FASCINATING HEAVY PLATE
Electrics and Automation
Central to the automation of metallurgical plants is today’s focus on high availability and ever-better quality of the final products. To meet these requirements, SMS Siemag decided many years ago to include in its range not only mechanical equipment, technological controls, and process models, but also the entire electrics, automation, and drive technology for our plants. That makes us an all-inclusive supplier, giving you engineering, construction, and commissioning of your plants – all from one source.

Even more: You can be sure all the mechanical and electrical system components mesh perfectly. Short paths, direct dialog, and everybody working toward the same goals… all this adds up to the best conditions for your success.
ALL-INCLUSIVE MODERNIZATION STRATEGIES

As an operator of metallurgical plants, you know how important it is to constantly add to and renew your production equipment so you retain your market standing with excellent product quality. It’s not enough to simply install the latest mechanical equipment. Your upgrades must also be integrated into the process, and ultimately the automation system, before they can really make a difference to the final product. SMS Siemag supplies seamless revamp solutions that support the technological improvement of your production across the board.

PROFESSIONAL PARTNER FOR HEAVY PLATE MILLS

Specialists in electrics, automation, technology and mechanics work hand in hand to ensure everything functions smoothly. That’s how we create intelligent, market-centered solutions with high potential for improved production. Our entire scope of supply and services – from plant engineering to process engineering, electrics and automation, manufacturing, assembly, Plug & Work testing, commissioning, right through to after sales service – is geared to the special requirements of plate manufacturing.
HARDWARE AND SOFTWARE AUTOMATION SOLUTIONS

X-PACT®

The electrics and automation systems of SMS Siemag are grouped together under the brand name X-Pact®. That goes for all process levels.

X-Pact® is a modular system. This means it can be flexibly adapted or expanded to meet your particular requirements. Specifically, X-Pact® links the different levels of electrics and automation together. Included here are not only the technological controls and process models, but also all tasks of modern plant automation from drive technology and sensors (Level 0) right up to production planning (Level 3).

So you benefit from a system solution in which the technology, mechanics, hydraulics, electrics & automation form an effective unit.

X-Pact® is a holistic concept.

MULTI-STEP STRATEGY

It’s a significant advantage that X-Pact® electrics and automation systems use globally available hardware and software, and comply with internationally recognized standards.

All systems are based on platforms that have a modular design. Naturally, we allow for current trends in hardware and software. Due to the extensive separation into different levels (basic modules, technology modules, system-specific modules,) you only have to make adjustments and changes where they are actually required.

If the IT environment changes, for example due to new hardware, all you need to adapt are the basic modules. If new technologies are changed, you merely change the technology modules. Project-specific functions and processes have been placed in the plant-specific modules. So here is a structure that brings you these advantages: It improves both the maturity level and service life of the technology modules, plus it ensures the stability of the system-specific modules in the case of new IT modules or device-related changes.
### SYSTEM ENVIRONMENT

It’s important in the automation of heavy plate plants to differentiate between quick technological process controls and drive and sequence controls.

There are not only material-accompanying controls, but also controls for auxiliary and ancillary units such as hydraulic stations, cooling systems, and lubrication systems.

What’s so special about automating our heavy plate plants is that all control functions are grouped together on the system platform X-Pact® ProBAS.

You won’t find any interfaces between different system platforms, since all process variables are immediately and simultaneously available to all sub-systems through the reflective memory (RFM) architecture.

Integrating other systems, for example stored programmable controls for drive and sequence controls e.g. in the shear section, is no problem at all.

It’s equally simple to incorporate a PDA system as an integral part of the overall system with RFM.

To respond flexibly to your standards or special requirements such as modernizations, we can easily integrate your existing controls.

### SIMPLE SYSTEM MAINTENANCE

Due to the open system architecture of the X-Pact® system, there is no need for proprietary solutions. The automation systems are fully implemented in logi.CAD on the basis of the internationally valid standard IEC61131-3. This is important for international projects and ensures that either we or you yourself can maintain, service and further develop our systems.

In terms of structure and handling, the FBD (function block diagram) technology used in logi.CAD is absolutely comparable with the CFC (continuous flow chart) technology used in the PLC programming environment.
AUTOMATION LAYOUT
OF A HEAVY PLATE PLANT
MODERN HARDWARE SOLUTIONS

HARDWARE AND SOFTWARE PLATFORM

We use ultra-modern computer technologies for our Level 1 real-time controls. Tried and tested for graphic programming and diagnosis is our ProBAS software. A typical configuration consists of:

- one or more engineering stations (MS Windows)
- an X-Pact® ProBAS development server
- one or more X-Pact® ProBAS systems

X-PACT® EMBEDDED AUTOMATION PC

Within the X-Pact® ProBAS system, X-Pact® Embedded is a cutting-edge hardware platform for modern, sophisticated control and regulations systems in hot rolling. It’s based on the modern Core™ 2 Duo technology from Intel® and provides the maximum computer power for all your applications.

