SMS group

X-Roll®

Hot strip mills
Modernization concepts

Vast experience with modernizations

Adapting existing hot strip mills to today's market requirements

It's due to their high output capacity and flexibility that hot strip mills are the key to efficient production of flat products. What's more, hot strip mills can achieve service lives of 40 years and beyond. That explains why some 35% of the conventional hot strip mills in operation worldwide were built before 1975. Back then, plants were designed as semi-continuous, three-quarter continuous, or fully continuous mills with up to 7 roughing stands. Today's mills attain annual production volumes of 3 to 5.5 million t with 1 to 2 roughing stands. Moreover, mechanical equipment, drive technology, and process automation have moved on. Latest-generation hot strip mills with their lower power consumption and higher productivity can produce hot strip at lower cost. Equally important is the better product quality that comes from novel technologies.

Flexible designs developed by SMS group allow older hot strip mills to be modernized so they meet market requirements in the same way as latest-generation mills. This also applies to the rolling of a wide range of innovative, increasingly high-strength materials to the required dimensions and tolerances.

We can point to 32 new hot strip mills and 20 new Steckel mills as well as modernizations of 81 hot strip mills between 1980 and 2017 as proof of our comprehensive experience. Included in many of these projects were the electrical and automation systems. Since 1990, we have also supplied and successfully commissioned Level 1 and Level 2 automation systems for hot strip mills (new plants and modernizations). That is now supplemented by several years of experience in providing complete electrical systems.

In this brochure, you can read about five examples of our numerous modernization projects from recent years. They each meet very different requirements and feature distinct design variants.

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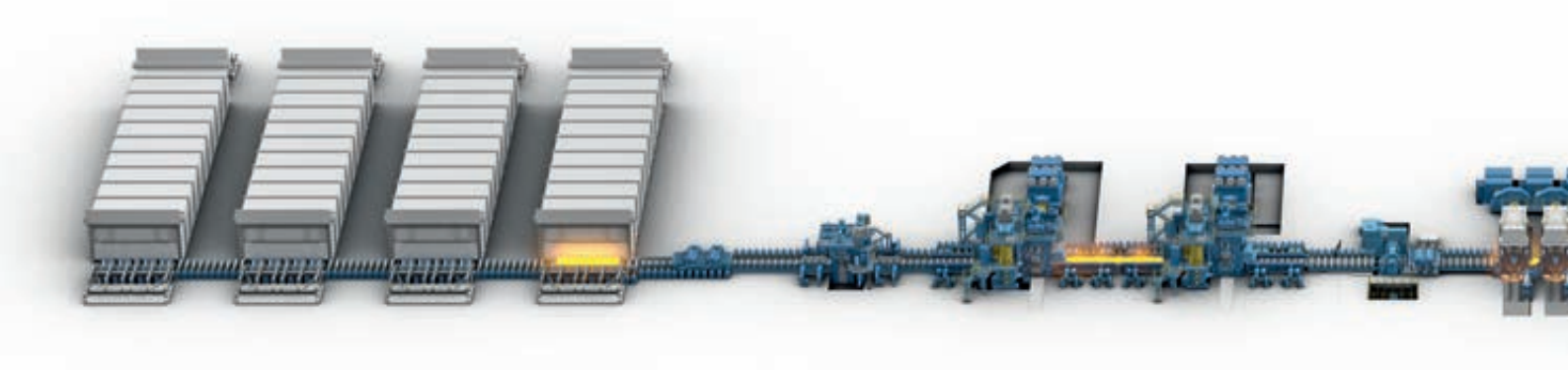
Requirements



Market requirements for hot-rolled products

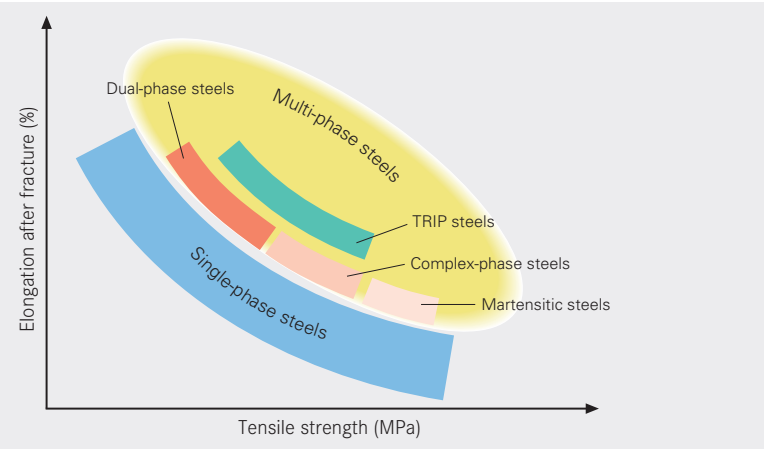
Over recent years, there has been a steady increase in the use of innovative materials in the automotive industry.

Included here are interstitial-free (IF) steels. They cope with both maximal deep-drawing and tensile stresses in the lower strength range due to their excellent cold formability. Multi-phase steels (DP, TRIP, CP) are stronger because their microstructure contains hard as well as soft phases. When used for the load-bearing components in vehicles, these materials help create ever-lighter structures. That cuts fuel consumption and improves passive safety.

High-strength materials (e.g. S700M) are required with thin final dimensions in the range of < 2 mm. They are used for instance in components for buildings and mobile cranes (crane jibs). Manufacturers require soft steel grades in thicknesses of down to 1 mm and thinner – in order to replace products that were cold rolled in the past.

Here, the geometric tolerances range from 1/4 to 1/2 of the relevant EN, ASTM or JIS standards. Excellent surface quality is used mainly for autobody parts, tinplate and wheel rim steels.

Hot strip suppliers need to meet all these requirements under high cost pressures. Customers also demand short delivery times.



Properties of conventional and innovative steel grades.

Example of a modern hot strip mill.

Requirements of hot strip mills

Rolling mills have to satisfy the following requirements:

- Higher productivity from increased yield and availability, plus lower maintenance
- Better product quality featuring precision thickness and profile tolerances achieved with high-performance control elements, process models, and monitoring systems
- Enlarging product mix, e.g. using new cooling strategies on the exit roller table
- More flexible rolling schedules to guarantee short delivery times and cost-effective rolling of smaller batch sizes
- Lower operating and energy costs with innovative equipment and monitoring systems

Example of use of AHSS steel grades.

Example of use of novel steel grades (TRIP steel).

Analysis and studies for concept engineering

Analysis of customer requirements

Older rolling mills that no longer meet today's requirements can be revamped to match state-of-the-art facilities.

There are different methods that mill users employ to determine the extent of the modernization they want.

Some decide themselves which plant components need to be replaced, supplemented, or upgraded. This results in contacting plant builders for concrete inquiries, e.g. for a new roughing stand, a new crop shear, or reinforcement of a coiler with clearly specified performance data.

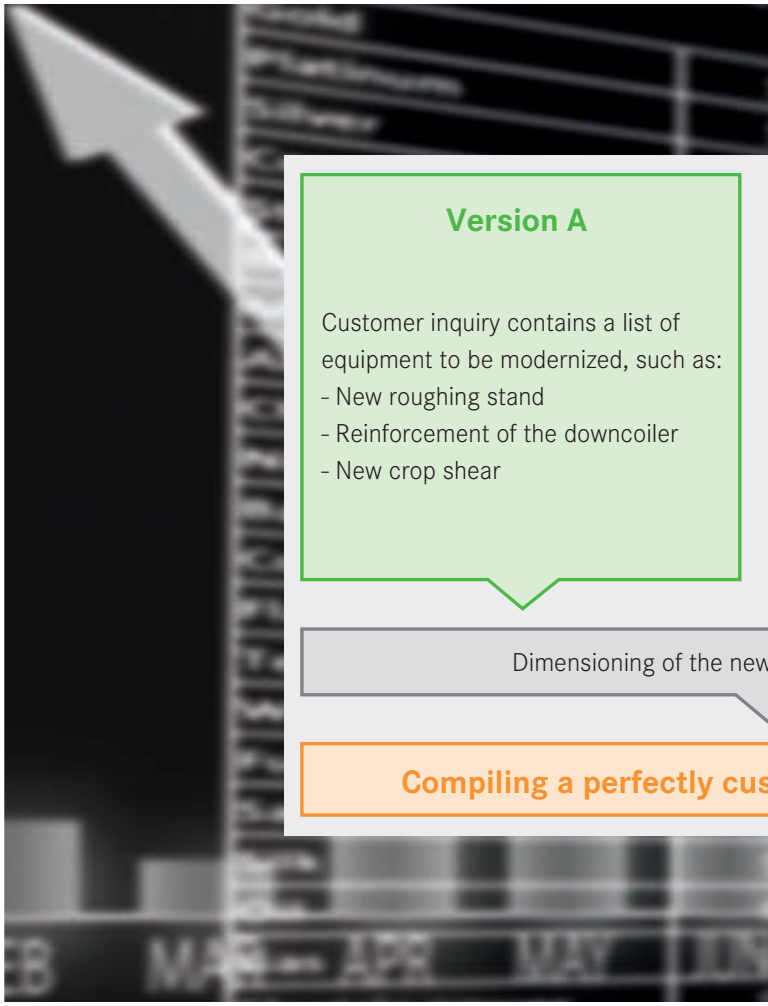
Other users specify their goals such as an increase in production, observance of specified target profiles or the production of certain high-strength grades. They leave it to the plant builder to work out a tailored modernization concept within the scope of a study.

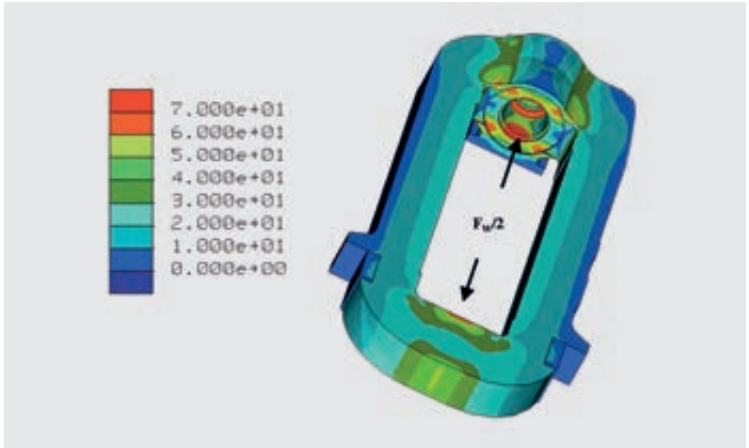
Whatever the scenario, the plant builder's job is to dimension the new facilities or upgrades and to draw up suitable revamping plans.

