Electrics and automation for ironmaking, steelmaking and continuous casting

Automation solutions, electrical systems, technological packages, and services from your life-cycle partner
Your challenge: Overcome the boundaries of legacy electrics & automation systems

Highest product quality
The steel industry is under pressure to provide products that fulfill ever increasing quality standards. Options for meeting those common quality issues range from the addition of small automation packages to revamps of entire machines.

Older or outdated automation systems often require immediate attention in order to enhance and improve the production process. Some of these urgent issues include insufficient documentation regarding the production process, along with poor tracking of quality-related data.

Maximum plant efficiency
While demands on products and processes are ever increasing, steel producers meet limits that are caused at least in part by inadequate automation technology. Often, outdated automation systems offer inefficient or even unstable process optimization that can cause failures in the production. Meanwhile, maintenance costs for legacy systems continue to rise.

Since profit is lost during slow-downs or production halts, special emphasis has to be put on short project realization periods. Every new or upgraded plant has to be brought into full operation within the shortest possible time. This is especially true for small, quality-related upgrades on existing machines, which must not interfere with current production.

Flexibility in changing markets
Entire production routes, that may even be linked globally, have to be optimized. Sometimes, as a result of difficult market situations, production has to be transferred to different locations, and bottlenecks are shifted to different plant units. That requires flexible methods in plant logistics and production planning.

In order to comply with the demand and conform to the particular state of the economy steel producers must not only maximize the production but also optimize the throughput at lower production levels.

Environmental care
Converting raw materials into finished steel products is very intensive in terms of energy consumption.

The continuous efforts of the metal industry are driven by cost pressure and environmental regulations. However, despite the steel producers’ success in reducing energy input, it is still one of the leading cost factors.

International agreements and national laws require a reduction of pollution, energy consumption and CO₂ emissions. This has to be achieved in the most cost-efficient way. Rising environmental standards require intelligent approaches in electrics and automation.
Fully optimized automation and electric systems are the basis for reliable production processes, maximum plant performance, and quality products that meet all market demands. Solutions must be executed quickly, with minimum interference to ongoing operations. They must also be compatible with the existing automation environment.

You expect ...

- Automation solutions that support cost-optimized production and maximum plant efficiency
- Assured and documented product quality
- Flexibility in raw material usage and product mix
- Modular modernization packages that ensure short start-up times and easy system tuning
- Optimized production for energy savings and the reduction of emissions
Leading basic automation, process control, and process optimization created within our company play a key role in stable processes and high system availability. Our systems generate improvements throughout the entire iron and steel production by combining reliable solutions for the power supply, drives and automation with technology-specific applications.

Advantages of Siemens VAI electrics and automation:

• **Integrated automation solutions** – combined technological, operational, electrical and automation expertise from one source

• **Highest product quality** – standardized operations yielding homogenous iron and steel quality that fulfills certification requirements

• **Energy and cost savings** – proven solutions enable the intelligent use of energy and raw materials

• **Maximum reliability** – power solutions, drive systems and instrumentation from a single world class supplier guarantee maximum reliability

• **Service orientation** – customer and service orientation throughout the entire life-cycle of the electrical and automation systems

• **Powerful modernization packages** – modernization solutions tailored to your needs
Our solution:
Tailored electrics & automation concepts for your competitive advantage

A background of experience
With the experience acquired from more than 1,000 automation and electrical projects worldwide, Siemens VAI is the leading software house dedicated to the metallurgical industry. On the basis of our in-depth technological and metallurgical expertise, a full range of solutions is available from a single source for all of your electrical, instrumentation and automation (hardware and software) requirements. These can be implemented on a turnkey basis, from the planning, engineering and procurement up to installation, integration, start-up and commissioning.

For every metallurgical plant
We offer a comprehensive spectrum of cost-effective electrics and automation applications for all production units in the iron and steelmaking industry from one single source. As repeatedly demonstrated, our solutions can dramatically improve the performance of production and the quality of your products.

Consistent operator guidance and process information across all metallurgical units permits the steady control of production. This leads to plant-wide standardization for maximized plant performance, availability and flexibility. Process tracking functions provide sufficient documentation of iron and steel production as well as the extensive acquisition of quality-related data.

On all automation levels
Modern and powerful process control systems ensure a safe and user-friendly plant operation.

Stable process optimization systems comprise advanced process models, artificial intelligence, graphical user interfaces and operational expertise. The process models optimize the different production processes with regard to reduced energy consumption and emissions.

In addition, our Energy Management and Manufacturing Execution Systems allow for the plant-wide optimization of processes, and ensure the seamless flow of production data. To round off the spectrum of solutions, the quality control system supports completely quality-assured production processes.

There when you need us
We provide solution-oriented services for all stages of the project – from feasibility studies to start-up and client training. Forward-looking concepts ensure the continuous, high availability of the automation systems.

Secure online connections are established to customers all over the world for support and services. Local Siemens representatives assist the trained customer maintenance personnel for first level support.
Across your entire production process:

Integrated automation.

A vast background of experience in electrics, drive systems, process control, process optimization, expert packages and plant logistics, combined with our strong commitment to research and development, is the foundation for decisive improvements in product quality, plant performance and profitability.

Ironmaking
Page 8-15
Application of expert systems and electrics & automation packages can help producers reduce raw material consumption and emissions.

Steelmaking
Page 16-23
Sophisticated models and technological packages are the basis for efficient steelmaking, higher productivity and fulfillment of steel-grade targets.
Continuous casting
Page 24-29
State-of-the-art automation complemented by advanced mechatronical packages ensures maximum caster performance, flexibility and product quality.

