THE ROAD TO INDUSTRY 4.0
AUTOMATION FOR THE METALS INDUSTRY
Dear Customers,

What will the smart steel plant of the future look like?

At the Electrics & Automation division of Primetals Technologies, we have thought long and hard about what developments can be expected in the next 10 to 20 years in terms of digitalization. And while some variables remain, one thing is certain: The road to Industry 4.0 will be specific to every single steel mill. It will depend on the level of automation already implemented at the plant, and on the challenges and targets set by the mill’s owner.

It is our mission to support you in achieving new levels of sophistication in the automation of your plant. We would like to offer you the consultation you may require to form a detailed development strategy for your facilities and operations. It is clear to us that aspects such as the condition of your equipment and the demands placed on you by your own customers will greatly influence the goals you will want to set.

Enclosed, you will find a compendium of packages. It addresses some of the most prominent challenges faced by today’s steel producers, such as:

• Reduction of production costs
• Reduction of energy consumption to comply with changing legislation
• Improved product quality
• Flexibility in production
• Safety and environmental considerations
• Ease of use and operator assistance
• Maintenance and long-term support
• Logistics

We are convinced that these packages will give you a head start on your journey toward Industry 4.0, and look forward to having deeper discussions with you on how to obtain the results you are looking for.

Yours sincerely,

Hans-Jürgen Zeiher
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### LEGEND OF KEY PRODUCT BENEFITS

The modernization packages of Primetals Technologies were designed to future-proof your metals-production operations. Developed to optimally serve your needs, they all bring numerous substantial benefits. We are therefore pointing out the most relevant advantages of each solution at the end of its section.
Imagine your steel plant as an orchestra where all components work in harmony to manufacture products of highest quality. The “smart” plants of the future contain equipment that is interconnected and can be orchestrated with ease to deliver unparalleled efficiency and reliability.

“Instruments for the digital era of steel” is the slogan that Primetals Technologies has created to mirror the concept behind its new and future-proof equipment-integration approach. It is based on the notion that all components of your plants need to be ready to meet future challenges, and it is driven by three goals:

• The production quality of a steel plant should be as reliable and consistent as possible.
• The production chain should be adaptable to respond to specific customer requests, changes in raw materials, and other factors.
• Any steel producer worldwide wants to lower production costs and increase output.

Our Metals Orchestra concept reflects today’s requirements for a fully digitalized facility in the metals industry. There are striking parallels between the players in an orchestra and the units in a metals-production plant.

In an orchestra, all musicians need to be able to play perfectly just by themselves as well as alongside each other. The same is true for a steel plant, where each production unit has to be highly optimized in itself but is also required to flawlessly work together with all other equipment of the production chain. To achieve a high-quality production, great flexibility, and exceptional productivity, all units within the complete production chain need to be in harmony.

Every single musician of an excellent orchestra has to be thoroughly trained to reach perfection. He or she also needs a good and well-maintained instrument and the correct music sheet to lay the basis for a proper orchestration of all individual efforts. In metals production, each production facility needs to fulfill certain requirements to participate in a digitalized production setup.

So what does a plant have to implement in order to reach a state where its individual units can be directed just like the players of a good orchestra? We have developed many solutions to bring you one step ahead to turn your plant into a world-class “Metals Orchestra”. Find out more on the following pages.
PRODUCTION MANAGEMENT SOLUTION FOR THE METALS INDUSTRY

Production-management systems for steel plants should ideally cover the entire metals production process from iron- and steelmaking to rolling and processing to shipping of the final product.

At the core of the PMS lies the capability to evaluate whether it is feasible to manufacture a given product with the available plant equipment, and to determine exactly how the production process will be executed. To enable this kind of sophisticated assessment, the PMS requires extensive knowledge about the explicit and implicit processes taking place at every step of the steel-production chain. It needs to incorporate detailed information about both the production process with all associated equipment, and the transformation that the product itself undergoes until it is finalized. Primetals Technologies has laid the necessary groundwork with its Through-Process Optimization technology and know-how related services and incorporates those now into its Production Management Solutions.

OPTIMIZE YOUR FACTORY WITH OUR PRODUCTION MANAGEMENT SOLUTIONS

The PMS plans and schedules orders according to plant utilization, and considers machine capabilities and throughputs as well as planned maintenance efforts and temporary equipment deficiencies. This approach allows steel producers to dynamically enforce a strategy of highly customizable end-products, and they no longer need to restrict themselves - or their customers - to a static product portfolio. The steel producer’s sales team also profits immensely from the PMS, as the system makes it easy to determine what products can be delivered within what time frame. In the end, the ultimate beneficiary is of course the producer’s end customer, who profits from faster order fulfillment and a greater degree of freedom in choosing optimal product specifications.

PLANNING AND SCHEDULING

- Anticipation of future demand
- Material-flow optimization
- Capacity utilization
- Material allocation
- Order and line scheduling
- Evaluation of planning, KPIs

PRODUCTION MANAGEMENT

- Order-based production management
- Manufacturing execution
- Raw-material and stock management
- Production tracking
- Management of production equipment

QUALITY

- Comprehensive quality from definition through quality control
- Seamless integration and application of Through-Process Optimization
- Handling of quality deviations by integration of deviation management with production control

LOGISTICS

- Stock management
- Order-based transport coordination
- Transport optimization and execution
- Shipping and delivery

MAIN BENEFITS

- Optimal plant and equipment utilization through planning and scheduling
- Reduced order-turnaround time
- Reduced inventory
- Improved delivery performance
- Higher product quality
- Lower production costs
- Lower energy costs
- Reduced logistics costs

The production-management solution offered by Primetals Technologies is based on PSImetals, a comprehensive software suite that provides a large number of modules specifically developed for the metals industry. It is a product that has already proven its merits in numerous steel-production plants worldwide. The product is continuously developed by PSI, a German-based company Primetals Technologies forged a partnership with in the summer of 2016. As a result of this cooperation, customers receive perfectly matched, complete solutions from a single source - consisting of equipment, basic automation, and process automation from Primetals Technologies, as well as a production-management system (PMS) that combines the deep metallurgical know-how of Primetals Technologies with the PSImetals software product of PSI.
CHALLENGE
State of the art process optimization is doing an excellent job for what it is designed for: the optimization of individual production units. Recently the quality requirements by the final customers, the increased need for seamless process and quality documentation as well as extremely demanding new steel grades have created an urgent need of optimizing and documenting the entire production process in a holistic way.

To meet these demands Primetals Technologies has introduced the Through-Process Optimization (TPO) package, which allows the digital interconnection of various production units, the digitalization of know-how and the quality control and documentation along the entire production chain.

THROUGH-PROCESS QUALITY CONTROL (TPQC)
TPQC covers the collection and processing of data for the production lines from the liquid phase to the finishing and packing lines. It incorporates information from sensors, automation packages, laboratory systems as well as special measurements such as inspection systems and assigns them to the exact location in the (semi-) finished product throughout the entire production process. With its exact tracking of intermediate steps in the production process it allows:

- In-depth process data analysis based on time or length
- Quality and process documentation with long term data storage and data evaluation via business intelligence and data analytics

- Statistical process control and key performance indicator analysis
- Digital assistant for rule based quality control and assessment

THROUGH-PROCESS KNOW-HOW (TPKH)
Primetals Technologies supports you with its own accumulated know-how that is stored in the digital assistant covering every stage of the value chain: from innovation, sales and project execution to commissioning, best practice operation and service. We can assist you with your own experts and with external consultants providing:

- Excellence in process and metallurgical assistance
- Development of new steel grades
- Assistance in root cause analysis, process optimization or trial runs
- Support in setting up and modifying the TPQC package

EXPERIENCE FROM FIRST INSTALLATIONS
TPQC has been installed in plants that are located in different locations but belong to one production chain. Immediate benefit was that downstream facilities had fast and intuitive access to process and quality data from upstream entities and vice versa. For the first time analysis of process data together with surface inspection information could be done in one shot and could be used for coil grading, defect cause analysis as well as production optimization. The integration of a big data analysis tool along with the support provided by experienced metallurgists and data analysts proved to be extremely successful: when problems arose in the production of a critical steel grade, root causes could be found in the set up parameters along the entire production chain. By inserting this know-how in the digital assistant, the production process could be improved in very short time.

OUTLOOK
TPQC is one part of the digital unity comprising also the PMS and the MAT packages. The mid-term view on digital unity is that information will be flowing in between the systems and automatically adapting the aspects of production i.e. quality, production planning as well as maintenance according to machine learning algorithms already in place or still to come.

MAIN BENEFITS
- Sustainable overall product quality and production efficiency
- Fast and intuitive access to production and quality data
- Defect root cause analysis speeded up by factors
- Digital knowledge management for the entire production process
- Efficient and quick development of new steel grades
- Built-in machine learning
- Automatic grading of the final products
- Support for claim management
Excellency in maintenance reduces risk and improves performance and MAT helps you get there. Primetals Technologies uses all data available, plus its industry-specific expertise to transform unproductive and time consuming maintenance routine into a smart asset management program, allowing maintenance decisions to be made strategically and more dynamically. With MAT, your workshop is now just a click away from all data history about a particular plant part, how often it has needed repairs, when was the last time it had to be replaced, which improvements have been made. Through data analytics, maintenance can run smoother: predictable, better planned, allowing maintenance staff to focus on creating value to your product, reducing ownership costs and boosting productivity.