Concept engineering

Studies for drawing up modernization concepts or analyzing weak spots are geared to the specific wants and needs of the customer.

These studies analyze the production range and determine the forces and torques required for the plant components.

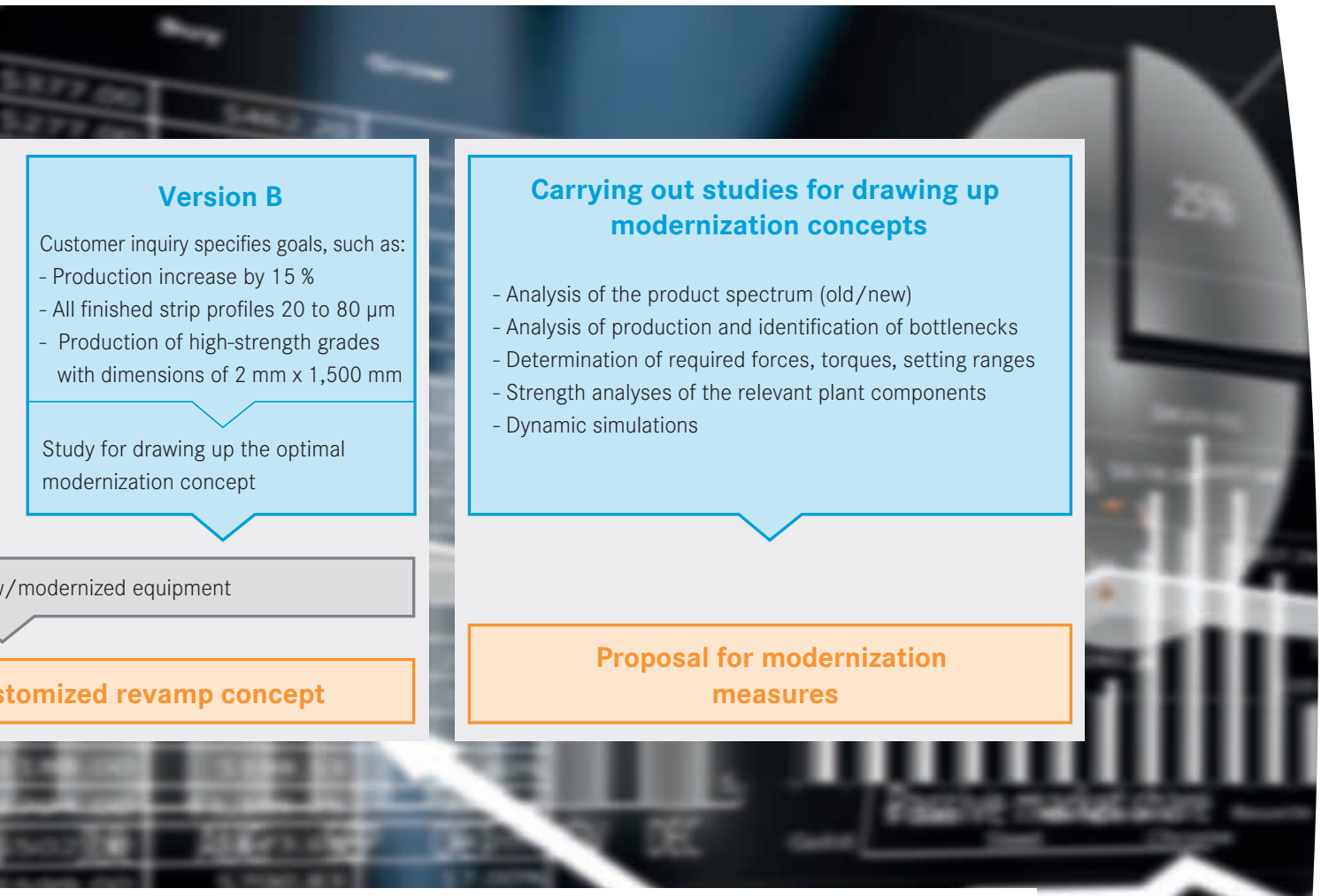


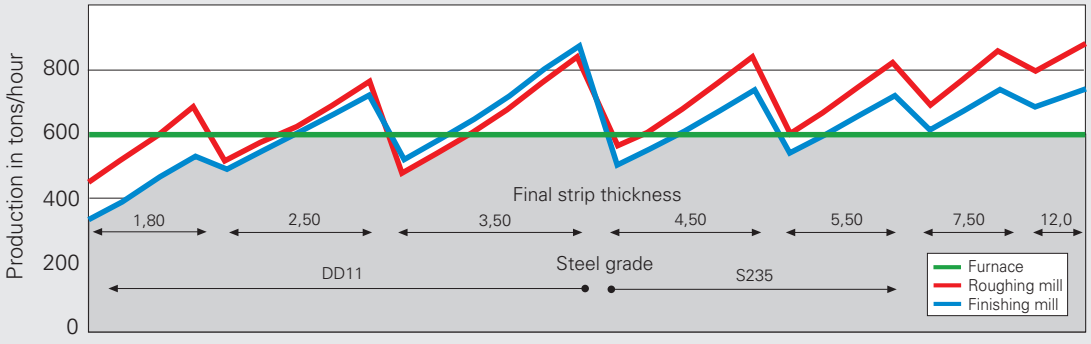


FEM strength analysis. Finishing mills F1 to F3, total rolling force (FW) = 45,000 kN.

A production analysis identifies bottlenecks in the mill's process chain that impede an increase in production. Equally important, FEM analyses examine the static loads and the dynamic behavior of plant components. Our experts apply measured data from the mill to create dynamic simulations of drive trains, for example. These simulations indicate plant behavior under extreme loads.

Working on the basis of these studies, we draw up the modernization measures required to meet our customers' goals.





Identification of production bottlenecks.

Implementation concepts

Concepts

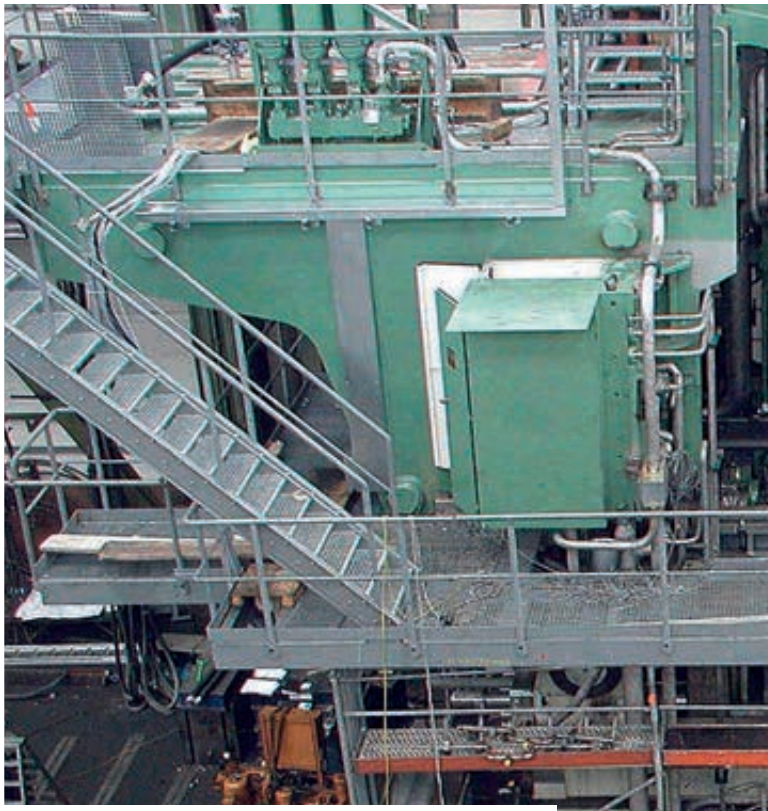
Implementing modernization projects requires the utmost in experience and close cooperation with our customers. Systematic project management ensures high quality of the individual components and adherence to schedules. Here is our approach. First, we precisely determine the current state of the mill, then we adapt our designs to existing foundations and other local conditions. This is where our creativity comes in. What follows are short shutdown times for new installations or renovations. That minimizes production losses.

Yet it's clear that every revamp involves risks, so we do everything possible to ensure work goes smoothly.

New facilities are completely assembled and piped in our workshop. Next, our experts try out all operations mechanically and hydraulically. Often, the automation system is tested and the control parameters preset in the workshop.

Prior to installing the equipment on the production line, extensive tests ensure that the plant attains the planned production and quality level within a minimum time after revamping.

Read on to find out about a number of our modernization projects. You'll see how 40 to 50-year-old hot strip mills can be modified to meet today's market requirements and match the performance level of new mills.