Energy, logistics, quality
Page 30-39
Fully optimized and integrated systems related to the distribution and management of energy, order execution and quality control are decisive factors for reliable and cost-efficient metals production.
Ironmaking

Enhancing processes with ironmaking expertise
Ironmaking processes, which include coking, sintering, direct reduction and smelting reduction, are the largest energy and raw-material consumers within a steel works. They also pose enormous environmental challenges. With the application of individually tailored process models and expert systems, it is possible to dramatically reduce specific consumption figures and that leads to considerable cost savings and emission reductions.
A milestone in sinter process control
The major goal of a sinter automation system is to ensure stable production at the highest possible productivity level and with consistent quality. The ultimate solution represents the SIMETAL Sinter Control system with its process control features in combination with the process optimization system SIMETAL Sinter VAiron.

At the level of process / technological controls (level 1), the main applications are:

- Raw mix ratio and feed controls
- Moisture control for constant permeability
- Sinter mix charging control for constant and compression-free material charge
- Ignition hood control for proper ignition
- Sinter machine speed control
- Control of cooler and sinter screening area

The leader in process optimization
The SIMETAL Sinter VAiron process optimization system, which features layers for information management, models and an expert system, pre-processes raw data, evaluates active and historical data, and compares limit mismatches.

The process models that rely on the integrated process knowledge of our experts match perfectly with the requirements of state-of-the-art plant control.

Main SIMETAL Sinter VAiron models:

- Stacking plan model
- Ore bed distribution model
- Raw mix calculation model
- Permeability calculation model
- Burn-through time prediction model
- Burn-through point calculation model
- Harmonic diameter calculation model
Closed loop sinter expert system
The SIMETAL Sinter VAiron expert system assures a production process with high productivity accompanied by low fuel consumption. Sintered material with stable chemical and physical properties is one of the main production targets. At the same time, the system supports the maintenance of environmental limits.

The unique sinter expert system is capable of processing corrective actions in closed loop operations. The calculated setpoints are automatically transferred to the process control system.

The expert system utilizes information at a very early stage of the production line in order to control the processes and use information gathered at a later stage to self-tune the control system. This attains high control accuracy despite fast corrective actions.

Main features:
- Integrated solution for ore preparation and sinter process
- Optimization of sinter belt velocity
- Adjustment of material composition to maintain waste gas limits
- Efficient monitoring of process measurements and resulting indices
- Fully closed loop operation for all provided expert system rules

Main benefits:
- Higher productivity
- Reduced fuel consumption as a result of optimal mix of charged materials
- Stable and shift independent operation
- Stabilization of sinter basicity
- Stabilization of harmonic diameter of sinter
- Stabilization of production and usage of sinter return fines
Environmentally sustainable development is an important issue in coke production today. Pollutants are an inevitable by-product of the cokemaking process. With good plant design and operation, however, emissions can be cut to low levels or eliminated altogether. It is also advantageous to achieve efficient coke oven plant performance in order to produce high quality coke for blast furnace operations.

Siemens VAI provides a comprehensive variety of state-of-the-art automation solutions to minimize impacts of cokemaking process on the local and global environment as well as to optimize plant energy economy and production rate.

The SIMETAL Coke product portfolio covers the entire coke oven plant area, including battery-, machine-, coke dry quenching- and by-product plant automation. The products offer a full range of automation solutions from basic E/I/A to sophisticated process optimization packages, which provide optimized plant efficiency through low capex and opex, resulting to short payback time and substantial cost savings. In addition, implementation of these proven automation solutions offers safe and reliable production, while increasing the plant lifetime.

### SIMETAL Coke solutions:

#### Coke oven battery

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
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</thead>
<tbody>
<tr>
<td>Coke Oven Battery (CPMS)</td>
<td>Stabilized coke battery operations</td>
</tr>
<tr>
<td>Advanced process models</td>
<td>Reduced energy consumption</td>
</tr>
<tr>
<td>Optimized heating control</td>
<td>Improved coke quality</td>
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<tr>
<td>Efficient scheduling operations</td>
<td>Increased battery service life</td>
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#### Pushing Management System (PUMAS)

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<tr>
<th>Features</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>Automatic machine positioning &amp; interlocking</td>
<td>Accurate positioning with fast and reliable interlocking</td>
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<tr>
<td>Pushing parameter measurement</td>
<td>Continuous measurement of pushing parameters</td>
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<tr>
<td>Online oven monitoring</td>
<td>Improved preventive maintenance and refractory conditions</td>
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<tr>
<td>Wireless data communication</td>
<td>Fast and reliable wireless data transfer</td>
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#### Coke dry quenching process

##### Coke Dry Quenching (CDQ)

<table>
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<tr>
<th>Features</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>Unmanned &amp; emission-free operations</td>
<td>Reduced dust emissions</td>
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<tr>
<td>Dust emission control &amp; collection</td>
<td>Improved coke quality, low moisture content of coke</td>
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<tr>
<td>Advanced E&amp;A solutions</td>
<td>High pressure steam generation</td>
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#### Coke by-product plant

##### By-Product Plant (BPP)

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<tr>
<th>Features</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>Advanced E&amp;A solution</td>
<td>Reduced emissions &amp; process leakages</td>
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<tr>
<td>Predictive models</td>
<td>Improved process safety</td>
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<td></td>
<td>Improved quality of gas</td>
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<td>High reliability</td>
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Coking plant at Ruukki Metals, Raahe, Finland
Smelting reduction automation
Siemens VAI very successfully introduced SIMETAL Corex and SIMETAL Finex as technologically and commercially proven new processes for smelting reduction. The SIMETAL VAiron process automation is part and parcel of the success of these economical and environmentally-friendly ironmaking technologies.

SIMETAL VAiron is based on advanced process models, enhanced software applications, graphical user interfaces and operational know-how. Excellent process performance and significantly lower production costs are the proven results.

