

A New Era in Steelmaking

Industrial production in the endless mode has commenced at the new Arvedi ESP (Endless Strip Production) line in Cremona, Italy. For the first time ever, hot-rolled coils can now be commercially produced in a thin-slab-casting/rolling plant directly from liquid steel in a continuous and uninterrupted manufacturing process. The plant is based on Arvedi technology and was jointly implemented by Acciaieria Arvedi SpA and Siemens VAI. Due to the technical features of the plant, thin-gauge strip can be produced in better quality and at lower costs compared to alternative processes. This new facility represents the world's most compact thin-slab-casting/rolling line for the production of hot-rolled strip.

Cremona, 1716

Antonio Stradivari, certainly the most well-known violin maker of all times, had just applied the final coat of varnish to a violin that would eventually become known as the *Messiah*. It was the product of more than five decades of experimentation and improvements, and is today considered by most experts to be the consummate violin. The craftsmanship is exquisitely precise and no violin made before or afterwards approaches the quality and elegance of this masterpiece. During his long lifetime, Stradivari produced more than 600 marvelous violins and changed the art of violin making forever.

Cremona, June 19, 2009

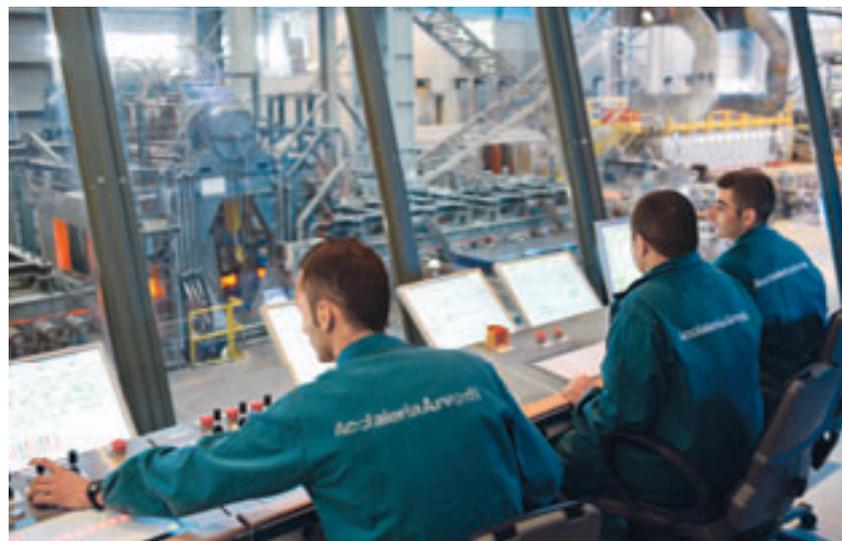
In the steelworks of Acciaieria Arvedi SpA, an unusually large number of people including operators, process engineers, technicians, specialists and management personnel began to gather alongside the Arvedi ESP casting/rolling line. The automation staff remained in the control pulpit and stared into their computer screens. Although the plant had already been successfully operating in the batch mode for several months, the time had now arrived for the switchover to endless mode. At exactly 6:04 p.m., Daniele Cavina, the mill's Automation Manager, gave the order to go from batch to endless production. The strand exiting the caster was rolled to a thickness of 19 mm in the high-reduction mill positioned immediately after the caster. It then disappeared into the mouth of the induction heater without stopping. After the intermediate strip emerged from the furnace, powerful jets of water blasted away any scale clinging to the surface. The strip then shot through the finishing mill followed

by cooling in the laminar cooling line. Up until now, the crowd of onlookers had closely followed the band of glowing steel on its journey through the plant. With each process step, the excitement had steadily increased. The big question was whether the automatic switchover from one coiler to the other would function as designed. After the first coiler was full, the high-speed shear severed the strip, which was then instantly snapped by the pinch roll of the second coiler. For the first time in the history of steelmaking, liquid steel was cast, rolled and coiled in a continuous and uninterrupted industrial process in a thin-slab casting/direct-rolling facility. Although a lot of work still had to be done, it was now time to celebrate.

Music for the ears of steelmakers

On the basis of its unique design and operating features, the new Arvedi ESP plant is capable of producing thin-gauge strip in better quality and at lower costs than established casting and rolling processes. With a length of only 190 m, the entire facility is less than one-half the length of a typical hot-strip mill. Initial capacity exceeds two million tons of hot-rolled coils per year and the plant is designed to cast three million t/a following adaptations to the casting line. The thin and ultra-thin gauges can be immediately used for numerous industrial applications, eliminating the need for cold rolling. Products from the Arvedi ESP line are suitable for use in the automotive, appliance and building industries, as well as for the production of tubes, profiles, machinery and mechanical equipment.

Thanks to the endless strip-production mode of ESP lines, repeated threading into the individual rolling stands is no longer necessary. This is the basis for the >>



Control pulpit of high-reduction mill

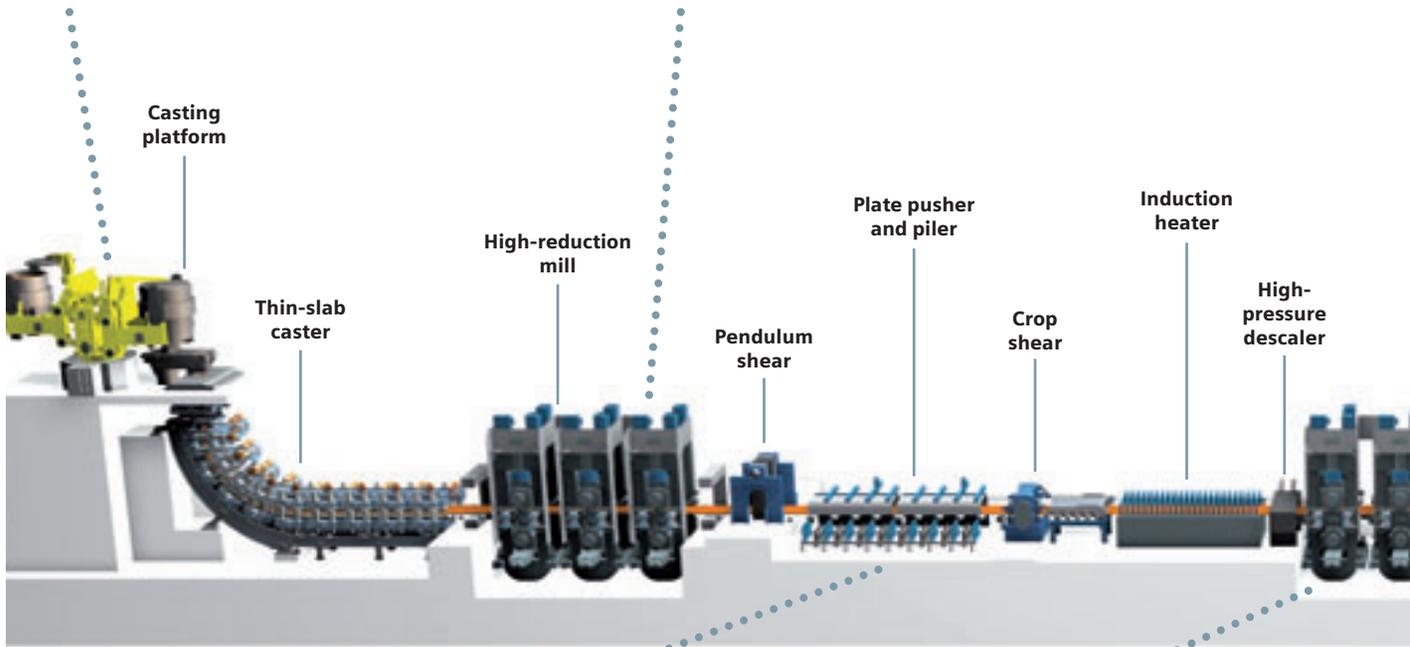
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1 Slab caster



2 High-reduction mill



3 Induction heater



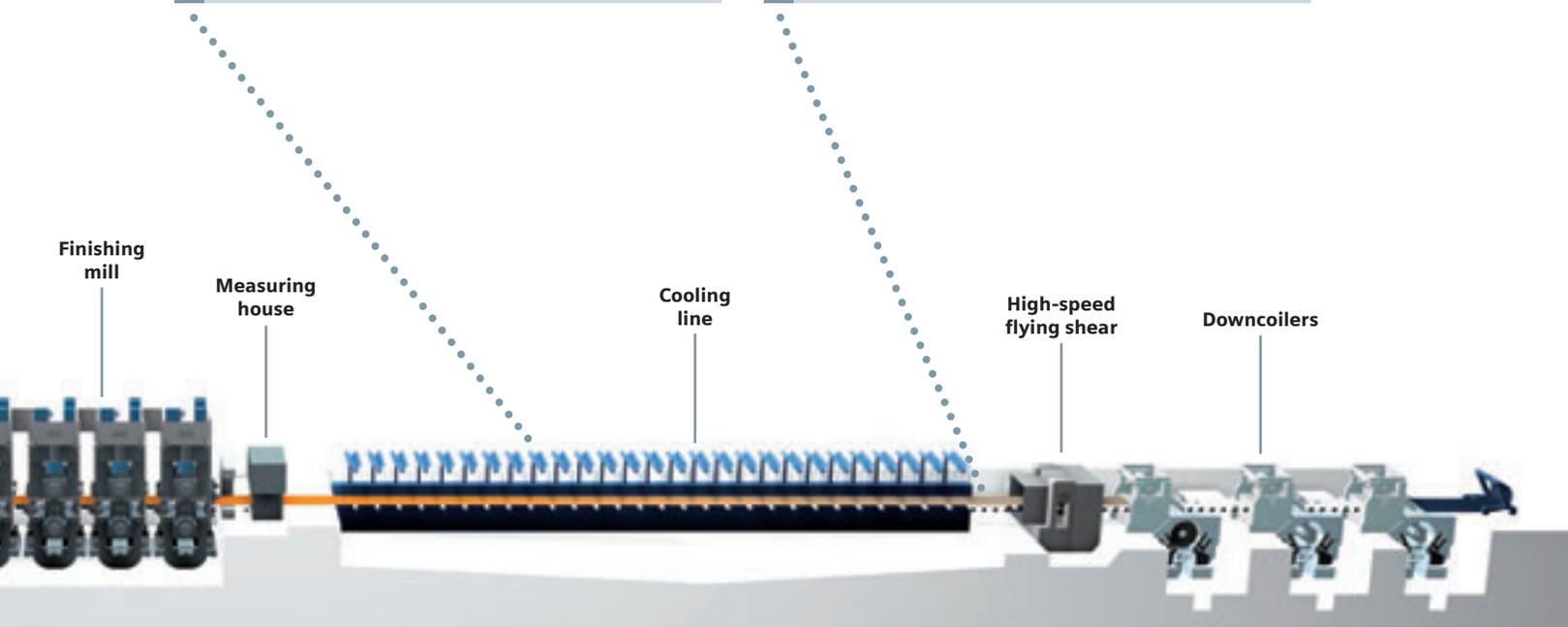
4 Finishing mill



5 Laminar-cooling section



6 Runout area



>> production of ultra-thin gauges. The rolled steel is characterized by its high surface quality and homogeneous structure. The strip is under continuous tension, eliminating the danger of cobbling due to high speeds and insufficient strip-head stability. Overall yield is maximized compared with conventional lines because cropping of the strip head and tail ends is no longer necessary.

Energy requirements are also significantly reduced compared with conventional lines. Online measurements have demonstrated a 45% reduction in the energy consumption compared to conventional casting and rolling processes. This creates additional value for producers. A lower energy consumption also means reduced CO₂ emissions.

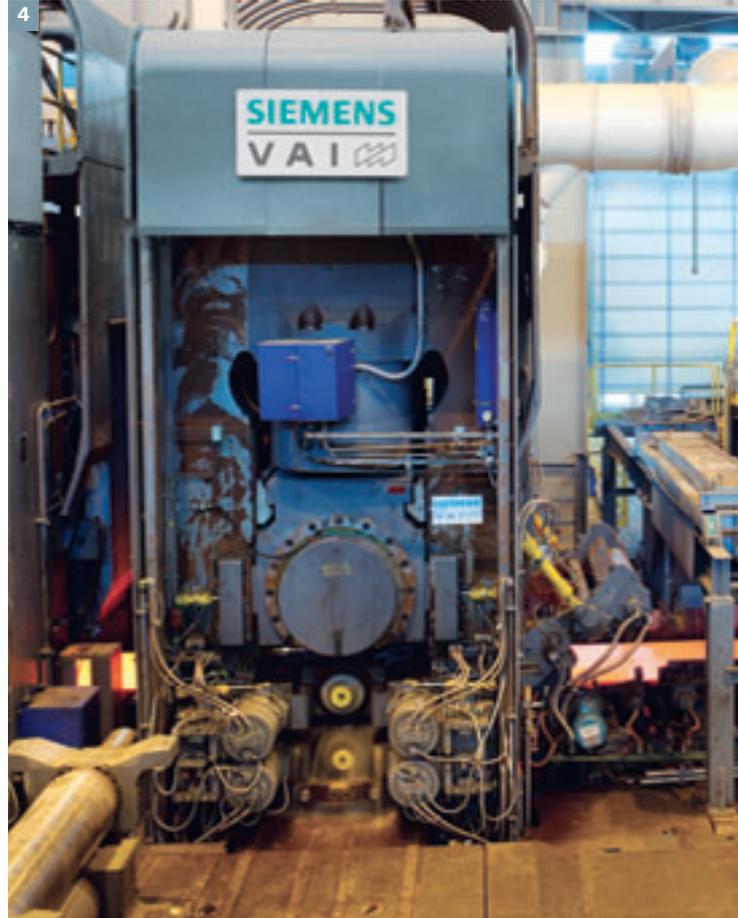
The Arvedi ESP line is equipped with a broad range of advanced technological features and systems. The integration of highly advanced automation and process-control systems fully regulate all casting and rolling operations to ensure stable and

reliable plant production. This is complemented by a plant-wide quality-control system, which assures that the required quality standards are met.

Plant sections

The Arvedi ESP cast-rolling line is composed of four main plant sections: The first section consists of a high-speed thin-slab caster where steel is cast at thicknesses between 70 mm and 90 mm. Liquid-core reduction is carried out as an important factor for the high internal quality of the cast steel. The strand is then cast-rolled, i.e., passes directly from the continuous caster to a 3-stand, 4-high reduction mill installed at the exit of the caster. The cast-rolling process, a typical feature of Arvedi ESP technology, significantly reduces the energy required for strand-thickness reductions thanks to the high thermal energy of the liquid-steel core. Strip quality is also improved. The intermediate strip with a thickness of only 10–20 mm – compared to 55–65 mm in conventional casting and rolling lines – also means a drastic

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1 Mold area of slab caster
2 Entry of strand into high-reduction mill
3 Work rolls in standby position reflecting hot strip
4 Final stand of finishing mill
5 Control pulpit of coiling section



ROLLING >

>> reduction in the required mill power during finish rolling to reach the targeted strip gauges.

In the second section the temperature of the intermediate strip is adjusted according to the requirements of finish rolling in a 10-m-long induction heater. Flexible heating up to a temperature of 1,200°C is possible.

In the third section a high-pressure descaler efficiently removes scale prior to the entry of the intermediate strip into the 5-stand finishing mill where the strip can be rolled to 0.8-mm gauges at strip widths of up to 1,570 mm. The built-in SmartCrown technology package assures that the most demanding flatness parameters are met. An advanced laminar-cooling system installed at the exit of the finishing mill is the basis for the production of a wide range of steel grades, including HSLA (high-strength, low-alloy) and multi-phase steels.

The fourth section of the ESP line features a high-speed flying shear that cuts the steel strip followed by coiling in coil weights of up to 32 tons.

Cremona, October 2009

The Arvedi ESP plant is in full industrial operation and all of the produced coils are sold on the market. Optimization work continues and a wide range of medium, low and ultra-low carbon steel grades in addition to HSLA steels have been produced. Rolled strip is gradually approaching minimum-gauge thicknesses at maximum plant-strip width.

Cremona will be known henceforth not only as the city where the world's most exquisite violins were made, but also as the site that saw the birth of a new era in steelmaking. Innovation, pioneering breakthroughs and dedication to excellence were the decisive factors for revolutionary developments in both music and steelmaking. ■

“For me, the successful start-up of the ESP line is a dream come true. It is a vision that I have had all of my life. I feel that I have made an important contribution to progress in steel-making.”

Giovanni Arvedi, inventor of the Arvedi ESP process



Joint celebration of successful implementation of industrial endless production (Giovanni Arvedi surrounded by start-up team)

Main Benefits

- World's most compact directly linked thin-slab casting and rolling process, meaning reduced investment costs
- Proven 45% reduction in energy consumption compared to conventional production lines due to full exploitation of thermal energy of liquid steel, meaning reduced operational costs and environmental emissions
- Intermediate slab handling not necessary
- Endless production as the basis for the production of high-quality ultra-thin strip with uniform mechanical properties
- No strip cobbling thanks to endless production mode
- Improved yield due to elimination of strip head- and tail-end cropping
- Suitability of the process for the manufacture of a wide range of steel grades
- High added-value product mix for fast payback of investment

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ROLLING >



Proven automation solution helps engineers commission the Xiangtan Plate Mill No. 2 in record time

Proven Solutions Save Time



A combination of intelligent automation architecture and highly coordinated cooperation between Siemens MT, its subsidiary in China and a number of local subcontractors was key for setting standards in project execution. Siemens MT delivered the core automation equipment and finished cold commissioning of the new 3,800-mm heavy-plate rolling mill for Hunan Valin Xiangtan Iron & Steel Co., Ltd. (XISC) in a record time of just four weeks.

A stable, reliable and safe automation solution based on highest-quality standards together with close cooperation between the customer and all local and foreign companies involved made it possible: on June 28, 2008 – one month ahead of the contractual time schedule – XISC produced the first plate in full automatic mode with nine passes on its 3,800-mm plate mill No. 2. The final acceptance certificate was issued four months ahead of contractual time schedule on January 8, 2009.

Deployment environment

The automation system of Siroll^{CIS} PM was used in XISC's new plate-rolling mill in Xiangtan, in the Hunan Province. The plate mill is designed for an annual output of one million tons of structural carbon steel, low-alloyed structural steel, high-quality structural carbon steel, ship and pipeline steel as well as boiler and pressure-vessel steel with a thickness range between 6 mm and 120 mm and a width of up to 3,600 mm.

The mill area features side guides for slab centering and turning roller tables on both sides of the stand. The horizontal stand is equipped with a mechanical screw-down system (electrical gap control), back-up roll-balancing system and hydraulic gap control with an AGC (automatic gauge control) function. The roller-table sections are adjustable for thermo-mechanical rolling and support batch-rolling operation.

Local sourcing wherever possible

Mechanical and electrical equipment for XISC's heavy plate mill No. 2 was supplied by local companies. In terms of automation, this medium-sized plate mill required a flexible and integrated automation solution, competitive pricing and shortest delivery time. The solution chosen was a balanced mix of local equipment where possible and imported elements where necessary. The basic automation system was mainly engineered by the Siemens plate-mill team in Shanghai,

which was also closely involved with commissioning. Siemens MT specialists in Erlangen, Germany, engineered all process automation. In the course of the system integration test, both systems were dovetailed and optimized for commissioning.

Siemens MT scope of delivery

Siemens MT supplied the core automation system of the XISC plate production line, the Siroll^{CIS} PM solution that supports the rolling area between primary descaler, and the mill exit site. The system provides interfaces to the customer's production control system (Level 3), the furnace and the other automation systems.