MAT SYSTEM
MAT system is the solution that is much more than a Computerized Management System: it actually walks you, step by step, to a fully digitalized Asset Management Program. It enables and assists your team with maintenance and management of all your resources, by offering decision making support and making sure that staff’s tacit knowledge is transformed into explicit knowledge. As a member of the Digital Unity network, MAT can share its information and knowhow with other networks to reach an optimal system for all systems. MAT is portable, it can be on tablets, which allows sharing information and feedback on demand, as well as instructions. MAT is a global software as a service, the perfect solution to keep companies competitive.

MAIN FEATURES OF THE MAT-SYSTEM:
• Traditional Maintenance Management System functionality
• Full asset history
• Maintenance assistance with rule-based suggestions (Rule Editor)
• Advanced Planning and Scheduling
• Graphical resource deposition
• Management Cockpit with dynamic Reports and Dash-boarding
• Improvement and Deviation management
• Interfaces to ERP, Condition Monitoring System (CMS), Level 1, Level 2 and Data Mining Platforms
• Interfaces to other Digital Unity Members
• Mobile Works Execution
• On Premise or Off Premise as software as a service (SaaS)

MAT KNOW-HOW
Four smart modular packages:- Predictive Maintenance, Planning & Shutdown Optimizer, Reporting & Business Intelligence and Strategic Asset Management- are there to make customers achieve superb maintenance, step by step. MAT can come pre-configured and loaded with everything you need: from criticality assessments and maintenance strategies for specific equipment to procedures, documentation and checklists for responding to specific alarms, bringing with it decades of domain expertise and intelligence. MAT has decision alerts which automatically answer to questions like: What must be done when a specific alarm goes off? What are the features to take into account to schedule a service? Should you schedule a service or wait until the part fails? Can you postpone an inspection until after the next big order? Will it pay off? All these questions and more will be answered by MAT, always taking into account profit maximization, minimizing waste and saving up resources. On top of that, MAT saves and analyses all information related to cases, creating a database that will be available for further analysis.

MAT is a must have for superb steel plant maintenance and the key to outpace competition!

MAIN BENEFITS
• Reduction of maintenance cost
• Increase in maintenance productivity
• Enabling and building maintenance domain know how
• Optimization of maintenance operation and asset performance
• Possibility in analytics on maintenance supporting strategic decisions
• Ensuring interface to ERP, L2, L1, CMS
Primetals Technologies offers a comprehensive condition monitoring (CM) portfolio for the metals industry, ranging from stand-alone packages, to modular and scalable systems, plant-wide solutions, and customized services. Information from several plant levels is integrated, carrying not only process and equipment but also metallurgical and automation know-how. By detailed analysis a solid basis for high-end predictive and proactive plant maintenance is provided.

**OUR SOLUTION**
Condition monitoring is one of the key technologies for the digital transformation. It helps to avoid unplanned downtimes and save associated costs. Thus, plant availability and productivity are considerably raised.

As part of its CM portfolio Primetals Technologies features a Condition Monitoring System (CMS) which employs the principles of edge computing, facilitating efficient interfacing with existing automation and higher-level systems such as Computerized Maintenance Management Systems (CMMS) and Enterprise Resource Planning (ERP) systems while guaranteeing physical proximity to the machinery.

**INFO BROKER**
The Info Broker is the web-based front-end view of the CMS which gathers distributed data for the user, integrates it into one central platform, visualizes it and optionally uploads results to a back-end application, for example as a basis for various data based services or up-to-date and safe cloud solutions. In addition to the established colored alarm messages reflecting the current status of the monitored equipment and processes, the configurable Info Broker provides more technical details like long-term trends, latest key performance indicators etc., and reports any detected abnormalities to the production and maintenance teams allowing for fault isolation. Through individualized views and report classifications, the Info Broker’s output can be adjusted to the needs of different user groups, for instance e-mail notifications for the status of certain critical equipment. The Info Broker might also be integrated into an existing visualization.

**EVALUATION SYSTEM**
The evaluation system is basically designed for read-only access which allows data acquisition via various interfaces and supports graphical engineering of analysis and diagnostic tasks. The results are sent to the Info Broker while the raw data is stored in the evaluation system.

**CONDITION MONITORING FUNCTIONS**
Due to the customizability, modularity and scalability of the CMS, the user can choose the configuration that fits the needs best. Numerous monitoring functions are available ranging from common solutions for pumps, valves, drives, weighing equipment, vibration monitoring, leakage detection, oil analysis etc., to plant and application specific analyses, e.g. hearth wear model of blast furnaces, monitoring of slowly rotating bearings as used for steelmaking converters and ladle turrets, roll eccentricity, bridge rail slippage and spindle monitoring in rolling mills.

**SERVICES**
The CMS is complemented with remote, data based and on-site services including:
- Provision of frequent reports with expert evaluation and recommendations for further actions
- Expert services on-site
- On-demand support in case of critical events
- Adjustment of the CMS to the current needs
- Temporary leasing service

**SYSTEM SECURITY**
The CMS is completely separated from the production process. The plant maintenance organization is able to work with the system, adapt and scale it at any time without affecting the operation of the plant. It is an ideal access point for secure remote services - which are only granted to authorized personnel - without connection to or interaction with automation, control and production systems of the plant.

**MAIN BENEFITS**
- Focused and holistic view on equipment and process condition
- Optimized maintenance activities
- Higher plant availability due to fewer downtimes
- Optimal utilization of equipment lifetime
- Reduced maintenance costs due to early fault detection
- Increased health status of plant
- Increased energy and plant efficiency
- Maintaining constant product quality
YOUR CHALLENGE
Increasing competitive pressures along with fluctuating demand create a serious impact on the price of all types of steel products. Continuously rising costs for energy, raw materials and transport make it essential to optimize both operating and maintenance costs.

To ensure a steady output of high-quality products, optimization on a regular basis is a must. Periodic maintenance is mandatory to avoid unplanned shutdowns, which usually result in expensive production losses.

OUR SOLUTION
To improve both efficiency and performance, Primetals Technologies as one of the leading plant builders worldwide, offers a full bunch of services for all kind of mechanical, hydraulical, mechatronical and electrical & automation issues.

ADVANTAGES OF PRIMETALS TECHNOLOGIES ELECTRICAL & AUTOMATION SERVICES
• Global presence which allows access to the Primetals Technologies expert pool
• Increased plant availability
• Electrical and automation services tailor-made for your specific needs
• Spare part expertise from a single source of contact
• Extended life-time of the automation systems

YOU LOOK FOR THE RIGHT SPARE PARTS...
Our global service team serves as a single-source partner and provides high quality spare parts fast, reliably and cost-efficiently. Moreover Primetals Technologies offers repair services for selected parts and replacement solutions for outphased material. Visit us also on our webshop m.buy and learn more about a customized purchasing platform as well as new possibilities for documentation services at our m.doc.

YOU LOOK FOR CONTINUOUS SUPPORT OF THE INSTALLED AUTOMATION SYSTEMS...
Annual service contracts are the perfect way to get access to our global pool of experts. You can expect fast, unbureaucratic support via telephone, email or secured remote connection. With our lifecycle services we aim to keep your automation systems on a consistently high level by instant trouble-shooting, continuous small modifications, and add-ons, as well as support during and after planned maintenance shut-downs.

YOU LOOK FOR LOW-COST IMPROVEMENTS WITH SHORT ROI FOR AN OPTIMIZED MAINTENANCE...
Primetals Technologies is permanently developing small automation solutions helping our customers to streamline maintenance processes and to cut maintenance costs. Learn more about our products in the following chapters.

YOU LOOK FOR TAILOR-MADE TRAINING...
Discover possibilities on m.academy located at the newly launched m.space platform.
m.space

m.space is the new web-based solution of Primetals Technologies for steel-mill management through a unique “software as a service” package. m.space lets metals producers quickly and easily order spare parts with m.buy, obtain a new hoisting drum with m.crane, train staff members with m.academy, or keep documents at hand with m.doc. Discover the many sides of m.space in this overview.

m.academy

LEARN, IMPROVE, SHARE.
In today’s globalized and interconnected world, knowledge is power and having the know-how provides a decisive advantage over the competition. m.academy is the first online training platform of Primetals Technologies. It offers a growing number of courses and e-learnings for the various sectors in the steel industry. Improve the technological and operational skills of your employees so that they can reach their full potential. Find the right package and leave the rest to Primetals Technologies’ m.academy.

m.buy

SPARE PARTS, ALWAYS AT YOUR FINGERTIPS.
m.buy is an spare parts catalog tailored for your Primetals Technologies plant. The catalog allows inquiries and procurement of spare parts regardless of time and place. Through various search functions m.buy enables steelmaker to search for spare parts in a structured way. By linking drawings with parts lists, spare parts can be easily identified. m.buy enables quick and easy procurement of spare parts and supports maintenance and avoiding delays and an unnecessary plant shutdown.

m.doc

TECHNICAL DOCUMENTATION, STORED SAFELY AND ORGANIZED.
With m.doc the Document Management System from Primetals Technologies the plant documentation is organized and ready for use. Schematics, drawings, parts lists, instructions, etc. are managed with m.doc structured and are easily to find at any time. Thanks to a note function provided by m.doc and the linking of the service from Primetals Technologies, the documentation of your plant will be up to date even in the case of changes.

m.crane

SAVE TIME AND MONEY WITH AUTOMATED DESIGN.
m.crane is an automated online engineering service for hoisting drums of cranes. Guided by the program, the necessary parameters (weight, height, speed, rope drive etc.) are entered and the drum will calculated and designed in less than 15 minutes. The design documents (drawings, 3D files, calculation reports) will provided at the end of the process. The system also offers a convenient way to directly send the calculated specification of your drum as a quotation request to Primetals Technologies.