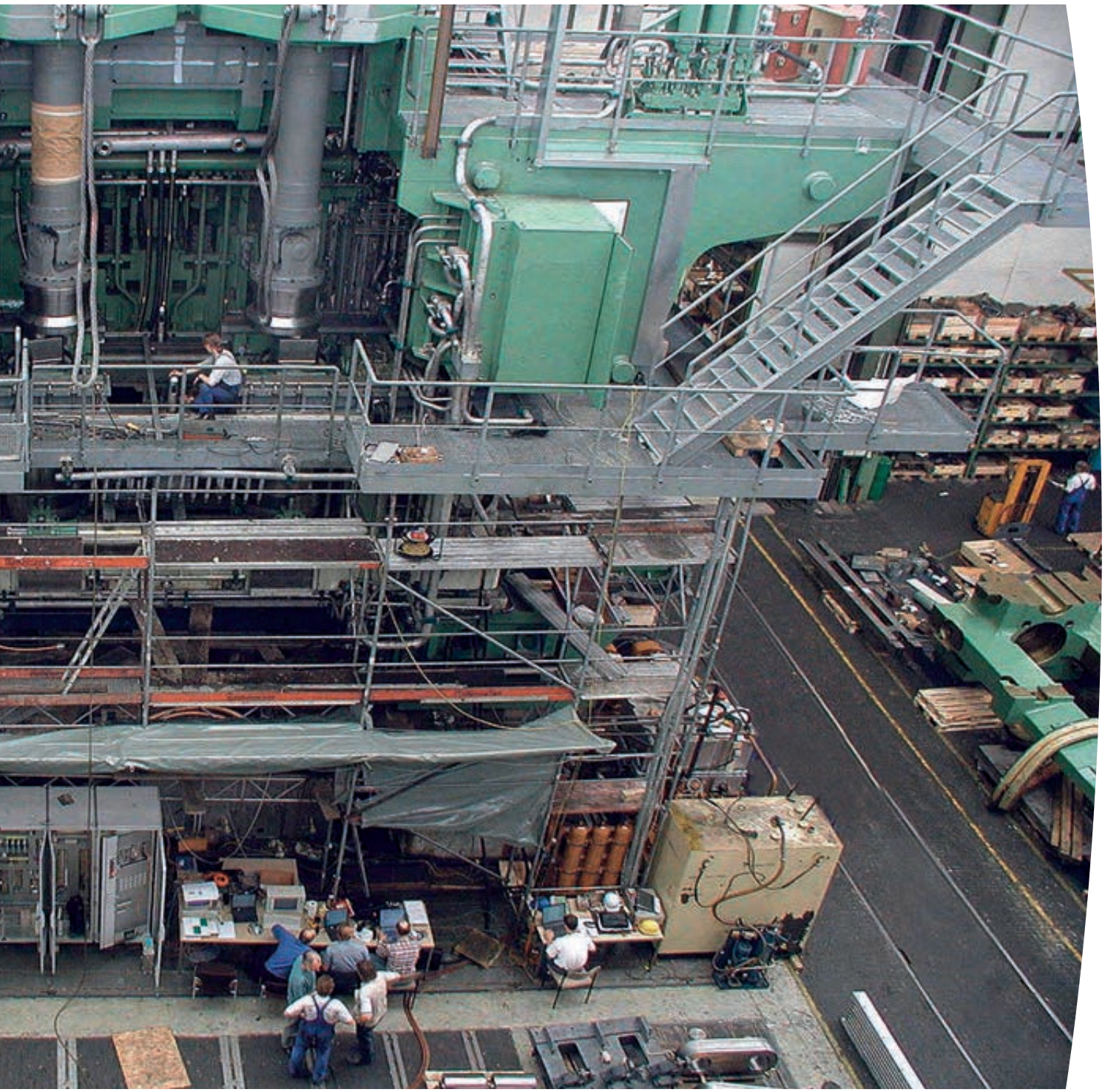


Hydraulics test stand.

Mill shutdowns

Shutdowns are a critical part of revamp projects. To avoid surprises here, we leave nothing to chance. We perform preparatory work during routine maintenance downtimes and use regular shutdowns (e.g. summer shutdowns) to install new equipment or revamp old facilities.

As far as possible, we put together our pre-assembled and pretested equipment next to the production line and test it in “shadow mode”. That is followed by further tests after installation in the line.



Complete pre-assembly and electrical/hydraulic commissioning in our workshop.

Hot strip mill
Shanghai Meishan, China

The hot strip mill of Baosteel Group Shanghai Meishan Corporation Ltd., or Shanghai Meishan for short, had been in operation in Japan for 21 years. Then, in 1994, it was dismantled, rebuilt, and recommissioned in Meishan, China. The new location is a five-hour drive away from Shanghai, to the north-west. We received the order for the extensive modernization of the finishing mill in 2000.

The goal of boosting production from 1.2 to 1.8 million tpy was achieved just a few months after recommissioning. Now, with a daily production of more than 7,000 t, annual production exceeds 2 million t.

The acceptance tests demonstrated that the revamped equipment met all requirements. On completion of the first renovation stage, we received a new order to revamp the roughing mill in 2004.

This time, the goals were to raise production to 3 million tpy and to improve quality in terms of closer width tolerances and better rolling stability by avoiding transfer-bar cambering.

Main features of the modernization

Stage 1

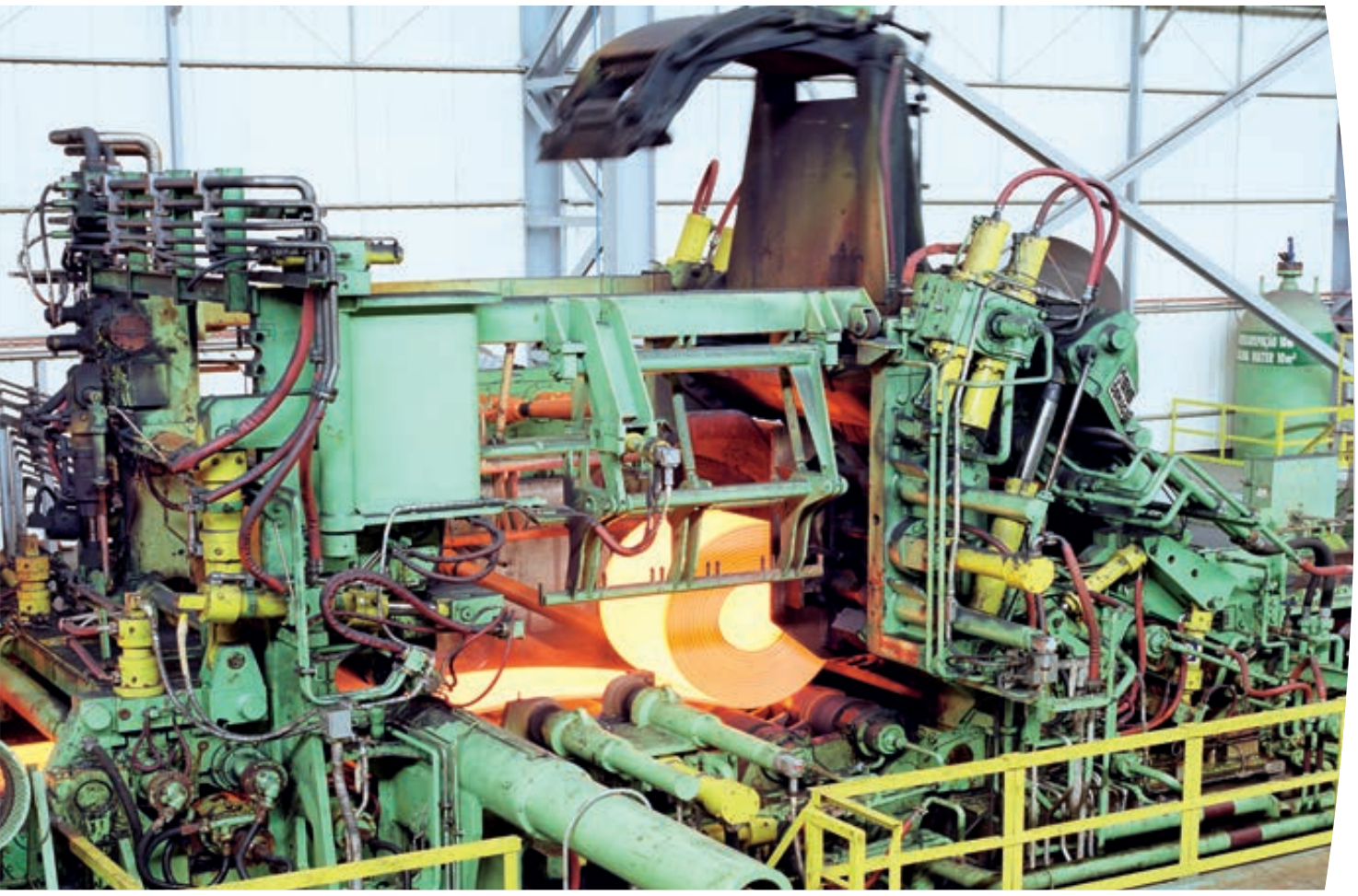
HGC	
F4 to F6	Rolling force 30,000 kN
CVC®plus	
F1 to F6	Stroke ±100 mm
Work roll bending	
F1 to F6	Bending force 1,200 kN per neck
New laminar cooling line	
	52 microzones, 16 trimming zones
New runout roller table	
New coilers 1 and 2	
	Step Control, coiler 1 retractable

Stage 2

Descaler (primary)	
New	160 bar
Edger	
New	Edging force 7,000 kN
Roughing stand	
New	Rolling force 40,000 kN
Coilbox	
New	Transfer-bar thickness 20 to 40 mm, coiling speed up to 5.5 m/s
Crop shear	
New	50 mm x 1,320 mm, shearing force 9,600 kN
Descaler (secondary)	
	Relocation of existing descaler to in front of the new stand F0
Finishing stand F0	
New	Rolling force 38,000 kN

2014 – finishing mill

Screw down system for F1 to F3
6 new hydraulic adjustment cylinders



Installation of a coilbox in the second modernization stage.