Siroll^{CIS} PM automation covers all sequencing and tracking functions for primary and secondary descaler, roller-table controls, turn tables, side guides, mill-water systems and mill stand, as well as the technological control. Process automation performs overall material tracking and data handling and contains all process models for a simulation of physical processes. The system's technological functions span the entire hot-rolling process:

Multipoint set-up: Instead of using just one set point, a set-point curve is calculated for each pass as a function of rolled length. The curve includes references for all technological control functions like HAGC, DPC, etc. This ensures constant thickness even for large temperature variations throughout the plate, and permits rolling of variable target thicknesses, e.g., for taper plates. Multiple plate-batch rolling is made possible using intelligent pass-schedule sequencing. This ensures maximum plant throughput and efficiency.

Thermo-mechanical rolling (TMR): This function enables fully automatic control over mechanical properties and grain refinement of rolled steel, thus reducing costs for pricey alloying elements. Various rolling phases are interleaved in batch mode. After the material is rolled in the first phase, it is held for a certain time until it reaches a specific recrystallization temperature, and then enters a second rolling phase to reach its final thickness at a specified target temperature. During this holding period, several other slabs may be rolled down to holding temperature. As a result, these slabs can be treated identically as a batch in the final rolling phase. When the batch is brought back to the stand's entry side (unloaded pass), the final rolling pass will start with the first (coldest) slab in the batch. Batch transport and oscillation are controlled by the Level 1 automation system, based on the Level 2's cyclic calculations of the remaining cooling time for all slabs in the batch.

Plan view pattern control (PVPC) combines the two mill actuators (turning thickness and variable >>

>> thickness rolling) to ensure improved rectangularity and better yield. Automatic overspeed alignment (AOA) ensures proper threading into the roll gap, reducing cropping losses, maximizing plate rectangularity and increasing yield. Moreover, it boosts material throughput and productivity. Multisection speed control (MSSC) optimizes rolling speed for higher throughput. Global temperature monitoring (TempMon) monitors plate temperature in every process step from furnace discharge to the mill-exit area. Real slab-temperature control (RSTC) and rolling-temperature feedback (RTF) ensure correct and reproducible mill-entry temperatures. Automatic gauge control (AGC) corrects roll-force deviations from the target value and ensures constant thickness of rolled material.

The system's technological functions span the entire hot-rolling process.

Line coordination control (LCO) enables shortest reversing cycles while ensuring safe plant operation. Fastest mill reversal avoids unnecessary temperature losses and consecutive undesirable extreme roll-force deviations for strip head and tail ends, thus ensuring highest productivity.

On-board service tools and optional connectivity to the global Siemens service network provide fastest

reaction times. A common HMI based on Simatic WinCC for rolling-mill operation, diagnostics and maintenance requires fewer operators.

The Siroll^{CIS} PM system features flexible adaptation to product-range changes or new quality requirements, safeguarding the customer's investment.

Project management made it happen

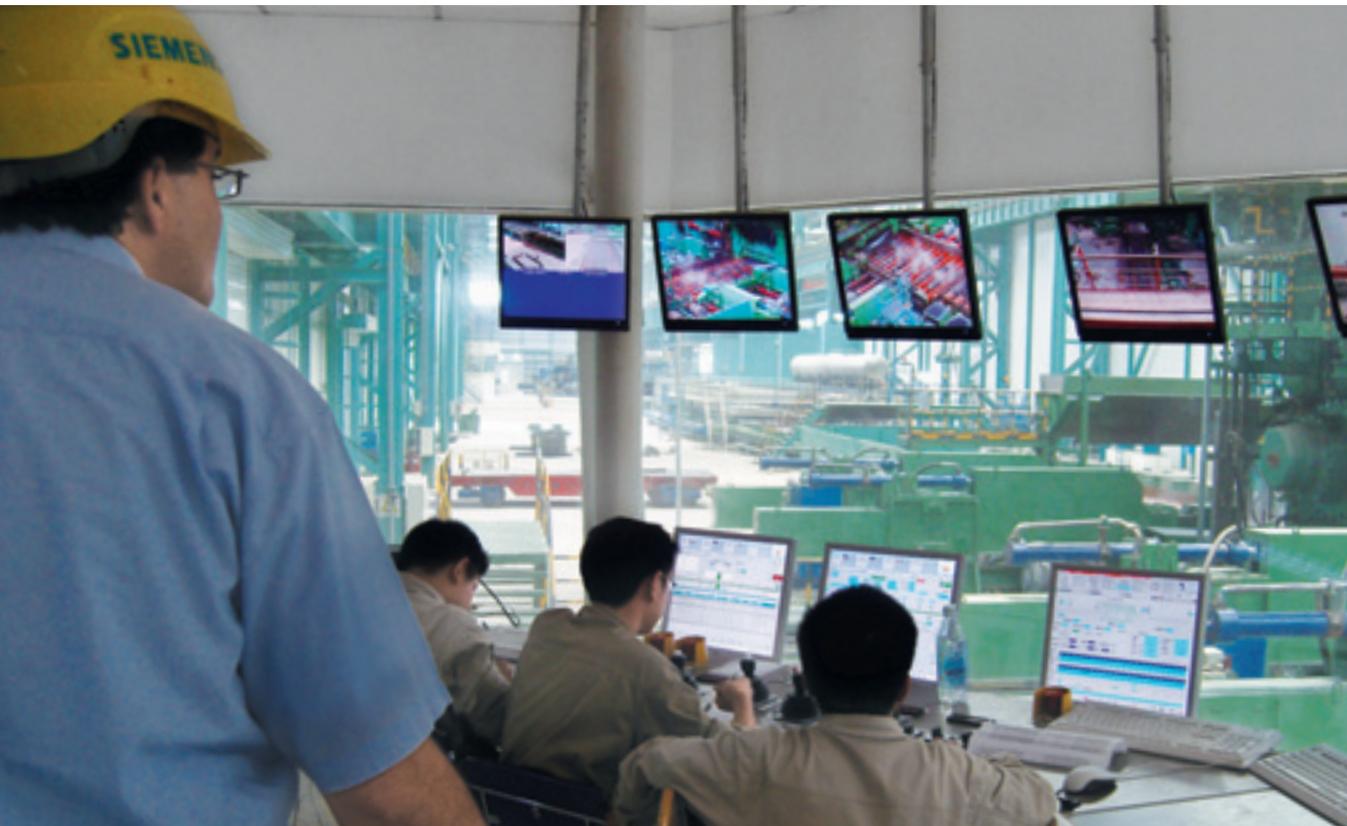
Coordinated installation and commissioning of all plant elements from different sources required close cooperation of all parties.

The team at Siemens MT in Erlangen handled project management, guidance and coordination of the whole design process. The execution of the basic design was finished just four months after the contract came into force, including basic design review, which was followed by detail design and customer personnel training. All tasks in the customer's responsibility were also carried out during this period.

A combined system-integration test followed: The automation equipment was verified in a testing bay. A global team of software engineers and commissioning specialists from Siemens MT in Erlangen, Siemens China and other suppliers integrated and verified the various system functions. This ensured a smooth start-up, and the first plate was produced as early as possible. After just four weeks of testing, the system passed all quality tests and was released for shipment to China. This short time was only pos-

ROLLING >





sible using the proven, optimized and innovative Siroll^{CIS} PM core software.

Installation and commissioning: Electrical equipment installation at XISC was carried out by a Chinese installation team. Throughout the entire installation period, the team was guided by Siemens MT installation supervisors. The electrical installation was completed for equipment hand over to the commissioning team just one month after the Siemens MT supervisors arrived.

Cold commissioning in record time: Following intensive coordination in the design phase, clear definition of interfaces and a thorough system integration test, the first plate was rolled on June 28, 2008, just in time for XISC's 50th anniversary, and within one month of cold-commissioning time.

Hot commissioning and start-up curve: Subsequently, the plant increased production and after three months of hot commissioning and optimization reached almost 80% of its specified plant capacity of one million tons. First batch rolling was achieved just 39 days after the first plate.

A promising outlook

As a result of the project's smooth execution, XISC placed an order for a third 5-m-wide plate mill with

About Hunan Valin Xiangtan Iron & Steel Co., Ltd.

Headquartered in Xiangtan city, in China's Hunan Province, and founded in 1958, the Hunan Valin Xiangtan Iron & Steel Co., Ltd. (XISC) is a large-scale key iron and steel complex with an annual production of 4.4 million tons of crude steel (2007). XISC operates an integrated steel plant, comprising cokemaking, sintering, ironmaking, steelmaking and rolling. The company's bar products include pipe, carbon structure steel and alloy structure steel.

Siemens VAI in June 2008 – this time with a complete supply of mechanical, electrical and automation engineering for the entire mill line, including Mulpic ACC and a direct quenching (DQ) cooling system, hot plate leveler, shearing line and cold plate leveler with associated design, services and project management. ■

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Work-roll lubrication for hot-strip rolling mills

Small Upgrade, Large Payoff

The installation of work-roll lubrication in existing hot-strip mills leads to cost reductions, improves product quality, boosts product diversity and increases mill availability.

Lubrication reduces friction. When applied to a strip-rolling mill, this process can improve many aspects of mill operation beyond just smoothing the flow of materials. What does the Siroll^{CIS} HM work-roll lubrication package consist of and what benefits does it offer?

Simple retrofit

Work-roll lubrication is typically installed in mill stands that are subject to the highest thermal stress. In many cases these are mill stands No. 2 and 3. The main lubrication unit is installed on the work-roll entry

side (see Figure 1). Additional wipers, work-roll cooling and side guides are mounted on the rolls' exit side.

The lubricant is applied at the entry side of the finishing mill stands. Mixing units located on the top and bottom entry wipers and in direct vicinity to the work-roll surface combine synthetic oil with additives and water in a tightly controlled ratio. A special nozzle arrangement with an optimized design applies the mixture to the strip and ensures minimum consumption and even lubricant distribution.

A correct wiper-system function is crucial for efficient work-roll-lubrication-system operation. The entry wiper ensures best sealing operation for roll-gap lubrication using a special sandwich structure. The sealed entry roll gap ensures low oil consumption in the range of 40–80 ml/min per mill stand when entry work-roll cooling is permanently active (which is important for a high mill throughput). This design also guarantees safe operation for special steel grades such as silicon, pipe and high-carbon grades.

Containing standardized interfaces and flexible communication options, the Siroll^{CIS} HM work-roll lubrication package allows easy integration with existing plant automation.

A correct wiper-system function is crucial for efficient work-roll-lubrication-system operation.

Numerous benefits

Work-roll lubrication has a positive effect on product quality, product diversity, conversion costs and mill availability.

The lubrication process avoids scale build-up and peeling of the work-roll surface. Consequently, strip-

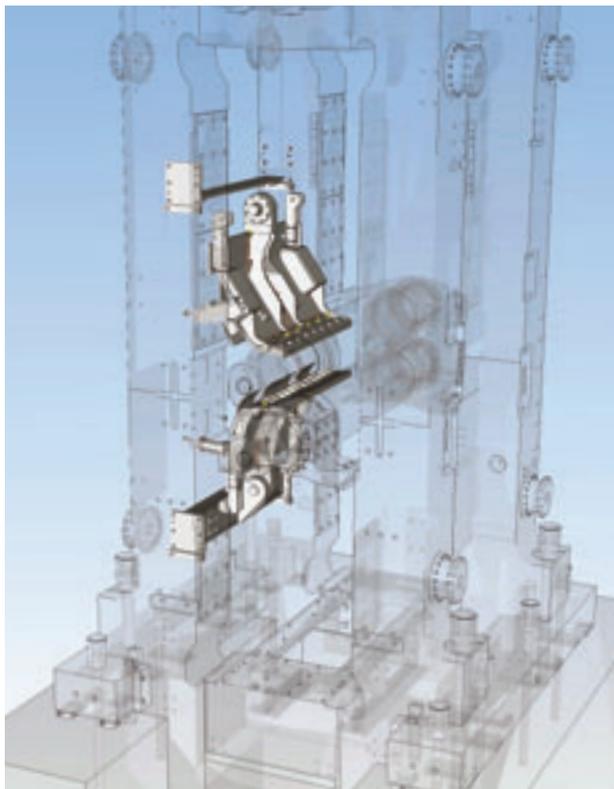


Fig. 1: The Siroll^{CIS} HM work-roll lubrication system is installed on the mill's entry side

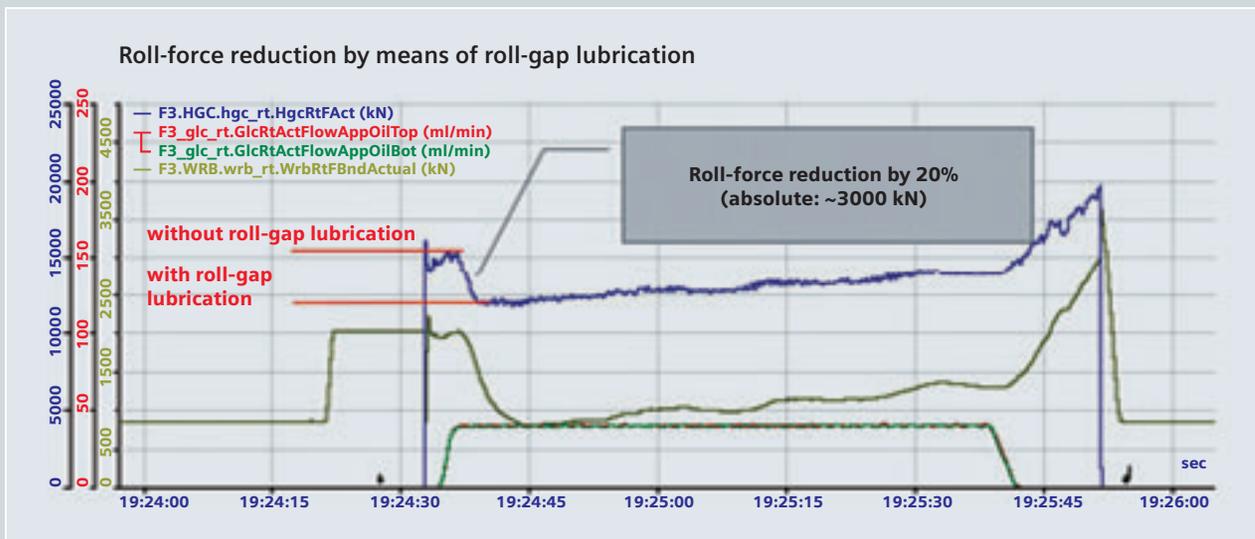


Fig. 3: Roll-gap lubrication reduces rolling force (Source: finishing mill stand No. 3 at a recently installed HSM)

surface quality is improved because there is no scale inside the strip rolls.

Another benefit is that work-roll lubrication can extend the mill's operating limits: maximum strip-thickness reduction can be increased, just as minimum achievable gauges are lowered. Thus, a larger variety of strip thicknesses can be produced with essentially unchanged equipment.

Since work-roll lubrication reduces friction, it can decrease the deformation energy required in the mill. In relation to an entire strip, this reduction can be up to 20% (see Figure 3). Recent measurements showed that the savings for a reference strip of 2 mm final thickness amount to 13%. This translates directly into corresponding electrical energy savings!

Another benefit of lubrication is reduced work-roll wear, facilitating longer rolling campaigns between scheduled maintenance breaks and higher mill uptime.

A good investment

The Siroll^{CIS} HM work-roll lubrication package is a cost-effective and efficient upgrade for the modernization of strip-rolling mills. Apart from its mechanical content, the package also comprises a set of standardized interfaces and flexible communication options for easy integration into existing automation systems.

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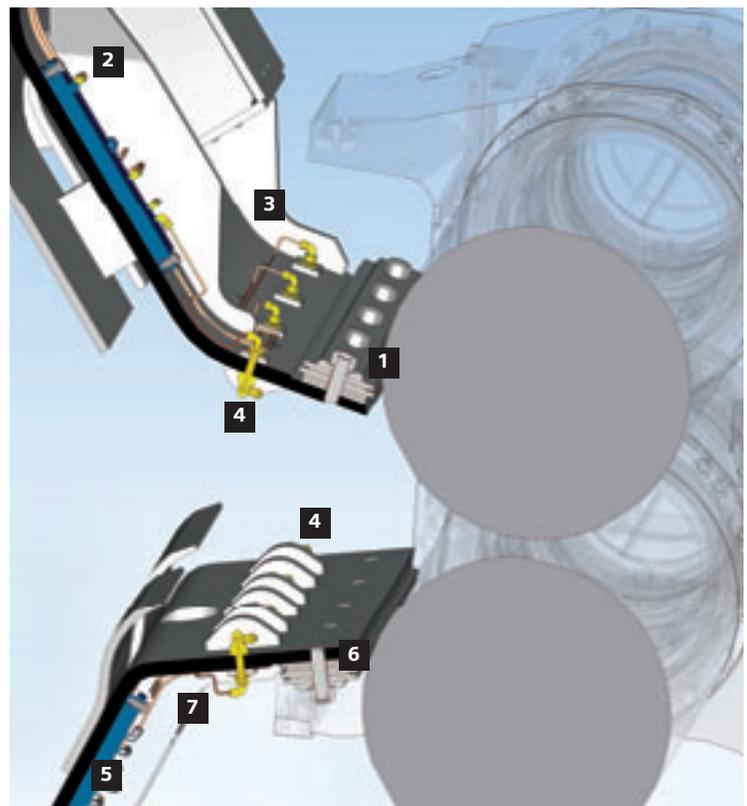


Fig. 2: Detail view of the Siroll^{CIS} HM work-roll lubrication system

- 1) Entry side – upper wipers
- 2, 5) Mixing unit
- 3) Entry side – work-roll cooling
- 4) Spray nozzles
- 6) Entry side – bottom wipers
- 7) Entry side – work-roll cooling

Siroll^{CIS} HM profile and flatness control

SmartCrown's Large Adjustment Capability

Siroll^{CIS} SmartCrown[®] is a worldwide established and installed technology to control profile and flatness. Due to SmartCrown's large adjustment capability, only one grind can replace all roll grinds of conventional rolls, which are usually employed in a mill stand in order to comply with the profile and shape requirements of various rolling programs. SmartCrown allows more flexible creation of pass schedules and rolling programs, and thus helps to optimally utilize mill capacity. SmartCrown is a simple and powerful profile and shape-control system. Axial roll shifting is performed by means of standard hydraulic cylinders.

ROLLING >

Strip profile distinguishes the variation in strip thickness across the width, including other conditions like crown, wedge, etc. After the rolling stock enters the roll gap, the work rolls are forced apart by the acting rolling force.

The effective work-roll crown plays a significant role in the generation of the strip profile, which is established by three components:

- Mechanical or ground crown profile – the initial shape of the rolls is determined by the SmartCrown roll shape
- Thermal crown profile – roll expansion due to heat transfer from the strip and friction heat
- Work-roll wear profile – reduction of roll diameter due to continual contact with the strip

The effective roll profile is always the sum of the above-mentioned profiles. The strip profile is established as a result of the roll-stack deformation, taking into consideration the actual roll profile as described.

In order to keep profile and flatness within a certain range, various actuators, designs and strategies are employed.

The general target is to adjust or keep the roll-gap contour within a certain range by considering unloaded roll gap, stretch of mill housing, roll flattening, deformation of roll assembly, thermal crown and wear of rolls.

Furthermore, the actuator should have a simple mechanical design and have the capability to suppress all types of buckles. Therefore, several actuators and controls are implemented. These are, in addition to SmartCrown, dynamic work-roll cooling for a better thermal crown control and extended shifting strategies on the last mill stands to enhance roll life.