It’s an added advantage that X-Pact® Embedded hardware saves space in the control cabinet. A cover on the front of the device protects the drive bays (DVD, HDD) as well as two Compact-Flash ports. Switching between drives is made easy by the modular insertion feature. To make working with this hardware even more convenient, all ports and interfaces are located on the top of the housing. There are no protruding ports at the back which would demand extra installation depth. You can always add modules to the hardware, adjusting it to the complexity of your plant. Whatever the installation situation, you can rely on an array that makes optimal use of the space inside the control cabinet. That’s due to the different capacities of X-Pact® Embedded modules with one, two, or several card ports (for PCI/PCI express cards).

ETHERNET-BASED FIELDBUS SYSTEMS

X-Pact® automation from SMS Siemag supports the latest technology in real-time-capable fieldbus systems. Here are the advantages of an Ethernet-based system over a classic fieldbus solution:

- Much higher performance
- Real-time-capability for fast control
- Extensive diagnosis options
- Wide-scale use with very good acceptance
- Interfaces to classic bus systems

Furthermore, using this technology drastically cuts hardware engineering requirements because for the first time signals for the highly dynamic actors/sensors can be picked up close to the mill by the non-central periphery devices. That eliminates masses of cable as well as the associated adaptation of process signals. The technological regulation systems from SMS Siemag use EtherCAT (from Beckhoff) as a real-time-capable fieldbus. All this goes to show that, with our new technology we harness a modern, powerful and real-time-capable communication medium for our automation systems. Flexible tree structures ensure you can expand the network as you want, when you want.
ENERGY DISTRIBUTION AND DRIVE SYSTEMS

Our Electrics and Automation Division also supplies all the equipment you need for energy distribution and drive technology in heavy plate mills.

SCOPE OF SUPPLY FOR ENERGY DISTRIBUTION

Included in our supply range for energy distribution are high and medium-voltage switchgears, distributor transformers, compensation and filter systems, emergency power generators, USV plants, as well as low-voltage main distributors and the associated Emergency Off strategies.

ENERGY DISTRIBUTION FROM ONE SOURCE

We use a single-line scheme to design your energy distribution system. You can also rely on our support in choosing the best method of connection to the integrated network. To determine the necessary filter and compensation plants, we analyze the network. This includes identifying the reactive power requirement and the level of network harmonics. Our in-depth process know-how means we can exactly determine the diversity factors. The result? We optimally dimension all components, from overhead line feeds to mechanical control elements.

SCOPE OF SUPPLY FOR DRIVE SYSTEMS

Whatever drive system you want for your heavy plate mill, we supply not only the full range of variable drives, but also constant drives in all power classes. The main benefits of our energy distribution and drive systems are low investment and operating costs because of minimal power losses, plus compact design, and low maintenance.
RELIABLE DRIVE SYSTEMS

There are many parameters that play an important role in designing the drives, particularly when large outputs are involved. Teaming up with reputable suppliers, we have in recent years developed and optimized our drive design concepts. Intelligent circuits reduce the network harmonic load to such an extent that a filter system is not required on the network rail. We dimension these drive trains (medium-voltage circuit breaker, static converter transformer, converter and motor) on the basis of the real process requirements. These can be found in SMS Siemag’s own pass schedules. An optimized drive system means we offer our customers a plant with the highest possible flexibility for designing production programs.

The technological functions related to the drive, such as ski formation or load sharing control between the upper and lower motor, are also covered by our X-Pact® electrics and automation so that the interface with the drives is lean and standardized.

The drive media system developed by us controls and monitors all media in the motors and drive transformers. This allows us to offer a continuous connection to our plant automation whichever company supplied the drives.
The development of high-strength steels has led to altered rolling processes that also make higher demands on plate cooling as well as the downstream levelers. That’s why, in recent years, we have responded by upgrading and optimizing our rolling, cooling, and leveling technologies.