WANT TO KNOW MORE?
GO TO
primetals.com/mspace
IRONMAKING
OPERATIONAL TARGETS
The ultimate aim in pelletizing is to produce consistently high pellet quality at high productivity rates and low conversion costs—while at the same time fulfilling the emission limits imposed on operation. Different shift operators tend to operate the machine in different ways. Equalizing to optimized operational decisions over all shifts will lead to maximum production of quality pellets at minimal production costs.

COMPLEX PROCESS INTERACTIONS
Owing to the mutual interdependence of the different pelletizing process steps, precise simulation is essential to reliable process optimization.

PROCESS OPTIMIZATION
Primetals Technologies has developed the Expert System for pelletizing plants, which is supported by advanced process models that provide additional insight into the process and support operational decisions. The pellets on the surface, the bottom, the walls, and the center face different process conditions, so the process models predict, evaluate, and track these conditions on a fine-meshed grid in all cross sections throughout the whole process chain. Extended simulation capabilities support the identification of optimal operational points—in order, for example, to optimize the trade-off between the energy supply to the different process steps in the drying and induration zones.

EXPERT SYSTEM
The Expert System for pelletizing plants models the knowledge of experienced pelletizing process engineers and operators, the cause-and-effect relationships of process disturbances, metallurgical know-how, and the prevailing control philosophy. It thus monitors and foresees the process status, provides graphical displays, counteracts process disturbances, suggests control measures, and explains suggested measures in the form of verbal messages. The Expert System uses the information from the Process Information and Data Management System and the advanced process models to standardize the operation, achieve stabilized product quality, and lower fuel consumption. Thus process-control practice becomes more uniform and efficient across different shifts.

MAIN BENEFITS
- Quality improvement: typical reduction of standard deviation of product KPIs by 5 to 10%
- Increase in pelletizing production of up to 3%
- Energy consumption reduced by up to 4%
- Typical pay-back time of less than one year
SINTER PLANT OPERATION CHALLENGES
They may not be the main focus for investments, but sinter plants often hold significant potential in terms of improvements that can be made to reduce conversion costs. One measure with one of the shortest payback times is, in many cases, the installation of a VAiron Sinter Process Optimization system. Given the large variety of raw materials that are used, the delay caused by long-belt conveyors, the interaction of the material on the strand with the ignition of the material and the propagation of the flame front, and increasingly stringent environmental regulations, process optimization is not as straightforward as the slow motion of the sinter strand might suggest.

PROCESS OPTIMIZATION
In order to achieve optimization goals under these conditions, a process optimization system must provide sophisticated tracking, diagnosis, and control models to ensure stable, reliable, and efficient production.

The process models cover calculations and predictions as the burn through time (based on the permeability) the sinter product chemistry (considering the loss on ignition) and other important process parameters. They closely interact with the Expert System which monitors the process 24 hours per day, executing corrective actions in a closed loop where necessary.

EXPERT SYSTEM
In closed-loop operation, the system will execute all necessary changes fully automatically. The Expert System—a rule-based decision system—counteracts process fluctuations caused by changes in the rawmix composition and quality, or process conditions. The sooner the system responds to an abnormal or changing process situation, the smoother the overall sinter operation will be. Accurate timing of control activities and anticipation of disturbances are critical to maintaining high production rates at low costs.

HIGHLIGHTS
With numerous successful installations in place, Primetals Technologies is able to guarantee significant improvements in product quality and reduced fuel consumption for sinter plants using the Expert System solution. In conjunction with sinter process control and process optimization systems from Primetals Technologies, the Expert System ensures high productivity and product quality as well as stable and shift-independent operation 24 hours a day. The system can be easily integrated into an existing automation environment, and the standard period of amortization can be expected to be less than a year.

MAIN BENEFITS
- Quality improvement: typical reduction of standard deviation of sinter basicity by 5 to 10%
- Increase of sinter production by up to 5%
- Energy consumption reduced by up to 3%
- Typical pay-back time of less than one year
Primetals Technologies is the leading supplier of automation systems for the iron and steel industries, and in particular blast furnace process optimization systems, which are currently operating in more than 70 installations worldwide—with furnaces of all sizes, ranging from 500 to 5800 m³.

The VAiron Blast Furnace Optimization system—the package of solutions for automated blast furnace operation—was developed in close collaboration with voestalpine Stahl in Linz, Austria. The technology is based on sophisticated process models, artificial intelligence, mass and energy balances, a closed-loop Expert System for fully automatic operation, and other advanced software.

**STANDARDIZED OPERATION**

The ultimate aim in blast furnace operation is to achieve stable furnace conditions and stable hot-metal quality for the lowest possible production costs. The VAiron Blast Furnace Optimization system monitors the process 24 hours per day, executing corrective actions in a closed loop, if necessary. The system thus counteracts changes in the process caused by fluctuations in process parameters such as raw-material quality. In addition, the Expert System also provides explanations for its decision-making process for full transparency.

**KNOWLEDGE BASE**

A vitally important component of the system is its knowledge base, which was developed in close collaboration with voestalpine Stahl and which allows steel producers to benefit from the vast experience gathered from numerous blast furnace projects. This knowledge base can be modified and extended to adapt to the customer’s specific operational philosophy and practices.

**HIGHLIGHTS**

The Expert System, which supervises and controls the blast furnace, helps to avoid drastic control actions and critical process situations by reacting quickly as conditions change, subsequently increasing furnace lifetime. Thanks to the high maturity of the system, closed-loop operation is possible even for complex control actions such as the fine-tuning of burden distribution.

Rule-based operation equalizes operational decisions over all shifts, leading to highly stable furnace conditions, consistent hot-metal quality, and reduced coke rate. As a result, the investment typically pays for itself within a matter of months.

**MAIN BENEFITS**

- Typical savings for coke > 5 kg/tHM
- Quality improvement: typical reduction of standard deviation of product KPIs of 10%
- Flexible raw material utilization
- Standardized, shift-independent operation
- Increased productivity
- Typical pay-back time of less than one year
# DRIpax

## Process Optimization for Direct Reduction Plants

**Seamless DR Plant Operation**
Maintaining smooth and stable operation of Midrex direct-reduction (DR) plants in order to produce consistent-quality, direct-reduced iron (DRI) can be a demanding task. This task is supported by DRIpax, an advanced process optimization system leading to considerable savings in the downstream area or by higher product prices on the market.

**Prediction of Product Quality**
One of the greatest challenges for direct-reduction plant operators is having to cope with delays of several hours between a process change and the arrival of laboratory measurements for the resulting product. Primetals Technologies and partner Midrex Technologies have therefore devised a new Level 2 process-optimization system called “DRIpax,” which accurately predicts product quality based on first principle models, and delivers the result hours faster than any laboratory. The ability to predict metallization and carbon levels quickly following a change in the reduction process or in raw-material properties enables better control over DRI consistency. DRIpax thus typically reduces deviations from target values of metallization and carbon by about 30%.

**DRIpax Expert**
The DRIpax DR Plant Expert System is a rule-based advisory system and was created to assist panel operators in the decision-making process and—if the operator so chooses—to make data-driven decisions entirely on its own in “closed-loop” mode. Among other things, the system helps to avoid inconsistencies in plant operation owing to shift changes.
At the heart of the Expert System is a knowledge base that incorporates comprehensive metallurgical and automation know-how from Primetals Technologies and Midrex, as well as plant-specific operational knowhow and control philosophies of individual customers.

**Standardized Operation**
The diagnoses, corrective actions, and explanations given by the Expert System are based on the logic defined in the knowledge base. An adaptive system design makes it easy to expand and adapt the Expert System to each individual type of Midrex DR plant. If required, diagnoses or corrective actions can easily be adjusted or added depending on the particular plant situation.

In conjunction with the full scope of the DRIpax process optimization system, the Expert System represents a major step toward fully automated quality control in DR irsmaking that is uniform across all operators and allows for shift-independent “best practice” plant operation.

**Main Benefits**
- Quality improvement: typical reduction of standard deviation of product analysis by ~30% both for:
  - product carbon content
  - product metallization
- These improvements lead to significant savings in the downstream plants using the DRI
- Typical pay-back time of less than one year
IRONMAKING PLANT CONTROL
PROCESS CONTROL FOR BLAST FURNACES, SINTER-, PELETIZING-, AND DR-PLANTS

Primetals Technologies is the leading supplier of automation systems for the iron and steel industries with a total of over 5000 successfully implemented projects.

The extensive process expertise of our experienced specialists, combined with innovative instrumentation and state-of-the-art automation technologies, makes us a one-stop-shop for cost-effective solutions.

A reliable process control system, incorporating highest IT security levels, is key to the transition to smart manufacturing, often referred to as “Industry 4.0”.

VIRTUALIZATION
Established and efficient techniques such as server virtualization increase system flexibility and availability and help to reduce administration, hardware, and maintenance costs.

SIMULATION
Complementing the process control system, Primetals Technologies offers extended simulation systems for all process in- and outputs with a simulated system response, including metallurgical modeling of the underlying process. For instance, a trainee operator can initialize a sequence and will receive immediate feedback about the eventual consequences. The simulation system is therefore ideal for training new process engineers and operators. Furthermore, experienced operators can use it – in a way similar to a flight simulator – to train for the handling of critical plant situations. Finally enhancements to the process control system can be tested with worst-case scenarios before any application in the real-world production environment.

SAFETY INTEGRITY LEVEL (SIL)
To ensure maximum operational safety for both personnel and the plant equipment, it is crucial to be aware of the hazards involved in the metallurgical process. Based on extensive process know-how, Primetals Technologies is able to support process and hazard analysis (HAZOP) based on the IEC 61511 standard as well as risk analysis pursuant to EN ISO 13849. All safety-related functions are integrated into the process control system to safeguard personnel and equipment without compromising production.