SmartCrown

SmartCrown is a well-established roll contour developed by Siemens VAI. This patented contour is the result of a sinusoidal and a linear function, and is used for both the work and back-up rolls. The work-roll set-up position is computed by the Level 2 automation system according to the actual profile and flatness requirements.

In order to achieve an almost uniform load distribution between material work and back-up rolls, the back-up rolls are equipped with a complementary contour (Figure 2).

Profile and flatness control – SmartCrown benefits:

- Significantly enhanced control range compared to work-roll bending
- Replacement of all conventional roll contours with a single SmartCrown roll contour per stand
- More flexible pass-schedule design due to large adjustment range of the SmartCrown rolls
- More flexible rolling campaign design due to single roll contour per stand
- Almost linear relationship between work-roll shift and equivalent roll crown
- Lateral shifting performed by means of standard hydraulic cylinders
- Capability to control the strip contour in addition to the strip crown
- Enhanced shape control by suppression of all types of buckles including quarter buckles

The SmartCrown adjustment range of fourth-order is extremely large, not just the crown (center thickness, edge thickness) of a strip or plate can be controlled properly, but also the entire contour across the strip width.



Finishing mill stand with SmartCrown technology

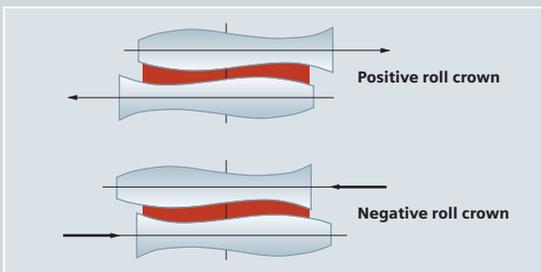


Fig. 1: Strip profile by work-roll shifting

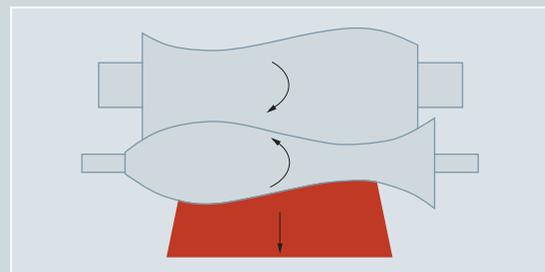


Fig. 2: Simplified Smart-Crown contour

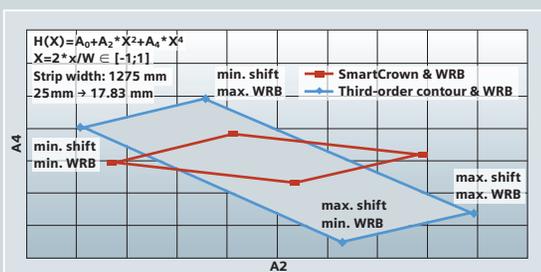


Fig. 3: Contour adjustment range – comparison of Smart-Crown system and third-order system

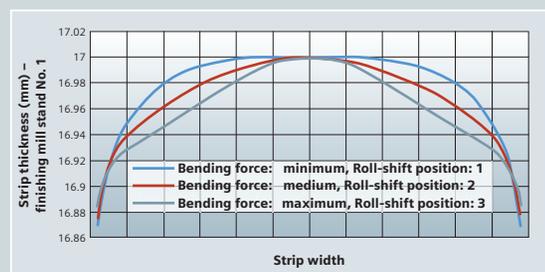


Fig. 4: Strip contours that can be reached by Smart-Crown strip contour control

Typically, the target contour is a parabolic curve, but any intermediate contour between the blue and the green curves can be achieved by a proper combination of the shifting position and the bending force. Systems from other suppliers using a third-order contour only are quite limited in the control of the target profile (crown) of a strip beyond the second order. By the same token, such systems have a limited capabili-

ty to correct strip contour disturbances of higher than second order to finally achieve a parabolic crown on the finished product. ■

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Microstructure target-cooling model saves costs in hot-rolling mills

Technology for a New Cooling Concept

Since the properties of the material that emerge from a hot-strip mill are mostly defined by the phase transformation in the cooling section, it was always an important task to control the temporal cooling course of the material as precisely as possible. This ensures the right mechanical properties of the material, such as tensile strength and yield stress, as well as the uniformity of these parameters along the strip length. Therefore, cooling-control systems have been implemented for a long time in the automation systems of hot-strip mills.

Until the end of the 1990s, this was typically done by pure feedback models, following the time-temperature course defined by the plant metallurgist, which was based on the calculated cooling rates needed for the material, and verified and fine-tuned using the measured results.

For this approach it was important that the other parameters like exit speed, water temperature and application, chemical composition, etc., remain as constant as possible. The use of specific cooling patterns and the feedback control in combination with usual process variations often showed that it was quite possible to control the coiling temperature target. However, neither the temporal cooling course towards the coiling temperature nor the phase transformation of the strip and its location – and thus the mechanical properties – could be adequately controlled.

With these limitations in mind, methods were developed to calculate the phase transformation using time-temperature diagrams. First steps were taken in the 1990s for the online use of the phase transformation knowledge. With the availability of more computational power, the work of Johnson, Mehl and Avrami could be put into practice, which lead to first results by controlling time-temperature curves with an



The new Siemens VAI microstructure target cooling model was introduced in 2007. Since then it has proven its capabilities to support the production of new and complex steel grades in a precise way, showing cost savings due to less out-of-tolerance production, less recoiling efforts due to phase transformations on the coiler, and an enhanced product spectrum. Especially in older plants with many restrictions and limitations, the new cooling-section automation system allows for the flexible manufacture of modern steel grades. After the presentation of the results at three revamped plants in the last issue, we focus here on the technology behind the model.



extensive set of parameters and the need for constant optimization and manual adjustment in the model. A major drawback of this approach is that tuning the model for a wide product mix is very complicated. For each steel grade, model parameters must be tuned for the heat capacities, the released transformation heat and the speed of phase transformation itself. It can be shown that choosing these parameter sets independently from one other leads to a misbalanced model, which contradicts the energy balance. Furthermore, modeling the phase transformation with Avrami's approach is valid only for the temporal cooling course for which it has been tuned. Changes to the cooling course lead to inaccurate results as well.

Consequently, the main requirement is a control system that correctly calculates and displays the temperature curve and phase components along the whole cooling section in real time, detects any deviations and appropriately reacts to such deviations. The mechanical limits of the cooling-control elements must be taken into account, but the control system must not impose any additional limitations.

Model-predictive controllers based on Gibbs' phase model

At this point, the new idea of an online-capable steel-grade parameter-free model using Gibbs' free enthalpy came from Siemens VAI, making it possible to calculate the phase transformation online without the need to optimize the model again after the addition of every new steel grade. This drastically minimizes the need for model maintenance. By means of a model-predictive control function, the stipulated time-temperature path in the cooling section is optimally followed for the whole strip within the limits of the plant. This enables Siemens VAI to offer a cooling section that works >>

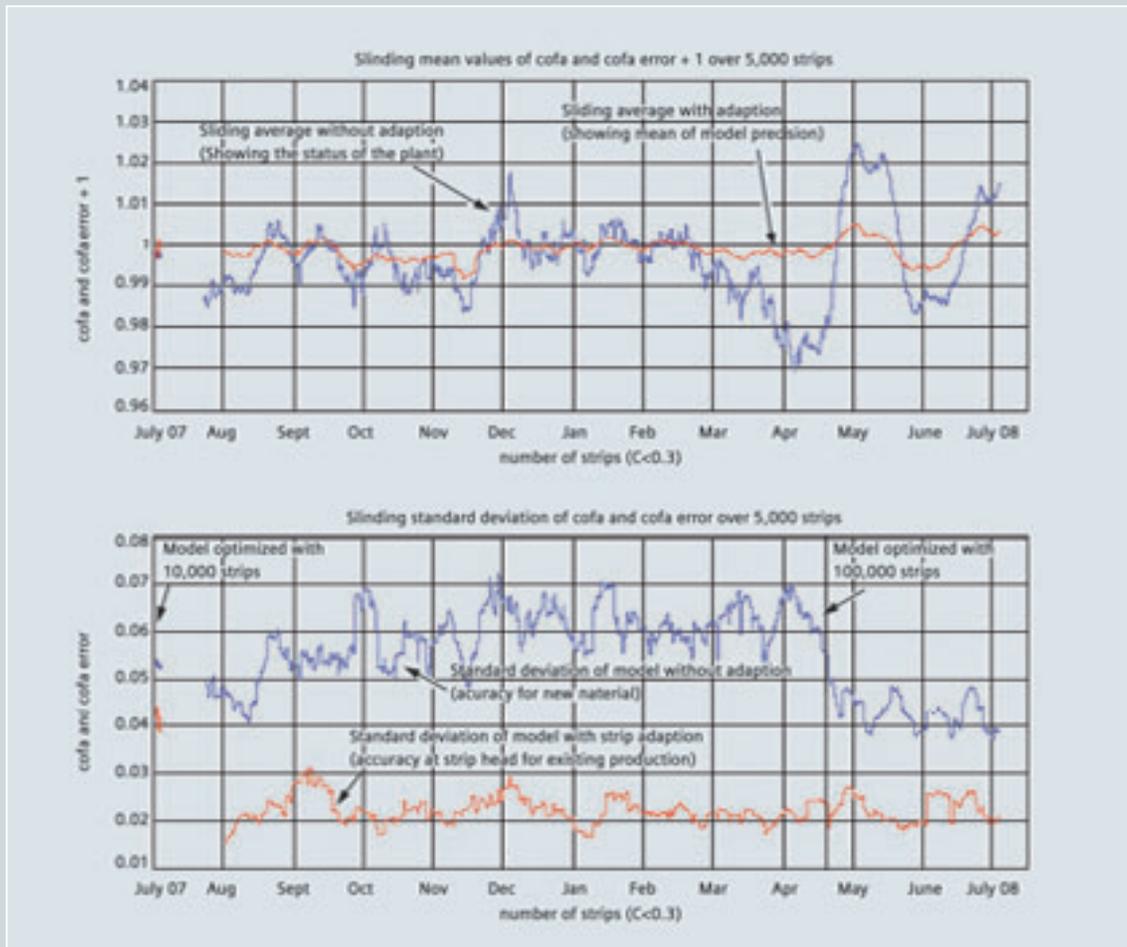


Fig. 1: Display of the correction factor for the physical model: with adaptation and optimization the factor varies only in a minimum way from the theoretical optimum 1.0. A typical standard deviation of the adapted model on the strip head is 2% of temperature difference between finishing mill exit and coiler temperature

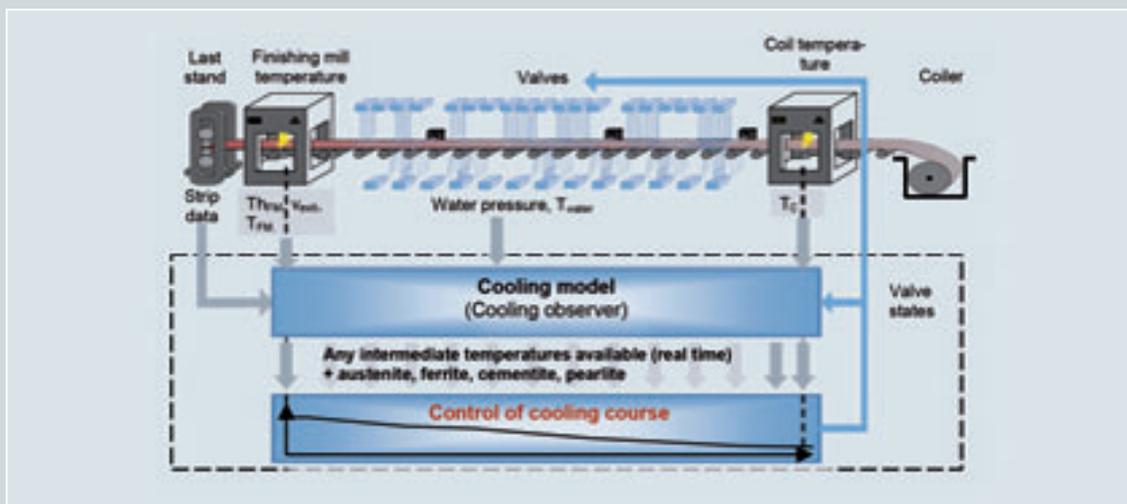


Fig. 2: Every 200 ms the system calculates the time temperature course for all points in the cooling section along with the resulting phases in order to adjust the valve pattern with a model-predictive control

>> with the steel producer's targets: the microstructure-dependent properties of the strip.

On the basis of Gibbs' free enthalpy, the equilibrium conditions at the interphase can be determined. Gibbs states that the material of a phase mixture will always occur in that phase where Gibbs' free enthalpy is minimized. At 700°C, the body-centered cubic crystal structure of alpha ferrite has a lower Gibbs' free enthalpy than austenite, i.e., unalloyed steel will occur in the ferrite phase in this case. Between a transformation temperature of 911°C and just under 1,400°C, the austenite phase has the smallest Gibbs' free enthalpy.

The basic idea of minimizing Gibbs' free enthalpy can now be extended to alloyed iron. The speed of phase transformation into pearlite, ferrite or cementite is now determined by the degree of carbon diffusion within the austenite. With these methods, the physical steel-transformation model is able to correctly describe the influence of different alloying elements and also take into account any resulting cooling curves. This is exactly the same approach as used by commercial programs for material design, such as ThermoCalc, Pandant or ChemSage.

Modeling of the transformation process on a physical basis now enables the control system to calculate the temperature curve to be used for particular phase components. On the basis of the current strip speed, measured temperature when the strip enters the cooling section, measured valve settings, and current water pressure and temperature, the cooling model calculates the cooling effect and the phase components of austenite, ferrite, cementite and pearlite along the strip.

The advantage here is to fine-tune the optimum cooling pattern for every strip point along the cooling section. Combined with the control concept of the model-predictive control instead of a simple feedback control, it is possible to keep the strips' temporal cooling course as close to the target as possible, and therefore reach an optimum result regarding the mechanical properties of the strip. For standard steel grades, the cooling course is specified as a time-enthalpy trajectory, with a final enthalpy value adapted in a manner that the final strip temperature matches the desired coiling temperature. Especially the latter strategy ensures constant material properties along the entire strip, and is particularly suitable for high-carbon steel grades that make their phase transformation under the coiling pyrometer.

Cooling strategies based on the time-enthalpy trajectory

By means of a model-predictive control function, the stipulated time-temperature path in the cooling section is optimally followed for the whole strip within the limits of the plant. The thermodynamic approach needs no

special parameter set for each different steel grade, hence reducing the necessary maintenance efforts for the model. Figure 1 shows, for example, the correction-factor deviations for the model being very close to 1.0, the theoretical optimum for a model that attempts to describe reality.

To ensure that the material properties are kept as close as possible to the target, the cooling section contains a controller that runs in cycles of 200 ms. In each cycle the controller recalculates the temperature model (including the phase transformation) for every strip point along the length of the cooling section, so that the time-enthalpy trajectory of each strip point is known at any time and can be controlled. The principle of this model-predictive control is illustrated in Figure 2.

Results

The improved quality and capabilities of the cooling model save production by reducing the number of out-of-tolerance coils and giving capabilities that models without online phase calculation and control cannot offer, and therefore make the plant ready for new complex steel types. Moreover, the strip cooling model increases the flexibility of the rolling mill: it is possible to switch over production between different types of steel whenever the situation demands, and new steel grades can be included in production without altering software or model parameters. The advantageous switch-over strategy with the resulting preview can be applied as well. This makes the new cooling models from Siemens VAI the best choice for the revamp of an old plant and a must for each new plant.

A new mill with accurate modeling of physics is particularly easy to start-up very quickly, with saleable products right from the first strip. The production range typically grows with time and thus the model can be adapted to the mill specifics during the commissioning phase. The replacement of the automation system in ongoing production demands a different strategy.

The microstructure target-cooling model from Siemens VAI was successfully implemented as a revamp in hot-strip mills at TKS Hoesch Hohenlimburg and ThyssenKrupp Steel WBW2 in Beeckerwerth (both in Germany), and the ArcelorMittal Vanderbijlpark in South Africa. These implementations were covered in the last issue of metals & mining. ■

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Latest technology to produce harder steel grades

New 6-High Reversing Mill at Borcelik

The newly commissioned Reversing Mill No. 3 (RCM3) in Gemlik, Turkey, is equipped with the latest Siroll^{CIS} CM technology. The capacity of this powerful reversing cold mill could be raised up to 50%. With the ability of RCM3 to produce harder steel grades, it serves primarily the automotive industry.

ROLLING >

In late 2006, the Turkish steel producer Borcelik, a joint venture of Borusan and ArcelorMittal, awarded Siemens VAI a contract to increase the rolling and processing capacity of its cold-rolling-mill complex located in Gemlik.

The project included a new reversing mill and galvanizing line as well as the upgrading of the existing pickle line. The scope of supplies and services covered engineering, supply of mechanical, electrical and automation systems and commissioning.

Following the start-up of the new and modernized facilities at the end of 2008, Borcelik was able to increase its output of processed products from 900,000 to 1,500,000 t/a.

RCM to produce harder steel grades

Siemens VAI is in a unique position to offer the complete scope from its portfolio, from PLC to inverter, from sensors to mechanical actuators. The perfect understanding of the process with the ability to control and supply all critical equipment is the key of the success of our Siroll^{CIS} product.

The main components such as the hydraulic roll-force cylinder, bending system and Planicim[®] shapemeter are engineered, manufactured and tested at our plant in Montbrison, France. In addition, automation systems have to pass severe integrated testing before being delivered to the customer's site. Those measures secure the erection and start-up time.

The mill is composed of a 6-high mill stand featuring a high-speed hydraulic roll-force cylinder, bending for workroll and intermediate roll, and long-stroke shifting of the intermediate roll and selective cooling on the entry and exit side. The fast actuators accurately control the strip thickness and flatness independent of the input product. Strip geometric characteristics are precisely monitored by entry and delivery X-ray

gauges, and a Planicim[®] shapemeter on delivery side ensures measurement of the product quality. The mill is served by two powerful coilers with an independent hydraulic gripper bar. This feature brings important yield improvement by allowing the full tension of 140 kN to be applied after only half wrap.

Plant data

| | |
|------------------|--|
| Mill type | Single-stand, 6-high reversing cold-mill |
| Annual capacity | 450,000 t |
| Rolling speed | max. 1,200 m/min |
| Main drive power | 2x3,000 kW |
| Roll force | 20,000 kN |

Production data

| | |
|-----------------------|-------------------------|
| Material | CQ, DQ, DDQ, EDDQ, HSLA |
| Entry strip thickness | 1.5–6.0 mm |
| Exit strip thickness | 0.25–3.0 mm |
| Strip width | 700–1,550 mm |
| Coil weight | max. 30 t |

For the first pass, a pay-off reel with a state-of-the-art preparation station including five roll flatteners guarantees an optimum shape for strip tail and head end. Perfect strip preparation in addition to automation-assisted threading support the operators in minimizing the idle time and improve production ratio.

The Siemens VAI automation and drive system ensures the perfect control of the equipment for the benefit of the product quality. As a crucial feature, safety complies with the EU standard to allow for comfortable working conditions, directing the operator's focus to production issues and increasing the added value of the process.



Reversing cold mill, Borcelik, Turkey

Latest-generation automation system

The automation is based on the tried-and-tested Simatic S7 400 System with FM458 for high-speed technological controls.