**MAIN CHARACTERISTICS OF HEAVY PLATE**

When it comes to heavy plate production, we distinguish between these characteristics:

<table>
<thead>
<tr>
<th>Property</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength</td>
<td>Yield strength</td>
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<tr>
<td></td>
<td>Tensile strength</td>
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<tr>
<td></td>
<td>Yield strength ratio</td>
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<td></td>
<td>Brinell hardness</td>
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<tr>
<td>Toughness</td>
<td>Notch resistance</td>
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<tr>
<td></td>
<td>Transition temperature</td>
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<tr>
<td></td>
<td>Final fracture area</td>
</tr>
<tr>
<td>Processing capability</td>
<td>Carbon equivalent Ceq</td>
</tr>
<tr>
<td>(weldability, cold formability)</td>
<td>Pre-heating temperature</td>
</tr>
<tr>
<td>Product shape</td>
<td>Flatness</td>
</tr>
<tr>
<td></td>
<td>Geometry</td>
</tr>
<tr>
<td>Resistance to media</td>
<td>Weather-resistant plates</td>
</tr>
<tr>
<td></td>
<td>Resistance to sour gases</td>
</tr>
</tbody>
</table>

It’s vital to keep all this in mind when choosing automation and model calculation systems for your plate production. There are various strategies for achieving the properties you want by influencing the shaping process and temperature.

**ROLLING STRATEGIES**

Apart from different rolling strategies, several types of longitudinal and lateral rolling modes are available. These modes work on the basis of the geometries of the input slab and the finished product. What’s more, they use lateral rolling to stretch the material crossways.

**PROCESS MODEL FUNCTIONALITIES**

The main process model functionalities are:

- Pacing
- Pass schedule calculation model (PSC)
- Profile and flatness control model (PFC) for CVC plus
- Roll temperature model
- Roll wear model
- Control for optimizing the plate rectangularity (ASC)
- Adaptation model

Reference: Paper presented at Iron and Steel Conference (Eisenhüttenstag) AG der Dillinger Hüttenwerke, Dr.-Ing. Alois Streißelberger, Dr.-Ing. Franz Hanus, Dipl.-Ing. Wolfgang Schütz, Dr.-Ing. Ralf Hubo
Rolling strategies and thermal treatment of plates

Normal rolling
- Normalizing (annealing)
- Heat treatment

Temperature controlled rolling
- Recrystallization rolling
- Thermo-mechanical rolling

Recrystallization rolling
- Replacing for normalizing annealing
- High-strength structural steels
- Pressure-vessel steels

Thermo-mechanical rolling
- Micro-alloyed high-strength steel with higher ductility requirements
- Steels for pipelines
- High-strength shipbuilding steels

Structural steels
- Shipbuilding steels
- Structural steels

High-strength steel
Re > 500 N/mm²
- Structural steels

Pre-phase
Intermediate phase
Final phase

Temperatur waiting - rolling - waiting rolling cooling

ACB cooling

Waiting phase 1
Waiting phase 2

Air cooling
ACC cooling

Recrystallized austenite
Non-recrystallized austenite
Austenite and ferrite
Ferrite

Reheater
Finishing stand
ACC cooling

Time
LEVEL 1 – AUTOMATION

Stability, simple maintenance, uncomplicated adaptation to new conditions, and high-tech solutions – these are the demands modern automation systems must meet. To achieve all this, they require a straightforward yet effective basis. Our X-Pact® systems are completely modular in structure. As a result, we can easily adapt them to different levels of complexity.

What do our control solutions mean for you? Quite simply, excellent technology and functionality that ensure you achieve your target values with hydraulic and electrical control elements.

Other stand-out features of our Level 1 systems are maximum availability and a high degree of process automation coupled with effective service functions.

This applies to the systems for the entire hot-rolling section, consisting of edger, mill stand, pre-leveler, plate cooling, and hot plat leveler, as well as for the cold area with its cooling beds, shear lines, and finishing lines including cold plate levelers.

HOT AREA
The Level 1 system consists of various automation functions. Each function works independently and is linked with the corresponding sensors and actors.

Here are the main functions:
- Area Control System
- Technological Control System
- Support Control System
- Drive systems

Area Control System
The Area Control System coordinates the rolling process and the communication between all the automation systems involved. These can be the Level 2-system, the technological systems for the mill stands, levelers, and plate cooling, as well as the adjacent Level 1 automation systems such as for reheating furnaces, cooling beds, the HMI system, and safety system. Essential here is continuous plate tracking and control.

Technological Control System
The technological control systems ensure perfect product quality, a stable process, and high plant availability.

Chief among the technological controls are fast control loops for the actuators, and superordinate process control loops. These include thickness control in the mill stand, and profile and flatness control. Just as important are the controls for the levelers, consisting of hydraulic adjustment, load equalization for the drives, and a process-driven threading in/out function. What makes all the difference in plate cooling is precise control of the pinch rolls and the water circuits.