TECHNOLOGICAL PACKAGES
Primetals Technologies has developed technological packages for critical plant areas. For example:

RAW MIX / STOCK HOUSE CONTROL
The innovative material-based charging system allows for a dynamic assignment of materials to the stock house bunkers, supporting flexible utilization of raw materials.

BURDEN DISTRIBUTION CONTROL
Smart distribution solutions are available for all common types of material distribution systems: ring distribution, full rings, and weight- or time-based distribution, as well as innovative spiral charging.

HOT STOVE CONTROL
Optimized combustion control comprises flexible sequencing for either three or four stoves.

IGNITION FURNACE CONTROL
Safe and reliable operation of the ignition hood to achieve a stable flame front at minimized energy cost.

Similar packages are available for other ironmaking plants.

MAIN BENEFITS
• Process know-how & automation competence
• State-of-the-art equipment & automation technology, including virtualized solutions
• Modular, extendable and upgradeable automation packages
• Extensive simulation package
• Universal application of latest automation technology
• Structured programming – easy to maintain
• Context-sensitive, integrated online help/documentation
• Fast project implementation and start-up
STEELMAKING
BOF Optimization is the key to implementing a flexible and high-quality BOF converter steelmaking process. Intelligent BOF converter automation includes dynamic production control with optimization models for minimal production costs, an optimum raw material strategy, user-friendly operator guidance, modern process visualization, and comprehensive heat tracking with flexible reporting tools.

FUNCTION
A comprehensive bundle of process models optimizes and controls the steelmaking process. The objective of the Steel Expert BOF model package with respect to quality and flexibility is to achieve reliable hitting rates for the carbon content and the steel bath temperature at the end of the blowing phase. A set of tailored melting profiles are defined for all steel grades in order to ensure stable and uniform production. The produced heat is released in full compliance with the defined temperature and chemical composition as required by the production plan and the defined steel grade.

The models can be applied to the BOF process with varying scrap-to-hot metal ratios, to operation with and without bottom stirring, hot metal with high and low silicon and/or phosphorous content, and to combined blowing (e.g. DeV + DeC process). The Steel Expert BOF process model package ensures dynamic process guidance by means of a cyclic online model, a prediction model for the simulation of the entire BOF treatment, and a number of set point models for the various production steps. Integrated heat tracking stores all process-related data for heat-specific reporting and data analysis tools.

The new user-friendly HMI, also known as pure.hmi, can be configured according to the specific needs of the user. It guides the operator through all steps of production to ensure a consistent and reproducible product quality.

OPERATIONAL EXPERIENCE
Successful BOF Optimization applications show reproducible and stable hitting rates for temperature and carbon at end-of-blowing for BOF steel melt shops equipped with a sub-lance measurement and/or an offgas analysis system. The cost-optimized charge mix calculation results in considerably lower conversion costs. Finally, an integrated alloying model ensures best alloying practice during BOF production and tapping.

INCREASING DEGREE OF AUTOMATION AND INDUSTRY 4.0
BOF Optimization helps to address variations in raw material behavior and ensures high-quality steelmaking with minimal production costs. BOF Optimization is the cornerstone of steelmaking and metallurgical process know-how for any steel grade. It therefore provides a very important link between requirements for today’s steelmaking and all future developments in the shift toward Industry 4.0 strategies for fully integrated steelmaking. In combination with fully automated probe sampling systems and automation solutions for automated converter tapping, BOF Optimization represents an excellent springboard to the next level of melt-shop automation. Seamless automation solutions also have a positive influence on work safety and accurate process execution.

RELATED PRODUCTS
- Lomas - offgas analysis system
- Dynacon - dynamic process control for BOF steelmaking
- Automated converter tapping
- Slagmon - slag detection system
- Vaicon Slag Stopper
- Sub-lance measurement systems and probe manipulators
- LiquiRob - robot automation for steel melt shops

SERVICES
- Hardware engineering and equipment supply
- Software engineering and integration
- Advisory service for installation, erection, and commissioning

MAIN BENEFITS
- Full control of the BOF converter process - continuous online calculation and dynamic control of steel and slag properties using well-proven process models
- Optimization at its peak - optimal raw material strategy and automatic end-of-blowing control at minimal conversion costs
- Process visualization and operator guidance with a state-of-the-art HMI – user-defined screens, reporting tools for heat logging, delay handling, and alarm generation
- Well-established solution - based on decades of metallurgical experience and continuous system improvement

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New look & feel for BOF online process visualization.

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DYNACON
PEAK PERFORMANCE
BOF PRODUCTION
WITH DYNAMIC
PROCESS CONTROL

FUNCTION
Dynacon is the online calculation model and prediction tool for BOF steelmaking, which works in combination with a measurement of the BOF converter offgas, taking into account the actual analysis values for CO, CO2, and O2. The Dynacon model features a very accurate calculation of the temperature, weight, and chemical analysis of the steel and slag. The significant change in the offgas composition close to the end of the converter treatment allows the end-of-blowing time to be precisely calculated. Oxygen blowing is automatically stopped when the desired carbon target for the steel is reached.

LOMAS-DYNACON
Dynacon is an advanced process control and optimization system for BOF converters equipped with a continuous offgas measurement. Typically, Dynacon is used in combination with the extractive Lomas offgas analysis system, which determines all required values from the offgas composition. Lomas is a fast and reliable offgas analyzing system with high accuracy for all measured values. Its effective availability exceeds 99% under actual operational conditions.

The Dynacon model provides an automatic end-of-blowing control so that over-blowing of the heat and the unwanted re-oxidation of the iron in the raw steel can be avoided. The quantifiable benefits are improved hit rates for the desired carbon target and temperature values. The number of rebows decreases significantly and the iron (FeO) content in slag is smaller compared to a delayed end-of-converter blowing phase. Finally, the required amount of aluminum (Al) for de-oxidation is also reduced. An increase in BOF productivity is ensured because there is no need for additional measurements or to interrupt the blowing process.

FEATURES
• Full control of converter process via continuous online calculation and dynamic control of steel and slag properties based on offgas analysis
• Automatic end-of-blowing control
• Modeling and automation of different BOF practices, e.g., intermediate de-slagging
• Simulation of the complete converter treatment by Steel Expert prediction model
• Steel Expert setpoint model Steel Expert online supervision model
• Development tool for metallurgists to improve production practice
• Process visualization and operator guidance with a state-of-the-art HMI (pure.hmi)
• Comprehensive tools for plan data handling, reporting, delay handling, and alarm generation
• Heat tracking for integrated steelmaking

RELATED PRODUCTS
• Lomas off gas analysis
• BOF Optimization
• Automated Tapping for BOF converters
• SlagMon - slag detection system
• Vaicon Slag Stopper
• Sublance measurement systems and probe manipulators
• LiquiRob robot automation for steel melt shops

MAIN BENEFITS
• Dynamic control of the BOF converter process - continuous online calculation and dynamic control of steel and slag properties using well-proven process models
• Highest hitting rates for target values - narrow statistical spread windows for temperature and carbon
• Process visualization and operator guidance with a state-of-the-art HMI - reporting tools for heat logging, delay handling, and alarm generation
• Well-established solution - based on decades of metallurgical experience and continuous system improvement

SERVICES
• Hardware engineering and equipment supply
• Software engineering and integration
• On-site training for operation and maintenance personnel
• Advisory service for process improvements and fine-tuning of operations
• Spare part supply
AOD OPTIMIZATION
DYNAMIC PROCESS OPTIMIZATION FOR
HIGH-PERFORMANCE STEELMAKING

AOD Optimization is the key to implementing a flexible and high-quality AOD converter steelmaking process. Intelligent AOD converter automation includes dynamic production control with optimization models for minimal production costs, an optimum raw material strategy, user-friendly operator guidance, modern process control and comprehensive heat tracking with flexible reporting tools and state-of-the-art visualization.

FUNCTION
A comprehensive bundle of well-proven process models optimizes and controls the process throughout treatment in the AOD converter. The objective of the model package with respect to quality is to reduce treatment time, improve the hitting rate, and to ensure stable and uniform production. At the end of the AOD process, the heat is released in full compliance with the defined temperature and chemical composition, as required by the production plan and the steel grade.

The model package for the AOD process includes a complete pre-calculation for the heat. The pre-calculation warns the operator of any problems that may occur before the heat is started. The pre-calculation model is also the perfect simulation tool for technologists to optimize metallurgical practices or to develop new steel grades prior to physical production. The Steel Expert AOD model package features dynamic process guidance by means of a cyclic online model, a prediction model for simulation of the entire AOD production process, and a number of setpoint models for the various production steps.

The integrated heat tracking function stores all process-related data for heat-specific reporting and data analysis tools. The new user-friendly HMI, also known as pure.hmi, can be configured according to the specific needs of the user. It guides the operator through all steps of production to ensure a consistent and reproducible product quality.

OPERATIONAL EXPERIENCE
Successful AOD Optimization projects show reproducible and stable hitting rates for the steel bath temperature and the desired chemical composition within a very narrow statistical spread for all target values. The flexible software environment is well-established in the production of stainless steel and serves as a powerful tool for the kind of special steelmaking with extraordinary process requirements.

INCREASING DEGREE OF AUTOMATION AND INDUSTRY 4.0
AOD Optimization helps to address variations within raw material behavior and ensures high-quality steelmaking with minimal production costs. AOD Optimization is the cornerstone of steelmaking and metallurgic process know-how for special steel and provides an important link between requirements for today’s steelmaking and all future developments in the shift toward Industry 4.0 strategies for fully integrated steelmaking. In combination with fully automated probe sampling systems and automation solutions for automated converter tapping, AOD Optimization represents an excellent springboard to the next level of steelmaking automation. Seamless automation solutions also have a positive influence on work safety and accurate process execution.