The automation solution of Siroll^{CIS} CM achieves tight strip-thickness performance. It relies on the proven AGC (Automatic Gauge Control) combined with the highly sophisticated REC (Roll Eccentricity Compensation), which are employed to compensate – as far as possible – thickness errors entering the stand as well as those caused in the rolling process, and to achieve close thickness tolerance on the finished strip. These very fast compensations are possible thanks to two main hydraulic cylinders controlled very accurately and dynamically in position and force modes by the HGC (Hydraulic Gap Control) function. The strip-thickness deviations are measured by two thickness gauges, one on each side of the roll bite. The following control modes are available on this mill along with other complex compensations:

- Feed forward control
- Feedback control
- Mass flow control

The flatness control uses a Planicim[®] shapemeter and controls the flatness with a proven multivariable control algorithm called FLC (Flatness Control), part of Siroll^{CIS} CM and patented because of its specificity.

This control optimizes the use of all actuators available on the mill: intermediary and work rolls bend, tilt, shift and selectively cool for optimum product quality.

The drive system is equipped with synchronous motors and the latest generation of Siemens AC drives – Sinamics SM120. This ensures excellent control performance, especially for the coilers. As an additional feature, direct tension control has been implemented for the coilers using tensiometers.

Successful launch and upcoming success

The project has been very intense with only 24 months between signature of the contract and the first coil. This achievement was possible with the constant and close cooperation between Borcelik and Siemens VAI.

After the ramp-up, the mill is now running at the nominal production and quality is stated to exceed the other facilities. This complex includes also a continuous pickling line and a new hot-dip galvanizing line, both supplied by Siemens VAI. ■

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Small modernization packages for cold-rolling mills

Get Rid of Third-Octave Mill Chatter

Third-octave mill vibration still remains a challenge in many cold-rolling mills, since it often reduces mill productivity by limiting the mill's maximum speed. Today this phenomenon can be handled effectively thanks to a newly developed high-speed servo-valve that actively dampens the production-compromising oscillations by inducing damping to the mill stand.

ROLLING >

Third-octave chatter is self-excited vibration common to practically all tandem cold mills. The phenomenon's name is derived from musical octaves, whereby the third musical octave is 128–256 Hz. The new Siemens VAI anti-chatter damping system does not require speed reductions that usually mean lowered mill productivity (see Figure 1), or chatter marks, which cause the material to be downgraded. Additionally, overall vibrations of mechanical components are reduced, which result in a longer lifetime for individual mill components.

Intensive measurements and investigations have to be carried out to understand when and why third-octave chatter occurs. In order to lower chatter risk, operators intervene by reducing the speed when they start to recognize noise. Third-octave chatter is a diverging (unstable) vibration that often builds up too quickly, and once it has set in, it is difficult to avoid. The chatter causes the strip to tear off between two tandem mill stands. Measurements show that maximum accelerations go up to several g (gravitational acceleration).

By understanding third-octave mill chatter as an instability, it becomes clear that a stabilizing controller is required to eliminate this phenomenon at its source. The rolling process is a highly nonlinear system, so the challenge was to develop a proven stabilizing controller. The stabilization is performed via "damping injection." Based on various studies, the hydraulic roll-force cylinder was chosen as the location for damping injection. With a nonlinear controller that uses acceleration and pressure measurements as inputs, an additional active chatter damping servo-valve is actuated. The controller action of the active damper is sharply limited around the chatter frequency. Thus there is a very clear frequency separation between an AGC controller and the active chatter damping system.

The active chatter damping system is consistently designed as a completely integrated and autonomous mechatronic solution. Thus it is also ideally suited as an intelligent and efficient "add-on" in existing installations.

The active chatter damping servo-valve and the hydraulic roll-force cylinder represent a functional unit, since direct attachment onto the hydraulic cylinder is required in order to avoid delays imposed by the transport time of oil in pipes (see Figure 2).

The decentral and independent controller is completely modular with quality-assured robust and pretested components that form a functional unit.

In Figure 3 you can see an overview to the Siroll^{CM} active chatter damping system.

No servo-valve available on the market could fulfill the dynamic requirements. MOOG entered into a development cooperation with Siemens VAI, which resulted in a completely new servo-valve generation that fulfills the requirements.

The actuator now meets the essential requirements as follows:

- Frequency range beyond 150 Hz
- Phase shift maximum 30° to 50° up to 150 Hz ■

Main Benefits

- Increase in yield
- No speed reduction required
- Overall vibration reductions in mechanical components
- Cost savings in respect to yield increase and reduced material downgrading

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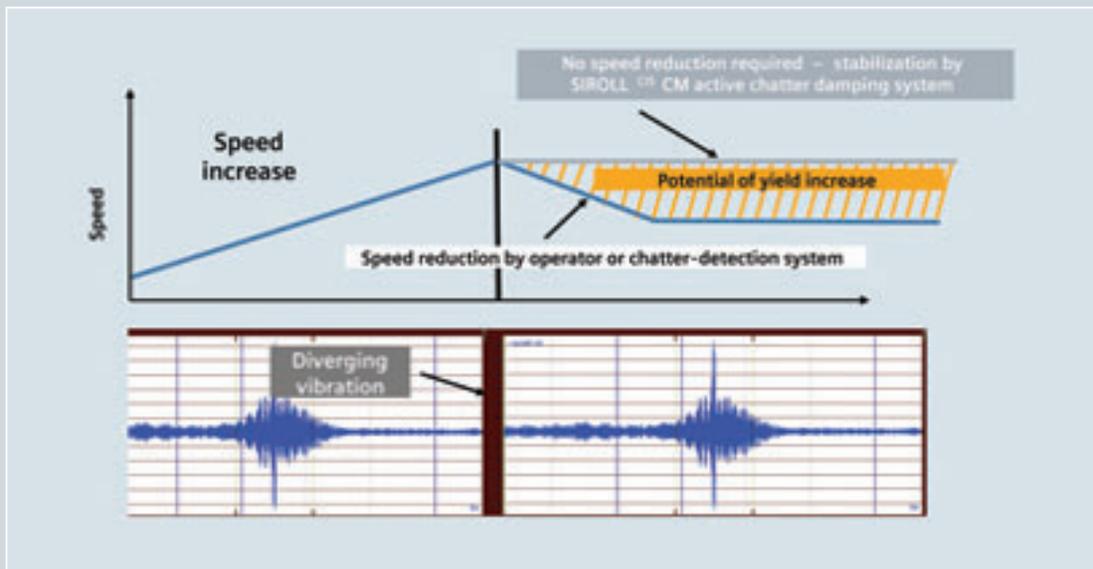


Fig. 1: Concept to avoid third-octave chatter

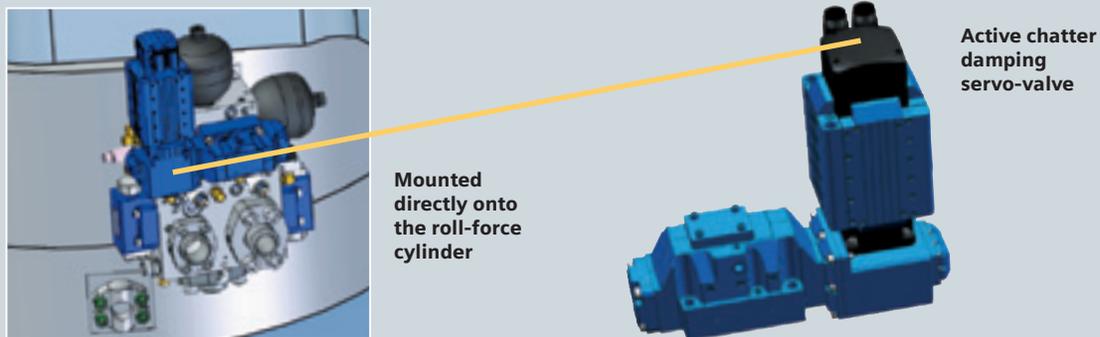


Fig. 2: Servo-valve is mounted directly on the cylinder

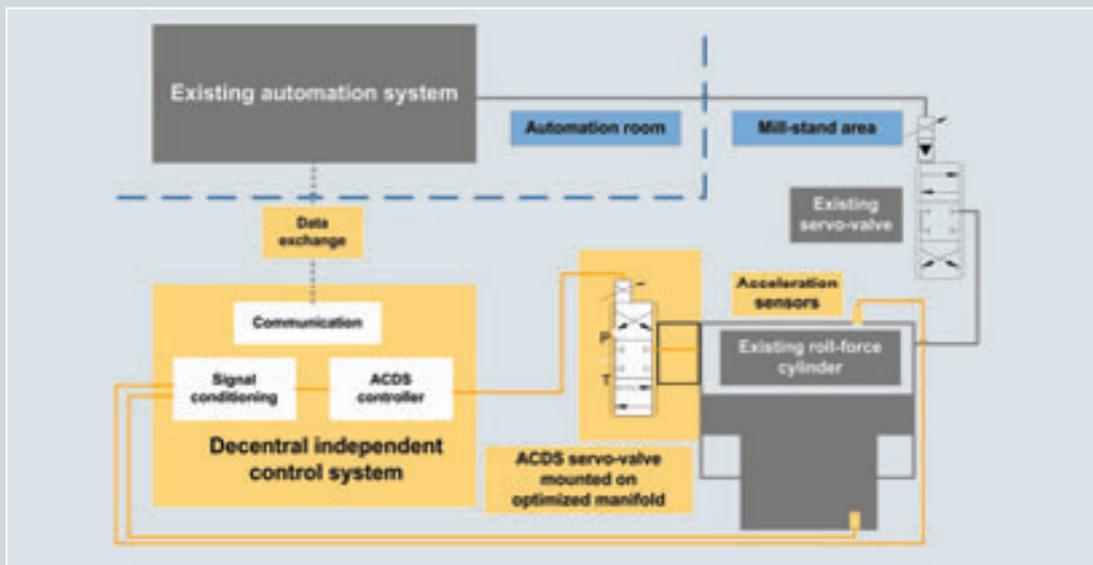


Fig. 3: Siroll^{CM} active chatter damping system

Gain performance and save costs

Upgrading Tandem Mills

Batch cold-rolling mills as well as separate, existing pickling lines and tandem mills offer potential for performance and yield improvements, cost savings and added product diversity through intelligent line upgrades.

ROLLING >

Many high-quality-product markets like the automotive, household and appliance industries place high demands on strip products in terms of strip thickness, flatness, surface quality, mechanical properties and microstructure. These requirements can only be met efficiently using continuous cold rolling. With the current market situation and cost pressures, cold-rolling tandem-mill operators are hard-pressed to upgrade their existing lines if they want to preserve market shares or enter new markets that require higher-quality strip products.

Economical considerations

Continuous mill operation influences various operating-cost aspects: energy costs are impacted since continuous operation requires less overall deformation energy as well as maintenance and consumables (personnel, rolls, general wear parts, emulsion, etc.).

Continuous operation also brings savings because threading-in and tailing-out operations are eliminated. Off-gauge lengths are shorter, which directly improves yield performance. On top of that, there is no more coil storage between pickling and rolling, saving floor space and stocking costs.

Process benefits

A Siroll^{CM} upgrade package typically comprises a new pay-off reel solution, a laser welder, a looper, bridles, and an exit section with a new flying shear and a 2-tension-reels or carousel-coiler solution (see Figures 1 and 2).

Apart from the mechanical upgrade or extension of the pickling line and the tandem cold mill, various process-control functions help to optimize throughput. To improve strip thickness and flatness control, the technological control system includes hydraulic gauge control (HGC), control loops for optimum thickness performance and tension control.

However, the two most important functions in continuous mode are speed optimization and flying gauge change: The speed-optimization control module uses line parameters, operating constraints and product data to optimize looper positions and speeds in each line section. The objective of this function is to ob-

tain highest throughput at any time in all situations. The flying gauge change helps to extend the range of grades and sizes that can be welded together. This in turn provides more flexibility for production scheduling.

As a whole, upgrading from batch to continuous rolling, or even an integration of a separate pickling line with an existing batch mill into a PLTCM (Pickling Line Tandem Cold Mill) can yield substantial improvements and savings, as shown in Figure 3.

Preparatory consulting

Companies considering an upgrade of their production facility to continuous and/or coupled mode can use two Siemens VAI service offerings: 1) a mill study for upgrading tandem cold mills from batch to continuous mode or 2) a mill study for coupling pickling line and TCM (tandem cold mill) linking the pickling and cold-rolling process. In the first step, both studies analyze the existing TCM, taking into consideration the layout of the mill, coil-transport system, product mix, production capacity and current performance parameters. In the second step, upgrading measures are identified that help to increase production capacity and improve quality. Subsequently, new layout options and suggestions for new, additional machines or upgrades are prepared, providing the client with a clear set of data for investment decisions.

Proven services and upgrades

Siemens VAI has a convincing track record of modernization projects that focus on coupling existing facilities or installing equipment that allows continuous rolling in what previously were batch mills. Arcelor Mittal, Benxi, Panzihua, voestalpine, Krakatau steel mills and other customers around the world serve as references for successful projects of this kind. ■

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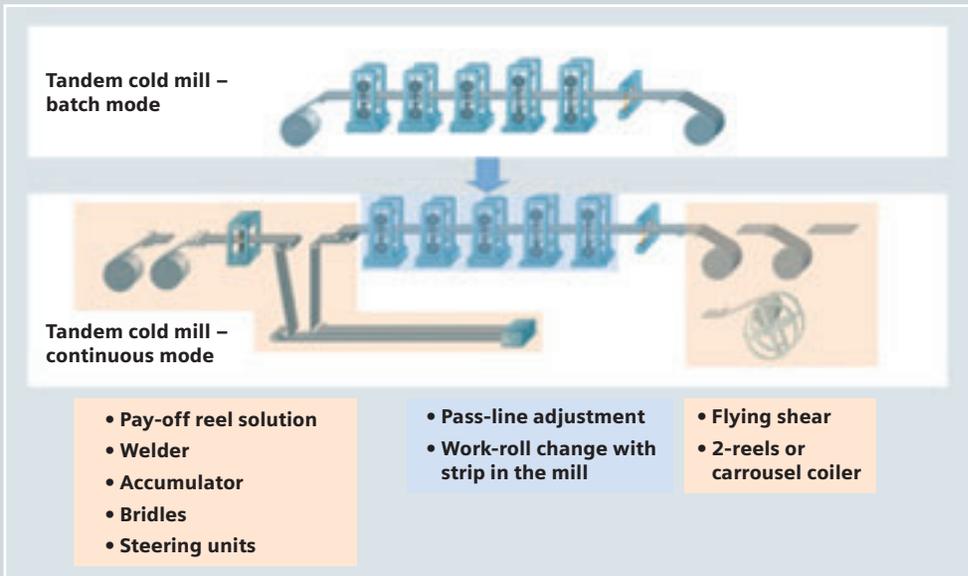


Fig. 1: Continuous cold rolling: from batch to continuous operation

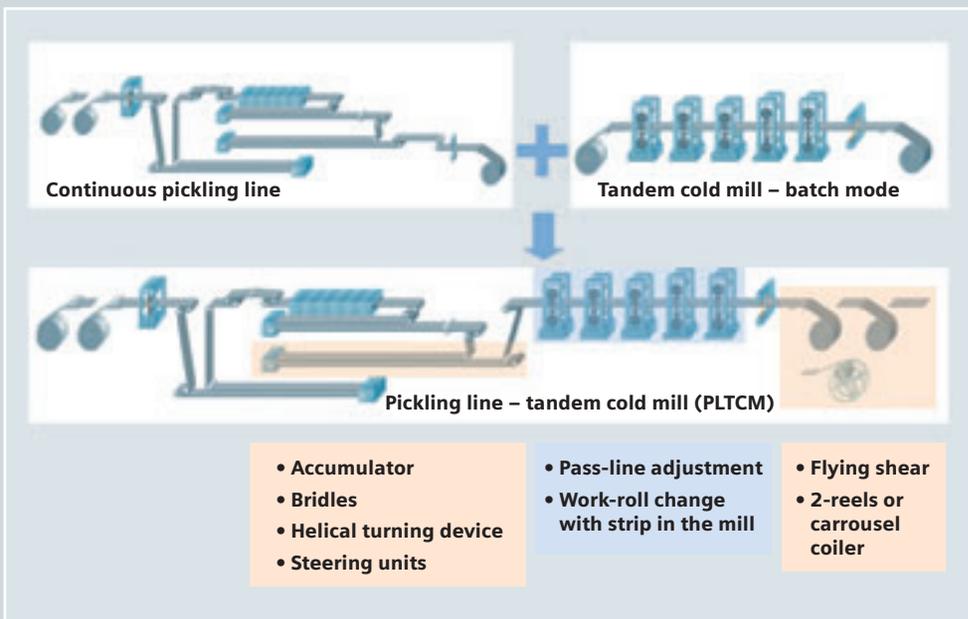


Fig. 2: Continuous cold rolling: coupling of existing pickling line and the existing tandem mill to a PLTCM

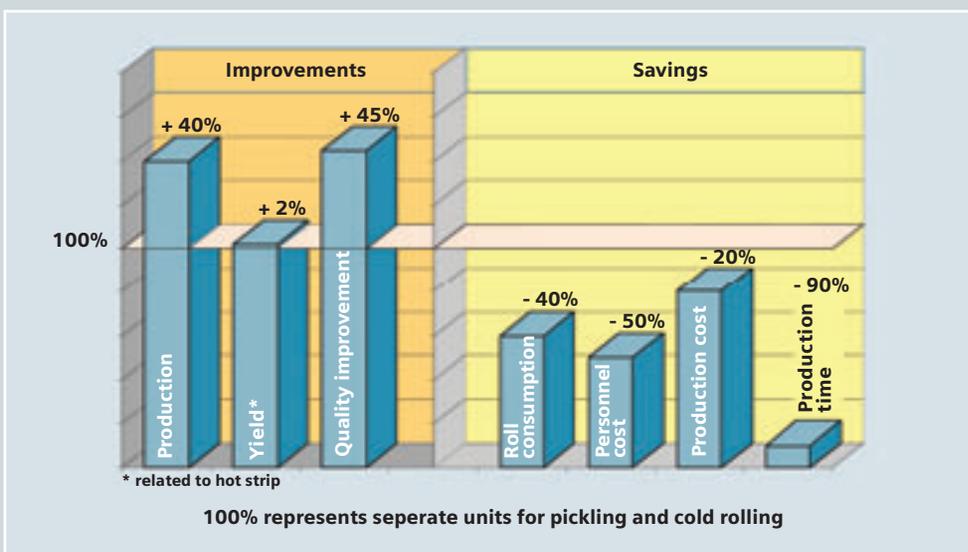


Fig. 3: Potential savings and improvements after a conversion of an existing pickling line and an existing batch mill to a PLTCM

AFGC technology from Siemens

Fast Flatness and Gauge Control

To meet the increasingly challenging demands for improvements in product quality in the stainless steel market, Siemens VAI has developed a set of technology packages for upgrading and revamping 20-high mills and for incorporating these features in new mill installations. Automatic Flatness and Gauge Control (AFGC) is designed to upgrade reversing mills for enhanced flatness and thickness production performance.

ROLLING >



The main element in the innovative AFGC technology package is Siflat, a Siemens development for flatness measurement. Siflat provides a contactless flatness measuring system and totally eliminates potential strip surface damage and high maintenance costs associated with the conventional shapemeter roll-flatness measuring system.

Siemens has also developed a variant of the Siflat that includes a thickness gauge measurement. This solution eliminates the typical C-Frame and saves space in the mill, giving more flexibility for re-vamping 20-high mills.