Goals	Results
Stage 1 • Increase in production from 1.2 to 1.8 million tpy • Improved hot strip tolerances • Better coil quality	• Production > 2 million tpy • Thickness tolerance for strip thicknesses from 1.2 to 4 mm: 99 % of strip length ≤ 40 µm • Temperature tolerance of finished strips: 95.4 % within ±15°C • Profile tolerance for strip thicknesses ≤ 2.5 mm: ±25 µm of setpoint value
Stage 2 • Increase in production from 1.8 to 3 million tpy • More rolling stability (avoidance of cambers) • Improved width tolerances	• Commissioned in May 2006

Continued
hot strip mill – Shanghai Meishan

Stage 1
of the modernization at Shanghai Meishan

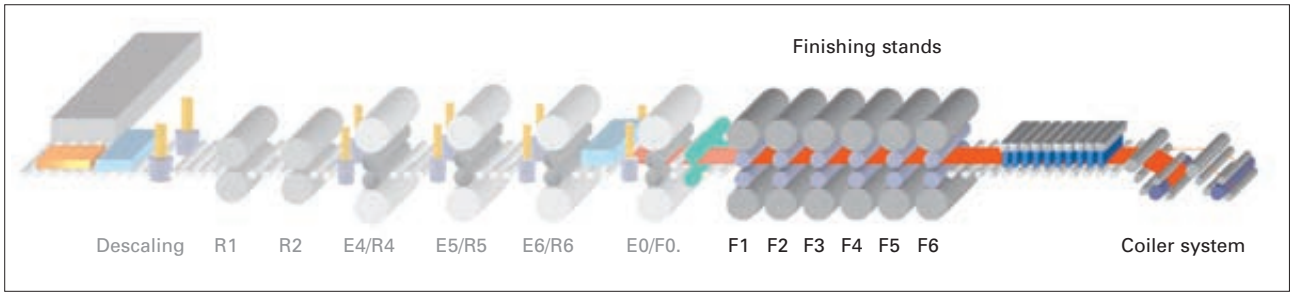
It took a 37-day shutdown (40 days were planned) to totally revamp the finishing mill up to the coiler. Hydraulic adjusting systems in the last three stands plus hydraulic loopers ensure a stable strip flow and improved thickness tolerances. Also fully operational are CVC®plus shifting systems and work roll bending systems in all the stands that offer wide setting ranges. This means our customer obtains the specified hot strip profiles from the beginning to the end of each rolling campaign. Good strip flatness always has top priority.

The new laminar strip cooling system in combination with a corresponding process model ensures the required material properties. Two new fully hydraulic coilers featuring Automatic Step Control coil the strips with straight edges and at the defined strip tension.

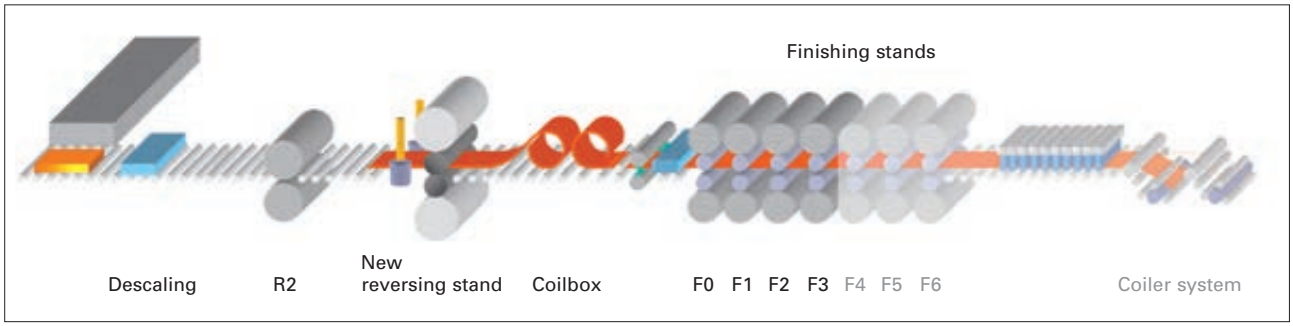
Stage 2
of the modernization at Shanghai Meishan

As part of the second revamping stage, we extensively renewed the roughing mill. The two main shutdown periods lasted 25 and 30 days. Roughing stands R1 and R4 to R6 and edgers E4 to E6 were replaced by a reversing rougher with attached edger. Roughing stand R2 remains in use. A coilbox replaced the old finishing stand F0 and a new F0 stand was arranged upstream of the finishing mill.

Finishing stands F1 to F3 were equipped with six new hydraulic adjustment systems in 2014.

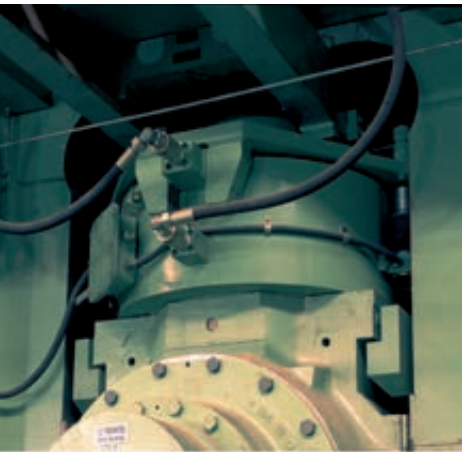


First modernization stage.

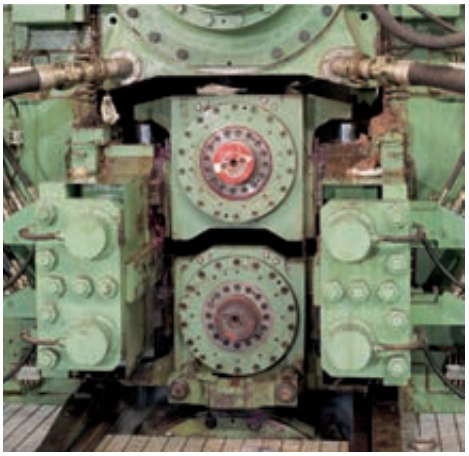


Second modernization stage.

New reversing stand with a view of the edger.



Hydraulic adjusting system.



CVC®plus shifting and bending system.

Coilbox uncoiling station.

Steckel mill
Outokumpu Stainless, Finland

The extension of the Steckel mill at Outokumpu in Finland is an example of a very unconventional modernization job. The customer's goal was to boost the mill's annual production from 0.8 to 1.8 million t of stainless steel strip.

Modernization steps and project sequence

This drastic increase in production was achieved by installing additional finishing stands downstream of the exit-side Steckel furnace. Furthermore, we replaced the old pneumatic coiler with a hydraulic coiler featuring Step Control, and renewed the laminar cooling section.

During the first two-day shutdown, the roller tables in the area of the planned finishing stands were suspended from a roller table bridge. While production was in progress, a foundation pit (1) was prepared in which the foundations for the drive motors and the stands were completed. On the operator side, a foundation block was poured, then the rolling stands were assembled on this base as far as possible (2). Together with the foundation block, they were moved into the line (3), aligned, and arrested during another shutdown lasting five and a half days.

It was also during this shutdown that we commissioned the new coiler and removed the old coiler.
The Steckel mill, with the new coiler, attained its normal production level just two days after the end of the shutdown.

The foundations and the roll changing facilities for the new stands were completed while production continued (4). After the subsequent two-week summer shutdown that was used to complete the stands, the new finishing stands successfully went into operation.

Original state

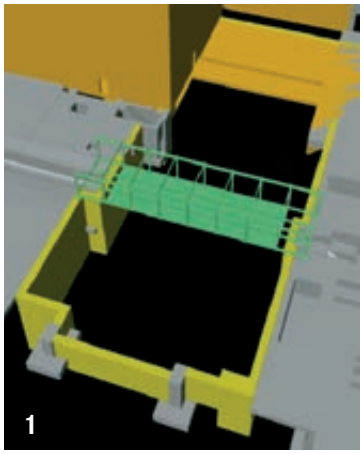
Production	800,000 tpy
Steel grades	AISI 304, 316, 904L, 430
Thickness range	2.3 to 12.7 mm
Width range	800 to 1,625 mm
Coil weight	Max. 30 tons; 22 kg/mm

Goals

Increase production to around 1.8 million tpy

Measures

- New automatic slab feed
- New walking beam furnace
- Installation of 3 new finishing stands
- Installation of a new coiler
- New cooling section
- New Level-2 system and extension of basic automation
- **2016 modernization of descaler**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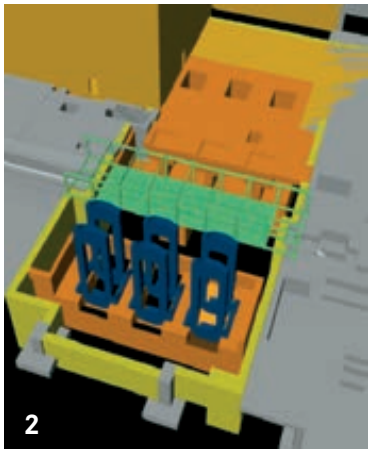
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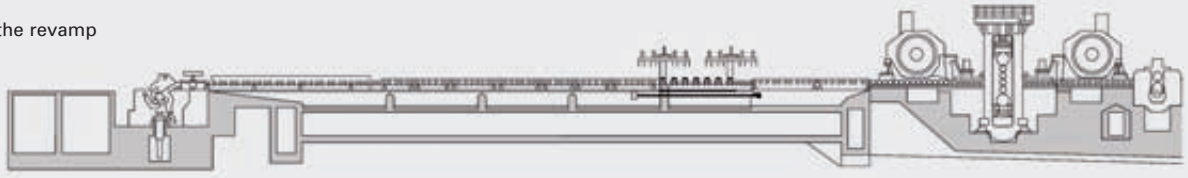
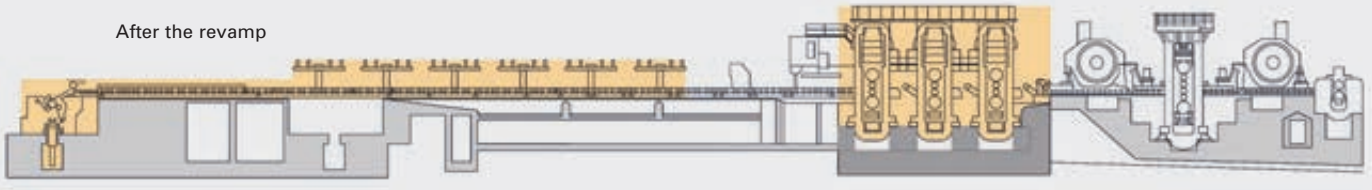
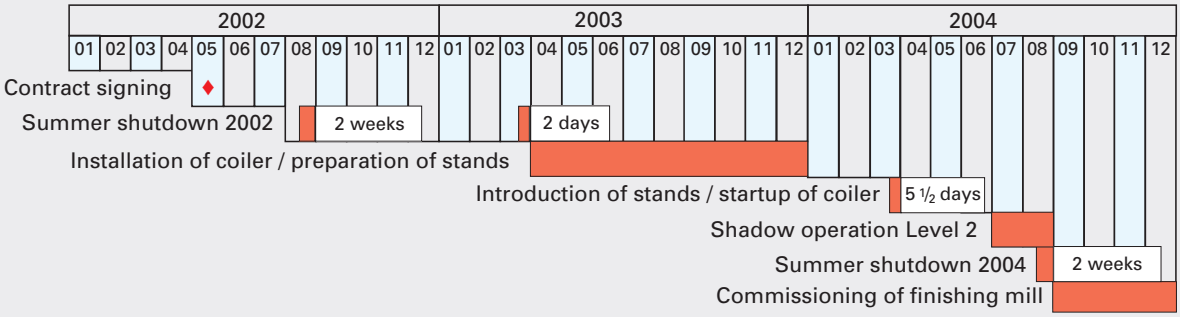
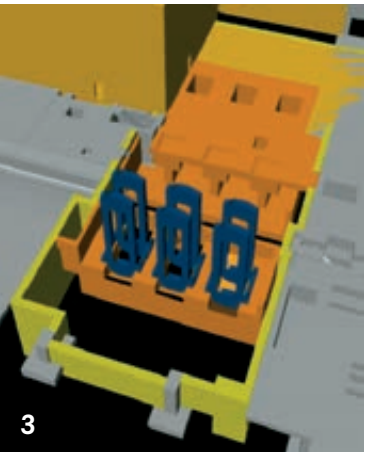
Before the revamp