Support Control System
This is all about the media systems, such as: hydraulic stations, oil lubrication systems, grease systems, and water supply system.

Drive systems
Included here are the main drives of the mill stands, plus drives for the levelers, plate cooling system, and roller tables. The “Speedmaster” in the area control system coordinates all the drives involved in the material flow.
Plate cooling: Combination of spray and laminar cooling.

Multi-plate rolling
It goes without saying that our automation systems support "normal rolling" and "temperature-controlled rolling" modes for single or multiple plate production (static and continuous batch).

SPECIAL CHARACTERISTICS OF PLATE COOLING
Plate cooling sections often consist of both spray and laminar cooling units. There’s a good reason for this, because the combination of the two cooling systems and the pinch rolls allows for extremely fast cooling with optimum flatness. That makes the configuration an excellent tool for producing high-strength plates.

Key to the process is exactly metering the quantity of coolant to achieve the cooling rates and temperature development calculated by the Level 2 cooling model.

As a rule, the head and tail ends of the plates are colder than the centers. The plate ends are masked to reduce this effect and to influence the effective cooling length.

A special function available here is intermediate cooling of the plates before they go on to thermo-mechanical rolling.

SPECIAL CHARACTERISTICS IN THE MILL STAND AREA

Thickness control
To achieve the target thickness at the exit of the mill stand you can rely on not only the spindle and hydraulic adjustment systems, but also on these function modules:

- Automatic Gauge Control (AGC)
- Roll Alignment Control (RAC)
- Dynamic Disturbance Compensation (DDC)

Profile and flatness control
This module covers all the systems for the mechanical control elements:

- CVC plus - work roll shifting
- Work roll bending

Thickness control method.

Set values

Roll alignment control RAC
Automatic gauge control AGC
Dynamic disturbance compensation (DDC)

Hydraulic roll-gap control HGC
Electro-mechanical screw down positioning EMP

Roll-gap control

Thickness measuring device

Plate cooling: Combination of spray and laminar cooling.
LEVEL 1 - AUTOMATION

SPECIAL CHARACTERISTICS OF LEVELERS

You can choose from a variety of levelers to ensure the flatness quality you want throughout the plate manufacturing process: pre-levelers, hot plate levelers and cold plate levelers. Installed at different locations within the production process, they guarantee the finished plate flatness quality that makes all the difference.

The technological control system (TCS) developed by SMS Siemag controls all the adjusting elements such as parallel adjustment, skew adjustment, tilt adjustment, bending and individual roll adjustment, as well as variables such as leveling speed and drive torque. Everything depends on the properties of the material at the current plate temperature, the plate dimensions, and the waviness of the plate to be leveled.

COLD AREA

The Level 1 system consists of various automation functions. Each function works independently and is linked with the corresponding sensors and actors. These are the main functions:

- Area Control / Machine Control Systems
- Support Control Systems
- Drive systems

Area Control / Machine Control System

The individual sections in the cold area are designed specifically for the plate production process. Included here apart from the cooling and inspection beds are the shear line with machines such as crop shear, double side trimming shear, slitting shear, dividing shear, sample shear, and the finishing line equipment. There’s an Area Control System for each section that coordinates communication with the systems involved in the process. These can be Level 2 systems, the automation systems of the adjacent sections, the HMI, or the safety system. Due to this modular design, it’s easy to put together different levels of complexity.

Support Control System

This controls the media systems, among them hydraulic stations, oil lubrication systems, and grease systems.

Drive systems

Drives for the shears and the cooling bed/finishing line equipment as well as the roller table drives fall into this category.
Our HMI systems link the plant and the operator. They map the production process including everything to do with materials and technology. Armed with the information from the process observation, the operator uses the latest graphical methods to manually influence sequences and control the machine groups, e.g. media units.

In line with our operator-centered approach, our employees work closely with your operating personnel. Involving your team in the Plug & Work tests is another effective way to prepare them for their new tasks.

NEW OPERATING PHILOSOPHY FOR MORE QUALITY IN THE PRODUCTION PROCESS

Your operating personnel will appreciate clear and simple functions that make their job so much easier. They can benefit directly from no-nonsense controls that minimize operating errors.