High-tech mechanical actuators for performance

Another key component of the Siemens package is the mechanical actuators, consisting of two fast hydraulic screw-down cylinders, dynamic crown-control cylinders and the flexible backing assembly. This equipment provides the main gauge and flatness control actuators. The low friction cylinders ensure a fast response and are controlled by high-precision, digital position transducers.

The crown-control cylinders act on B&C shafts in a dynamic and fully automatic mode during rolling, while the A&D shaft-positioning devices are used for static presetting. These features contribute higher rolling speeds, higher mill productivity, fewer strip breaks, no strip marking and low maintenance.

A further flatness-control tool involves lateral shifting of the first four intermediate rolls. This is a push-pull system actuated by two hydraulic cylinders attached to each roll. This actuator is available when rolling above a minimum speed and complements the dynamic crown-control cylinders.

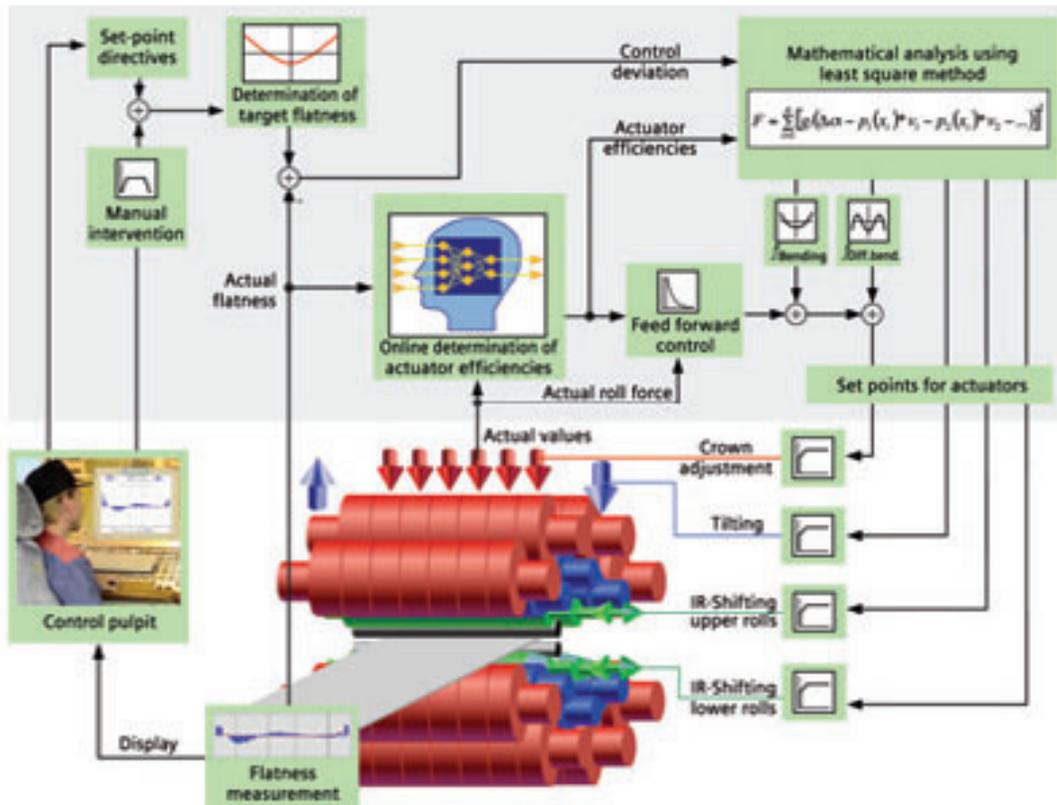
Gauge-control and crown-control systems along with lateral shifting is combined to form the perfect set of actuators for Siflat flatness measurement in order to achieve the best flatness results.

Neural network flatness control

Siemens VAI flatness control ensures the best possible roll-gap profile at all times based on reliable measurement of the tension distribution in the strip. Using the actual flatness deviation and self-learned effectiveness of the actuators, an intelligent algorithm generates the optimum correction for the flatness error.

To achieve maximum knowledge of the actuator effectiveness, Siemens VAI has developed a neural network that adapts the effectiveness continuously during the entire rolling process. Best dynamic behavior

Siroll^{CS} Advanced Flatness Control principle



is achieved by the control system monitoring the actuator priority as well as the actuator speed, resulting in a high-precision flatness control system.

Acroni ZR21 revamping project

Siemens VAI recently carried out a highly successful 20-high mill revamp incorporating all the described technology and features for Acroni, the largest Slovenian steel manufacturer. The company specializes in the production of flat steel products, especially stainless, structural, electrical and special steels that meet the demanding requirements of the global steel market.

All of Acroni's production of cold-rolled strip is processed on their 30-year-old ZR21 20-high reversing cold mill. In order to meet the increasing quality demand for silicon and stainless steel, while reducing operating costs, Acroni decided to upgrade the gauge control system and add the new Siemens flatness control package.

Siemens VAI supplied the complete technology package comprising:

- Two Siflat shape measurement with integrated thickness gauge
- Dynamic crown actuators (B&C shafts)
- Dynamic screw-down cylinders (B&C shafts)
- Dynamic first intermediate roll push-pull side shift
- Closed-loop shape control system

- Hydraulic power unit

Just as important as the technical solution, Siemens VAI mobilized a highly professional team to ensure overall coordination and customer satisfaction. The Acroni project demonstrated the ability of Siemens VAI to reach performance milestones in record time while operating in a downtime window of just 13 days. Fully automatic operation of the flatness control equipment was achieved – at full speed – just one week after the end of the shutdown period.

Benefits to Acroni and elsewhere

Benefits from the Acroni mill revamping have been several and far reaching. In fact, each part of the AFGC package contributes to the achievement of the different objectives required by the customer.

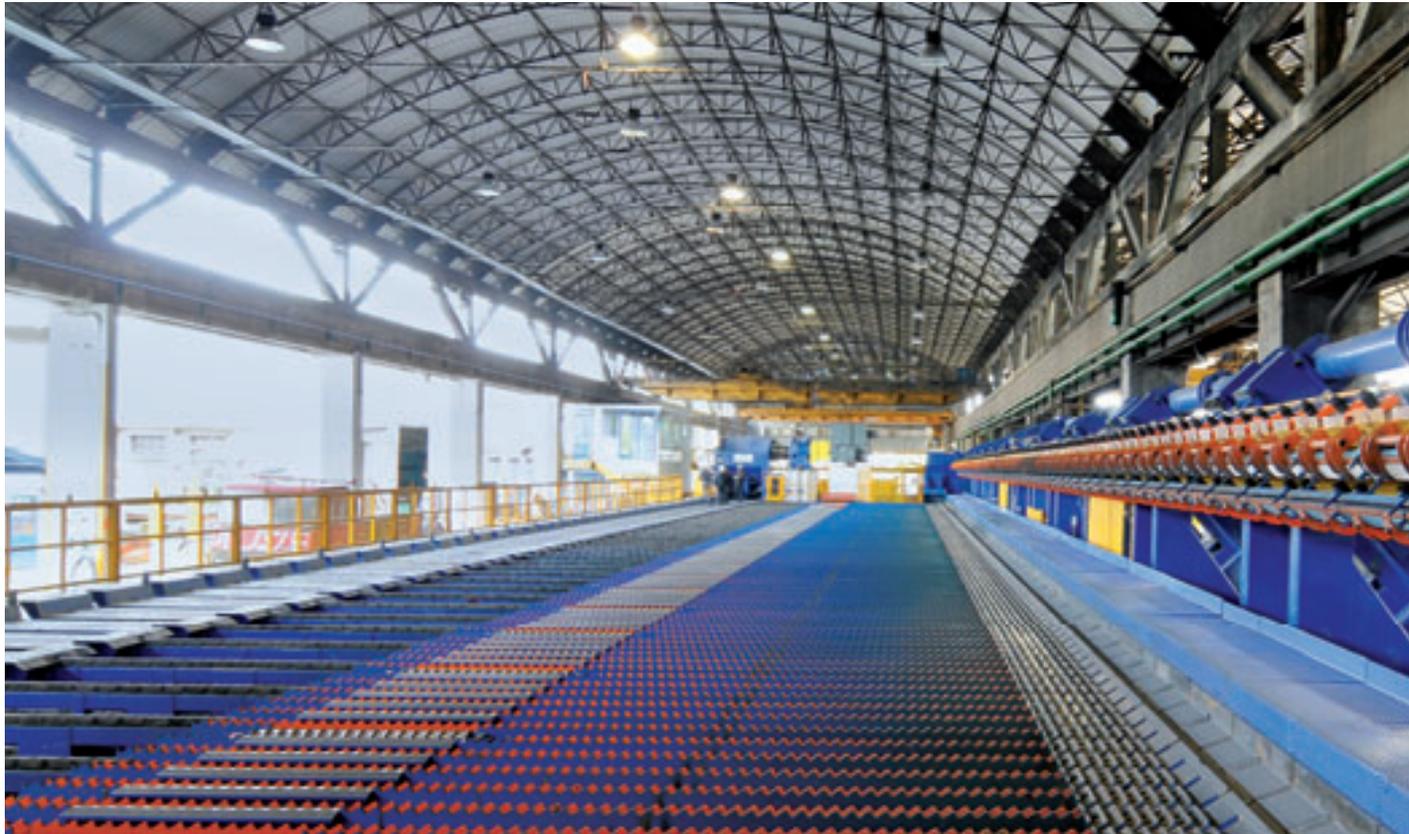
Productivity has been improved through stable rolling at higher speeds, reduction of strip breaks and higher equipment availability. There has also been a noticeable reduction in operation and maintenance costs, even while the yield of higher-quality strip with fewer strip marks and better surface flatness has been achieved. ■

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Start-up of the modernized rebar mill at Ferriera Valsabbia SpA, Italy

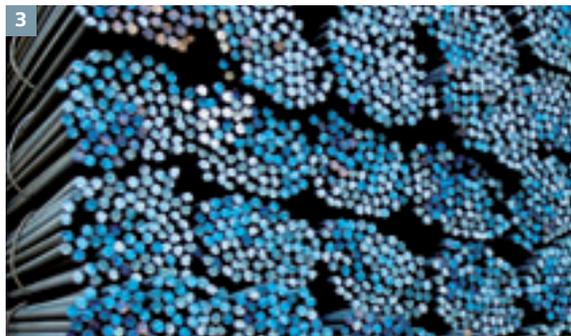
25 Percent Capacity Boost

In June 2006, Siemens VAI received a two-phase contract for the revamping of the rebar rolling mill at Ferriera Valsabbia, located in Odolo, in the Italian province of Brescia. A principal target of the mill modernization was to expand the annual production capacity of reinforcing steel by approximately 25% to 750,000 tons. New equipment had to be installed and existing equipment upgraded with minimum interruption in ongoing mill production.

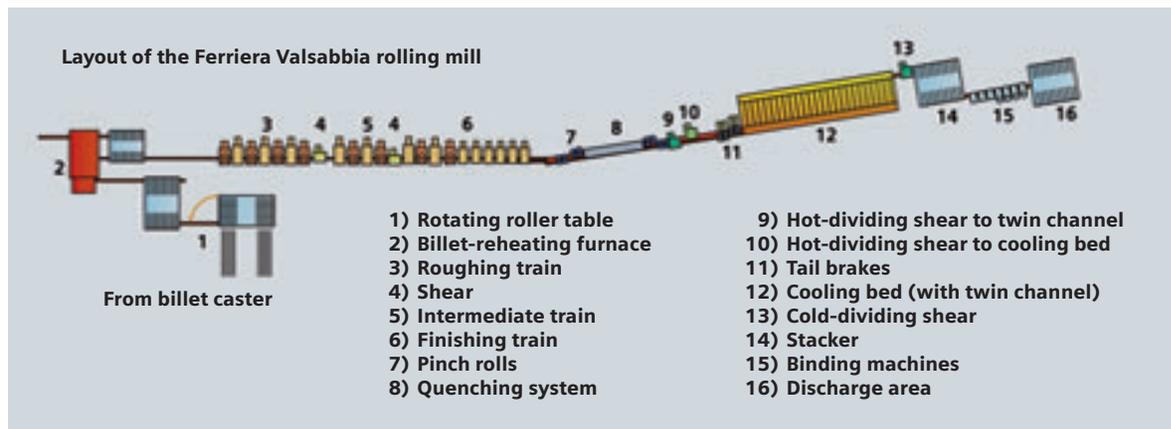
This highly challenging project was carried out in two phases during 2007 and 2008. Work included the supply, installation and start-up of a new billet hot-charging system, 14 so-called RedRing rolling stands and a new cooling bed equipped with both apron and high-speed delivery equipment. Seven of the existing rolling stands were retrofitted. Lubrication and hydraulic systems, operational change parts, all of the shearing equipment for the rolling line and cold-cutting area, machines for counting and bundling steel bars as well as services for erection and commissioning were also provided.

The reheating furnace, which has a capacity of 100 tons per hour if the billets are cold charged, could be

increased to up to 130 tons per hour with the hot-charging system supplied by Siemens VAI. Rapid replacement of rollers and stands, allowing a flexible changeover to different end products, is made possible thanks to the company's unique RedRing stand design. The upgraded rolling mill is capable of rolling billets to rebars with diameters between 8 mm and 40 mm. In two-slit rolling mode, a maximum bar diameter of 20 mm is possible. Bar transfer to the new 64-m-long cooling bed is carried out either by means of a lifting apron with magnetic brakes, or by applying a high-speed bar-delivery system that allows rolling speeds of up to 27 m per second. The latter is designed in such a way that individual steel bars can be trans-



- 1 Cooling-bed section
- 2 Exit of billet from reheating furnace
- 3 Quality rebars ready for dispatch



ferred to the walking rakes, even in the two-strand-rolling mode. This facilitates subsequent bar counting and bundling.

Mission accomplished

Meticulous project planning and the flawless interface with the customers' production schedule kept mill shutdown time to an absolute minimum. The associated loss in production was more than compensated for in the following months through enhanced mill performance. All of the project targets were achieved. Thanks to the excellent cooperation between Ferriera Valsabbia and Siemens VAI, installation could be "planned to a T," while the very limited

plant downtime could be ideally utilized for on-site installation work.

State-of-the-art technology from Siemens VAI combined with the customer's operational expertise allows the Ferriera Valsabbia rebar rolling mill to be flexibly operated at the highest levels of performance and reliability. ■

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Interview with Ruggero Brunori, Managing Director of Ferriera Valsabbia SpA, about their mill modernization project

Continuing the Tradition of Excellence

ROLLING >



Silvano Braga of Siemens VAI (left) and Ruggero Brunori (right) of Ferriera Valsabbia SpA

What were the main reasons for this modernization investment by your company?

Ruggero Brunori: Let's start by saying that the existing rolling mill was somewhat obsolete, having been installed about 20 years ago. Although it still had a good productivity, we felt it was inadequate for several reasons. The meltshop was casting around 30% more billets than the mill could roll, and we were forced to sell the excess billets, even to our competitors. We also thought that we would significantly lower our energy consumption by installing a state-of-the-art mill, which did in fact happen. Furthermore, we wanted to provide the best working conditions for our rolling operators and optimize control of the production process. Valsabbia got an installation that is certified according to all applicable European standards.

Could the overall project progress be kept on schedule?

Ruggero Brunori: It could. All parties were zealous in relentlessly tracking the project development and optimizing all its tasks. Therefore, the overall project could indeed be kept on schedule.

Why did you select Siemens VAI as the main partner for this project, and how would you characterize the working relationship with them?

Ruggero Brunori: We chose Siemens VAI because we considered the company to be the most reliable plant supplier, both for the technical scope as well as contract management. Ferriera Valsabbia has always had a positive relationship with Siemens VAI

"We chose Siemens VAI because we considered the company to be the most reliable plant supplier, both for the technical scope as well as contract management."



**Ruggero Brunori,
Ferriera Valsabbia SpA**

What were the key challenges that had to be met during the project?

Ruggero Brunori: As the new mill was to be installed in the same area as the existing one, this would inevitably affect production. In order to minimize disturbance, all construction activities had to be carefully planned and sequenced, and as much work as possible had to be carried out with the existing mill still in operation. To keep production stops to an absolute minimum, installation times were very tight.

Would you still have made this investment if you had known that the economy would go into a recession?

Ruggero Brunori: Yes, we would still have invested in this project. Ferriera Valsabbia has been operating for more than 50 years, which gives us a special ability to appreciate the market scenario. We knew that we had to innovate and modernize the rolling mill.

based on mutual trust and commitment to the respective responsibilities and pledges.

How do you envision the outlook for your company? Any further investments planned?

Ruggero Brunori: Valsabbia is committed to a long-term market presence and to maintaining its image as a reliable and first-rate producer. Future investments will, of course, depend on the economic situation in the steel market. At the moment, no new projects are planned for the short to mid term. ■

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Building long product mills in the GCC area

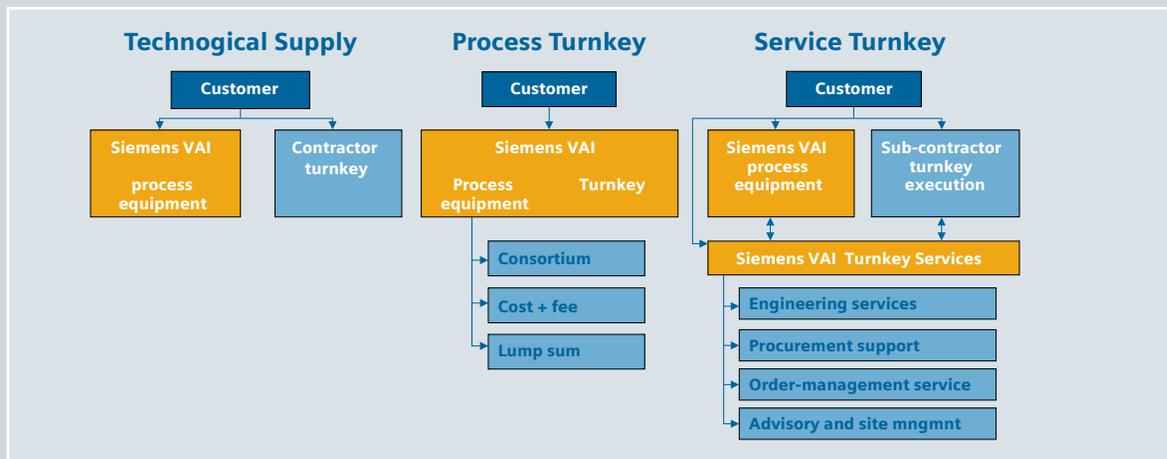
Project Models at Work in the Gulf

The Gulf Cooperation Council (GCC) area is known for its massive investments in construction projects, which need to be completed in compact time frames. Different project-contract schemes are possible, ranging from the simple supply of the core equipment to full turnkey plants where different risk profiles must be assessed and managed. PM@Siemens is a complete methodology that can be extended over the entire life cycle of a rolling-mill project.

ROLLING >



Rolling mill at Union & Iron Steel, Abu Dhabi, U.A.E.



Lump-sum turnkey contract, supply contract for core technological packages, and turnkey service models

Steel is recognized as a major driver of growth in virtually every industrialized economy. An explosive growth of steel demand started in the GCC area in the early 2000s, originating from the re-investment of the strong oil revenues to structure a manufacturing and service base in the region, facilitated by the strategic location at the crossroads of the main trade flows from China and India to Europe and from the Black Sea and Middle East to the Far East.