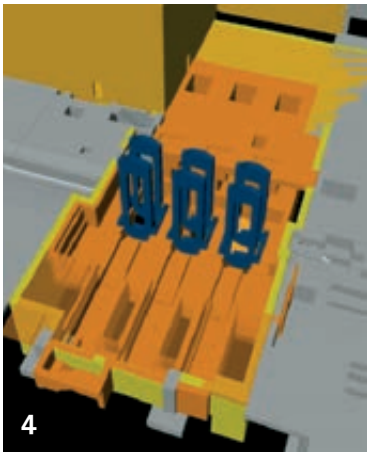


After the revamp









Continued
Steckel mill – Outokumpu Stainless

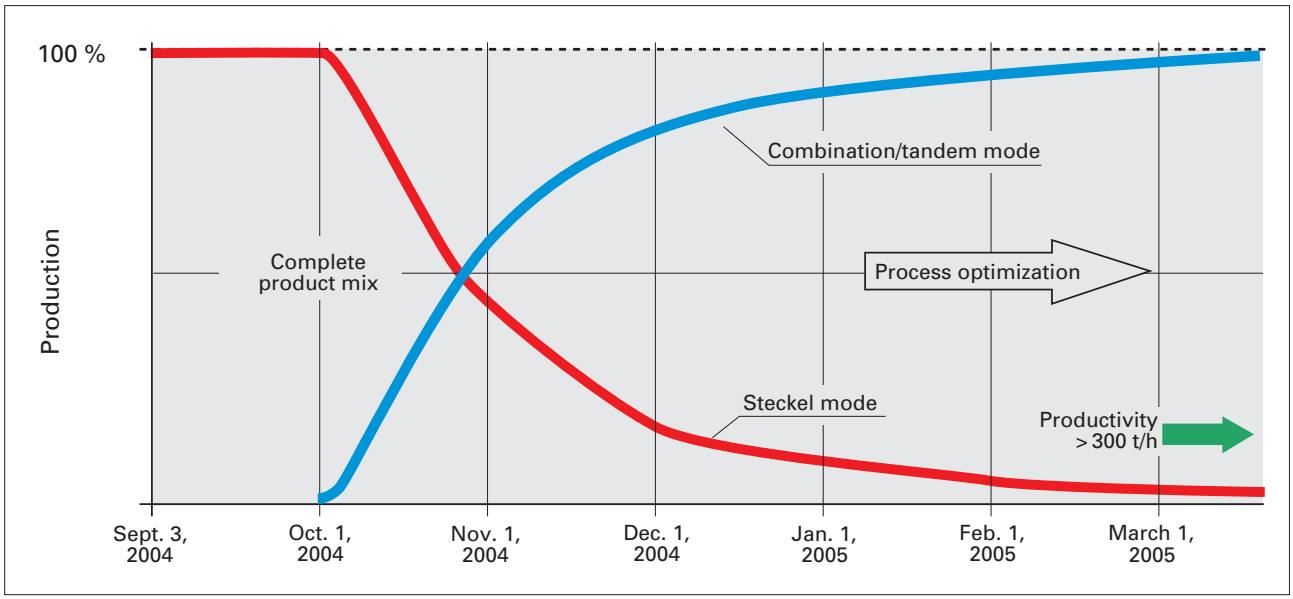
Results

During a transition phase, production took place alternately in Steckel mode (5 or 7 passes on the Steckel stand) and combination mode (3 passes on the Steckel stand, 1 pass each on the new finishing stands).
As early as the second day after the summer shutdown, Outokumpu was able to produce its full production spectrum again. Four weeks later, our customer celebrated the successful premiere of rolling in combination mode. The share of production rolled in Steckel mode decreased continuously until the end of the year, while production in combination mode increased to the same extent.

The contractually agreed availability of the new facilities (mechanical equipment and automation) was reliably achieved during testing. It even increased to over 99 % by the end of the optimization phase.

Today the plant produces mainly in combination mode. Thicker strips – from 5.5 to 7.5 mm, depending on the width – are rolled in tandem mode (one pass on the Steckel stand, one pass each on the new finishing stands).

The SMS group pass schedule calculation (PSC®) and profile, contour and flatness calculation (PCFC®) models calculate the set-up values for the roughing mill, the Steckel mill, the new finishing stands, and the coiler. Thickness deviations at the strip head of considerably less than 100 µm underline the quality of the Level-2 system.



The new finishing stands are on stream.

New coiler.

Laminar cooling section.

Hot strip mill Salzgitter Flachstahl, Germany

The hot strip mill at Salzgitter Flachstahl GmbH in Germany went into operation in 1963. Ever since, it has been continuously adapted to the ever-increasing requirements of the market. The most recent modernization started in 2001 with the installation of a new sizing press. It ended in 2003 after integration of a new roughing stand with flanged-on edger, CVC®plus facilities, and a work roll bending system in finishing stands F2 to F5. A new automation system completed the package.

Installation of roughing stand and edger

In terms of logistics, the installation of the new roughing stand and the edger was the most demanding part of this modernization job. Within a shutdown period of just 18 days, the old components were dismantled, the new ones installed, and the plant put into full operation. Then it resumed production right on schedule. Just one week later, the mill had already attained 80% of its normal production level, surpassing the highly ambitious target. We manufactured and preassembled the roughing stand and edger in our Hilchenbach workshop, including all pipelines. Then our commissioning team tested all the main movements of the stand and the edger right up to pre-optimization of the controls.

On completion of the workshop tests, the facilities were dismantled, reassembled next to the rolling line in Salzgitter, and tested again with the final electrical and automation systems.

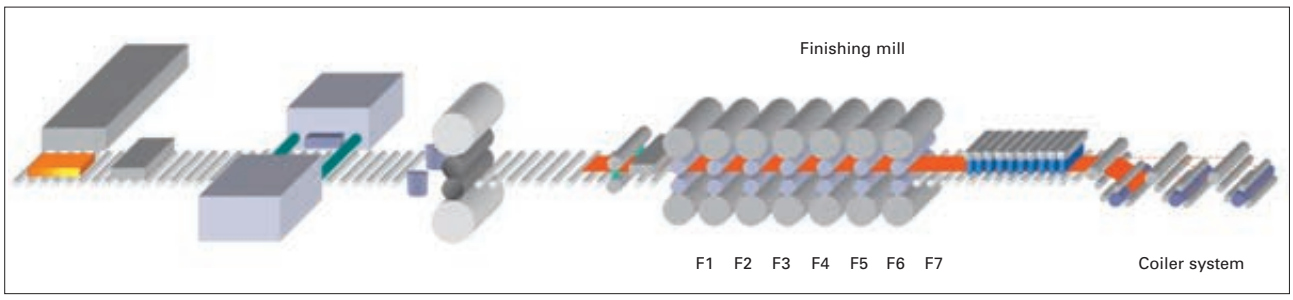
Goals

- Increase production
- Improve product quality
- Increase the production share of high-strength steels
- Prepare the hot strip mill for future market requirements

Modernization steps

1990-2000	2 new coilers, hydraulic looper, CVC®plus and bending system for F5 - F7
2001	New sizing press
2003	New roughing stand with flanged-on edger, CVC®plus and work roll bending for F2 to F5
2003	New automation system for the roughing and finishing mills
2007	Mill widened to 2000 mm New cooling and lubrication systems for finishing train New no. 3 coiler (UNI plus coiler)
2012	Renovation of polishing device

We adapted the housing contour of the new roughing stand in the design phase so that the foundations remained almost unchanged after the old stand had been removed. Due to an innovative concept, the time needed to align the bedplates was reduced from 36 to 12 hours. The assembled new roughing stand weighed approx. 850 tons. It was moved on rails from the preassembly area to its final position. Finally, a special lifting device and the bay cranes positioned the edger in the rolling line.



The new roughing stand with attached edger.

Sizing press.

The new roughing stand is pushed into the rolling line.

Continued
Hot strip mill – Salzgitter Flachstahl

Commissioning and start of production

We timed all the shutdown activities down to the last minute. Following erection and connection of the utilities and cables, the roughing stand and edger went on stream after less than 18 days, and seven hours before the contractually agreed deadline.