Direct reduction automation
Several technologies are available on the market for direct iron oxide reduction. The most reliable and well established technology is the Midrex® Direct Reduction Process.

Our proven DR process control system is supplemented by a process optimization system called SIMETAL Simpax. This powerful package consists of three main parts:

- Product quality prediction models for metallization and carbon content
- Superdata Model provided by Midrex
- Simpax expert system

The models detect problems in the product quality or process conditions that are undesired for the equipment in an early stage. The expert system generates suggestions for adequate counter actions bringing the process back to optimal conditions. The expert system works in closed loop mode and ensures stable process conditions, high productivity and product quality.

**Main benefits:**
- **Manageability:** The information system allows for in-depth familiarity with actual process behavior.
- **Observability:** The operator gets reliable online and simulated data on inputs and outputs.
- **Controllability:** Each state remains controllable.
- **Productivity:** Stable process conditions allow the system to maximize operations.
Process control system
SIMETAL BF Control comprises successful solutions for all aspects of blast furnace operations. These basic automation systems have been installed at many blast furnaces worldwide, often within the framework of very tight construction or rebuilding programs, including:

- Stove control for cyclic, parallel, lapped parallel and staggered parallel, 4-stove operation
- Stockhouse control of sequential batched materials with in-line weighing and material layering
- Furnace top control of skip or belt charged tops with complex charging patterns and burden distribution
- Advanced control for chute charging system as well as Gimbal Top
- Fines charging control
- Coal injection systems
- Casthouse operation and control
- Slag granulation
- Gas cleaning control
- Plant safety and shutdown design
Process optimization
The SIMETAL BF VAiron process information management system supplies an extremely flexible and powerful database to provide continuous improvement of process knowledge. The built-in calculation tool allows to create and adapt additional models. SIMETAL BF VAiron interprets process data, performs model calculations and visualizes the results in windows or web-based graphical user interfaces.

Closed loop expert system
SIMETAL BF VAiron includes the first blast furnace expert system which does not require operator interaction to control the main parameters of the blast furnace. Main controls like coke injectant rates, basicity and even burden distribution can be simultaneously and automatically executed in a closed loop mode.

Process models
Precise optimization of the blast furnace operation, with all associated process and production benefits.

Maintenance assistance:
• Mass and energy balance
• Plausibility check
• Hearth lining monitoring

Control models:
• Burden control
• Burden distribution
• Hot stoves control and optimization
• Blast furnace supervision
• Indirect reduction
• Fuel injection
• Raceway calculation
• Flame temperature
• Tapping management

Research tools:
• Blast simulation
• Minimum fuel consumption
• Neural system

Main benefits:
• Reduced fuel consumption
• Significantly decreased standard deviation of Silicon content in hot metal
• Reduced overall production costs
• High productivity
• High degree of fines charging
• Amortization period typically less than 6 months
Steelmaking

Improve plant performance and steel quality
Advanced automation solutions are the basis for fully optimized process operations in electric steelmaking, oxygen steelmaking and secondary metallurgy for the production of carbon-, alloyed-, stainless- and special steel grades. Sophisticated metallurgical models and technological packages shorten tap-to-tap times, ensure that the quality targets are met, and substantially reduce overall costs.
Furnace switchgear

The SIMETAL Sivac-X furnace switchgear is perfectly adapted even for the extreme requirements of ultra high-power arc furnaces. At voltages of up to 40.5kV and load currents up to 4,500 A, and with the new current VCB as single circuit breaker for up to 4,500 A, it ensures reliable energy supply and plant operation. Moreover, the long maintenance interval of 10,000 operating cycles allows for very low operating costs.

More than 30 years of experience in vacuum circuit breakers, and our in-depth knowledge of furnace switchgears, ensure smooth and reliable production without excessive over voltages or switch failures.

In addition to its impressive performance characteristics, SIMETAL Sivac-X excels through its simple operation and high efficiency.

EAF process control

The process control system SIMETAL EAF Control includes basic automation (level 1) and technological control functions to enable EAF steel production in an effective and stable way. A redundant HMI layout configuration combined with fail safe state-of-the-art control devices ensures highest availability of the automation system.

Advanced controls are used for:

- Scrap / ladle transfer car
- Furnace transformer operation
- Oxygen lance
- Refining combined burner (Carbon, lime and DRI injection)
- Weighing and dedusting system
- Furnace breaker
- EAF movements
- Hydraulic system
- Interlocking and alarm system

Electrode control

SIMETAL Simelt is a fully automatic, end-to-end solution for electrode control in three-phase electric arc and ladle furnaces. It regulates and dynamically adjusts the electric arc and makes the most efficient use of electrodes, ensuring the best performance of the EAF and LF.

The electrode control can be integrated into any system environment and architecture. This technology has been successfully implemented in more than 300 plant units worldwide.

The electrode control system SIMETAL Arcos provides on the whole the same functionality as SIMETAL Simelt but differs in the used PC-based hardware platform.
**Foaming slag manager**
SIMETAL SonArc FSM is an advanced add-on to the electrode control system enabling a fully automated foaming slag process. A combination of current analysis and structure-borne sound analysis enables precise sectional and electrode-related slag height detection. Thus, the foaming slag distribution inside the furnace is determined. By controlling and optimizing the carbon injection, a uniform distribution of the foaming slag in all furnace sections is ensured.

**Condition-based scrap melting**
SIMETAL SonArc CSM uses the same measurement equipment as the foaming slag manager to detect the state of the melting process inside the furnace shell. The electrical operating point is adapted to the progress of scrap meltdown. Therefore, a smooth and standardized meltdown behavior is achieved under SonArc CSM operation. Furthermore, the system enables optimal charging of subsequent scrap baskets by signifying the completed meltdown of the actual basket.