The strong overall economic performance of the GCC area has boosted the construction sector for which steel long products, and specifically rebar, are the mainstay both for urban property and for infrastructure developments. Siemens VAI, a world leader in the engineering and construction of hot-rolling mill plants for long products, is participating in this development of the steel industry in GCC countries. It has already supplied 11 new complete plants, six of which are in the United Arab Emirates alone.

Project structure and internal management processes

A complete hot-rolling-mill project comprises a core technological line (mechanical equipment and related media services, electrical engineering and automation, water-treatment plant, process expertise – all of which are Siemens proprietary packages), complemented by main non-proprietary packages (re-heating furnace, workshops, etc.) as well as the overall plant infrastructure and service equipment. All of these packages are technically integrated in a turnkey plant, typically developed on a greenfield basis in the GCC area.

Without detailing the technological contents of the rolling mill, a specific feature of the projects execut-

ed by Siemens VAI in the GCC region is that they are based on standardized and integrated core packages. The efficient incorporation of the available product solutions in a single plant project revolves around a structured PLM (product life-cycle management) system interacting with an articulated project-manage-

PM@Siemens plays a key-role in combining stringent project-time requirements with absolute production reliability and convenience of plant operations.

ment system, such as PM@Siemens. These two structural approaches form the backbone of effective utilization of core lines, which is essential for combining stringent project-time requirements of the GCC area with absolute production reliability and convenience of plant operations.

Contract models govern project execution

The contract models applied to the construction of a rolling mill are typically of two types: the lump-sum turnkey and the supply contract for core technological packages. The attractiveness of both these models may be limited in terms of sales volume, financial risks and added project value (organizational setup, market visibility, business-driving effect, partnerships, etc.). For this reason Siemens VAI has proposed to the market and successfully applied two other models of project-execution contracts.



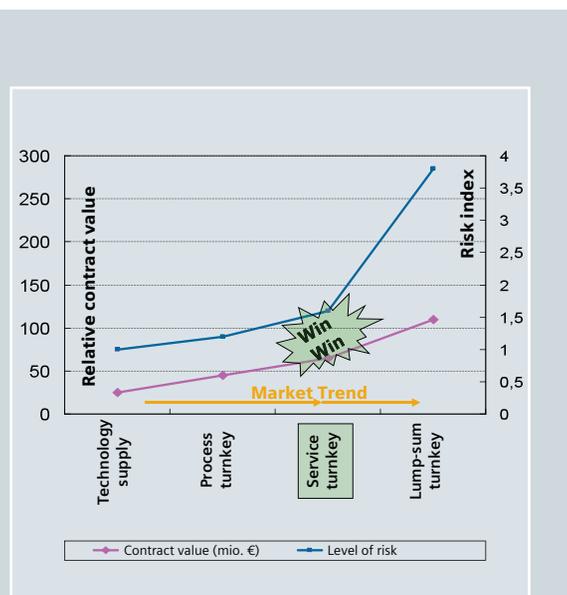
>> Process Turnkey Model

Using this model, Siemens VAI supplies a large core technological portion, including proprietary technologies (mechanical, electrical, automation, water-treatment plant, related services), as well as some non-proprietary packages (typically re-heating furnace, workshops). This core technological portion is integrated by the basic design data for the remaining BoP items to complete the turnkey plant. The customer retains the ability to choose the turnkey contractor.

Service Turnkey Model

With this model, the direct scope of Siemens VAI supply is enlarged beyond core equipment to include basic and detailed engineering for the balance of project and supporting technical specifications. Significant project-management experience in steel plants and related businesses, together with engineering capability available at Siemens, enable Siemens VAI to exploit the service and supply partnership with the customer well beyond the purchase-order phase. This model is particularly suitable for projects in which investors require a higher level of management coordination and leadership from a contractor like Siemens VAI.

With this model, Siemens VAI provides the customer with all the technical and project-management services of a general contractor, but without marking up on the total of the turnkey packages and excluding "risk balance" hedging. Such values remain as potential savings to the capital investment of the customer, which turns the Service Turnkey Model into a win-win project solution.



Contract value vs. risk Index

Project model comparison based on ROI indices

The most objective comparison of the effectiveness of the different models for project execution is based on the Return on Investment index (ROI = ratio between profit and capital investment). Performing this comparison involves combining the KPIs of investment budget, the overall project life-cycle time, and the plant operational efficiency (production ramp-up and stability in the time intended as a ratio between the actual and the nominal capacity of the plant). Precise

The Service turn-key model results attractive due to the more balanced risk scenario.

KPIs exist for rolling-mill-plant implementation, based on market indices and on the particular experience of Siemens VAI in the execution of a number of similar projects in different contexts worldwide.

Overall project-execution performance can be measured by examining the sum of the deviations from the benchmark values of each KPI, assumed equal to 1. A value greater than 1 for the budget and the schedule KPIs means worsening deviation versus benchmarks, whereas, for the plant-operability KPI, it stands for better than the forecasted target. The combination of the three KPIs provides a concept of evaluation for the various contract-execution models.

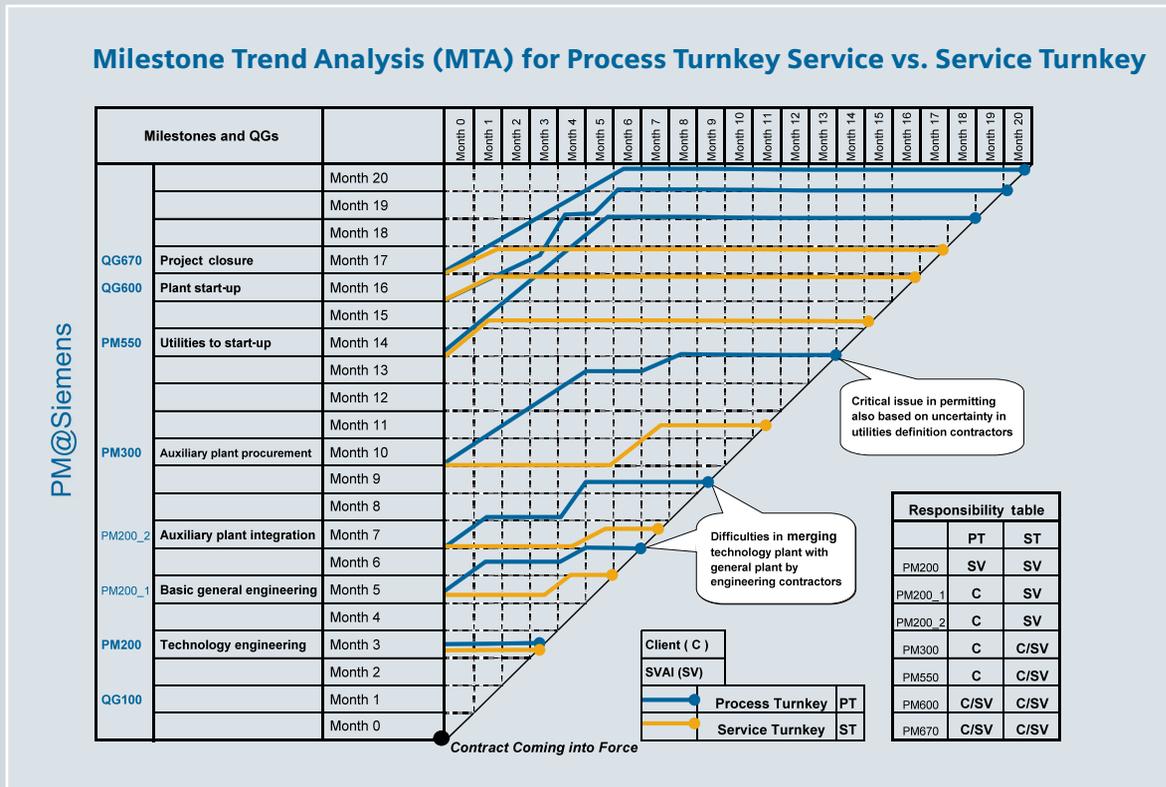
The Service Turnkey Model offers the most balanced form of risk management together with the best technical and financial added value, especially for those customers with weak project-management organizations, limited strengths and little experience in the field. The particular strength of this model lies in its ability to merge the customer's market-oriented perspective with the project-execution-oriented perspective of Siemens VAI.

Dynamic programming with PM@Siemens

Under the PM@Siemens approach, the project life-cycle structure is based on project milestones and quality gates placed at crucial points to deliver a set of management decisions. The decision matrix revolves around a series of standard tools at the core of a dynamic programming/monitoring process.

The main tools are the Milestones Trend Analysis (MTA), linked to the Cost Trend Analysis (CTA) and to the Project Risks & Opportunities Concept (PROC). These tools work in parallel with categorized assess-

Milestone Trend Analysis (MTA) for Process Turnkey Service vs. Service Turnkey



Comparative MTA: Turnkey Service vs. Process Turnkey

ments applied iteratively at each project phase or in the presence of specific disturbing events.

The MTA is a project-time-efficiency indicator tracking the status and forecasting the development of the main project events versus target dates, thus allowing a timely reaction to the detected and potential divergences. The CTA is used to breakdown the potential variance of a project into a packages cost variance versus budget and a performance variance versus schedule. It ensures that the cost and the schedule components are not mixed as in the case of a conventional planned/actual comparison. The PROC, a risk-management tool, is structured in modules: risk/opportunities identification (standard database); evaluation before measure (value and probability); setting measures (responsibility, timing, status, cost); and evaluation of residual risk after measures.

Putting the key into turnkey

Soaring steel demand in the GCC area during the last decade, in particular for long products, has made it essential to offer contract variants that accommodate massive levels of investment in an extremely short time frame and in a business environment with dy-

namic peculiarities. Local institutions, major steel-industry players, private investors and financial-investment companies are all vying for prominent positions in the GCC steel market.

Against this background of rapidly changing opportunities, a structured product- and project-management system provides consistent guidance for winning projects as well as the execution of the contract upon which these projects are based. The Process Turnkey and Service Turnkey process models, along with PM@Siemens life-cycle project management, represent innovative and efficient solutions for customers, giving them access to the full range of Siemens VAI resources and emphasizing the importance of cooperation and joint responsibility in project execution.

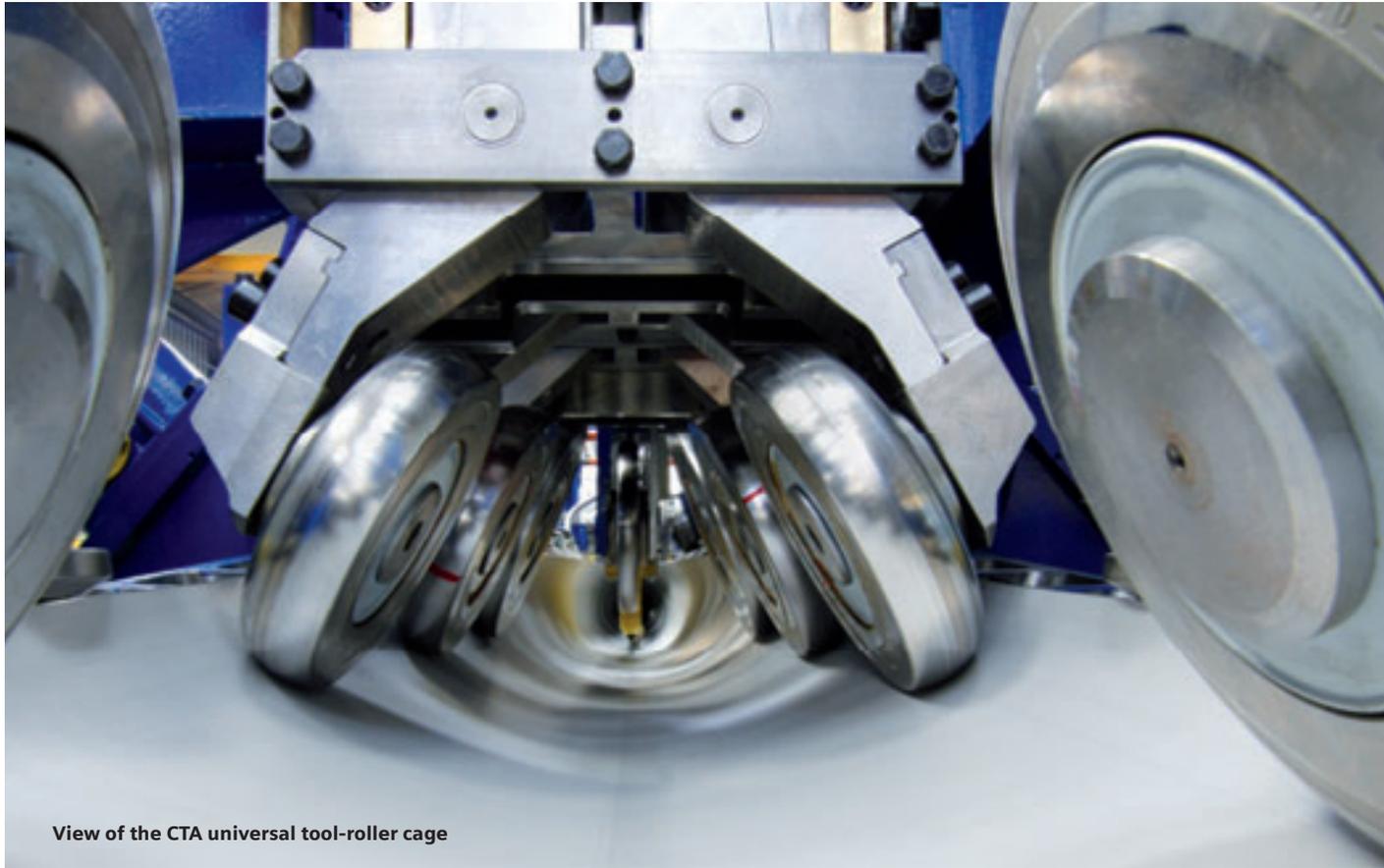
In the GCC area, bundling customer competence with the capability of Siemens really puts the key into the turnkey concept for hot-rolling mills. ■

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View of the CTA universal tool-roller cage

Upgrade of the ArcelorMittal stainless steel tube-welding line with CTA technology

Cutting-Edge Technology

For the first time ever, a stainless steel tube-welding line was upgraded with CTA technology. VAI Seuthe GmbH, a company of Siemens VAI, carried out this project for the French tube producer ArcelorMittal Stainless Tubes Europe S.A., located in Ancerville. CTA, which stands for central tool adjustment, allows the flexible manufacturing of a wide range of tube and pipe diameters with the same automatically controlled tooling set. This solution, combined with the installation of a laser welder and a unique flying-saw unit, resulted in a number of decisive operational and cost benefits for the producer.

ArcelorMittal Stainless Tubes Europe, a long-standing customer of VAI Seuthe, had been operating a stainless steel tube-welding line for many years. It was outfitted with a 6-inch TIG (tungsten inert gas) welding aggregate, a conventional forming section and a flying band saw. With the given equipment, a maximum line speed of only about 5 m/min. was

possible – depending on the wall thickness of the end product. Set-up times for tool changes typically required between 12 and 24 hours. It was mainly because of these uneconomic operational parameters that the decision was made to modernize the line. VAI Seuthe was selected as the partner to jointly develop a modernization concept and put the solution into practice.

Project scope

The upgrade of the existing 6-inch welding line comprised three main activity areas as follows:

1. Installation of an advanced CO₂ laser-welding aggregate by the customer in addition to the existing TIG welding unit: This allowed the line and production speed to be increased from 5 m/min to 15 m/min, depending on the wall thickness of the tube. By keeping the old TIG welding unit in the line, greater production flexibility was provided since the TIG tube-welding method is vital for specific applications.

2. Replacement of the first five forming stands of the conventional forming section with the patented CTA forming solution: This step enabled necessary changing times of the tube-welding line to be kept to less than three hours, as requested by the customer. This is because the same set of universal forming rolls mounted in a roller cage can be used for the production of a multitude of tube dimensions in the forming section up to the fin-pass stands. These are automatically positioned by means of the respective production program controlled from the operator stand.

3. Replacement of the existing band saw with a newly designed flying cut-off unit: This was developed and built by VAI Seuthe in accordance with the customer request that it be capable of cutting the entire product mix of the line at low costs. The use of nearly backlash-free planetary gearings combined with a fine adjustment control provided by Siemens Simotion software allows HSS (high-speed steel) saw blades with a diameter of only 600 mm to be used for all tubes produced on the line up to the maximum tube diameter.

Start-up and benefits

Following the start-up of the stainless steel tube-welding line, a number of impressive operational and cost benefits could be achieved. The average line-production speed could be increased by a factor of three and the set-up times for tool changes, which used to take between 12 and 24 hours, could be reduced to less than three hours. Overall line flexibility could be increased to produce a wider product range. Application of CTA technology notably cut total tooling costs. The price of one new roll set for a specific tube-diameter range is now roughly 50% lower compared to the costs in a conventional forming line. The new flying saw unit capable of cutting the entire product range saves money due to far lower costs for stock keeping and purchasing. Set-up times for dimensional changes are also reduced, as it is no longer necessary to replace the saw blade with one that has a bigger diameter.