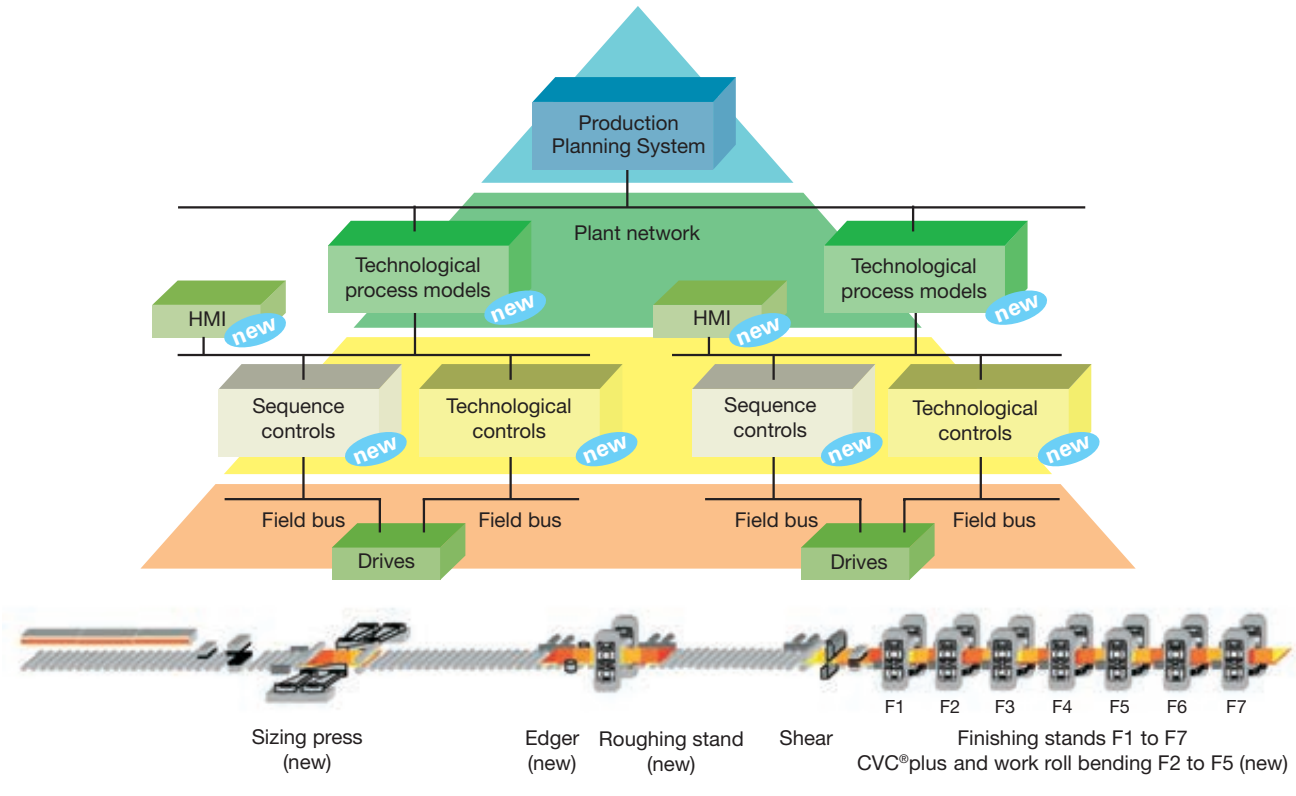
New automation system

Parallel to the mechanical revamp of the hot strip mill, SMS replaced the existing automation system. The new modular X-Pact® system features process models based on physical relationships, plus extremely fast technological control systems. It's specifically geared to today's rolling process requirements.

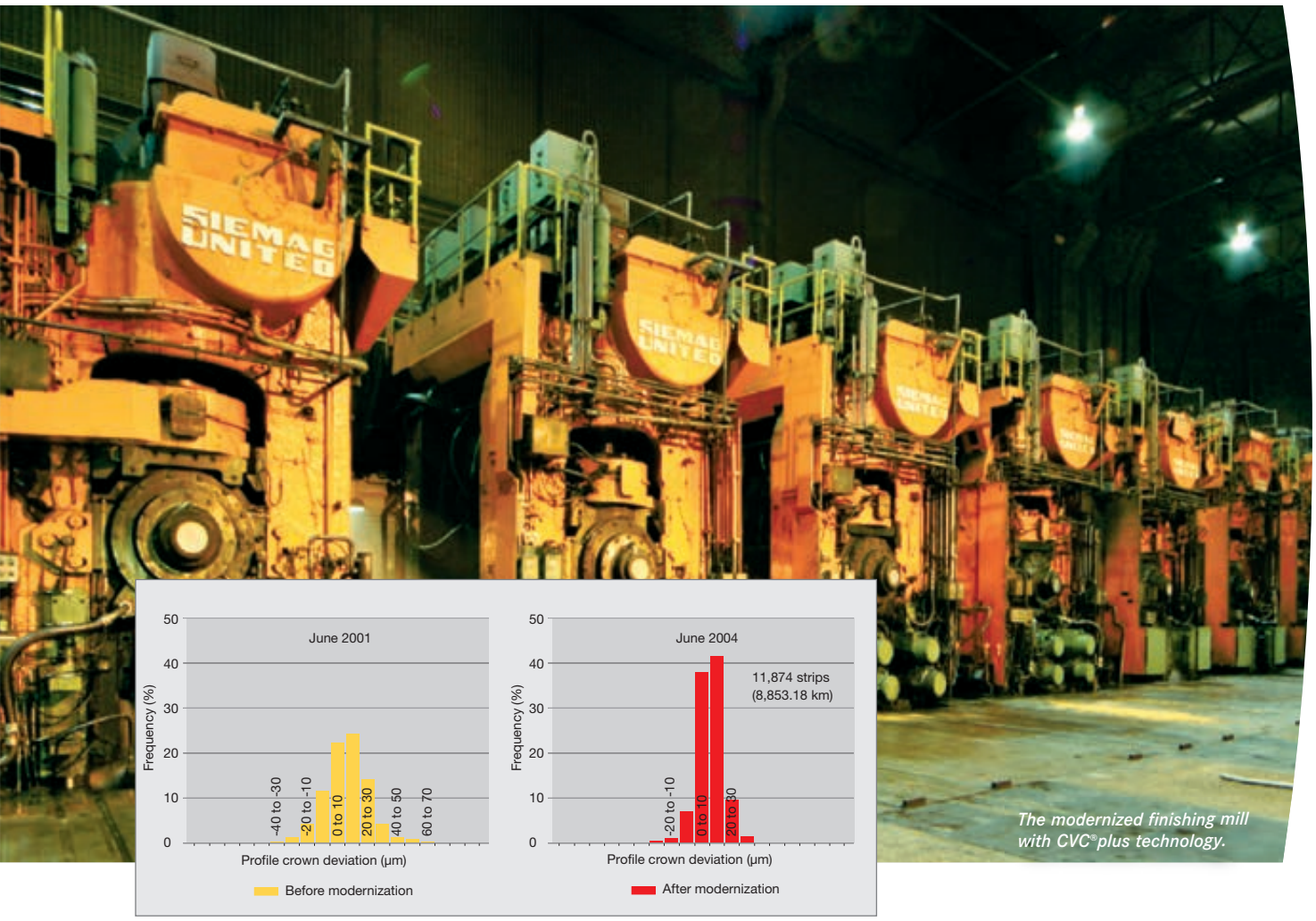
Improved product tolerances

Innovative solutions for optimizing the rolling process are crucial to the stable rolling of special materials with extreme dimensions. The thicknesses and width tolerances attained here speak for themselves.

The strip profiles remain within very close tolerances – from the strip head to its tail and from beginning to end of each rolling schedule. Specific strategies for CVC®plus shifting and work roll bending systems enable longer phases of rolling strip in the same width without any undesirable profile anomalies in the edge area.

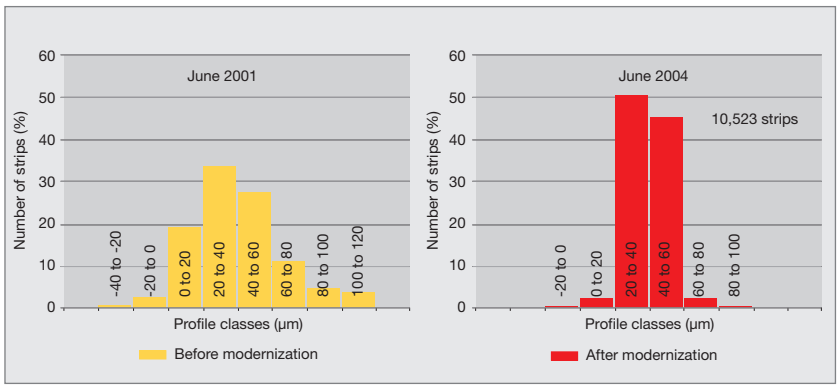


Structure of the new automation system from SMS group.



The modernized finishing mill with CVC® plus technology.

Operating results: rolling stability prooved according to thickness tolerances.



Operating results: profile precision of the PCFC® model.

Sideguides during shop testing.

Hot strip mill 1
ThyssenKrupp Steel Europe, Germany

The yield and cost-effectiveness of hot strip production depends on how far the mill achieves straight strips without any wedges in the thickness profile. This requirement was the basis for the modernization of hot strip mill No. 1 at ThyssenKrupp Steel Europe in Bruckhausen.

Formerly, extremely cambered transfer bars frequently resulted in unstable rolling of these bars in the finishing mill. Now, the integrated SMS automation system, new hydraulic sideguides upstream and downstream of the roughing stand, and hydraulic adjusting systems in the rougher have boosted quality beyond even optimistic expectations.

Minimizing transfer-bar cambering

Cambers can form due to thickness wedges in the slab cross-section or asymmetric heating. However, the right interplay between sideguides and hydraulic adjusting system ensures a straight-rolled transfer bar.