RELATED PRODUCTS
- AOD top-blowing lance
- AOD drive damper
- LiquiRob robot automation for steel melt shops
- Horizontal measurement systems and probe manipulators

SERVICES
- Hardware engineering and equipment supply
- Software engineering and integration
- Advisory service for installation, erection, and commissioning
- On-site training for operation and maintenance personnel
- Advisory service for process improvements and fine-tuning of operations
- Spare part supply

MAIN BENEFITS
- Full control of the AOD converter process - continuous online calculation and dynamic control of steel and slag properties using well-proven process models.
- Simulation of the entire AOD process - calculation of necessary additions and gas consumptions.
- Process visualization and operator guidance with a state-of-the-art HMI.
- Comprehensive reporting tools - for heat logging, delay handling, and alarm generation.
- Well-established solution - based on decades of metallurgical experience and continuous system improvement.

New look and feel of the the common Level 2 Dashboard for process visualization.
Automated Tapping allows for a safe and fully automatic converter tapping procedure, including the control of vessel position, ladle car movement during tapping, as well as the positioning of the chute for ladle alloying. In combination with an installed slag identification system, e.g. optical or magnetic slag detection and a slag stopper system, there is minimal carry-over of converter slag in the teeming ladle.

**FUNCTION**

At the end of converter treatment, the operator initiates the Automated Tapping procedure by pressing the start button. The converter is automatically tilted to the initial tapping angle and a fully automatic tapping procedure is executed. During the tapping procedure, all of the equipment involved is coordinated simultaneously. The primary task of the operator is to monitor tapping progress. The position of the vessel and the ladle car, the ladle alloying system, and the installations for slag detection and the slag stopper are controlled by the software module. Multiple safety functions such as maximum tilting speed, minimum waiting time for each step, online weight monitoring, and ladle fill level detection are included with Automated Tapping. There is always the possibility for the operator to intervene at any time, either to meet special requirements resulting from exceptional tapping situations or to maintain operational safety. Automated Tapping is available for all converter types and for slag pouring at the end of the tapping procedure.

**FULLY AUTOMATED CONVERTER OPERATION**

The understanding of a fully automated operation is to execute the entire sequence of all required process steps for converter steelmaking charging - blowing - tapping & alloying in an autonomous manner. Following the trend of a fully digital production according to the cornerstones in Industry 4.0, then the Automated Tapping becomes an integral part beside BOF/AOD Optimization. The union of BOF/AOD Optimization and Automated Tapping is one important step towards time-optimal best practice steel production. In combination with comprehensive crane automation for hot metal handling, the complete converter steelmaking process is managed by the Automated BOF/AOD Operation (under regular production conditions). The primary task of the operator is to supervise the automatic mode and to implement measures in exceptional cases to force the current situation back to the regular process execution.

**SYSTEM FEATURES**

With Automated Tapping, a reproducible, standardized, and safe tapping procedure is implemented independently of the operator’s experience via the automatic calculation of relevant parameters. The ladle transfer car and alloy chute are positioned and controlled automatically. The application of Automated Tapping ensures greater operational safety thanks to remote control directly from the main control room; it is no longer necessary for an operator to leave the main control room for tapping. Potential causes of error are eliminated while the reliability of the tapping process is improved. Several implemented safety functions guarantee a smooth and safe tapping procedure.

- Full control of converter tapping procedure
- Automatic control of the vessel position, ladle car positioning, automatic alloying chute positioning
- Integration of the slag detection system and generation of trigger signal for the slag stopper system
- Module for automatic tapping control implemented in PLC
- Comprehensive layer operational safety concept
- Manual converter tapping maintained

**MAIN BENEFITS**

- Full automatic tapping procedure – best practice operation independent from operator’s experience
- Time-optimal tapping and minimal slag carry-over
- Comprehensive safety concept – to meet the latest standards for operational safety
- Maintain manual tapping – for training only
- Combination with BOF process control – implement a seamless control sequence: blowing-alloying-tapping

**SERVICES**

- Hardware engineering and equipment supply
- Software engineering and integration
- Advisory service for installation and commissioning
- On-site training for operation and maintenance
- Advisory service for process improvements and fine-tuning of operations
- Spare part supply

**RELATED PRODUCTS**

- BOF Optimization
- Dynacon
- SlagMon - Slag detection system
- Vaicon Stopper - Slag stopper
- Measurement systems and probe manipulators for ladle sampling
- LiquiRob robot automation for steel melt shops
EAF OPTIMIZATION
DYNAMIC PROCESS OPTIMIZATION FOR ELECTRIC STEELMAKING

EAF Optimization is the key to implementing a flexible and high-quality electric steelmaking process. Intelligent furnace automation includes dynamic production control with optimization models for minimal production costs, an optimum raw material strategy, user-friendly operator guidance, modern process visualization, and comprehensive heat tracking with flexible reporting tools.

FUNCTION
A comprehensive bundle of process models called Steel Expert EAF optimizes and controls the steelmaking process. The objective of the model packages with respect to quality and flexibility is to achieve reliable hitting rates for the carbon content and the steel bath temperature at the end of EAF treatment. A set of tailored melting profiles are defined for all steel grades in order to ensure stable and uniform production. The produced heat is released in full compliance with the defined temperature and chemical composition as required by the production plan and the defined steel grade.

The models are applicable to electric steelmaking with varying scrap to-hot-metal ratios, different scrap bucket strategies, and continuous HBI/DRI melting. The Steel Expert EAF process model package ensures complete process guidance by means of a cyclic online model, a prediction model for the simulation of the entire EAF treatment, and a number of setpoint models for the various production steps. Integrated heat tracking stores all process-related data for heat-specific reporting and data analysis tools.

The new user-friendly HMI, also known as pur.e.hmi, can be configured according to the specific needs of the user. It guides the operator through all steps of production to ensure a consistent and reproducible product quality.

OPERATIONAL EXPERIENCE
Successful EAF Optimization applications show reproducible and stable hitting rates for temperature and carbon at the end of the EAF refining step. In combination with an offgas analysis, a fully dynamic furnace control is implemented based on the measured behavior of the heat. The cost-optimized charge mix calculation results in considerably lower conversion costs. Finally, an integrated alloying model ensures best alloying practice during EAF production and tapping.

INCREASING DEGREE OF AUTOMATION AND INDUSTRY 4.0
EAF Optimization helps to address variations within raw material behavior and ensures high-quality steelmaking with minimal production costs. EAF Optimization is the cornerstone of steelmaking and metallurgical process know-how for any steel grade. Therefore, it represents a very important link between requirements for today’s steelmaking and all future developments in the shift toward Industry 4.0 strategies for fully integrated steelmaking. In combination with fully automated probe sampling systems and automation solutions for automated furnace tapping, EAF Optimization represents an excellent springboard to the next level of steelmaking automation. Seamless automation solutions also have a positive influence on work safety and accurate process execution.

RELATED PRODUCTS
• Lomas - offgas analysis system
• SlagMon - slag detection system
• Automated furnace tapping
• Manipulators for automated probe sampling
• LiquiRob - robot automation for EAF

SERVICES
• Hardware engineering and equipment supply
• Software engineering and integration
• Advisory service for installation, erection, and commissioning
• On-site training for operation and maintenance personnel
• Advisory service for process improvements and fine-tuning of operations
• Spare part supply

MAIN BENEFITS
• Full control of the EAF treatment - continuous online calculation and dynamic control of steel and slag properties using well-proven process models
• Optimization at its peak - optimal raw material strategy and automatic melting control
• Process visualization and operator guidance with a state-of-the-art HMI - user-defined screens, reporting tools for heat logging, delay handling, and alarm generation
• Well-established solution - based on decades of metallurgical experience and continuous system improvement

New look & feel for EAF online process visualization

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EAF HEATOPT
THE MOST EFFICIENT EAF CONTROL SYSTEM

CHALLENGE
Every heat is different. For safe, efficient, and environmentally compliant electric steelmaking, a thorough knowledge of all of the processes that influence EAF production is essential. For a holistic picture all the results, measurements and status figures have to be taken into account and processed for furnace optimization. Obviously, furnace optimization has to be carried out in real time in order to guarantee an efficient and reliable production process.

FUNCTION
The new EAF Heatopt system represents a holistic approach to optimized EAF furnace operation. EAF Heatopt controls the distribution of the primary energy sources (electrical power, chemical energy, and natural gas burner) in order to achieve the most efficient EAF operation possible for every heat. The available online-data from all installed offgas measurement systems and the actual slag foaming practice are considered in the mathematical optimization model. The combination of online measurements, data-based tools and intelligent calculation models helps the operator to increase overall EAF efficiency so that the furnace operates permanently at the minimum energy requirement for the given production conditions.

HOLISTIC APPROACH
The EAF Heatopt system collects all available process data from the installed online measurement systems as well as any model calculations for the EAF furnace in order to achieve optimum energy input for every heat. A detailed analysis of all process conditions is crucial to optimization. Online measurements, data-based tools and intelligent calculation models are all elements of the mathematical optimization tool and allow the most efficient furnace operation to be calculated. The EAF Heatopt controls the distribution of primary energy sources like electrical power, chemical energy, and natural gas burner input, as well as the auxiliary gas flows for oxygen, nitrogen, etc., and the coal injection for foaming slag practice. All inputs are calculated and controlled in real time throughout the entire heat.

