INTEGRATED PROCESS CONTROL IN THE STEELWORKS
Electrics and Automation
ELECTRICS AND AUTOMATION
for steelworks

HOLISTIC SYSTEM COMPETENCE

Modern metallurgical plants from SMS Siemag have a high availability and fulfill today’s even increasing end product quality requirements. It takes harmonized system components to meet these demands. That’s why SMS Siemag made the decision, many years ago, to also offer the overall electrics, automation and drive technology for the plants alongside the mechanics, technological controls and process models. That means we are your “main contractor” and offer you the overall engineering, construction and commissioning of a plant from a single source.

You benefit from short distances and direct agreement between everybody involved because these factors create the best prerequisites for your success. SMS Siemag makes its extensive expertise available to you from the start in order to be able to identify, based on numerous criteria, the right type of steelworks and the required process routes. This is how we make all important decisions well in advance in order to ensure high economic efficiency, productivity and the environmental protection of your steelworks.

PARTNER FOR EAF, LF, BOF, CONARC AND AOD

SMS Siemag offers you all types of steelworks: electric steelworks with ARCESS electric arc furnaces or CONARC® furnaces, BOF converter steelworks and stainless steelworks with ADD converters.

Special to our line is that all units are harmonized with each other in terms of their interfaces. Our automation technology plays a crucial role here. That’s because only automation technology allows you to produce a wide range of high-quality steels in a modern steelworks – saving both money and resources in the form of raw materials and energy. The aim is to produce the desired steel grades with precise chemical analysis at the specified temperature and the required steel weight, by means of optimized process control. All this goes to show: SMS Siemag offers you ingenious solutions… and more.

SAFEGUARDING YOUR COMPANY’S FUTURE VIA MODERNIZATIONS

You can efficiently increase your productivity, flexibility and product quality by means of targeted modernizations. SMS Siemag offers the mechanical, automation and electrical components as well as special conversion expertise that ensure minimum downtimes.
INTEGRATED PROCESS CONTROL

X-PACT®

The automation systems of SMS Siemag are grouped under the name X-Pact®. This applies to all plant types. Crucial for us is high economic efficiency as well as the transparency of the control solutions. Our automation covers levels 0 to 3.

SCALABLE SYSTEM CONCEPTS

All systems in the steelworks are based on platforms that have a scalable design. The extensive separation into different levels (basic modules, technology modules, system-specific modules) means you only have to make adjustments and changes where they are actually required.

To give you an example: when you implement new technologies, all you do is change the technology 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.

OUR PROCESS EXPERTISE

Central to automation in steelworks are the process models for the cost-optimized calculation of the required energy, charge materials, and alloys. Why? Because you can only efficiently control the complex overall “steelworks” system with its wide range of units using these models.

It’s imperative that all process data is made available, checked, adjusted, and communicated to the subsequent system along the entire process chain - from the raw material via the melting and secondary metallurgical treatment to the handover to the casting machine.

Based on the steel grades to be produced, the overall process route is planned in terms of the required automation technology, controlled online and monitored. All this is possible because the technology systems of SMS Siemag seamlessly interact with each other.

PROCESS ROUTES

Process route in electric steelworks
- Scrapyard management
- Pig iron supply
- Additives management
- Electric-arc furnace or CONARC® furnace
- Secondary metallurgical treatments
- Environmental protection systems
- Logistics systems
- Drive systems

Process route in converter steelworks
- Scrapyard management
- Pig iron supply
- Additives management
- Converter blowing process with control of oxygen-blowing lances and sublances
- Secondary metallurgical treatments
- Environmental protection systems
- Logistics systems
- Drive systems

Stainless steel route
- Scrapyard management
- Pig iron supply
- Additives management
- ARCESS electric-arc furnace
- AOD converter blowing process
- Secondary metallurgical treatments
- Environmental protection systems
- Logistics systems
- Drive systems
THE HIGHLIGHTS

BOF / AOD VALVE STATION
We supply everything you need from a single source – all the engineering, automation technology, and mechanical components for the valve stations of the inert gas and oxygen injection systems. That ensures you can count on high functional reliability for these complex systems.

BUNKER SYSTEM LOGISTICS
Our logistics module for bunker systems includes the mathematical description of the material delivery routes. This means you don’t have to spend money on additional programming for flexible feeding of the steelworks with additives.