**Main benefits:**
- Controlled and optimized foaming slag process and meltdown behavior of scrap
- Shorter power-on times
- Reduced specific energy consumption

**EAF process optimization**
SIMETAL EAF Optimization supports production of a wide range of steel grades, including carbon steels, stainless steels, and special steels. At the same time, it accommodates variable charging ratios of scrap, direct reduced iron, and hot metal.

The application of Steel Expert, the set of process models for the optimization of the steelmaking process, leads to fewer steel treatment correction steps, a minimum number of downgraded heats, and exact adherence to tight production schedules.

**Holistic process control**
The newly developed SIMETAL EAF Heatopt system enables a closed loop control of the oxygen and gas burners, the carbon injectors as well as the post combustion injectors. It takes actual process data, the offgas analysis (continuously measured by the Lomas system), the offgas flow, and the foaming slag index into account.

**Main benefits:**
- Closed loop control of burners and injection devices based on actual melting conditions
- Reduction of tap-to-tap time
- Reduction of energy consumption and alloying material costs
- Reduced carbon consumption
State-of-the-art automation solutions are an essential factor for maximum performance and product quality in the converter steel plant. Our automation systems cover the complete range of carbon steelmaking converters (LD, BOF, K-OBM) as well as stainless steelmaking technologies (AOD, CLU and K-OBM-S).

The unique advantage of the integrated approach is that it considers all aspects of process stability, product quality and operational flexibility, while ensuring efficiency and profitability throughout the entire plant life-cycle.

**Process control**

The basic automation systems (level 1) for converters, SIMETAL BOF Control and SIMETAL AOD Control provide the platform for sequential and closed loop control and include all relevant technological control functions, such as:

- Converter tilting drive
- Bottom stirring – single line control
- Oxygen lance control system
- Sublance measuring system
- Horizontal Measuring Manipulator
- Automatic tapping system
- Waste gas cooling and cleaning
- Gas recovery and analyzing
- Human machine interface

**Converter tilting drive control**

The converter tilting drive control system features excellent reliability and precision. Depending on the converter size, up to four motors with dedicated frequency converters are used to enable closed loop position control.

Load sharing between the individual tilting motors is provided. The control system ensures full functionality even in emergency situations.

**Automatic tapping system**

SIMETAL AutoTap provides an automatic converter tapping procedure including control of ladle car movements and positioning of the alloy chute. At the end of the converter treatment the operator initiates SIMETAL AutoTap by pressing the tapping button. The converter is automatically tilted to the initial tapping angle to start the fully automatic tapping procedure. Thus potential sources of error by operator are eliminated and the reproducibility of the tapping process is improved considerably thereby. Several implemented safety functions guarantee a smooth and optimized tapping procedure.
**Process optimization**

The optimization systems (level 2), SIMETAL BOF Optimization and SIMETAL AOD Optimization, are based on advanced algorithmic equations that accurately represent the complex thermodynamic-metallurgical reactions. The solutions are particularly suitable for a wide range of operating conditions, e.g., variable scrap-to-hot-metal ratios, minimum slag practice and varying phosphorus content. They cover all available carbon and stainless steel converter technologies.

Steel Expert, a comprehensive group of process models, perfectly images and optimizes the production process. The prediction model precalculates the production and provides a forecast of the heat progress for the operator.

The cost-optimizing charge calculation determines the cheapest mix of available scrap types in order to produce the target steel quality.

Whereas the supervision models monitor the metallurgical and thermal process (calculating online the actual condition of steel and slag), the setpoint models determine the oxygen amount and all charged materials that are necessary to meet quality requirements.

If a sublance is available, the Steel Expert Inblow model uses the measured values for achieving the required end-point values for carbon and steelbath temperature.

**SIMETAL Dynacon for BOF**

If a continuous offgas measurement (analysis and flow) is available, SIMETAL Dynacon is applied to dynamically optimize the blowing process. It can achieve the target carbon content of the steel from the offgas information without taking a steel sample. SIMETAL Dynacon features increased carbon hitting rates at low investment, maintenance and operational expenses.

**Main benefits:**

- Flexible and modular automation packages in response to a dynamic market situation
- Reduced scrap material expenses due to cost-optimizing charge calculation
- Increased productivity and yield
- Improved hitting rate for temperature and carbon content
- Increased safety as a result of manless tapping procedure
In order to achieve high product quality with the lowest production costs, final adjustments in steel chemistry and temperature are carried out in secondary metallurgical facilities. Meeting narrow tolerances and a fully automatic production sequence from steelmaking to casting is only possible with the support of sophisticated automation systems.

Depending on required steel grade and quality demands, our automation systems handle all types of process variants and operational procedures for ladle treatment facilities and furnaces, as well as vacuum degassing plants.

Process control
The process control systems (SIMETAL RH Control, SIMETAL LF Control, SIMETAL VD Control) for the various groups of secondary metallurgical plant units provide an efficient and proven solution for economic production. Technological packages, e.g., electrode control systems for ladle furnace, are integrated into the individual automation packages.

Depending on the plant’s technical equipment, process control functions are provided for:
- Hydraulic and cooling system
- Transformer and switchgear
- Oxygen and stirring lance
- Temperature and sampling device
- Weighing and dedusting system
- Vacuum pump

Process optimization
For the different treatment steps in secondary metallurgy the following highly advanced process optimization systems are applied:
- SIMETAL LF Optimization
- SIMETAL RH Optimization
- SIMETAL VD Optimization

Beside the basic functionalities, such as heat tracking and operator guidance, the Steel Expert process model package features dynamic online optimization for consistent and flexible production.
Prediction of entire treatment
The precalculation model – Steel Expert Prediction - previews the theoretical course of the complete treatment and supports the adaptation of the treatment practice to the heat-specific requirements. The model optimizes the scheduled treatment steps and inserts additional actions if necessary.