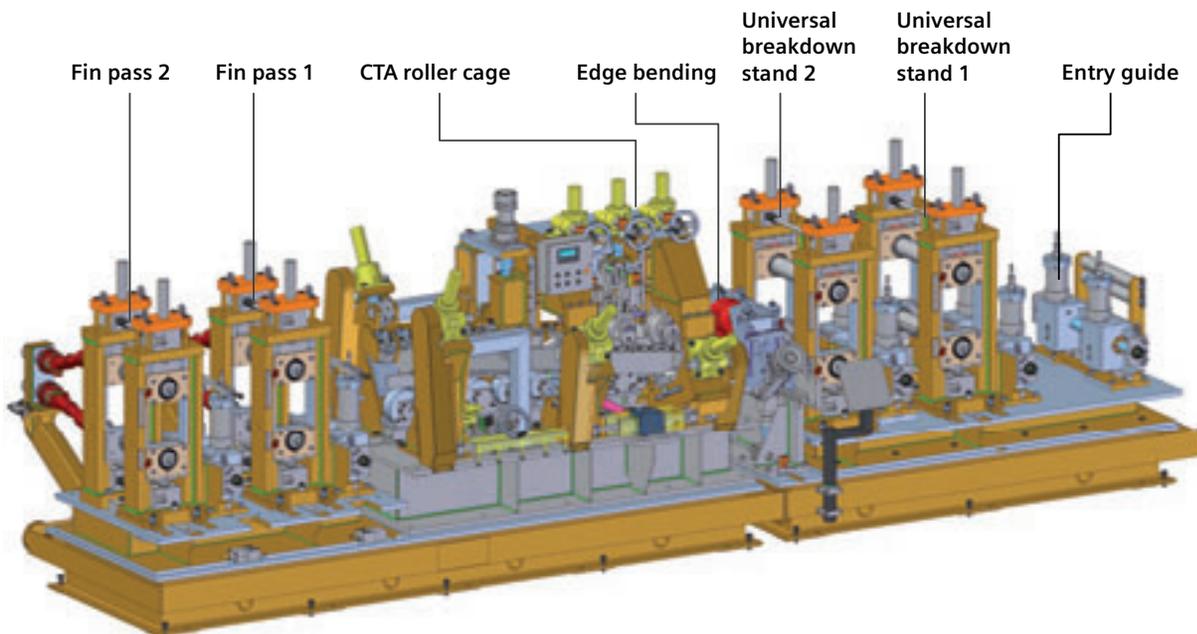
VAI Seuthe received the Final Acceptance Certificate for this unique and highly challenging project in May 2009. The upgrade of this tube-welding line with the combination of CTA technology, a high-performance laser-welding system and a uniquely designed flying cut-off unit allowed the customer to achieve far higher productivity, an impressive gain in flexibility and a substantial reduction in production costs. ■

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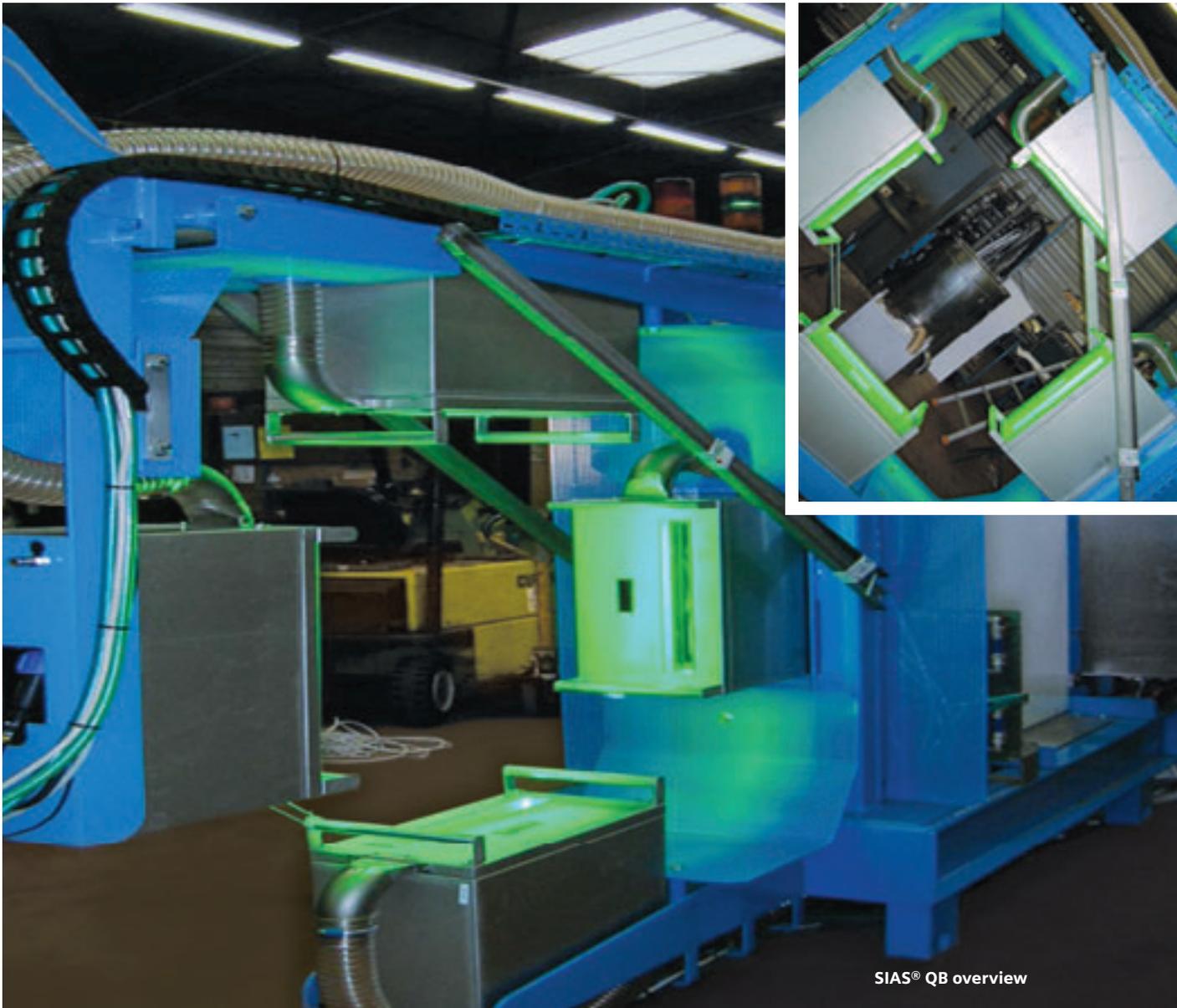
Schematic view of the upgraded CTA forming section of the tube-welding line at ArcelorMittal Stainless Tubes Europe S.A.

Innovative surface inspection of long products

SIAS[®] QB Discovers Defects in Real Time

Online surface inspection is the key to increasing process transparency and minimizing product rejection for steel producers. Based on 20 years of experience in surface-inspection technology, Siemens VAI has developed an optimal solution for long products. SIAS[®] QB was first installed in 2008 on a hot-bloom mill at voestalpine Stahl Donawitz in Austria.

PROCESSING >



SIAS[®] QB overview

SIAS surface inspection started in the 1990s with flat products, first on processing lines (galvanization and annealing lines), then upstream on hot-strip mills. The latest version of SIAS – Surface Inspection for Billet (with rectangular section) – is a vision system capable of detecting and identifying in real time flaws in the acquired image. SIAS® QB is essentially composed of an online sensor (light source and cameras) coupled with image-processing hardware and software.

The system features a dedicated head per facet. Each head is a stand-alone system with its own camera and lighting system. The heads are mounted on a carriage, which can be removed when a billet is stocked in the line. The line-scan, multi-spectra camera features LED lighting for maximum service life.

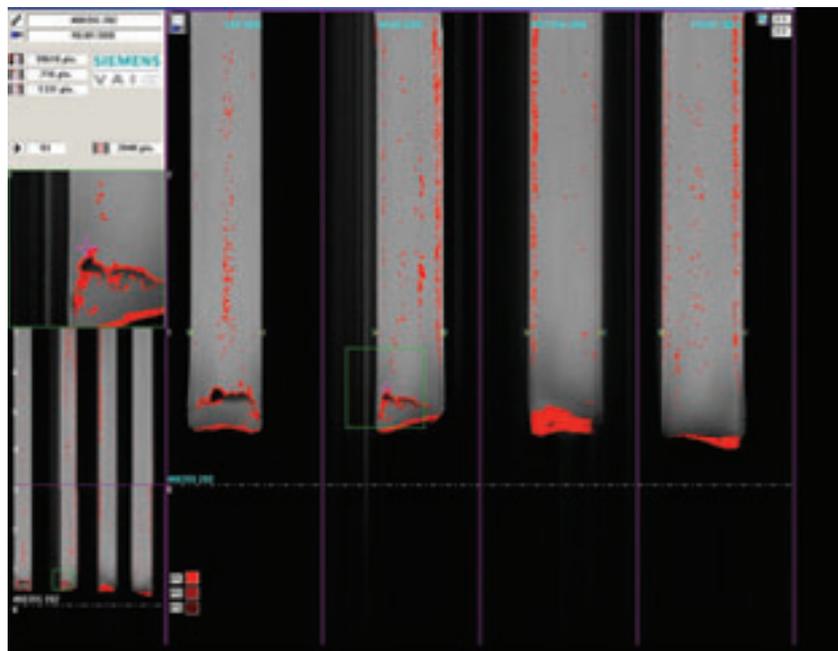
Producing a sharper image

As it is being acquired, the image is conditioned to eliminate the negative impact of both sensor-related (electronic noise) and product-related (product-aspect variations) phenomena. In this way, image processing is consistent and performed on an image that is free of external disturbances. Detection algorithms are applied to the image, and each pixel is analyzed to determine whether it is a “suspect.” The algorithms combine filtering and thresholds, in real time. System sensitivity is programmable and depends on the product type.

Additional auto-adaptive algorithms have been introduced to cope with the increased variability observed in the surface texture within a same incoming steel grade, automatically adjusting the sensitivity to background noise. This accelerates and simplifies on-site tuning. During the classification phase, software analyzes each object’s image to identify which defect category it belongs to.

The Siemens SIAS QB system provides total traceability and monitoring of the inspection process.

SIAS’s exclusive, patented classification method is a multi-stage approach for streamlined operation and maximum efficiency. Classification basically consists of comparing the newly detected flaw with a knowledge base, or defect library, which is a group of defect images that is typical of what can be seen on the line. Moreover, the Siemens SIAS QB system provides total traceability and monitoring of the inspection process,



Operator HMI, with live view of the product surface

which is key for both high confidence in the results and ISO-level quality management of the measurement.

Grading coils more effectively

Coil-grading software is another tool that aids decision-making by automatically computing a decision proposal from the complex information including the defect map, end-user name and steel-part application. The result is a simple red/yellow/green light in its simplest expression as straightforward advice for the inspector. It may also include a suggested cut-and-repair reprocessing sequence at a downstream repair line. After only two weeks of operation, the system was able to detect and classify the most critical defects such as cracks (longitudinal and transversal), porosity and scale.

SIAS QB enables quality experts to see surface defects right after the last stand rolling and before the scale appears on the surface. All this takes place in real time, without the need to wait for the product to cool down. Immediate corrective actions can then be taken to eliminate bar loss. ■

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How Siemens VAI France recovers valuable production assets worldwide

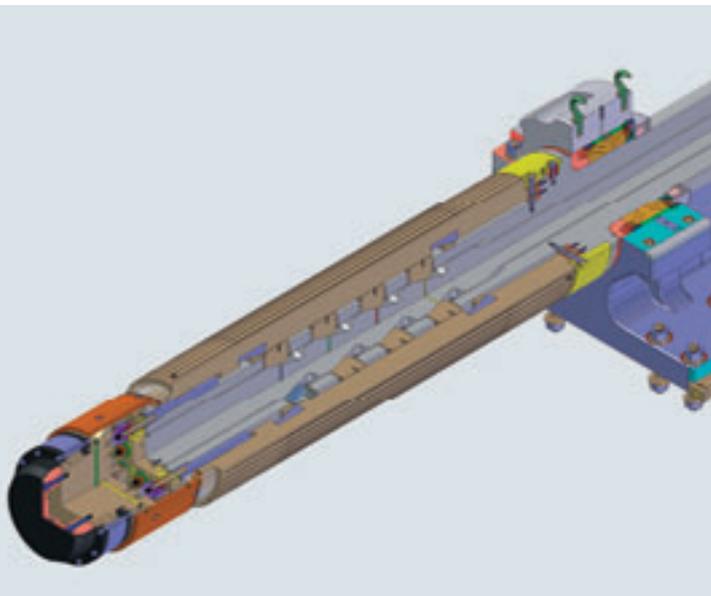
Focused on Recovery

The need to maintain or gain competitive advantage, combined with the obsolescence and aging of equipment, is driving steel makers to modify and upgrade their production plants on a continuous basis. Challenges include achieving rapid and seamless evolution of equipment and smooth transition to more advanced technological solutions. Siemens VAI in Montbrison, France, helps customers to meet these challenges cost effectively while reducing the risk involved.

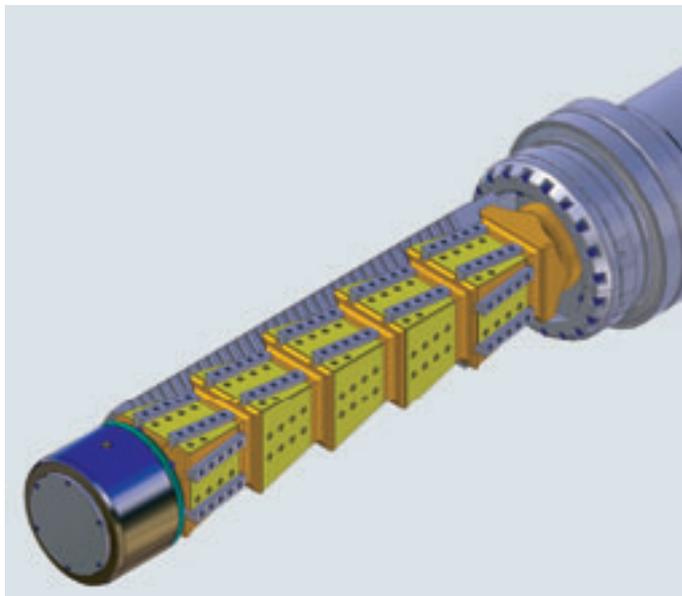
PROCESSING >



The Siemens VAI MT Workshop in Montbrison, France, featuring a 19000 m² covered workshop for manufacturing and assembly; lifting capability up to 150 tons; boring up to 14 m length and 5 m height; milling up to 3 m width and 10 m length; lathes up to 13 m length; CNC machines; inhouse engineering and 3D services; and equipment assembly, pipe work, and static and dynamic testing



3D views of a mandrel nose



Over the years, Siemens VAI has gained a wealth of experience in small and mid-scale revamping projects for rolling and processing carbon and stainless steel. Taking advantage of its experience as an OEM (Original Equipment Manufacturer) product and life-cycle service partner, Siemens VAI executes revamping projects in rolling mills and processing lines that typically operate under uncompromising conditions.

After several years of operations in a harsh environment, aging components represent a risk. Moreover, as the steel market evolves to meet end-customer needs, steel grades to be processed may change in terms of product dimensions (width, thickness, coil weight); quality and mechanical properties; and coating requirements. Especially at a reduced production level, steel producers still seek continuous improvement of their overall equipment efficiency in terms of line speed, quality yield and process control.

Anticipating market needs

Any revamping project for a rolling mill or processing line requires the combination of specialized capabilities in mechanical, fluids, electrical, automation technology and process technology. These capabilities should also be available from one single source for best efficiency in their utilization.

An internationally recognized project-execution leader and life-cycle partner, Siemens VAI has the expertise in equipment redesign as well as the experience to assess equipment conditions and solutions for retrofitting. This experience has been consolidated along many years, thanks to a continuous and close

follow-up of the existing installed base through online maintenance and offline refurbishing.

Additional life-cycle services available to Siemens VAI customers include supply of spare parts; supply of strategic and other components; on-demand technical assistance; offline (refurbishing, repair) devices and online maintenance services; and modernization and upgrade projects.

Modernization of a cold plate leveler in Germany

A German plate manufacturer was looking for a partner to upgrade its existing plate leveler. The company called on Siemens VAI to execute a rapid transition to a fully automatic leveler, including an important review of the mechanical design.

The main challenges for Siemens VAI: the leveler was from a competitor and the project had to be finished within seven months of contract signing. Siemens VAI met these challenges by providing instrumented bending cylinders, capsules retrofit and spares, entry and exit roll-positioning-speed increase, a new flatness-gauge feedback for quality assessment and extra pass calculation – all in the time allotted and without significant impact on production.

Now, there are fewer downgraded plates off the production line and 95% of plates conform to flatness requirements specified by EN 10029 after just one mill pass.

Coiler for a continuous pickling line in France

For another customer in France, Siemens VAI was requested to modernize equipment designed and manufactured in the 1960s and unused for more than 20 years. One additional difficulty concerned incomplete >>

>> technical drawings and bill of material for the equipment in question.

A main step in the revamping process was a condition assessment of the equipment by Siemens VAI in its Montbrison facility. A complete review of the engineering to include new drawings was performed and determined improvements to be made throughout the repair process. The refurbished coiler was recommissioned a short time later.

Adding value with a revamped skin-pass line in Belgium

A Belgian customer specializing in strip-finishing services expected additional process value in its existing finishing process. The contract called for refurbishment of an old skin-pass line, which had been decommissioned for two decades, and a review of the equipment design, working from an incomplete set of drawings and an outdated bill of material.

Siemens VAI provided a solution comprising the integration of electrical and automation equipment, cylinders, motors and drives, and AGC technology and process tuning for current steel grades (force, elongation, texture control). Implementation of the skin pass was accompanied by complete training of operating and maintenance personnel.

The customer is now self-sufficient from an equipment standpoint and able to offer more value and higher quality to its customers as well.

Mandrel upgrade in Turkey

The mandrel of a downcoiler is a key component on any mill or processing line. The greasing system is a critical subelement that ensures unrestricted operation of the mandrel during production. With this in mind, a Turkish customer called on Siemens VAI to upgrade the existing greasing system to ensure reliability of the coiler, as well as the reduction of operating costs.

Siemens VAI performed one on-site assessment of the mandrel, which was originally manufactured by a third party. Work following this assessment included installation of an up-to-date greasing system for the mandrel in operation and for all spare mandrels. As a result, there has been a significant improvement in the availability rate of the mandrel in operation as well as cost savings through a decrease in grease consumption.

Gearbox modernization in France

The customer expected a significant increase in line speed, but was limited by its existing gearbox. Siemens VAI supplied the basic and detailed engineering for the mechanical modifications to be done

PROCESSING >



1 Continuous pickling line coiler

2 Skin-pass revamp project to recover state-of-the-art design and performance



3 Mechanical structure of the gearbox

4 Siemens workshop in Shanghai – HAGC test stand

for the integration of a new gearbox and drives as well as for the strip-tension calculations. Main constraints were the bulkiness as well as the management of the project itself.

Gearbox manufacturing was supervised by Siemens VAI to avoid any delay in on-site installation and commissioning. As a result of this modernization project, the target line speed has been achieved, while maintenance costs have been reduced.

Strengthening the Siemens VAI competitive advantage

At Siemens VAI, great emphasis is placed on the identification of innovative solutions to be implemented during refurbishment and modernization projects. Their purpose is to ensure improvement of the process control, reliability and component service life. Additional services include on-site assistance during restart operations, training services, and assistance for maintenance operations and minor and major overhauls.

What is more, a local customer focus optimizes the availability of expertise, response time and tailored services for rolling and processing applications. Local workshops specializing in components manufacturing, refurbishing and testing operations have been continuously expanded in different strategic locations worldwide. The North American area is served by the Siemens Worcester Workshop (Worcester, U.S.A.), China is served by a Siemens workshop in Shanghai, and the East Asian region is served by a Siemens workshop in India.

Its global reach down to the local level keeps Siemens VAI in touch with customers wherever they may be while actively promoting best practices and the spread of engineering excellence to all customer and company locations. ■

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Improving production for steel and aluminum mills

Investments in Mill Modernization Pay Off

A closer look at peripheral equipment and processes helps optimize production, quality and profit for steel and aluminum producers.

In today's economical situation, producers are holding back investment and focusing more intensely on modernization for maximum short-term return. Here, key criteria are quantity and quality enhancements as well as operating-cost reductions and ease of maintenance. Siemens VAI offers a variety of solutions for upgrading rolling-mill equipment to increase plant capacity and capability while enhancing product-line quality and profitability.

Flatness measurement with reduced maintenance

The new Siroll^{CIS} Heavy Duty Shapemeter enables accurate measurement of cold-rolled strip with a thickness from 0.05 mm to 5.5 mm and widths up to 3 m.

It can also be adapted to a wide range of end products and varying production conditions.

The Shapemeter features both high load-bearing capacity and a robust design, and is optimized for use in cold-rolling mills for aluminum and steel. It continuously provides plant operators with flatness data on the cold strip during rolling and offers one of the highest resolutions available today. Its Automatic Trend Alignment (ATA) provides precise measuring of the roll relative to the strip at all times.

Like all other Siemens VAI Shapemeter systems, the heavy-duty version has a modular structure that facilitates commissioning, reduces maintenance work and minimizes spare-parts stock levels.

Profile perfection for round and non-round products

Another solution – Siroll^{CIS} Orbis+ – sets new standards for the profile measurement of round and non-round long products. Using the shadow principle, Orbis+ measures the profile of products during the rolling process. The system's optical unit uses an LED-based light source and one or two line-scan cameras to quickly determine dimensions and profiles irrespective of orientation or vibration level. In fact, it can perform more highly accurate full-profile measurements per unit of length than any other system on the market.