CONVERTER TILTING DRIVES
We adjust the drive technology to the different load conditions with variable torques. The result is a homogeneous load distribution to the drives that takes into account and dynamically compensates for the specific behavior of the liquid steel bath. It’s an added advantage that the control technology is very closely harmonized with the tilting behavior because we also provide the core drive technology elements.

SLAG DETECTION IN THE BOF
The converter vessel is monitored by means of acoustic measurement in order to determine the foamed slag development. The acoustic pattern, which is evaluated online, permits the identification of a trend in the foamed slag development. Overflows can thus be counteracted in good time.

SLAG CONTROL IN THE EAF
A similar acoustic measurement process for monitoring the foamed slag is used in the EAF. Its purpose here is to systematically influence the slag control by varying energy supply and coal injection, and to maintain it at a specific level. The foamed slag ensures better energy input into the heat and protects the EAF refractory lining.

FEOS FOR THE ELECTRIC ARC FURNACE
The FEOS (Furnace Energy Optimization System) is an EAF automation module for controlling the optimized and simultaneous energy input of all primary and secondary energy carriers. Significant here is a uniform energy input that is adjusted to the process. This means the interaction of primary electrical energy with secondary energy sources via injector systems for oxygen and coal. The aim is to use the electrical and fossil fuel energy as efficiently as possible in order to reduce overall energy consumption and at the same time achieve high productivity. There is a major focus here on a control-based energy input. Parameters such as temperature and acoustics form the basis for the process description. You can see, for example, that FEOS permits the input of additional energy where the water-cooled furnace wall is still below the temperature limit. Using this process, it is possible to increase the productivity significantly while at the same time adhering to the chemical analysis of the steel. This is where the individual processes are interlinked and interdependently controlled.

WIRELESS MEASUREMENT IN THE EAF
One of our most recent developments is wireless transmission of the furnace vessel temperature. It replaces the costly and maintenance-intensive special cables that transmit the signals of the temperature sensors in the water-cooled panels. So, thanks to our new technology, signals from several dozen measuring points are sent by a transmitter directly and without interference from the sensor to a gateway connected to the automation technology.
ENERGY DISTRIBUTION
and DRIVE SYSTEMS

POWER SUPPLY STUDIES
The mains supply and distribution systems in steelworks must be considered in conjunction with the public power grids and the available infrastructure. Essential here is taking into account all the possible interactions. That’s why SMS Siemag carries out power supply studies in close cooperation with the customer. These form, on the one hand, the basis for the reliable supply of the works and, on the other hand, the foundation for calculating interference affecting the public power grid.

ENERGY LAYOUT
A steelworks usually works on a 33/35 kV level. It’s an adequate level we can use to design a cost-optimized distribution network for the consumption-intensive units or systems – for example an EAF steelworks or hot-strip rolling mill. Drawing on our process expertise, we identify an efficient and at the same time reliable layout for the equipment, such as transformers, thyristors, converters, and cables. Our power supply studies help us provide you with invaluable pointers when it comes to selecting the most suitable EAF power supply – AC or DC – and dimensioning the compensation systems for top efficiency.

EAF OPERATED WITH THREE-PHASE AC
Modern three-phase AC EAF furnaces have transformer outputs of over 1.5 MVA/t. Today’s high-impedance furnaces have low reactances on the secondary side as well as a reactor on the primary side of the furnace transformer. The electrical high-current section from the transformer up to the electrodes is designed for extremely high voltages.

DC FURNACE
DC electric-arc furnaces cause lower system disturbances than AC furnaces, making them suitable for connection to weak power grids. They are, however, more complex in design. To avoid undesired electric arc deflections and to achieve flawless bus-bar design, SMS Siemag carries out suitable computer simulations.

FURNACE SWITCH GEARS OF NEW GENERATION
Dedicated to making things easier for you, we looked at how to improve switching systems for electric-arc furnaces that operate with currents of more than 3,000 A and 36 kV. Cooperating closely with our suppliers, we developed a user-friendly solution that complies with the latest IEC standard. It controls all switching remotely, including extension and retraction of the switch. This means that during parallel switch operation, a switch can be replaced while the plant is running. The result? A vast increase in system availability.