That’s because SMS Siemag has developed a new, production-driven operating philosophy and a novel control desk design for your operating staff. Already, our innovative desks have been installed in a number of heavy plate mills and have proved a huge success. Central to the design is the operator’s view of the entire production process. To ensure this comprehensive overview, we tailor the automation structures to your plants.
LEVEL 2 – AUTOMATION

HIGH PRODUCTIVITY

The X-Pact® Level 2-systems are key to increasing the productivity of modern plate rolling mills. Improving product quality as well as increasing production volume and flexibility are the main tasks of the Level 2-systems, which are based on mathematical and physical process models.

To fulfill their role in quality assurance, process control systems must not only optimize processes, but also ensure efficient product and production data capture.

Just like the elements of the other automation levels, SMS Siemag Level 2-solutions are independent of the hardware structure. They provide for distribution of the individual functions over several computers.

Communication with the external systems, for example a production planning system spanning several plants, is implemented as a separate function to maintain high flexibility with regard to different connections.

TECHNOLOGICAL PROCESS MODELS

MILL STAND

PSC® Pass Schedule Calculation

PFC® Profile and Flatness Control

To ensure an optimum rolling process, it takes a good default setting. Our technological process models calculate, for every pass, the relevant parameters such as plate thickness, roll bending, roll shifting, speed and the rolling force to be expected. They also specify the associated rolling speed. The calculation always aims at maximum production throughput while complying with the required product quality. This involves allowing for the limits of the plant as well as the current plant situation, the material properties, product dimensions and the temperature.

Our calculations for profile and flatness as well as for the pass schedule are based on mathematical-physical models. That ensures we can calculate good set-points for new products – from the very start – where the material properties are known. Special to our line is that the Level 2 system uses short and long-term adaption functions to gradually equalize any differences between the calculated default values and the values measured during the rolling process.

![Diagram](image-url)
PLATE COOLING

SMS Siemag implements physical and mathematical process models that precisely control the cooling strategies. This is essential for setting the desired grain structures and mechanical properties of the plates.

According to the product requirements two cooling types are available: laminar cooling, or the spray cooling system developed by SMS Siemag. Characteristic of laminar cooling are a wide application range with low operating and maintenance costs. Spray cooling units feature powerful high-pressure stations and pinch rolls between the cooling beams. That ensures fast cooling and good flatness even of very thin plates.

LEVELERS

It’s the precise interaction of the mechanical equipment and the X-Pact® automation that produces really outstanding leveling results. The leveling model developed by SMS Siemag controls the process and calculates exactly how to adjust the straightening rolls and the torques.

The key parameters for these calculations are the material properties at the current plate temperature and the plate dimensions. Of course, the leveling process also takes into account any flatness detected by the operating personnel.

This is where unflatness and residual stress are removed from the plate. The cold plate leveler can be operated in 9 or 5-roll mode. That extends the leveling range without any need to change the rolls.
LEVEL 2 – AUTOMATION

CUTTING OPTIMIZATION

Another intelligent solution is our cutting optimization system. It takes the measured geometry of the mother plate, then alters the planned cutting pattern to ensure the best cut for production of the finished plate. Apart from the required geometry and quality of the finished plates, this system also takes into account the performance of the various shears.

To minimize scrap, the finished plates are positioned optimally within the measured contour of the mother plate. Included in the calculation data is the maximum throughput rate of the shear line.

If the measured geometry does not match the planned cutting pattern, the cutting optimization function calculates dividing cuts at the cropping shear and fits the finished plates into the new contour. All this happens fully automatically.

SUPERORDINATE MATERIAL TRACKING

Our Level 2 material tracking system is responsible for allocating piece information to production planning data. Applying this data, the Level 2 system supports a production-oriented overview of the material in the plant. Furthermore, Level 2 initiates set value calculations depending on the material position. These are the main functions:

- Primary data entry for specifying information on material flow and slab and plate processing in the various machines
- Sequence control for controlling the material flow of slabs and plates in the various machines
- Material tracking modules for controlling and monitoring position and condition of the various materials such as mother and daughter plates
- Communication modules for data exchange with various automation systems, from the slab furnaces to the piler equipment.
- Automatic set value generation for all machines in the plant
- Measured value capturing, filtering, and concentration for reporting and quality control
- Production monitoring and reporting
- Production of plate groups for multi-plate rolling in static and continuous batch mode.
PACING

To optimize plate processing, our pacing model maps the production times for each individual production area (rolling time, waiting time, transport time, etc.). It continually measures the current production time.

Applying all this data, our pacing model computes the optimum production spacing and the ideal time to discharge the next slab. Everything goes into the calculation: planned and unplanned delays, faulty rolling, stoppages, and more.