ONLINE MEASUREMENTS
Proper working measurement systems are important for the EAF Heatopt system. For instance, the Lomas system (Low Maintenance Gas Analyzing System) is used as the extractive and self-cleaning offgas analysis system for the continuous measurement of CO, CO2, H2, O2, and CH4. A smart slag detection solution based either on the current harmonics or a carbon saturation model is required to implement an advanced foaming slag practice. In addition, a gas-flow measurement in the offgas duct provides more process-related information for an optimum, real-time furnace control scheme.

EAF HEATOPT MODELS
The general idea behind a holistic approach is that all EAF control actions are based on current process conditions and the currently measured furnace behavior. Since every heat behaves differently, a dynamic control scheme has significant advantages over a simple static EAF operation. A cornerstone of the EAF Heatopt system is that it combines the well-established calculation models and the results of online measurement systems with a supervising optimization tool for real-time heat optimization. The outputs of the EAF Heatopt are adjusted setpoints for EAF operation. The exact distribution of chemical energy input, electrical power, oxygen flow rates, control scheme for natural gas burners, and carbon injection rates at the EAF furnace are calculated to achieve best practice operation for every heat.

MAIN BENEFITS
• Reduced conversion costs – via variable energy mix (approx. 2$/t for recent US project)
• Optimized inputs for gas, oxygen, and carbon injection – real-time control solution
• Less energy and electrode consumption – due to optimal use of chemical energy
• Process visualization and operator guidance with a state-of-the-art HMI – user-defined screens, reporting tools for heat logging, delay handling, and alarm generation
• Advisory service for process improvements – metallurgy and fine-tuning of operation

RELATED PRODUCTS
• EAF Optimization
• Lomas - offgas analysis system
• Slagmon - slag detection system
• Measurement systems and probe manipulators for EAF
• LiquiRob - robot automation for electric steelmaking
MELT EXPERT
NEXT GENERATION ELECTRODE CONTROL SYSTEM FOR ELECTRIC ARC AND LADLE FURNACES

MELT EXPERT – THE SUCESSOR OF ARCO AND SIMELT
Melt Expert has been developed based on more than 35 years of experience with well known Arcos and Simelt Electrode Control Systems. The new system unifies the advantages of the previous solutions. New features like KPI indication, plant monitoring, customer orientated interfaces as well as sophisticated control strategies ensure most efficient production.

OPERATION DATA PROCESSING AND KPI EVALUATION
A novel touch screen design allows simple and fast access to process relevant data and displaying key values such as actual consumption figures, melting time, regulation quality etc. in the form of benchmark reports. Should there be a significant deviation from normal process parameters, related information comes alive and will be indicated.

ON BOARD PLANT DIAGNOSTICS
Acquired data from hydraulics, mechanics and electrics is put in relation to actual operating conditions. In this way the electrode control system itself and its auxiliary systems are permanently monitored.

So called health checks are performed automatically in regular intervals in which the functionality of measurement loops and output circuits are verified without disturbing the process. Continuous signal collection in combination with long-term-trend analysis allows the detection of shifts, deviations and creeping in malfunctions in a very early stage with the aim to predict a possible event or damage, before it happens.

CUSTOMER-ORIENTED USER INTERFACE
Target group orientated screens provide conditioned information for different user needs like melt shop management, electrical / mechanical maintenance, operators, etc. Designated screens support optimization and parameter tuning for process experts. Regularly revisions are simplified by a special maintenance mode.

ENHANCED CONTROL ALGORITHMS FOR INCREASED EFFICIENCY
Based on actual process conditions, control parameters such as set points or controller gains are automatically adapted by the system. Arc length will be modified according to process needs. This results in a higher melting efficiency and reduced energy consumption.

A new algorithm is avoiding arc extinction and increase the power input during boring phase.

An integrated loop gain linearization model transforms individual mechanical furnace characteristics and uniform the control loops. Thus the parameter setup will be simplified which results in faster performance run ups and less time needed for optimization

Standard state of the art protection functions are included as well as more advanced modules like countermeasures against electrode oscillation.

OPTIONAL TECHNOLOGICAL PACKAGES
For fully automated process control additional packages like foaming slag control, melt down control and thermal furnace balancing are available.

NEW HARDWARE ARCHITECTURE AND PRECISE DATA ACQUISITION
Melt Expert is based on an embedded controller platform, in which the system is split in a PLC part and a PC part. This new concept unifies the advantages of both platforms concerning flexibility, robustness and computing power, which is necessary for fast and complex calculations as well as high dynamic HMI.

Control signal handling is done within the PLC part which simplifies the integration into the automation environment. Intelligent signal interface modules ensure very fast and accurate data sampling with on-board signal preconditioning.

HMI of Melt Expert

MAIN BENEFITS
• Reduced energy consumption and increased melting efficiency due to auto-adaptive regulation algorithms
• Higher productivity ensured by automatic melting profiles and process parameter adaptation
• Highest reliability due to main focus on robustness and operational safety in an industrial environment
• Ensured process quality due to target group orientated screens and highly sophisticated data recording and evaluation
• Amortization within less than nine months

Evolution of Primetals Technologies Electrode Control Systems
The Optical Foaming Slag Manager is an optical foaming slag detection and control system for automated carbon injection in all types of electric-arc furnaces. The main purpose is precise determination of the slag height inside the EAF vessel. It also contains advanced control algorithms intended to achieve the most efficient use of injection material.

The Optical Foaming Slag Manager is a closed loop control system used to control the height of foaming slag inside the electric-arc furnace. A cooled industrial camera, including advanced machine-vision software, detects the height of foaming slag inside the electric-arc furnace. The system successfully deals with temporary line-of-sight obstructions by using patented machine-vision software algorithms. An easy-to-install controller determines the amount of carbon needed for injection. The interface to the carbon injection machine is very versatile and allows different types of control valves for carbon injection. The integrated HMI makes it easy to define the setpoint height of the foaming slag.

FIELD OF APPLICATION
All types of electric-arc furnaces with slag doors and appropriate view of the slag door. Applicable with all types of carbon injection systems.
The modern operation of metallurgical melting plants and furnaces calls for high performance with regard to efficiency, safety and environmental protection. This requires a broad control, supervision and optimization of these plants and their processes. In most of the cases, the process conditions leave their fingerprint in the process offgas chemistry.

YOUR CHALLENGE
In order to improve your processes regarding efficiency, safety, quality and environmental protection, you first need to determine what is actually going on inside your converter or furnace. Process data can be efficiently collected through the analysis of the gases emitted in the course of the production process. In the case of BFs, BOPFs, AODs, EAFs, VODs and RH plants, gas analysis must be done on very hot and sometimes extremely dust-laden measurement points. Analyzing such process gases during the entire production processes - also during charging or tilting - is therefore often quite challenging and requires very special equipment.

OUR SOLUTION
The Lomas gas analysis system provides plants with the opportunity to save costs, increase production, ensure quality and efficiency and to protect the plant from dangerous process situations. All this is done with the advantage of flexible state-of-the-art analyzing sensors, patent-protected sampling devices and based on over 150 references worldwide - on all different plants mentioned above.

Lomas acts as an electronic eye for the chemical and physical process in the furnace. A typically redundant system continuously samples the process gas, which is then prepared and subsequently analyzed by means of adaptive, process-dependent analyzers. In the case of complex gas mixtures mass spectrometers can be used, in other cases infrared-, paramagnetic-, laser- or other technologies are implemented.

The layout and composition of the Lomas system is always plant-specific, so that a maximum of efficiency and benefit can be generated for the actual situation. This starts at the flexible analyzer technology and ends at the other side of the system, at the specific hoses, sampling probes and gas treatment equipment. The process gas analysis can be transferred to a Primetals Metallurgical Process Model or can alternatively and simply be used individually.

This special and proven design of the Lomas ensures high operational safety, a long service life and high availability. It offers precision, a modular concept, robustness and is easy to operate. These advantages and its low-maintenance focus make it to a very powerful gas analyzing system especially suitable for harsh environments and demanding process conditions.

The patent-protected Lomas probes are designed for very demanding process gas analyzing tasks and was installed more than 150 times worldwide as of now. The Lomas gas sampling on EAF furnace is a powerful gas analyzing system. It is specially designed for very demanding process gas analyzing tasks and was installed more than 150 times worldwide as of now.

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CHARACTERISTICS AND OPERATION
The patent-protected Lomas probes are designed as heated- and water cooled gas sampling probes made of Titanium alloyed corrosion resistant steel. For special processes, also Nickel-Super-Alloys and other materials can be considered. This makes the system especially suitable for the very demanding and fast-changing gas regions along the center line of offgas ducts.

In addition to this, several automatic and logic functions are embedded in the system. They assure an automatic self-cleaning, warn of dangerous situations, remind of maintenance or give forward-looking service information. But above all, the system also autonomously detects problems, react upon them and try to correct them (e.g. by automatic extra cleanings without disturbing the process, or by switching partially redundant system parts).

All in all, the Lomas System is a fully developed and powerful gas analyzing system. It is specially designed for very demanding process gas analyzing tasks and was installed more than 150 times worldwide as of now.

FEATURES AND TECHNICAL DATA

Gas sampling

- Maximum process gas temperature: 1,800°C
- Maximum dust load: 2,000 gram/Nm³

Typical analysis components

- Typical Gas Components: CO, O₂, H₂, CH₄, CO₂, etc.
- Safety indicators: H₂O

Fields of application

- Metallurgy: BOF, BF, EAF, RH, Copper furnace
CONTINUOUS CASTING
CC Optimization is the next level in intelligent caster automation. Through optimum interaction between sophisticated models and experts, the system provides plant operators with extended assistance and thus minimizes the risk of human error. CC Optimization is the next decisive step towards fully automated casting.