DRIVE SYSTEMS
We have defined drive groups for the steelworks, so you benefit from uniform and lean interfaces.

CONVERTER TILTING DRIVES
The tilting of converters requires very specific basic knowledge with regard to the load behavior of liquids. We have extensive experience in this field, underlined by the fact that our controls have been finely adjusted for the frequency-converter-controlled drives of converter tilting drives with two or four-motor technology. The basis of the controls are calculations of the load torque curves to ensure dynamic adjustment of the tilting drive. That prevents overloading or spillovers.

LANCE DRIVES
Our systems achieve high positioning accuracy in interaction with the frequency-converter-controlled drives for the lance systems – both for the oxygen-blowing lances and the measuring sublances. This is important because the level of the steel bath varies due to factors such as wear of the refractory lining. To allow for these variations, our systems use adaptive measurements and position the lances just right. That means the metallurgical process takes place under optimal conditions.

DRIVE SYSTEMS FOR LARGER OUTPUTS
We also deliver the blower drives for the gas purification systems. They can be designed for a conventional startup as direct start or soft starter or frequency converter controlled, respectively. It goes without saying that our design concepts fully comply with your specific wishes.
LEVEL 1 AUTOMATION

SYSTEM ENVIRONMENT

The system environment for the electrical and automation-related equipment with X-Pact® has a scalable design. That’s to say, each unit in the steelworks comes with its own controller. This ensures the other systems continue to work perfectly even during maintenance or a malfunction in a unit or shop.

FAIL-SAFE RING-TYPE BUS DESIGN

The operating and monitoring systems of the units in the steelworks follow a ring-type bus design and are connected with the subordinate controllers. That’s a clear advantage because this concept ensures greater security. Even if a cable breaks, the data transfer between the operating and monitoring system and the subordinate controller is not interrupted. The bus system has become generally established in steelworks. Furthermore, we implement the logic programmable controllers in a redundant design to meet your safety requirements. That is why there are different classifications depending on the safety concept. The automation system is designed in accordance with the statutory safety standards plus any extra requirements you specify. Depending on the classification, we use, for example, safety relays up to complete safety controllers.

X-PACT® LOGISTICS MODULE

The X-Pact® logistics module supports the flexible and rapid parameterization of bunker systems for time-optimized filling and removal of charge materials. Only the most sophisticated solutions ensure efficient operation of the complex bunker systems in steelmaking units such as BOF / AOD / CONARC / LF. This is where the X-Pact® logistics module comes in. It controls the logistics algorithm for starting and stopping the furnace conveyor belts and removal systems.

The simple parameterization of the HMI system supports monitoring of the path/destination. Advantages of the logistics module

This module enables your operator to fully execute charge material recipes (material type, weight, feeding sequence for charge material and point in time of charge material feeding). It selects the optimal feeding path for the charge material from the available bunkers to the respective unit. To keep the process flowing, additive recipes are processed in a staggered manner, while the metering bunkers and buffer tanks that are already emptied are refilled. It’s an added advantage that your operator can, at any time, supplement or delete recipes as a group of materials to be simultaneously fed, as well as change the recipe sequence. The module is used in all bunker systems of the process routes so the operator can respond to new process requirements – quickly and flexibly.

FEOS TECHNOLOGICAL CONTROL SYSTEM

FEOS records all important processes in the electric arc furnace in order to control them holistically using a superordinate energy optimization system. It’s a system that follows a simple and user-friendly design with refreshingly clear structures. The decisive actuating signals are controlled interdependently based on the input parameters (including continuous measurement of exhaust gas, temperature and acoustics), which are measured in real-time. These are:

- Energy control
- Injector control
- Foam ed slag control
- Reactance control

Equally convincing are these results from real applications:

- High melting performance
- No operation interruption due to deactivations at the temperature limit
- Rapid response in the case of a simultaneous reduction of the switch frequency
- Reproducible and efficient input of electrical energy
- Short tap-to-tap times

HMI SYSTEMS

Our HMI systems form the connection between the system and operator. They offer a production-oriented process display with all relevant information regarding material logistics and process. Also included are process-oriented displays that enable you to make purposeful manual interventions in the process control or the operation of the connected units. Then there is our proven operator-centered approach for user-friendliness. We achieve this as a result of intensive cooperation between our employees and your operating teams. This is effectively supported by integrating you in the Plug & Work tests.
LEVEL 2 AUTOMATION

TECHNOLOGICAL PROCESS MODELS

The process models, which portray the metallurgical processes for steel production in a mathematical and thermodynamic manner, are the brains of the steelworks. We have constantly optimized these models using our comprehensive practical experience and adapted them to the latest technological findings. There are corresponding technological process models for all units in the steelworks.