The basic Siroll^{CIS} Orbis+ configuration includes an inline gauge head and an operator workstation for numeric or graphical display of product dimensions and profiles, all of which have been specially designed for harsh rolling-mill environments. An additional optional pyrometer can measure product temperature. Using this data, hot-state dimensions can be converted to those prevailing after cooling. All values are displayed on the operator-control station, ensuring fast adjustment of rolling-mill operating parameters, if needed. Due to its modular design, the system is highly configurable for customer requirements.

In addition, Siroll^{CIS} Orbis+ is virtually maintenance free: optimized power transmission to the optical unit, the use of long-life LEDs for illumination and wireless data transmission between gauge and data processing minimize maintenance and ensure high availability. Siroll^{CIS} Orbis+ is currently in use in over 200 applications worldwide.

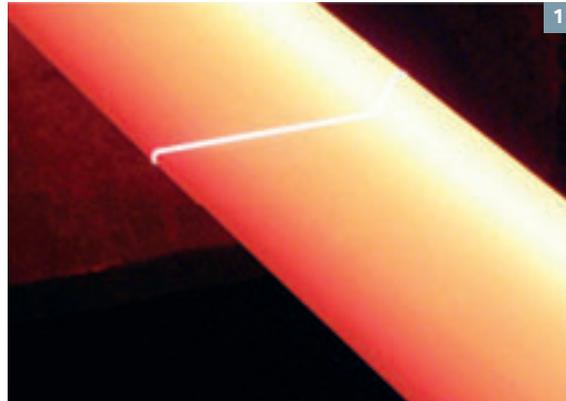
Reduced reject rates for complex shapes

Measuring complexly shaped hot-rolled products during operation is the domain of the ProScan laser-based gauge. The system, marketed by Siemens VAI, is usually installed after the rolling mill's finishing stand, where it measures the final product's full profile and automatically identifies any out-of-tolerance dimensions, enabling the operator to correct working parameters in real time. Using a subsequent analysis, the user can easily identify and correct potential errors and realize productivity improvements.

Beside the profile measurement system, the standard ProScan version also comprises 2D visualization for easy operation. Using an optional optical module, the system can also detect surface defects. An example of the system's benefits: when rolling rails, this solution can test the rail heads, reduce the reject rate and extend roll life through early defect detection.

Good advice can go a long way

In addition to the sensors described above, Siemens VAI Metals Technologies also offers Process Consul-



1



2

1 ProScan – detecting errors to realize productivity improvements

2 The new Siroll^{CIS} Heavy Duty Shapemeter and associated retraction mechanism

tancy Services. This service is provided by an interdisciplinary team of technical specialists for a variety of systems, manufacturing facilities and production processes. The aim is to boost manufacturers' productivity, yield and product quality. Additionally, analysis of existing production facilities provides information to assist decisions for pending investments in modernization, expansion or to extend capabilities to produce wider, faster products.

Today's economic climate could be tomorrow's opportunity: discovering how to intelligently optimize existing facilities can pave the way for cost-efficient improvements and thus help manufacturers prepare for new volume and quality demands as the market recovers. ■

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Remote support uses hot-mill cooling-section simulation model for data analysis

Virtual Expertise At Real Disposal

Continuous equipment wear and changes in the product range of a plant require constant monitoring to ensure that production results remain in the expected parameter window. Regular process-model simulations based on a line's performance and process data can help detect deviations at an early stage. Subsequent countermeasures require less effort and ensure consistently high product quality.

SERVICES >

Immediately after commissioning a new plant or completion of a modernization project, all process models and relevant parameters are in perfect condition. From this time on, plant-equipment stability and reliability as well as changes in environment influence production yield and quality. Generally, process-model software can adapt to minor changes and maintain high product quality. Major deviations and the cumulative effects of numerous minor changes, however, lead to lower quality. This necessitates adjustments to the process model, taking into account equipment wear and component failures as well as changes of environment.

Usually, nobody notices these changes unless process data are analyzed or product quality has visibly deteriorated. But once a process has drifted, a reconfiguration of process-model parameters can be costly.

Automatic data collection and transfer via remote access

In order to avoid such a creeping degradation, data analyses should be performed on a regular basis. Because this kind of analysis requires expert know-how – and because competent specialists cannot constantly move from one customer site to the next – Siemens VAI has set up its Metals and Mining Service and Support Center (MSC). This organization bundles in a central location specialist staff with all the necessary infrastructure and tools for detailed analyses.

Via cRSP remote connection*, process data are regularly collected and transmitted to the MSC, where a software-based analysis is performed. Subsequently, its results are evaluated by the MSC Service Manager.

If the automated analysis detects relevant process deterioration, the service manager consults with the MSC model expert and suggests appropriate action. The customer then decides if and when the suggested measures are carried out. This includes repair and replacement of hardware in case of wear and equipment failure, and adaption of the process software to compensate environmental changes.

Remote data analysis of the cooling section model

The necessary infrastructure and tools have been set up and are available at the MSC for the latest-generation cooling-section model. Also, a solution is on its way for the second-to-last model version, so that all Siemens VAI customers who had their cooling section installed in the last five years can benefit from this new service.

In the course of the remote data-analysis service, the current condition and quality of the cooling section and its on-site control model are monitored on a regular basis. The customer then receives a concise report about the current status of his cooling section. Due to its semi-automatic nature, the basic procedure of cooling-section health analysis is performed with consistently high quality, independent of human influence.

If corrective action is needed, changes can be applied via the existing remote-access connection to the plant. Should direct support be needed, the model expert can assist and provide support remotely and/or suggest an on-site visit by a Siemens VAI service specialist.

The offline data analysis described above can serve as the basis for a more detailed strip analysis. Such a

study can be performed on customer request, or be used to provide assistance for the resolution of any immediate problems. Consequently, the system's control-parameter history will not store any wrong settings, so that the cooling section can always use the latest, highly optimized control profiles.

If corrective action is needed, changes can be applied to the plant via the existing remote access connection.

The cooling section is just the beginning ...

A similar service is currently under development for the microstructure monitoring system (MSM) that

analyzes and controls process parameters that influence the metallurgical properties of rolled strip material.

Other important process models have already been evaluated, and offline data analysis as a remote service package will be developed and provided as an integrated solution for further process-model technology services.

The benefits of this approach are consistently high production quality and productivity, higher line uptime and minimized maintenance costs. ■

* See "Remote Support – a Good Idea is Making its Way," pp. 78–81, *metals&mining*, issue 2|2009 for a description of the corresponding IT infrastructure and data security aspects.

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Major service order received from NISCO for caster-roller maintenance

Service on Demand



Workshop center of Siemens VAI Manufacturing (Taicang) Co., Ltd., Taicang, China (40 km west of Shanghai)

A maintenance contract for roller refurbishment of two continuous slab casters was signed on July 15, 2009, between the Chinese steel manufacturer Nanjing Iron and Steel Co. Ltd. (NISCO) and Siemens VAI (Taicang) Manufacturing Co. (SVMC). This is the first such order received by the Taicang roller-refurbishment workshop since its inauguration in May 2009. A unique feature of the contract is that payment is based on a cost-per-ton model, which is orientated to the tonnage produced by the casters. In this way, NISCO can transform fixed maintenance costs into variable costs dependent on actual production.

The CCM1 and CCM2 single-strand slab casters at NISCO were equipped by Siemens VAI and have been in operation since June 2004 and August 2006, respectively. The first caster with an annual production capacity of around 1.5 million tons was designed to cast ultra-wide slabs with a thickness of 150 mm in widths of up to 3,250 mm. The second caster produces approximately 1.7 million tons of slabs per year in widths between 1,600 mm and 2,250 mm and at thicknesses from 180 mm to 260 mm.

With the target of improving the quality of refurbished caster rollers, which would have a direct impact on enhancing caster output and slab quality as well as saving costs, NISCO commissioned SVMC to re-

furbish their caster rollers for an initial three-year period. According to Andre Gottschalk, General Manager Business Administration of SVMC, "Caster rollers are constantly subjected to changing thermal stresses and shock loads during operation. This results in a high degree of thermal fatigue and acute wear. Well-maintained caster rollers are therefore vitally important for assuring uninterrupted casting operations, high slab quality and a long component lifetime."

If the two Nanjing casters run at full production, it is estimated that SVMC will refurbish more than 800 rollers each year. The first delivery of caster rollers arrived by truck at the Taicang workshop on August 12, and the first load of refurbished rollers were dis-

patched back to Nanjing at the end of September. To do the required roller-refurbishment work, SVMC has at its disposal four automatic welding/alloy-cladding centers, five conventional lathe machines with work-piece lengths from 2 m to 4.5 m, a special hydraulic disassembly and assembly press, a roller-washing machine, a roller pre-heating box, a radial boring machine and hand-welding machines.

Attractive payment model

This is the first time that this type of maintenance contract was signed in China. The payment model is also unique in that it is based on the actual production volume at NISCO. The higher the tonnage of steel cast, the higher the number of rollers to be refurbished – upon which payment is based – and vice versa. Therefore, customer maintenance costs are production related and variable, reducing fixed roller costs. Gottschalk further: “This service contract allows NISCO to additionally save money through the much higher lifetime of their rollers, which increases caster availability. We guarantee certain minimum roller lifetimes that are much higher than current actual performance. Another point to be mentioned is that our price is also quite competitive.”

SERVICE in capital letters

Siemens VAI is the world market leader in the provision of maintenance services for continuous slab casters. Company-operated maintenance workshops are also located in Brazil, France, South Africa and the U.S.A. where caster rollers have been refurbished for decades.

In China, the scope of services offered by SVMC encompasses local and international plant maintenance, including preventive maintenance, spare-parts management and manufacture, as well as the repair and renewal of wear parts in its own workshops. Equipment for the iron- and steel-producing industry is manufactured at SVMC not only for the Chinese market, but also for worldwide use in Siemens VAI products.

“With this new service contract for caster-roller refurbishment, SVMC has greatly extended its range of services offered to the Chinese metallurgical industry. The same benefits that NISCO will profit from are now also available to other Chinese steel producers in their own country,” summarizes Gottschalk. ■



- 1 First batch of caster rollers from NISCO
- 2 Initial cleaning of rollers
- 3 Refurbishing of caster roller
- 4 Finished rollers

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Timeliness Helps Earn Steed Award

The Steed Award from the Inner Mongolian government is bestowed for outstanding achievements in specific industries. This year, Heiko Nitschke, in his capacity as commissioning manager, accepted the award in the steel-industry category for his team's successful and on-schedule commissioning of the Baotou plate mill.

"We have had, and still have, an excellent relationship with the customer," said Nitschke as an explanation of the nomination by the customer, BaoGang. Major Chinese companies from various sectors submit the names of the candidates to the Inner Mongolian government, including an internal comment stating the reasons why the respective candidate is eligible for this award. The government representatives then select the seven award winners from the proposals. ■



Heiko Nitschke accepted the Steed Award

Medal of Merit Goes to Siemens VAI Employee

Joe Lee, process manager for plate mills at Siemens VAI, was awarded with the Medal of Merit, a joint initiative between the Sheffield Chamber of Commerce and Star Business Monthly. The award recognizes an individual's exceptional achievements, performances and contributions that lead to the success of an organization.

Joe joined Siemens VAI in 2005 after finishing his degree in material science and engineering at the University of Sheffield. He has since quickly climbed the ranks and was recently placed in charge of the company's overall plate-mill process and commissioning activities.

Aside from several projects in his native U.K., assignments have also brought him to sites in India, Turkey and China. In his relatively short career, the 25-year-old is also becoming a recognized authority in the global industry through his papers and presentations in Asia and North America. Joe is held in high esteem by his colleagues, who recommended him for the award. ■



Joe Lee was awarded with the Medal of Merit

Metallurgy Symposium in Russia

On September 29, 2009, representatives from the main Russian steel producers and R&D institutes participated in a one-day metallurgy symposium sponsored by Siemens VAI in Moscow. In a series of lectures augmented by workshops, a wide range of topics were presented and discussed focusing on cost-saving solutions, technological packages and the latest developments and references in the fields of LD (BOF) and EAF steelmaking, environmental technology and con-



A rewarding conference for all participants

tinuous casting. A new micro-electric arc furnace with tapping weights between 5 and 35 tons was introduced, which ideally meets the production requirements of foundries and micro-steelworks. Advanced primary and secondary dedusting systems for steel mills allow producers to meet the strictest environmental regulations. Technological aspects and the benefits of ultra-thick slab casting, especially for pipeline applications, were described, in addition to available technological packages for improved caster performance, flexibility and product quality.

Dr. Serafim V. Kolpakov, former Minister of Metallurgy of the U.S.S.R. from 1978 to 1985 and now President of the International Union of Metallurgists, praised Siemens VAI as a model company for doing business in the Russian Federation and for the company's strong presence in the Russian market since 1963. ■

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More information

You can find further information and company press releases at our online portal www.siemens-vai.com.

Events: Upcoming Conferences and Fairs

- NOV 12** Jahrestagung STAHL 2009, Düsseldorf, Germany, CCD Congress Center; <http://www.stahl-online.de/english/Stahltag/stahltag.asp>
- NOV 12 – 13** STAHL – “Performance for tomorrow,” Düsseldorf, Germany; <http://www.stahl-online.de/english/Stahltag/stahltag.asp>
- NOV 14 – 17** METALS MINERALS MANUFACTURING EXPO 2009 47th Nat. Metall. Day, Kolkatta, India, Science City Complex; http://www.nmd2008.com/46th_national_metallurgists_day.htm
- NOV 16 – 17** 2009 SEAISI ENVIRONMENTAL & SAFETY SEMINAR, Singapur
- NOV 16 – 17** 7th STEEL SUCCESS STRATEGIES – Who’s left standing? London, U.K., Marriott Hotel <http://www.metalbulletin.com/events/Details/Intro.aspx?EventID=1032&LS=>
- NOV 17 – 19** EURO INDIA TRANSPORTATION SYSTEMS, Metz, France; <http://www.eits-event.com>
- NOV 19** STAHLHANDELSTAG 2009, Hamburg, Germany <http://www.stahlhandel.com>
- NOV 20 – 21** INT. SEMINAR ON “Clean Technologies in Iron & Steel Industry,” Hyderabad, India, Hotel Taj Deccan
- NOV 22 – 24** 12th WORLD STAINLESS STEEL CONFERENCE, Mumbai, India, Trident Nariman Point Hotel <http://www.crugroup.com/Events/CRUEvents/WorldStainlessSteel/Pages/worldstainlesssteel.aspx>
- NOV 22 – 26** 39th ABM REDUCTION SEMINAR, Ouro Preto, Brazil <http://www.abmbrasil.com.br/seminarios/>
- NOV 23 – 24** 14. Fachtagung – Schüttgutförderertechnik 2009 – Innovationen gegen die Krise, Magdeburg, Germany
- NOV 26 – 27** 17th INT. RECYCLED ALUMINIUM, Bilbao, Spain, Hotel Carlton <http://www.metalbulleting.com/events/recalum>
- NOV 26 – 27** GASES IN STEEL: Processing & Product Requirements, London, U.K.; <http://www.iom3.org/events/gases>
- NOV 26 – 27** INSTANDHALTUNG 2010, Frankfurt, Germany, Sheraton Hotel <http://www.euroforum.de/instandhaltung>
- NOV 27** 32. VORTRAGSVERANSTALTUNG LANGZEITVERHALTEN WARMFESTER STÄHLE & HOCHTEMPERATURWERKSTOFFE, Düsseldorf, Germany <http://www.stahl-online.de>
- NOV/DEC 30 – 02** MINES & MONEY LONDON 2009, London, U.K.
- DEC 02 – 04** PROCEMIN 2009
- DEC 02 – 04** 2nd INT. CONFERENCE ON AUTOMATION & INFORMATION TECHNOLOGY IN IRON AND STEELMAKING PROCESSES, Ranchi, India <http://www.aitism.in>
- DEC 03 – 04** MetMat#4, Bad Honnef, Germany
- DEC 07 – 08** PROCESS, PLANT & MACHINERY 2009 (PPM MIDDLE EAST 2009), Dubai, UAE, Dubai World Trade Center; <http://www.processplantme.com/>
- DEC 07 – 09** 13th MIDDLE EAST IRON & STEEL CONFERENCE, Dubai, UAE, JW Marriott; <http://www.metalbulletin.com/events/1051/MENA/Iron-and-Steel/Intro/13-Middle-East-Iron-and-Steel-Conference.html?EventID=1051>
- DEC 09 – 11** INT. CONFERENCE ON THE ADVANCES IN THEORY OF IRONMAKING & STEELMAKING, Bangalore, India; <http://www.materials.iisc.ernet.in/~atis2009/>
- JAN 12 – 14** Energy & Environment in Iron & Steel Industry, Ranchi, India; <http://www.eeis2010.com/>
- JAN 19 – 21** 17th INTERNATIONAL STEEL SEMINAR & EXHIBITION, Kolkata, India, Taj Bengal Hotel
- FEB 15 – 19** MODERN ELECTRIC FURNACE STEELMAKING – A Practical Training Seminar, Columbia, U.S.A. <http://www.aist.org>
- FEB 18 – 20** METAL & STEEL 2010, Cairo, Egypt, Cairo International Conference & Exhibitions Center <http://www.arabiangerman.com>
- FEB 21 – 25** HOT FLAT ROLLING FUNDAMENTALS – A Practical Training Seminar, Orlando, U.S.A. <http://www.aist.org>
- MAR 03 – 04** STAHLMARKT “Ihr Neustart in den Aufschwung,” Düsseldorf; <http://vvhb.handelsblatt.com/stahlmarkt>
- MAR 11 – 12** 25. AACHENER STAHLKOLLOQUIUM – UMFORMTECHNIK, Aachen, Germany <http://www.ibf.rwth-aachen.de>
- MAR 28 – 30** 159th ISIJ MEETING, Tokyo, Japan
- APR 14 – 17** METEF – FOUNDEQ, Montichiari, Brescia, Italy, Garda Exhibition Centre; <http://www.metef.com>
- APR 19 – 25** BAUMA 2010, Munich, Germany
- APR 20 – 23** EXPOMIN, Santiago, Chile
- APR 20 – 23** METAL + METALLURGY CHINA concurrently the 6TH CHINA INT’L STEEL CONGRESS, Beijing, China, New China Int’l Exhibition Center
- MAY 03 – 06** AISTECH 2010 – The Iron & Steel Technology Conference and Exhibition, Pittsburgh, U.S.A., David L. Lawrence Convention Centre <http://www.aist.org>
- MAY 05 – 09** MTA MALAYSIA, Kuala Lumpur, Malaysia, Putra World Trade Center
- MAY 11 – 14** CISA, Beijing, China
- MAY 17 – 20** SEAISI Conference & Exhibition, Vietnam <http://www.seaisi.org/>



The next issue of metals&mining

India Rising – Portrait of the Fifth Largest Steel Producer

India is one of the most important steel-manufacturing countries worldwide. Analysts expect a 6.5% increase in production next year. In fact, the Indian government recently announced plans to increase its current annual crude-steel output of 52 million tons to 124 million tons within the next years. The country's hunger for steel is being driven by investments in infrastructure, housing, the energy sector and machine construction. Simultaneous with an increase in production capacity, a greater focus will be placed on improving steel quality at existing facilities. Examples such as the recently commissioned blast furnace at JSW Steel Ltd., the start-up of a slab caster for the production of plate grades for the petroleum industry at the same site and the blow-in of an upgraded blast furnace at Tata Steel Ltd. (Jamshedpur Works) document this trend.

The next issue of metals&mining is therefore devoted to the extensive steelmaking project activities of Siemens VAI in India and the solutions offered to assist India on its ambitious journey into the future.



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