The basic function of CC Optimization is production planning with heat and slab tracking from the first announcement of a heat until the last slab has left the caster runout area. Production events, including heat changes or turret and tundish movements, and quality-related information are tracked by the system.

A tight connection with the basic automation system ensures proper signal processing and reactions by the caster models and experts. Data received from production planning and upstream units in the steel plant are processed and used for tracking, heat pacing and quality assessment purposes.

MAINTENANCE AND SIMULATION SYSTEM
Primetals Technologies provides an all-in-one setup, testing and maintenance tool as an integral part of the package:
• Software deployment, configuration, start, stop, restart, and the permanent supervision and troubleshooting of caster optimization models and processes
• Powerful built-in offline simulation packages for developing and testing
• Replay and testing of various casting scenarios using predefined script files

FIELD OF APPLICATION
All types of continuous casting machines as well as casters supplied by third parties.

HUMAN-MACHINE-INTERFACE (HMI)
The HMI guides operators through the production process. Casting operator interaction is limited to quality- and safety-related activities:
• An overview of important information is presented on the main display – details can be easily accessed via an extensive set of dedicated screens
• Operator screens are displayed in the customer’s language and units
• The system administrator is entitled to grant access rights for applications or single screens
• Primetals Technologies’ process explorer comprises a configurable set of applications
• The user can select predefined texts instead of having to input them
• Operation via touch screen possible

YIELD EXPERT
The aim of the Yield Expert is to minimize scrap and to optimize the yield. It takes into account scrap portions, quality defects, weight restrictions, sample cuts, and width changes while producing the maximum number of scheduled products.
• 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
• Replay of cut-to-length optimization steps of actual production situations

A “DIGITAL TWIN” OF REAL-WORLD EQUIPMENT
The simulation part of the MSS provides the functionality necessary for testing parameter changes and training operators in an offline environment in order to achieve smooth system start-ups. It creates a virtual instance of the actual plant facility—a “digital twin” of real-world equipment. This allows engineers to run extensive simulations of new equipment or parameter changes before they are introduced to the actual casting process. It eliminates any disruptions in ongoing production and minimizes the risk of unexpected outcomes. Using predefined script files, it facilitates tests of various casting scenarios and can replay past events. The digital twin also allows for stress tests in order to predict the long-term effects of any modifications.

EQUIPMENT EXPERT
The Equipment Expert is designed to monitor the installed equipment of the caster and to provide operators with valuable information about any necessary maintenance work. Equipment might include, for example, an entire segment, individual rolls, a mold, or mold plates. For every piece of equipment, a lifetime or partial lifetime criterion is defined. These criteria can be the number of heats, casting time, casting length, tons, durations, or other factors. The Equipment Expert collects these criteria for each piece of equipment and informs the operators when the lifetime criterion will be reached.
• New equipment can be added without any programming
• Well-organized preventive maintenance for the caster equipment
• Possible condition monitoring integration
• Automatic equipment detection with RFIDs
• Equipment test reports, manuals, and instruction documents for equipment can be viewed in the HMI

MAIN BENEFITS
• A comprehensive range of metallurgical models and packages that can be easily integrated into any existing automation environment
• Connect & Cast® products with full functionality right from the first heat to ensure short project completion times
• Minimum plant downtime through maximized utilization of pre-tested, pre-configured and proven components
• Operation and maintenance support through dedicated HMI packages
• Service and support for system extensions subsequent to startup

The CC Optimization (Level 2) can be flexibly expanded with following models and experts:
• Quality Expert
• Model Suite
  - DynaPhase
  - Dynacs 3D
  - DynaGap Soft Reduction 3D
• Nozzle Expert
• Speed Expert
• Intermix Expert

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The advanced DynaPhase, Dynacs 3D, and DynaGap Soft Reduction model suite takes precision and control potentials to the next dimension with completely new concepts for secondary cooling and soft reduction.

**DYNAPHASE**

In order to calculate a 3-dimensional temperature profile of the strand, material properties like enthalpy, solid fraction, density, and conductivity as a function of the temperature must be known. These material properties can be entered in the MSS or they can be derived using the add-on package DynaPhase, which determines these parameters from the steel chemistry using the thermodynamic Gibbs free energy and the Avrami model.

Traditionally, steel grades are grouped and a typical chemical analysis for this group is used to determine the material properties. With DynaPhase, the material properties are derived from the actual steel analysis. Calculations show that there can be a difference in the point of final solidification of a meter or even more, by comparing the results of the actual steel analysis with the grade group analysis. This fact demonstrates the importance of having an online calculation using the actual steel grade in order to improve the quality of the cast products.

DynaPhase also indicates whether the current analysis of the steel is peritectic, and it alerts the operator in the event of an unexpected peritectic grade. This can reduce the risk of breakouts and improve quality.

**DIGITAL TWIN**

The digital representation of the machine allows the mainenance of the model suite’s parameters and settings. This powerful tool helps the metallurgists / technologists to run offline simulations and test different cooling and soft reduction strategies. It enables metallurgists to enter the machine geometry, cooling requirements, and formulas that describe water distribution and heat removal for each cooling loop, radiation, roll heat removal, mold heat removal, and natural convection.

Thanks to its modular design the model suite DynaPhase, Dynacs 3D, and DynaGap Soft Reduction 3D can be installed on slab, bloom and billet casters as well as on casters supplied by third parties.

**MAIN BENEFITS**

- 3D-temperature profile of the hot strand including critical edge temperatures
- Improved calculation of solidification area across strand width
- Natural shrinkage calculation for an optimal roll-gap adjustment
- Powerful offline simulation package
- Replay possibilities of actual production situations

**DYNAGAP SOFT REDUCTION 3D**

DynaGap Soft Reduction 3D is based on the combination of Smart Segments and Dynacs 3D thermal tracking model. It dynamically adjusts 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 thanks to minimized center segregation, especially for pipe and plate grades
Based on operational, metallurgical, and automation expertise, Primetals Technologies has developed a computer-aided quality control system, Quality Expert, that is replacing the former VAIQ (in operation in more than 200 slab/bloom/billet/beam blank casters worldwide).

Quality Expert determines the definitions 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 with on-line quality alerts and a preview of the quality of the casting strands in the machine.

Quality Expert is available in two distinct editions distinguished by basic or comprehensive product quality rating capabilities.

FIELD OF APPLICATION
All types of continuous casters.

MAINTENANCE AND SETUP SYSTEM
The on-line quality control functions can be flexibly configured using the Quality Expert maintenance and setup system. The necessary technological expertise is stored in a metallurgical database. The end user (metallurgist, process engineer) can adapt the quality rules or enter new ones without the intervention of software engineers. The extensive and easy configurability of Quality Expert allows the process engineers to react quickly and flexibly to changing quality demands.

The Quality Expert was designed for flexibility from the bottom up. It can be easily adapted to changing production requirements using its comprehensive setup system including a flexible rule editor, and it also features sophisticated process data-tracking capabilities.

PROCESS DATA TRACKING
Process data that influences product quality is recorded in detail targeting process documentation and product quality prediction. Data is recorded at high resolution (typical 1s) as transmitted from the basic automation system and process computers. A sophisticated projection method that takes the metallurgical area of influence into consideration makes it possible to determine the exact production conditions for each cast product from cut to cut.

QUALITY PREDICTION
Quality Expert features a completely new and flexible rule editor as part of its maintenance and setup system. The users can edit quality rules by setting up decision tables or can use more complex calculations to judge the quality of the cast products. Such, rule systems for predicting the quality of multiple product defect types (e.g. cleanliness, surface and inner quality) can be developed, from simple approaches to more sophisticated ones. The Quality Expert evaluates these quality rules online and displays the resulting quality rating. These quality previews are made available for the hot strands currently being cast in the machine and for products already cut, along with a root cause explanation of the quality rating.

QUALITY SUPERVISION
Plant operators are supported by online alerts in the event of limits or specifications being violated during production. Process engineers can specify which process parameters are monitored. Operators also can view a preview of the preliminary quality rating of the hot strands while they are leaving the mold. The explanations displayed for these ratings reveal any quality deficiencies along with the root cause and enable operators to take immediate action if applicable.

MAIN BENEFITS

• **Improved product quality**
  Thanks to consistent and dynamic production practice information that is made available to the plant operators

• **Cost savings**
  Product inspection and conditioning activities can be largely avoided, which reduces material losses and handling costs

• **Configurability**
  Quality Expert can be configured according to the user’s needs, using a flexible knowledge-base component

• **Quality-assured direct or hot charging**
  Online quality prediction of cast products allows potentially defective products to be separated before charging to the downstream production units

• **Quality certification**
  The long-term documentation of process specifications, process history, and quality results supports quality certification according to ISO 9001 standards
The Nozzle Expert helps detect clogged nozzles and broken hoses in continuous casting machines and consequently ensures that the strand is uniformly cooled for high-quality steel production.

It is crucial to product quality that hot steel is uniformly cooled during the continuous casting process. Cooling water is sprayed through nozzles onto the strand with the objective of achieving proper cooling of the steel. If, however, one or more of these nozzles becomes clogged, a section of the strand cannot be cooled to the required temperature. This may lead to surface defects, and the product will possibly have to be downgraded. Changing segments in the caster can also be a problem. Hoses can easily be ruptured or jammed. Given the consequences of broken or clogged nozzles, maintenance personnel spend a large number of working hours checking whether nozzles are operating properly.

**FIELD OF APPLICATION**
All types of continuous casting machines.

This software model automatically monitors the condition of the nozzles during the casting process. The model can also be manually activated during casting breaks. The advantage is that nozzle status can be checked following maintenance work or segment changes and repairs can be carried out immediately before the casting process is re-started. The Nozzle Expert is based on statistical models and indicates the ratio of clogged nozzles in each zone. Operators only need to inspect zones for which an alarm is generated.