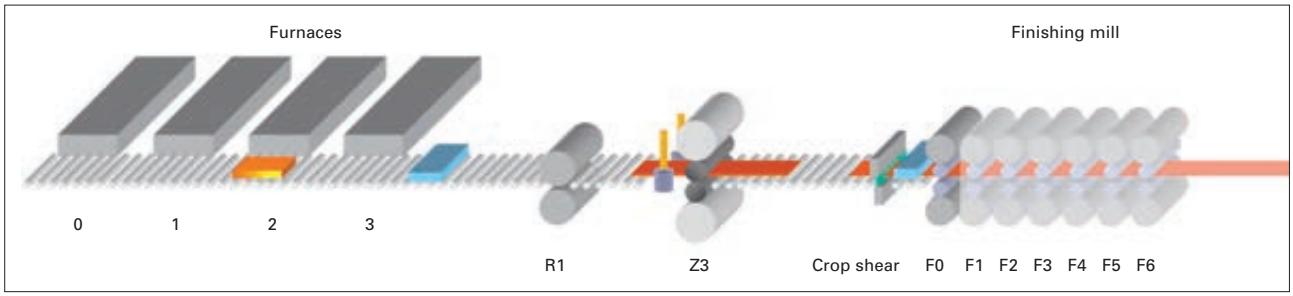
Goals
- Minimized transfer-bar cambering
- Improved rolling stability in the finishing mill

Measures
- Hydraulic adjusting system in R1
- New hydraulic sideguides
- Integrated automation concept

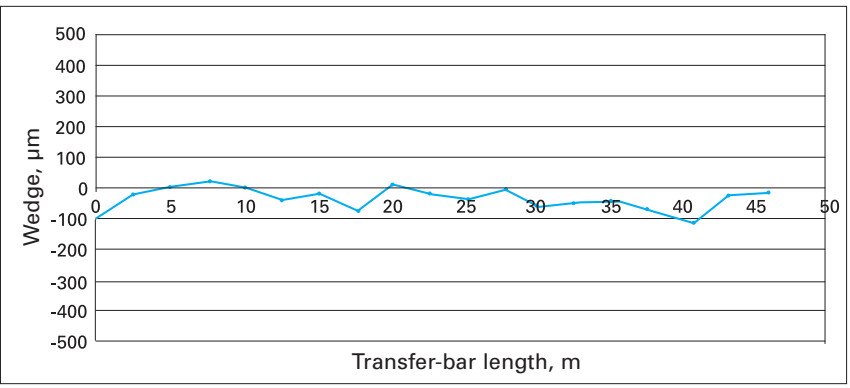
Results
“Thanks to the new sideguides in combination with Hydraulic Gap Control (HGC) in the roughing mill, we stabilized the strip tracking behavior in the finishing mill and improved the geometry of the coils.”
(Dr. Helmut Osterburg, Head of Production, Bruckhausen Hot Strip Mill, ThyssenKrupp Steel)

After the first pass.

After the final pass.



The modernized roughing stand with new sideguides.



Top: Cambering, Bottom: Transfer bar wedge.

Hot strip mill ArcelorMittal, Ghent

The hot strip mill at ArcelorMittal Ghent in Belgium dates from as far back as 1967. In November and December 2016, we implemented its long-planned and meticulously prepared modernization. Within just 19 days, SMS group replaced the first two rolling stands of the finishing mill with new state-of-the-art mill stands. Shortly afterward, they went into operation successfully.

The revamp was the last step in the modernization of the hot strip mill. What's more, it was the most important stage, involving installation of the two new finishing stands F1 and F2. From 2012 to 2015, SMS group had already increased the rolling force at stands F3 and F4. We also integrated hydraulic loopers into the finishing mill, equipped F1 to F3 with new drives and SIEFLEX® HT spindles (high-performance spindles), and supplied a new profile, contour and flatness control (PCFC®) system for the plant.

Preparation in the SMS group workshop

Preparations for the renovation shutdown started in our Hilchenbach workshop in the spring of 2016. To achieve the time schedule of just 19 days, SMS group completely pre-assembled both new rolling stands. The mechanical and hydraulic equipment was then thoroughly tested. ArcelorMittal performed its own tests to adapt the automation system installed in the hot strip mill to the new equipment.

Next, the disassembled mill stands traveled to Ghent and, in September, we pre-assembled them as far as possible next to the working line. ArcelorMittal Ghent used the time until the start of the revamp to further test the automation system.

Scope of the modernization

- F1 + F2: new rolling stands with hydraulic positioning system and CVC®plus
- F3 + F4: new hydraulic and mechanical positioning system to increase the rolling force, new oil film bearings
- F1 - F3: new mechanical drives including Sieflex® HT spindles
- F1 - F6: new loopers
- New profile, contour and flatness control (PCFC®) for the finishing mill

First coil after 19 days

The revamp of the hot strip mill started in mid-November 2016. After about five days, the two old rolling stands had been dismantled. Next up was foundation work to make room for the significantly larger and more powerful new stands. When planning the renovation, SMS group focused in particular on retaining as many interfaces as possible to utility services and re-using system components such as the media pumping station.

Approximately one week after the beginning of the shutdown, the pre-assembled stands were incorporated into the plant with the help of a sledge system. One after the other, the two stands – each weighing approximately 400 tons – were first moved parallel to the rolling line and then lowered into the prepared foundation pit. All work, including the subsequent final assembly of the stands, went without a hitch. That ensured the equipment could be handed over for cold tests two days ahead of schedule. Finally, on December 6, 2016, after a renovation period of just 19 days, ArcelorMittal put its hot strip mill back into operation and rolled the first strip.

Shifting F1 into position.

New rolling stands F1 and F2
Summary of the modernization plan

March – June 2016
Manufacture, full assembly and functional testing of F1, F2 in Hilchenbach

September 2016
Assembly of F1, F2 on site

Dec. 6, 2016:
1st coil

Dec. 2015 | **2016** | **2017**

1st shutdown: 14 days
- Conversion of F3, F4
- Replacement of the loopers F3 - F6

June – July 2016
Testing of all equipment and functions by the ArcelorMittal team in Hilchenbach

2nd shutdown: Main downtime period of 19 days:
Nov. 17, 2016 – Dec. 6, 2016
- Dismantling of the old stands F1, F2
- Installation of the new stands

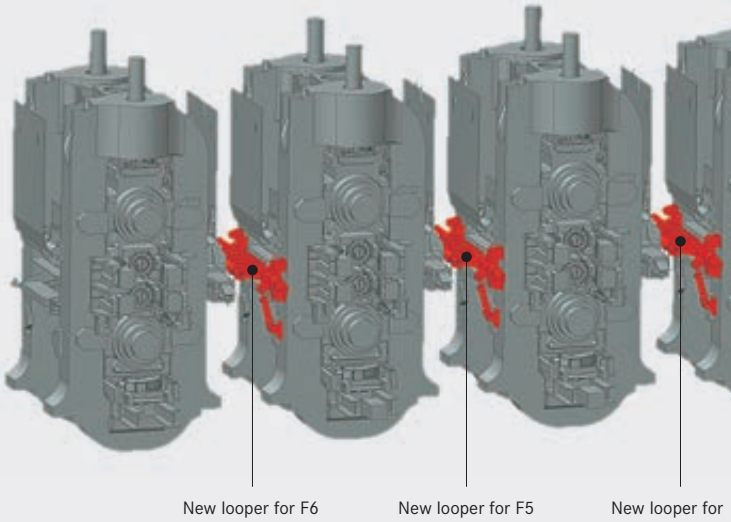
Continued
Hot strip mill – Arcelor Mittal

High-strength steels in new grades

With this modernization, ArcelorMittal has made its hot strip mill in Ghent fit for the future. The two new stands are equipped with powerful actuator systems such as hydraulic adjusting systems and CVC®plus with work roll shifting and bending systems. These control elements were integrated in the PCFC® model that was previously installed. They enable adjustment of the strip parameters right from the first finishing stand. Now our customer can attain major reductions in the first stands even when rolling high-strength steel grades. We previously upgraded stands F3 and F4 by increasing their rolling force.

What this plant technology means for ArcelorMittal in Ghent is an expanded portfolio of high-strength grades. The facility can now produce e.g. the Fortiform® range. This consists of novel steel grades for the automotive industry that significantly reduce weight and improve safety. In addition, ArcelorMittal achieves greater flexibility in production and can increase hot strip capacity at the site whenever required.

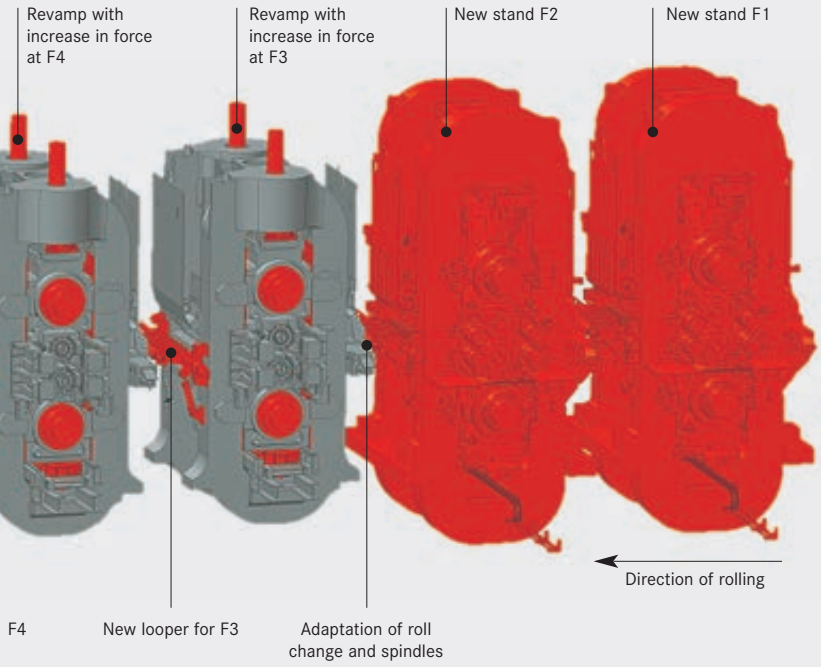
Supply scope included:
- Mechanical components
- Hydraulic components
- Installation including pre-assembly at the SMS group workshop in Hilchenbach
- Technical service
- Electrical and automation package (sensors and cabling)



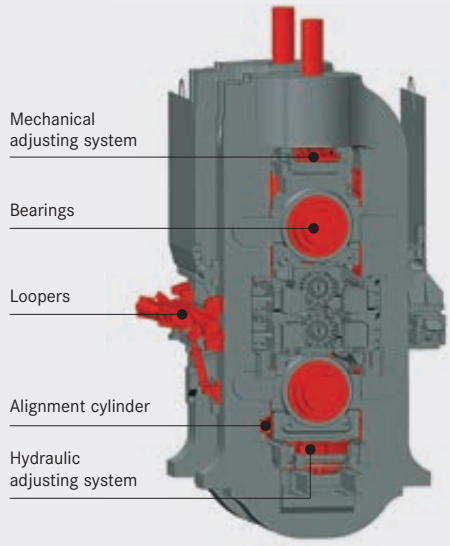
Modernization concept.