Supervision of the heat
The Steel Expert Supervision model cyclically determines the actual heat status. The model calculates the change of the slag and steel bath analysis that is due to the reduction process of the oxide phases in the slag, the oxidation process of the steel and external factors, e.g., alloying and arcing. All energy inputs and losses are considered to calculate the actual steel bath temperature. In case of vacuum degassing, the removal of hydrogen, nitrogen and oxygen is also controlled.

Final analysis adjustment
The setpoint models – Steel Expert Alloy, Steel Expert Deox, Steel Expert Desulph and Steel Expert Shape – calculate the materials that need to be added during the different treatment steps. They provide for the final adjustment of the steel analysis on a cost-optimized basis. The alloy model takes into account not only actual and target chemical analysis, but considers also various other constraints like linear equations of individual chemical elements and hardenability requirements.

If a reduction phase is necessary, the Steel Expert Reduction model is applied to ensure an optimized treatment phase.

Perfectly controlled oxygen blowing
For vacuum degassing plants equipped with an oxygen blowing lance, Steel Expert Oxygen calculates the total amount of oxygen needed for forced decarburization and/or chemical heating.

Reaching the aim temperature
The Steel Expert Temp model determines the required total energy as well as the duration of electrical or chemical heating. The actual treatment scheme is used as input and the entire process until treatment end is precalculated. According to the predicted final steel bath temperature at treatment end the respective measures for cooling or heating are recommended.

Main benefits:
- Consistently high and proven steel quality
- Increased productivity and plant availability
- Standardized and reproducible production
- Full transparency of operation
- Reduction of raw material costs
- Reduction of energy costs
Continuous casting

Continuous production improvement
We provide leading automation solutions for all types of continuous casting machines, i.e., slab, billet, bloom and beam-blank casters as well as endless strip production. A full array of automation packages that are deeply rooted in technology meet the requirements of plant performance, dimensional flexibility, product quality and maximized yield. Our solutions have been installed in hundreds of casters worldwide, for both new and existing plants.
Process control features
As a comprehensive solution for continuous casting plants, our technological packages deliver all of the components of your plant’s equipment requirements, including superior automation and technological solutions to precisely master the process and its complex parameters.

In addition to these technological packages, the Common PLC is responsible for movements of the ladle turret and the tundish cars in cooperation with the Safety PLC, which protects the equipment from collision and damages.

The Strand PLC manages the operation modes and all strand-related interfaces, including the torch cutting machine and higher-level functions.

Thanks to our integrated offsite testing, we are able to offer a quick installation and startup.

Main functionalities of SIMETAL CC Control:
- CC Explorer: Standard visualization for technological packages provides detailed operation and system status information
- DriveCon: Pre-configured modular system that controls withdrawal drives and pinch roll screw down
- LubriCon & HydrauliCon: Configurable controls for caster lubrication and hydraulic power systems
- CoolCon: System for controlling secondary cooling and closed machine cooling as well as for primary cooling
- SIMETAL 3D Sprays: Enables adjustment of nozzle position for the optimal combination of casting width and speed

Mold level control
SIMETAL LevCon applies an advanced control algorithm that takes into account process dead time, clogging, and surface waves in the mold as well as wear of the stopper or slide gate through improved dynamic behavior. Automatic smooth startup and resumption of the casting process are available for single, twin, triple, and multistrand casting. The new bulging compensation feature allows plant operators to reliably overcome unsteady bulging effects by precisely modeling the mold level behavior and applying a compensating signal that assures stable mold level conditions. Thanks to the controller’s modular concept, all standard mold level measurements, flow control mechanics, and actuators can be used.

- Dynamic adaptation of control parameters based on changes in width, casting speed, and steel grade
- Compact and lightweight, inline attached, linear electromagnetic servo actuator for user-friendly handling
- Actuator drive unit from the Siemens SINAMICS family
Hydraulic oscillator
The SIMETAL DynaFlex oscillator is a technological package comprised of a foundation frame and two individually exchangeable and interchangeable oscillator units, each fitted with one leaf spring-guided mold table and a hydraulic cylinder. Despite a freely selectable stroke, frequency, and curve pattern, we developed the so-called “inverse” oscillation mode.

- Improvement of surface quality especially at low casting speeds accompanied by a reduction in oscillation mark depth
- High casting reliability (safety) at high casting speeds due to higher powder consumption and the resulting reduced risk of breakouts
- Increased operating range and reduced maintenance expenditures
- Automatic adaptation of oscillation curves, stroke, and frequency through pre-defined and freely configurable parameters

Dynamic width adjustment
SIMETAL DynaWidth is the perfect solution for fast, remote width adjustment of slab caster molds. Width adjustment is performed by means of four hydraulic or electric drives per mold that are directly linked to the narrow faces of the mold. This technical solution can be realized even in cases of very limited space availability (for example, revamps).

In addition, it guarantees minimal mechanical backlash and high guidance accuracy. The hydraulic and electric drives consist of standard components typically used in steel plants. Therefore, in most cases, existing systems can be used as the power source for the SIMETAL DynaWidth system.