Based on the standardized steel catalog, practices and operating diagrams are predefined for each of the steel grade groups to be produced. These are adapted by the process model during the melting treatment according to the targets to be achieved at the end of the treatment, such as analysis, temperature, and steel weight.

During this process, the model receives all process data online and carries out corresponding optimization calculations. It also takes into account the costs as well as energy balance and mass balance in order to determine the efficient use of energy and material. The model determines, for example, the required charge materials, alloying agents and optimal treatment time.

Here is what you’ll gain from the use of SMS Siemag process models: optimized and reproducible process control which, in turn, leads to reduced production costs, improved product quality and higher productivity.

EAF
- Flexible charge material calculation for scrap, slag forming agents, alloying agents as well as HBI and DRI
- Dynamic process control for efficient use of electrical energy and chemical energy in the furnace

BOF
- Flexible charge material calculation for scrap, pig iron, slag forming agents and alloying agents
- Calculation of the oxygen for temperature, carbon and analysis for the end of blowing (blowing end point calculation)
- Dynamic process monitoring (blowing end point calculation) based on exhaust gas analysis
- Simple integration of sublance technology, bottom stirring, exhaust gas analysis and acoustic process monitoring

AOD
- Flexible charge material calculation for the optimization of scrap, slag forming agents, alloying and reducing agents
- Dynamic process control during the individual process phases (main decarburization, dynamic decarburization, reduction)
- Calculation of the process status for temperature, steel / slag weight, chemical analysis, decarburization speed, oxidation speed, metal oxidation

CONARC®
- Combination of the EAF and BOF process models
- Flexible charge material calculation for scrap, pig iron, slag forming agents, alloying agents as well as HBI / DRI
- Calculation of the oxygen-blowing end point for temperature, carbon and analysis

- Dynamic process control for the use of electrical and chemical energy in the furnace

LF
- Flexible charge material calculation for alloys, coolants, deoxidization (wire feeder), slag buildup
- Process forecast calculation and control for electrical heating and stirring (homogenization) taking into account the treatment objectives (analysis, temperature, treatment time)

OFFLINE SIMULATION MODELS

Our offline simulation models are available to metallurgists like you to help you simulate the melt qualities using the recorded process data as well as test and where required optimize new parameters under simulation conditions. Moreover, you can check production processes for new steel grades in advance.

CHARGE MATERIAL CALCULATION

Using our charge material calculation, you can determine the optimized use and portions of the additives. These include pig iron, scrap, cold DRI and hot DRI.

CENTRAL DATABASE SYSTEM

All level 2 systems communicate via a central database, in which all information is archived and can be exchanged with external automation systems via standard interfaces.

All process data is saved and processed for issuing reports or quality certificates. The parameter sets of the models, the steel quality and material specifications, as well as the process specifications are stored centrally. Also available here are dialogues that help your technologists change the specifications for process tuning purposes or in order to change process parameters. Your advantages:

- A central system for the entire steelworks
- Simplified maintenance
- Convenient handling
- Central administration and archiving of all data

MELTING AND PROCESS MONITORING

Special software modules monitor the material, melting and process monitoring in the steelworks. They facilitate the coordination and synchronization of the data to be exchanged between the individual units.

Based on the melting plan, each melt has a clearly identifiable number for monitoring in the overall process. That makes it possible to locate it (with analysis, steel weight, temperature and additional data) within the process at any time.

REPORTING

All process data is logged for quality assurance purposes and can be made available in reports and evaluations in line with requirements, e.g. for operators or management. Alternatively, you can, of course, choose to use interfaces to superordinate systems, such as SAP.

WEB SERVER

Your management can conveniently access the steelworks reporting via the web server. Plus there are retrieval options, for example, via conventional Internet browsers or smartphones.
LEVEL 3 – PRODUCTION PLANNING SYSTEM

It takes detailed planning of the production process to achieve the multiple goals of a large product variety, top quality, fast delivery times, and minimum energy consumption. You also need linkage with the production systems of suppliers and customers for seamless adjustment to new situations. Development here focuses on “Real Time Enterprise” (RTE), a method that checks and responds to these changes in real time.