These are the functions included:

- Pre-calculation of the time schedule
- Sequence monitoring from discharge out of the furnace to entry into the hot plate leveler
- Calculation of the furnace discharge intervals
- ‘Exit next slab’ signal to the operator
- Monitoring the current rolling sequence time schedule for analysis

PRODUCTION DATA CAPTURE AND REPORTING

Operating and product data capture is based on the process events of the Level 1 system. What happens here is that the Level 2 system tracks all products in the entry area of the rolling mill, along with their current status.

That provides data for plausibility checks for the production sequence and the calculation of product-specific processing values. The relevant production and product data is saved in a database where it is available for product evaluation as well as quality and product reports.
LEVEL 3 – PRODUCTION PLANNING SYSTEM

Today, there is a constantly growing product variety, while customers expect even shorter delivery times for top product quality. That demands meticulous planning of your production processes. What’s more, you need close links to the production systems of suppliers and customers so you can react quickly to changes. Development here focuses on “Real Time Enterprise” (RTE), a method that checks and responds to these changes in real time.

The restrictive factors are the technical and technological limits of the plants, which we have to take into account during program planning. That, in turn, creates a demand for comprehensive production planning systems.

systems, Level 3 production planning offers you these benefits:

- Maximization of overall production rate
- Planning and minimization of inventories for interim products
- Analysis of energy supply conditions for reduced energy consumption
- Uniform product tracking throughout the production line
- Overall quality assurance up to final quality approval
- Increased compliance with delivery dates

MANUFACTURING ORDERS

You can rely on our systems to convert your orders into technically executable manufacturing projects. That means, according to your specifications, an extensive calculation model generates the manufacturing data for the product.

- Definition of the necessary production steps and possible plant alternatives
- Definition of the dimensions and quality of the initial and intermediate products
- Planning of the output of every production stage to determine the necessary quantities of input material
- Definition of sample taking and test regulations

X-PACT® LEVEL 3

X-Pact® Level 3 provides you with all the tools you need for planning and control of the production processes in your metallurgical plants and rolling mill. An effective link between the commercial side of the business and the technological process automation
THE FACTORY MODEL

A uniform planning system covering all areas is based on a factory model. The factory model is implemented in the planning system in the form of an electronic planning table.

PRODUCTION PLANNING

It’s vital to determine the doable delivery dates for all manufacturing orders in advance. That’s where our capacity and deadline planning comes in, examining all the plants and plant alternatives available. As a result, you get a sequence plan for the individual plants as well as a plan of the available input materials for each manufacturing order.

QUALITY TRACKING

There is a data exchange between the Level 2 systems of the overall plant and the Level 3 system. That means Level 3 is informed at all times about every production step and the product quality after each step. Inspection and lab data add to the accuracy of the result. This forms the basis for quality approval of the final products before delivery.
SAFETY STRATEGY

Worldwide, the importance of machine and plant safety is growing. It’s not just plant operators themselves, but also laws and standards that demand personal and environmental protection.

Absolutely essential for safe plant operation is a coordinated approach during planning and design. The mechanical, electrical, and automation systems are the most important elements in our safety strategy:

- The layout of the danger zone
- Risk assessment
- The electronic-mechanical function “Safety”
- Emergency Stop plan

The danger zone layout divides the plant into various danger zones. It indicates all the plant-related safety equipment as well as the plant limits.

The risk assessment identifies and evaluates all the possible hazards inherent in a plant, and describes the necessary precautions.

An in-depth Emergency Stop plan is drawn up for each plant.

Together with you, we work out a practical solution with safety control functions that operate independently from the machine controls. This strategy also complies with all safety laws and regulations. And it reduces the time and cost of testing, documentation, and commissioning. Early on – during the Plug & Work process – we extensively test the safety control functions.
Level 1 (unsafe part of control system) - Separation of safety functions and control functions.
PLUG & WORK TEST

Our long-established Plug & Work service is increasingly popular among our customers. At the heart of Plug & Work are production simulations that mimic reality down to the smallest detail. You benefit from our years of experience in engineering and process technology, because we know exactly how processes behave and what regulators achieve which product qualities. The simulation system we use in our Plug & Work strategy reflects this complex interplay of factors.

MODULE AND INTEGRATION TEST

Plug & Work starts with module tests that put the individual hardware and software components through isolated function checks. Next in line are integration tests that examine the fault-free interaction of the modules. The usual procedure in the industry is to end pre-testing here, then continue trials after the plant has been erected on the construction site. We go one step further. That’s because, even before delivery, we install the entire automation system in one of our test fields and link it up to a simulation system. First, the functions and the customer-specific construction models of the plant, including all the kinematic and dynamic parameters of the plant behavior and the sensors, are set up. That creates a computer-aided simulation model ideal for testing the functioning and process sequences of the plant.