- High adjustment accuracy and speed with high adjustment forces, even at low adjustment speeds
- Ideal for utilization even with existing molds
- S-type width adjustment for optimized strand shell support

Main benefits:
- All technological packages have a mechatronic approach that optimizes the setup and performance of the package
- With clearly defined and standardized hardware and functional interfaces to other systems, it is easy to integrate these packages into complex new casters as well as to use them as stand-alone packages for caster revamping
- The universal software makes it possible to set up projects using only parameter settings, so that the proven and reliable software solutions can be used
- The completely standardized hardware, sensors, and actuators also facilitate optimized service and maintenance
Main functionalities of SIMETAL CC Optimization
The basic functionality of SIMETAL CC Optimization is production plan handling and heat and slab tracking from the first announcement of a heat until the last slab has left the caster run-out area. Production events (e.g. heat changes, turret and tundish movements) and quality-related information are tracked by the system.

Data received from production planing and upstream units in the steel plant are processed and used for tracking, heat pacing or quality assessment purposes.

The model output is automatically forwarded to the basic automation system (SIMETAL CC Control) in order to optimize the production process.

Mold monitoring / breakout prevention
SIMETAL Mold Expert offers a detailed look into the mold and beyond. It features:

- Auto-adaptive sticker detection and thermal monitoring for optimum breakout prevention
- Temperature and oscillation monitoring
- Friction and heat-flux supervision
- Level Expert for early detection and localization of bulging and roller deformation effects
- Operator warnings in the event of abnormal temperature distribution - such as hot spots and hot areas

Dynamic secondary cooling model
SIMETAL Dynacs 3D dynamically controls the water flow rates in the spray cooling zones to ensure a specified target temperature profile in the hot strand. This is achieved by solving the 3-dimensional heat transfer equation continuously in real time.

- A 3-dimensional temperature profile of the entire strand including the area of final solidification is calculated
- Available temperature at edge is used to optimize cooling strategies to avoid cracks in the edge area
- Powerful built-in offline simulation package for developing and testing of optimized cooling strategies

SIMETAL DynaGap Soft Reduction® 3D
This package is based on the combination of SIMETAL Smart Segment and SIMETAL Dynacs 3D thermal tracking module. It allows to dynamically adjust the roll-gap profile even in transient casting conditions.

- Dynamic adjustment of the roll-gap profile for the entire strand (depending on mechanical segment setup)
- Flexibility to cast any thickness within the design range
- Optimized roll engagement for machine protection
- Improved internal quality due to minimized center segregation, especially for pipe and plate grades
- DynaGap can be installed on slab, bloom and billet casters as well as on casters supplied by third parties
Quality control
SIMETAL Quality Expert supports operators and metallurgists in order to continuously improve the product quality and provides an online quality rating for each product leaving the caster.

Intermix
Intermix determines the chemical composition of strand areas in the event of analysis variations between two heats.
- Flow models of the tundish, mold and strand areas are used, taking the actual tundish content and strand speeds into account
- Information is provided as to whether or not a certain strand section meets the analysis specification of a heat

Yield Expert
Yield Expert provides tailored strategies for yield improvement.
- Optimization of product length or product weight in the case of scrap sections or quality related defects
- Scheduling of mold width adjustments
- Scrap section allocation algorithms
- Optimization steps can be switched on and off online

Speed Expert
The Speed Expert cyclically calculates the optimum casting speed for operator guidance. The calculation of the casting speed is based on different rules which are specified in the Speed Expert practice. A casting speed range is calculated from each rule. The intersection of all ranges is the allowed casting speed range.

Evaluated rules include:
- Caster practice definitions (min/aim/max speed) for steel grade or steel grade groups
- Superheat temperature, chemical composition
- Solidification point within the containment range
- Heat pacing

Main benefits:
- A comprehensive range of metallurgical models and packages which can be easily integrated into any existing automation environment
- Increased surface quality due to stable surface temperature
- Typically, more than 90% reduction in sticker breakouts
- Increase in yield and throughput
- Minimum plant downtime through maximized utilization of pre-tested, pre-configured and proven components
- Service and support for upcoming system extensions after start-up period
Energy, logistics, quality

Spanning the bridge across your entire production
For metallurgical plants to function effectively, numerous systems and processes must be simultaneously operating. These include solutions for the supply of energy and the quality of power, planning and scheduling systems, quality control, and efficient energy management. It is our comprehensive expertise in all aspects of industrial plant optimization that assures our customers the best integrated packages over the long term.
In metals and mining, nothing functions without power. This is why the generation and distribution of electrical power is one of the basic prerequisites for success – after all, the safety, reliability, and cost-effectiveness of the plant largely depend on power supply.

The SIMETAL/SIROLL Power family represents a number of world-class solutions for every requirement. With a worldwide network of experienced experts, we offer the development, manufacture and installation of systems for substations and distribution systems – tailored to your process requirements. Benefit from our extensive know-how in the fields of high, medium and low-voltage stations – all the way to complete turnkey solutions combined with our knowledge about the specific needs of your technological process. We create a solid basis for smooth production processes.

Voltage dips reductions or outages can incur high costs when they lead to production downtimes. Therefore, secure power supply via a well-designed and -equipped supply network is one of the prerequisites for successful plant operation. High-performance transformers, for example, are as important as the right switchgear solution for the various requirements.

But most of all, the specific technological requirements of your production process must be considered during the conceptual design of a tailor-made network concept. It goes without saying, that our SIMETAL Power solutions are designed to meet the requirements of the industry and the high demands with respect to operator safety and operational reliability.

Whether switchgear, substations or plant components, transformers, reactors or accessories – our product base always represents the state of the art, from engineering through manufacture, installation, and commissioning.

You can expect products that are easy to use and highly cost-effective. But their key aspect is that they enable your production to run smoothly and reliably – without downtimes caused by power failures or fluctuations.