What restricts the available options are the technical and technological limits of the plants themselves, and we have to take this into account during program planning. All this adds up to a need for comprehensive production planning systems.

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. Included here above all are the following steps:

- Definition of the steel grades
- Definition of the necessary production steps and possible plant alternatives
- Planning of the output of every production stage to determine the necessary quantities of input material
- Definition of sample taking and test regulations

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.

Essential for safe operation of our products is a coordinated approach during planning and design. Our engineering and electrics divisions work together on the main elements in our safety strategy:

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

The hazard area 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. The safety control functions are extensively tested early on – during the Plug & Work process.
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 can 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.

VIRTUAL SYSTEM AND PROCESS SIMULATION
The complete automation system is installed in one of our test bays and connected with a simulation system. The customer-specific system design modules, including kinematic and dynamic parameters of the system behavior as well as the sensors, are prepared for the simulation system. That’s how we create a computer-aided simulation model to check the operation and process flows of the system. For the operator, it’s just like working with the real system: All operations and processes are displayed to the operator in real time. He can virtually control production as well as become familiar with maintenance processes. Via this practice-oriented procedure, we are able to adjust the automation system in advance for trouble-free processes and efficient operability.

TRAINING
The first step of our customer training involves laying the theoretical foundation in classroom training sessions. This is where our technologically skilled employees pass on their expertise to your team. Additional instruction on the operation and maintenance of the measuring systems integrated in our automation systems is carried out by qualified specialists. Based on this initial training and instruction, the operator training on the “virtual system” continues as part of Plug & Work. This already takes place during the construction phase of the system, i.e. long before commissioning. The final step involves onsite training at the construction site. Your personnel is integrated into the system commissioning by us and familiarized with the systems and processes under practical application conditions.
MODERNIZATION STRATEGIES

As a metallurgical plant operator you must continuously expand your production facilities to maintain your leading position with excellent product quality.

Yet, nowadays, you cannot achieve such facility expansions simply through the use of newly developed mechanical parts. They must also be integrated into the automation so that the improvement in the end product really is accomplished. That's why we offer integrated modernization solutions geared to improving all aspects of production technology.

SMS Siemag has developed a strategy that enables 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

During their implementation, SMS Siemag revamp strategies take into account 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

CHALLENGE FACED BY AUTOMATION SUPPLIERS

More often than not, you cannot expand your existing automation to the required degree. The reasons for this can be factors such as a lack of software specialists, the system limits have been reached, or there are no expansion assemblies available.

Then it’s essential to find an economic solution for automation expansion or a partial replacement. That means that, for integration purposes, you need to use system interfaces, which may come from several automation generations. Equally imperative here is an outstanding understanding of the functions and technology in order to be able to analyze existing, well-established automation functions. We are ideally prepared for these challenges due to the extensive experience of our employees and our focus on metallurgical and rolling mill technology systems.

PROCEDURE

These are the main steps in a revamp project: current-state analysis, alteration work planning, 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, the knowledge gained here goes into a motor and component list, a technological process description, and a documentation of the interfaces for each alteration phase.

PLANNING THE ALTERATION PHASES

We plan the phases for the major revamp stages of mechanical, media, and electrical systems in close cooperation with you. These plans are mapped out in detail prior to the individual alteration steps. 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.

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.

TYPICAL MODERNIZATION PROJECTS

AOD or BOF gas control stations

To improve process control and increase system availability, you need to modernize the process gas control as well as distribution and equip them with state-of-the-art measuring and control technology.

It is usual in old systems for the flow rate of several rinsers / nozzles to be controlled by one valve. A big improvement in modern gas control stations is that...
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 the following 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 melt. Cold commissioning concludes with the first melt.

**Hot commissioning**
All mechanical and electrical functions are tested under load during hot commissioning in order to verify the functioning of the control systems.

**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.

Even during commissioning, we set up a service portal for optimal plant support. It is 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.

**BENEFITS OF THE SERVICE PORTAL**
We can eliminate some 70 percent of faults immediately. Alternatively, faults are isolated. 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.
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.