To your operator, it feels like working on the real plant: All the sequences and processes are visualized in real-time. He can control production virtually, and also learn maintenance routines. Using this hands-on method, we fine-tune the automation system in advance so you benefit from smooth running and perfect operability.

This process palpably reduces commissioning times, as well as on-site corrections. Equally beneficial, your operators appreciate the real-life training opportunity provided during testing because it’s an ideal way for them to prepare for their future work on the plant.
TRAINING

We take training of your personnel seriously. That involves intensive learning about the new, complex systems.

First comes the theory in the classroom, where our expert employees pass on their know-how to your team.

We always plan an extra instruction session for the manufacturer’s experts to explain the operation and maintenance of the measuring systems installed in our automation solutions. After this thorough grounding, we train your operators during the Plug & Work phase.

Only then do we follow up with on-site training at the construction location. We make a point of including your employees in plant commissioning, and as a result they get to know the systems and processes on the ground.

Each training module builds on the last so that by the end of commissioning your staff is able to operate the plant reliably and independently. If faults occur, they know how to pinpoint the cause and what to do about it.
MODERNIZATION STRATEGIES

SMS Siemag has developed a strategy that ensures production to continue throughout alteration or modernization work. Compared with conventional methods, it gives you a much higher protection against failure, shorter commissioning time, steeper run-up curves, and therefore an early return on investment.

REASONS FOR MODERNIZATION PROJECTS
- Improved product properties
- Better production/productivity
- Reduced production costs
- Increased availability
- Replacement of old systems

SMS Siemag revamp strategies utilize all aspects of modern metallurgical automation systems:
- Integration of new process technologies
- Reproducible process sequences
- Improved ergonomics and safety technology
- Replacement of obsolete systems
- Proven quality of product properties using technological values in the entire process

PROCEDURE
These are the main steps in a revamp project: current-state analysis, adaptation to plant operating procedures, alteration work planning, if necessary a switch-over plan, plant test, re-commissioning, and optimization.

CURRENT-STATE ANALYSIS
The first step to successful modernization is an in-depth assessment of the current state of the automation system. That includes an examination of the sensory systems installed to find out whether they can be re-used. This check simultaneously determines how new sensory and measuring systems can be installed. Significant here is that the current-state analysis examines all the relevant electrical and automation system components as well as the complete technological process sequence.

The second key stage is considering and selecting interfaces to the automation systems and IT infrastructure that will stay in place. Essentially, what we find out as a result of the current-state analysis goes into a motor and component list, a technological process description, and a documentation of the interfaces for each alteration phase.

HARMONIZATION OF OPERATIONAL PROCEDURES
Over time, all plants develop their own standard operational procedures. Yet it’s imperative to examine these SOPs during the current-state analysis. They are drawn up and documented on site with the operating and maintenance crews. Taking this as a basis, we develop and harmonize new procedures.

PLANNING THE ALTERATION PHASES
Together with you, we plan the phases for the major revamp stages of mechanical, media, and electrical systems in close cooperation with you. It all means you save time and money, because carrying out more operations in parallel before, during, and after production standstills slashes overall stoppage times. According to pre-defined milestones, each standstill is tracked and if necessary re-planned by expert construction managers working hand in hand.
SWITCHOVER PLAN

Simply switching the signals at the interfaces is the easiest way of changing plant operations over from old to new automation systems. To do this, the field signals are shifted from the old to the new automation system during the modernization standstill. We can test individual functions in advance — i.e. in the course of maintenance standstills before the upgrade. However, changeovers during standstills have a certain finality. It's almost impossible to change back to the old plant.

What we devise, especially in the case of complex interfaces and production-critical plant parts, is a switching plan. Following this plan, we can test partial functions of the new automation system over several scheduled maintenance standstills prior to the conversion standstill itself. Furthermore, the electronic version of the switch-over plan makes monitoring operation possible. This is how the relevant data and signals from the existing automation system are captured and analyzed by powerful monitoring systems.

Plus, in highly critical cases, the switch-over technology is designed so that the entire plant can be switched over from the old to the new automation system without any major production interruption. We cooperate closely with you to make sure the switchover plan is transparent, and you make the final decision, taking into account all the economic and technological aspects.

RE-COMMISSIONING

The steps described above reduce many of the risks inherent in alterations. Due to our many years’ experience in commissioning metallurgical plants, we can get your plant up and running again within a minimum timeframe.