Main benefits:
- Higher productivity ensured by safe energy supply throughout the plant
- Greater operational safety
- Same hard- and software base for lower-cost energy and process automation
- Solid emergency power strategy reduces risk for the production plants
Power quality: More safety, more stability
Large electrical loads in mines, steel plants or rolling mills have a significant effect on the public electrical supply network. Network disturbances such as reactive power generation, voltage distortion or voltage variation frequently occur. Utilities impose penalties upon the operator who causes the disturbance beyond certain limits. In the worst-case scenario, the plant might be shut down.

Our solution SIMETAL PQ
Compensation systems do not only reduce the negative impact of typical plant loads to specified limits, but can also result in savings in energy costs – and can thus pay off quickly. Based on our extensive experience with the processes in melt shops and rolling mills, we can
- reliably evaluate the potential disturbances that can arise in a given network configuration
- support our customers in their negotiations with public utilities and
- implement the compensation system that offers the best price-performance ratio for the specific application.

The available systems – filter circuits and dynamic reactive power compensators (SVC Classic and SVC PLUS) – can be connected to an existing supply network.

Filter circuits call for the lowest investment costs and can be used to reduce reactive power consumption and harmonic voltage distortion. Dynamic reactive power compensators (SVC Classic, respective SVC PLUS) also comprise a thyristor-controlled reactor (TCR), or a voltage source converter (VSC). In addition to the features provided by filter circuits, it reduces flicker and keeps the bus voltage constant – which in many cases allows for the increase in the production output, e.g., in three-phase electric arc furnaces.

In case a standard SVC Classic system cannot fulfill very demanding flicker requirements, an SVC PLUS system based on a voltage source converter (VSC) can be provided.

For greenfield sites as well as modernization projects, the best results are achieved if the entire equipment comes from a single source – from the power supply and compensation system right down to the arc or roll bite – ensuring a safe, stable production process.

Main benefits:
- Improved energy supply
- Compliance with the limit values
- Unprecedented operating reliability
- Suitability for restricted spaces
- Short amortization period
Manufacturing Execution System
SIMETAL MES provides transparency from the enterprise level down to the current shop floor situation. It also ensures a continuous, seamless flow of process information, thus keeping operators, engineers and managers equally informed. As a result, the solution is the ideal platform for plant-wide production planning and control – a solid basis for reliable quality and minimized operating costs.

Functions & features
SIMETAL MES is based on the ISA 595 standard covering main software modules like:

- Material Management for tracking and tracing different material types, from raw material to a semifinished product, and to the final product, including full genealogy
- Quality Management is provided for different stages of the production process. This guarantees that quality requirements are met.
- Production Order Execution gives details about all production order steps during production.
- Production Planning & Scheduling on different planning levels can be provided. This can be plant-specific, real-time scheduling, and company-wide production planning.
- Product Definition Management specifies how semi-finished or final products shall be produced, including routing and equipment parameters and process set points.
- Production Data Archives are available to store real-time production data redundantly for trending, reporting and data analytics.
- OEE & Downtime Management provides real-time information about status and efficiency of equipment and delays during production.
- Laboratory Information Management System to organize labs for chemical and mechanical analysis
- Standard interface connectors for easy integration in the IT infrastructure of the plant.
- Enhanced KPI & reporting tools

Main benefits:
- Reduced production costs
- Increased throughput
- Minimized lead times
- Minimized inventory
- More transparency
- Based on international standards
- Easy to customize and maintain
- Reduced IT costs of ownership
Boost your stockyard performance
Innovative logistics for metals

Stockyard Management System
Storing and retrieving raw materials, intermediate goods or final products takes up a significant amount of the production and delivery time. Optimized stockyard logistics offer significant advantages by reducing costs and increasing your competitive edge. SIMETAL SILOC is an innovative logistics solution that has been especially designed for the metals industry.

Increased efficiency
SIMETAL SILOC takes into account both customer orders and the latest production program at the time of stocking-in. This means fewer relocations of the goods, which translates into cost-efficiency and less manpower. Waiting time can also be reduced, as the material is more readily available. In addition, the production environment can be better utilized.

Optimized transport routes
SIMETAL SILOC's highly innovative logic considers all relevant transport orders, understands details of the production schedule, and even takes the latest changes into account. As a result, the software ensures stocking-in of material close to the location of the next processing step. In addition, it optimizes stack creation so that the materials needed are easily accessible for the next production steps without constraint violation.

Improved loading sequences
SIMETAL SILOC optimizes the stacking of goods and material according to transport orders and production schedules. It supports stacking of multiple orders on a single stack following the last-in-first-out principle (LIFO). This can dramatically reduce the stockyard space required – and therefore the costs involved.

Automatic detection of material movement
SIMETAL SILOC logistics software supports different position-measuring devices. This means that crane operators don't have to insert data manually when moving material, which reduces errors.

Main benefits:
- 100% correct stockyard image by automatic detection of transport events
- Calculation of optimal stockyard position avoids unnecessary material transports
- Take material constraints for storage into account to avoid material damage
- Improved stockyard performance (lead time)
- No longer manual search for material in the stockyards
- Fully automatic operating mode possible
- Reduction of operating costs

Accurate stockyard image with optimized transport orders
Predict and ensure quality
Automation solutions for quality control

SIMETAL Quality Expert

Quality is one of the decisive factors for successful and competitive steel production. Defined quality assurance procedures must be applied. The large amount of production and quality data to be processed requires dedicated automation systems which assist the quality assurance personnel in fulfilling their tasks.

We have developed a completely new computer-aided quality control system, SIMETAL Quality Expert, which is replacing the former SIMETAL VAIQ (in operation in more than 200 slab/bloom/billet casters worldwide).

SIMETAL Quality Expert determines the set-up necessary for quality-related process parameters, tracks the actual data during production, predicts the quality of the cast products and automatically determines the subsequent product disposition. It supports the plant operators by on-line quality alerts and a preview of the quality of the cast strands in the machine.