Finishing mill in the area of the rolling stands F1 and F2. First week of the second shutdown: dismantling the old stands F1 and F2

Initial situation: The two existing stands F1 and F2 are still in position. Already removed: existing edger upstream of F1. The edger is reinstalled once the new stands have been integrated.



Altered components:
- Machining of the rolling stands
- Installation of Backup roll alignment cylinders
- Installation of stand wearing plates
- Adaptation of the top pressure plate shifting unit
- Mechanical adjustment bolt/nut
- Thrust block
- Hydraulic adjusting system at bottom
- Support roll chocks (remachining the hole)
- X-Roll® oil film bearings
- Support rolls
- Loopers
- Machine pipe installation



Revamp of rolling stands F3 and F4.

Finishing mill in the area of the rolling stands F1 and F2. Second week of second shutdown: installation of the new stands.

Preparation of the foundation pit for the new, heavier and stronger stands. Assembly of the equipment to shift the stands longitudinally and laterally.

Benefits of modernization

DRIVE TECHNOLOGY

- Reliable and powerful
- Rolling high-strength materials needs higher torques
- A revamp project starts with a systematic examination of the drive trains.

SIZING PRESSES

- Higher throughput in steelmaking plant and continuous casting facility
- Reduced number of slab sizes required
- More flexible production planning

COILBOX SYSTEMS

- Higher coil weights
- Enlargement of product mix (decreased final strip thickness or rolling harder grades)

ROUGHING STANDS

- Increased production (fewer passes)
- Expansion of the product spectrum (e.g. higher-strength steels)
- Better transfer bar straightness in combination with heavy hydraulic entry and exit sideguides

SHEARS

- Improved cropping configuration (head and tail crop cut) for increased rolling stability
- Expansion of the product mix (e.g. higher-strength steels)

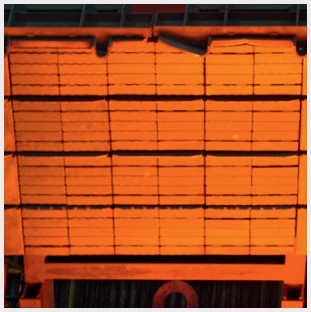
EDGERS

- Better width tolerances
- Higher output thanks to fully hydraulic edgers

DESCALERS

- Better strip surface quality
- Lower energy costs for descaling

HIBOX THERMAL INSULATION HOODS



- New design and materials
- Longer service life
- Higher performance
- Better temperature homogeneity throughout
- Less maintenance
- Lower cost for replacement
- Energy savings

CONVECTIONAL ROLL COOLING CRC

- Convection work roll cooling
- Maximum cooling performance
- Lower delivery energy thanks to lower pressure
- Precise distribution of water across the width of the roller
- Lower energy consumption by up to 80 %
- Lower water consumption

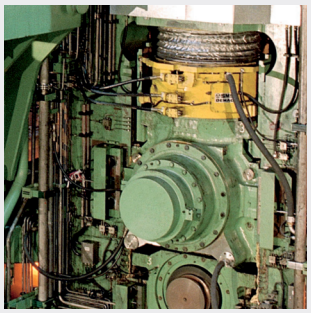
FINISHING STANDS

- Higher production
- Extension of product mix (e.g. high strength steels)
- Reduction of minimum final strip thickness
- Reduction of energy costs
- Improved rolling stability

HYDRAULIC LOOPERS

- Better rolling stability
- Better width tolerances

HYDRAULIC ADJUSTING SYSTEMS

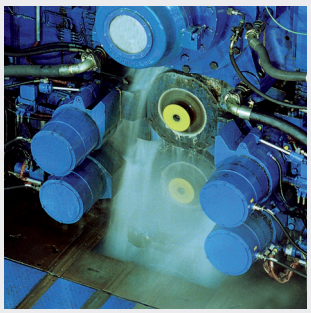


- Improved thickness tolerances
- Improved rolling stabilty
- Reduction of camber formation and transfer bar thickness profile wedge (in combination with suitable hydraulic side guides)

LAMINAR STRIP COOLING SYSTEMS

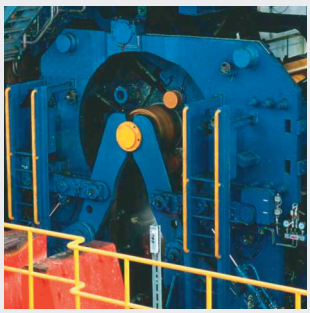
- Better coiling temperature tolerances
- Expansion of the product mix (e.g. dual-phase steels)
- Better temperature distribution across the width of the strip

CVC® BENDING AND SHIFTING SYSTEMS



- Better strip profile, flatness and rolling stability
- Extended product mix through CVC®plus
- Lower rolling costs due to longer rolling schedules
- More flexible production planning

COILER SYSTEMS



- Expansion of the product mix (e.g. higher-strength steels)
- Better coiling quality
- Specific requirements met (e.g. coiling very thin or very thick high-strength strips)
- Higher production
- Safe coil extraction

References, modernizations

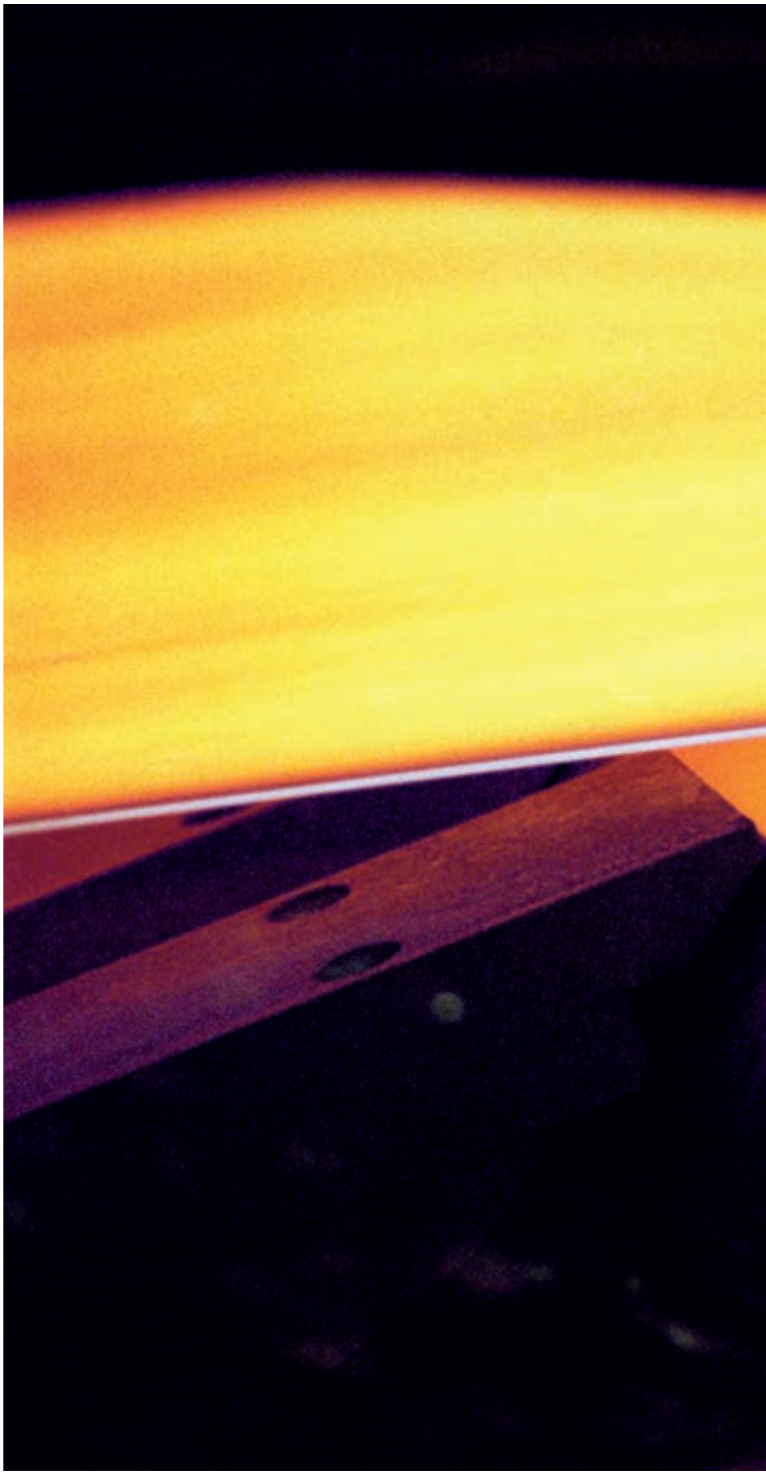
SMS group GmbH operates as a complete system supplier of hot strip mills. We offer mechanical, electrical and automation systems, plus the technology and process know-how to upgrade your plant.

We strategically respond to market requirements and develop concepts with maximum customer benefit.

Starting in the late 1980s, we have implemented many projects with our own electrical and automation systems. Since 1990, we have equipped 44 hot strip mills (new plants and modernizations) with process models and basic automation systems.

Factors that ensure our long-term partnerships with our customers are:

- Innovative developments
- Regular dialog
- Technological support
- Joint product development
- Services / Professional project management
- Advanced product quality support by the SMS group company MET/Con using the Product Quality Analyzer (PQA®)
- Preventive maintenance, e.g. with intelligent components



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