The high point of the whole project is the plant run-up after the revamp. Yet, before this happens, we team up with you to carefully plan production of the material quality and dimensions you require. The data recorded during monitoring operation is applied to pre-optimize our process models, clearing the way for immediate production start with marketable product quality.

Furthermore, you can rely on comprehensive support, starting with continuous assistance during run-up, through to technology support from our development departments. Sometimes both sides recognize the potential for joint improvements and sign a cooperation agreement that might even lead to exciting innovations! There are a large number of successful projects we have carried out that confirm the effectiveness of our revamp strategies.
SERVICES

COMMISSIONING

Early on, during the Plug & Work tests, our experienced commissioning teams are on the spot in the test field. Here, they prepare for successive transfer of responsibility for the plant. As the final stage of the Plug & Work test, when the scope of supply and functioning has been confirmed, they test the automation to make sure it’s absolutely ready for commissioning.

Essentially, commissioning on site consists of these stages:

- Cold commissioning
- Hot commissioning
- System optimization during production
- Performance tests

Cold commissioning
Included in cold commissioning are all the activities necessary for producing the first plate. The drive system is pre-optimized. Cold commissioning concludes with the first plate.

Hot commissioning
Hot commissioning starts with production of the first plate. In this phase, all the mechanical and electrical functions are tested under load to check that the open and closed-loop controls are working properly.

System optimization during production
During this phase, the parameters of all the systems are adjusted to ensure the new facility achieves the required performance.

Performance tests
Finally, a test program we run through together with you demonstrates that the plant meets the contract specifications.

AFTER SALES SERVICE

There is even more we can do for you in the form of our after sales service. This gives you continued access to our expert know-how.

Specifically for X-Pact® electrics and automation, the SP/1 service portal from SMS Siemag offers you the option of rapid support in troubleshooting – 24/7.

Even during commissioning, we set up a service portal for optimal plant support. It’s responsible for stable, protected communication between two networks. Via this portal, the SMS Siemag experts access your plant’s automation system to give you immediate support in the form of remote diagnosis and maintenance – worldwide and from day 1.

THE ADVANTAGES OF THE SERVICE PORTAL

Some 70 percent of faults can be corrected immediately. Alternatively, we isolate any faults that occur. Take for instance defective parts. Our experts can usually identify them online, possibly deactivate them, and send a service technician to replace them on site.
We manage the entire order documentation in an Excel-based spreadsheet. It comes complete with a table of contents that gives you an easy and immediate overview of the complete documentation. All the necessary documents, such as function descriptions, circuit diagrams, and operating instructions are saved in this list at one central, structured location. Equally useful, the solution integrates all the documents generated throughout the project. Every documentation transfer gives you the full current status in electronic form.

The spreadsheet itself contains all the necessary information on each document, e.g. file format, print format, language, version, and life cycle. From a central menu, you go straight to the heart of the program, so you find the document you want very quickly, and simply click on a link to open it. This is how the operator finds his operating manuals, the maintenance employee the data sheet for a sensor, and the programmer the software details for the automation. Once the project is completed, you can continue the documentation yourself and administer new documents or document versions.
ELECTRICS AND AUTOMATION FOR ALL SYSTEM VARIATIONS

HEAVY PLATE MILL WITH ONE MILL STAND

HEAVY PLATE MILL WITH TWO MILL STANDS

STECKEL / PLATE COMBINATION FOR MANUFACTURING STRIPS AND PLATES
Our X-Pact® automation systems use state-of-the-art computer technologies on the basis of ultra-modern real-time-capable field bus systems.

They offer you not only high availability, but also an ergonomically designed work environment that helps you improve the quality in your production process.

Furthermore, we supply the energy and drive systems for all SMS Siemag products. Equally favorable is the link-up between our mechanical and electrical design departments. That helps you optimize the drive concepts for our rolling mills – from the roll gap and the transmission design right up to the design of the frequency converters and motors.

Here is how you benefit from automation systems from SMS Siemag: they improve your product quality and result in a higher yield while also lowering your energy and personnel costs. As part of our Plug & Work concept, we perform comprehensive integration tests. This ensures fast run-up times.
“The information provided in this brochure contains a general description of the performance characteristics of the products concerned. The actual products may not always have these characteristics as described and, in particular, these may change as a result of further developments of the products. The provision of this information is not intended to have and will not have legal effect. An obligation to deliver products having particular characteristics shall only exist if expressly agreed in the terms of the contract.”