Compared to the previous version, it has been enhanced by many new features, among them improved process data tracking resolution, a flexible rule editor for quality prediction, machine learning capability and many more. The user interface now fully integrates with the HMI for other SIMETAL products such as SIMETAL CC Optimization, SIMETAL Dynacs 3D and SIMETAL DynaGap Soft Reduction® 3D.

Machine learning

Quality Expert provides support for the training and execution of leading machine learning algorithms. Extensive data sets containing process data and quality testing results can be used for training machine learning algorithms. The trained models can be released to the Quality Expert production system, where they will be used for quality prediction as an integral part of the overall quality prediction rule system. Thus hybrid rule based and machine learning based quality prediction is supported.

Main benefits:

- Improved product quality due to consistent and dynamic production practice information and advice for the plant operators
- Cost savings resulting from reduced slab/bloom inspection and conditioning activities
- Quality assured direct or hot charging – the online quality prediction allows potentially defective products to be separated before charging to the hot rolling mill
- Configurability to production needs using a flexible rule editor
- Quality certification supported by long-term documentation of process specifications, process history and quality results

Instant access to quality information
Minimize costs with intelligent control
Energy management to meet both economic and ecological demands

SIMETAL Energy Management System
The intelligent combination of modern process control and energy management systems has a significant influence to efficient energy consumption.

SIMETAL Energy Management System comprises of various modules for flexible application in different levels of the automation process:
- Operating & control system level
- Energy data management level
- Energy forecast and optimization level

Transparent energy efficiency
SIMETAL Energy Management System provides detailed information about efficient energy use, by making the energy consumption and the associated costs visible and comprehensible. This allows the customer to allocate and control the costs of energy consumption with precision, thereby reducing CO₂ emissions and environmental pollution.

Preventing energy peak loads
Thanks to the ability to monitor energy limits and intelligently regulate consumers, expensive energy peak loads can be prevented (peak shaving).

Intelligent forecast and optimization
The integrated prediction and optimization function forecasts and plans energy requirements. This provides the ideal basis for scheduling energy producers and transport to consumers in the right quantities at the right time.

SIMETAL Energy Management System considers supply contracts, maximum output, high tariff rates, energy quantities and limits and even time-dependent differences in energy prices.

Main benefits:
- Transparency and documentation of the energy balance
- Allocation of consumer-related costs
- Prevention of energy peak loads and adherence to the energy purchase contracts
- Energy demand and supply forecasts
- Reduction in energy costs and emissions

Efficient supply and consumption of energy
Siemens VAI provides a full spectrum of services to ensure that automation & electrical systems operate at a constantly high performance level over the entire life-cycle of a plant.

Individually customized service packages are combined to assist producers in the iron & steel industry in utilizing the full potential of their production units. In the worldwide Siemens network, a team of highly skilled engineers is available to support the customer’s automation staff.

Consulting and on-site surveys
Experience of more than 1,000 automation projects for the metals industry is the basis of our expertise. For both new and upgrading investments, the respective technological and economical aspects are evaluated in close cooperation with the customer. An assessment of the project scope followed by a proposal of benefit-oriented solutions and a tight completion schedule ensure a successful project outcome.

Training packages
Qualified automation personnel is a key factor for highest plant availability, performance and product quality. We offer tailored training packages to ensure that our customers’ staff is fully trained and capable of operating the installed automation systems. The relatively minor investment cannot be compared to the major benefits achieved in overall plant performance.

Technical assistance and on-site services
Dedicated automation engineers are available to assist company staff in detecting, analyzing, and solving all electric and automation-related problems. Our range of services can be greatly enhanced with the installation of online data links. Such links provide perfect support for utilizing the local Siemens automation specialists.

Remote service capability
Remote Access (cRSP = common Remote Service Platform) is a prerequisite for services such as remote diagnosis or remote data analysis. It allows our service specialists to provide expert support from any place in the world.

Spare part logistics
Spare part services range from the supply of single spare parts to acting as a single source for the entire spare parts supply.

System upgrading
To keep the plant at the maximum performance level and to ensure the latest technology available for implemented automation systems we offer economic upgrading and optimization packages reflecting state-of-the-art solutions.
**Modernization packages**
We have a long tradition of providing the metallurgical industry with both integrated systems as well as individual technological and automation packages.

Because of the modular design it is possible to install such packages as stand-alone versions or embedded into existing environments. In-house experience in software and hardware engineering is the key to achieving the fastest project implementation and start-ups.

**Annual service contracts**
Annual service contracts provide economic, fast and non-bureaucratic support carried out by our experts to overcome bottlenecks and secure fast trouble shooting routines at small investment costs. Our customers benefit from our expert’s knowledge regarding complex functions of the automation systems.

Local Siemens experts are often already integrated during the project phase of big investments and are therefore highly qualified to give our customers technical support at agreed response times.

**Metals Service & Support Center**
Many production plants operate for several decades. It is only natural that in the course of time a diverse automation landscape emerges, with a confusing and barely manageable number of individual systems.

With the Siemens service concept surrounding the Metals Service & Support Center (MSC), we are offering plant operators appropriate assistance ranging from a round-the-clock telephone hotline and help desk to the preventive replenishment of production-critical components. IT support based on web services and remote linking of the plants guarantees that the relevant information is quickly available when any disruption needs to be dealt with.

**Main benefits:**
- Trouble-free and reliable operation, increased availability, constant high, overall performance
- Fast automation and process support due to agreed response times
- Ensured investment value
- Secure expert’s knowledge regarding complex functions of automation systems
- Fast direct point-to-point connection to ensure safe communication
The information provided in this brochure contains merely general descriptions or characteristics of performance which in actual case of use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

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