**PRODUCT FEATURES**

**Online monitoring**
Calculations begin automatically with the Start Cast signal, and the conditions of the nozzles are monitored throughout the casting process.

**Offline monitoring**
The secondary cooling system can be tested by manually activating the Nozzle Expert during casting breaks. Problems with the nozzles can be detected and repaired before the casting process is re-started.

**NOZZLE EXPERT REPORT**
During production the Nozzle Expert monitors the performance of the cooling system. If the machine is in idle mode, the Nozzle Expert can be started manually and can perform a more detailed check because proper water flow rates can be selected. During this manual check, the water flow rates cover the full range between minimum and maximum flow and the performance of the controllers can be examined. The results of this check are collected in a detailed report so that the cooling system can be analyzed and maintained.

The report consists of an overview showing the states of all cooling zones on one page and a detailed section for each zone containing the time trends of all relevant zone data.

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The report consists of an overview showing the states of all cooling zones on one page and a detailed section for each zone containing the time trends of all relevant zone data.

### Main Benefits
Maintenance costs are drastically reduced because operators only need to inspect zones for which an alarm has been generated.
- Detects clogged nozzles and broken hoses
- Reduces the working hours required to check nozzle status
- Uniform cooling of the strand
- Proper cooling avoids downgrading of the product
- Detail report of the performance of the cooling system

The Nozzle Expert report shows if the controllers are working correctly, focusing in particular on how the controllers are behaving at minimum and maximum flow, and on the condition of the nozzles (okay, clogged, broken) during the testing period.

For each zone, the clogged ratio, set point, actual water flow, valve position, water pressure, air pressure, and water back pressure are displayed for the duration of the test. By analyzing the graph, any problems with the controller, for example, can be identified easily.
The Intermix Expert assures that prime quality in the strand is determined precisely in the case of mixing heats with different chemical composition during sequence casting. This information allows the Yield Expert to cut prime products before and after the incompatible section of the strand.

Steel mixing takes place not only in the tundish but also in the mold and upper parts of the strand. Mixing in these areas is evaluated by a mix-box-type submodel of the Intermix Expert that makes it possible to calculate the chemical composition of the steel at any position along the cast strand. On the basis of the chemical composition of the steel, the Intermix Expert calculates whether the mixed steel zones may be used for the desired product application or if the steel has to be downgraded or even scrapped. Input parameters like analysis, tundish weight, casting speeds, and dimensions of the strand are taken into account and the computed results are visualized in the HMI.

Graphs are displayed for single analysis elements or combinations of multiple elements. Valuable information like volume concentration, mixed steel length, scrap length, and heat ranges on the strand are shown on the bottom of the screen. Incompatible grade analysis lead to scrap sections in the strand (red bar in the picture on the right). Grades that are compatible will not lead to a scrap piece (see round picture on top of the page).

Configuration and simulation of the model can be easily done in the maintenance and setup system. The metallurgist can choose which chemical elements should be used to determine the intermix for any grade link.

**FIELD OF APPLICATION**
All types of continuous casting machines.

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**MAIN BENEFITS**
- Calculation of mix steel area and incompatible strand portions along the strand
- Exact knowledge of the chemical analysis at any position on the cast slabs
- Combining the output with the Yield Expert assures maximum prime-quality yield
- Digital Twin - Powerful simulation environment for testing intermix of different steel grades

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**SPEED EXPERT**
**OPTIMIZED SPEED IN ALL CASTING SITUATIONS**

Quality improvement and throughput are the main focus of the Speed Expert, where factors that influence the casting speed are combined and an optimal casting speed for any casting situation is cyclically calculated.

Selecting a proper casting speed on a continuous caster is crucial. Many factors (for example, superheat, min/aim/max speed of the grade, quality, safety, machine limits, and production requirements) influence the optimum casting speed. The calculation of the casting speed is based on different rules and takes different factors into account. Each rule determines a speed range that satisfies its requirements. The Speed Expert determines an optimal casting speed from the intersection of all of these speed ranges.

Priorities can be assigned to each rule. If there are contradicting results, the rule with the lower priority is ignored.

Optimum soft reduction can be achieved if the final point of solidification is at the end of a strand segment. A precalculation determines the required casting speeds for each strand segment. The following rules can be evaluated:
- caster practice definitions (min/aim/max speed) for steel grades
- casting speed based on superheat temperature
- solidification point within the containment range (warning)
- heat pacing, if the planned open time of the next ladle is available

A maintenance system is used to define the individual rules. In the online human machine interface the operator has the possibility to view the results and to interact in special cases (e.g. switch on/off rules).

**FIELD OF APPLICATION**
All types of continuous casting machines.

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**MAIN BENEFITS**
- Optimal casting speed for increased throughput and improved quality
- The recommended speed is calculated so that the point of final solidification is positioned at the end of a segment for optimal soft reduction
- Speed set-points are displayed in the HMI and are sent to Level 1 to be executed automatically
- Powerful maintenance system for defining new or modifying existing rules
LEVCON
MOLD LEVEL CONTROL WITH UTMOST PRECISION

LevCon is the most precise mold level control. Thanks to the advanced model algorithm, LevCon anticipates casting conditions and automatically adapts to changes. The result is maximum precision in continuous casting and a new level of plant reliability.

CHARACTERISTICS

The LevCon package combines state-of-the-art mold level control with additional features that reduce clogging effects, SEN wear and mold level fluctuations initiated by unsteady bulging effects. LevCon is capable of using signals from electromagnetic or radiometric measuring systems, and handles electromechanical or hydraulic actuators as well as mold level control by withdrawal speed.

The LevCon mold level control adapts reliably and extremely quickly to mold level fluctuations and changing casting conditions. This is made possible by advanced model-based control algorithms that can actually look into the near future to avoid disturbances in the control loop. Unsteady bulging is actively suppressed by a powerful algorithm based on modern control theory. SEN flow can be regulated swiftly and reliably by means of the very compact electromechanical actuator or a hydraulic actuator.

Furthermore, control of a cut-off gate or SEN changer is included in this package for stopper casting. In the case of open stream casting, a nozzle-changing device can be connected and controlled as well. The intelligent interaction between the advanced software and highly robust mechanical components improves safety and brings plant operators one step closer to fully automatic casting operation. Production personnel can then be assigned to quality-related control tasks. LevCon now allows quality, productivity and plant reliability goals to be achieved more easily.

FEATURES

The following features are included:

- Automatic start
- Clogging effect reduction
- Bulging compensation
- Compatible with all major electromagnetic and radiometric measuring systems
- Electromechanical or hydraulic actuator
- Open stream control by means of withdrawal drives
- Stopper rod or slide gate control
- Two-sensor operation possible

UNSTEADY BULGING COMPENSATION

When using this algorithm, the flow oscillations from the liquid core are compensated by an adequate steel flow modulation in the SEN by means of stopper or slide gate movements. This includes a mathematical model of the level disturbance generated by unsteady bulging, which depends on casting speed and the roller pitches of the bulging sensitive zone. The reliable estimation of this disturbance facilitates effective compensation. With this feature, mold level fluctuations caused by unsteady bulging are reproducibly suppressed and a smoother strand shell is produced.

ACTUATOR

The LevCon actuator controls the flow of liquid metal from the tundish into the mold. It is an enhancement of the proven tundish stopper control system. Given that no flammable fluids are required for the stopper drive, no flammable fluids are required for the stopper drive, the system increases safety on the casting platform. The stiff yet lightweight stopper mechanism facilitates reproducibly suppressed and a smoother strand shell is produced.

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MAIN BENEFITS

- Greater reliability through automatic adaptation to changes in width, casting speed and steel grade
- Easy integration thanks to the Connect & Cast® principle based on 100% tested and preadjusted technological package
- Bulging compensation ensures efficient suppression of mold level hunting
- Fast reaction to disturbances thanks to clogging prevention and effect reduction
- Due to advanced filters no stimulation of surface waves in the mold
- Automatic cast start enables reliable and predefined mold filling and start of drives

LEVCON – PROVEN SOLUTION

Over 400 successful installations worldwide in the last decade have contributed to the ever increasing functionality and quality of the LevCon technological control system. This comprises dedicated hardware and parameterizable software.
DYNAFLEX
HYDRAULIC OSCILLATOR FOR PERFECT SURFACE QUALITY

The DynaFlex hydraulic oscillation drive system enables dynamic adjustment of frequency, stroke and waveform during casting. Installation of this advanced technological package optimizes the performance of the casters to meet demands for productivity, product quality, production flexibility and economic operation.

CHARACTERISTICS

The DynaFlex oscillator is a technological package comprised of a foundation frame and two individually exchangeable and interchangeable oscillator units for slab casters – one oscillator unit each for billet and bloom casters. The oscillator is fitted with one leaf spring-guided mold table and a hydraulic cylinder. The leaf springs are perfectly designed for precise guiding and optimization of surface quality. Precise and quick calibration is possible by using an absolute value encoder.

DynaFlex represents the latest generation of oscillation technology. Dynamic online adjustment of frequency, stroke and wave form during casting by means of hydraulic oscillation drive enables high surface quality over a wide range of casting speeds. Despite a freely selectable stroke, frequency, and curve pattern, Primetals Technologies has also developed an “inverse” oscillation mode.

INVERSE OSCILLATION

The oscillation allows control of powder consumption which is important for operation reliability and quality. Upon start of casting a short stroke / high frequency practice is used to minimize oscillation mark depth. With increasing casting speed the stroke is increased and the frequency reduced according to preset constants. This keeps the negative strip time at a constant level for shallow oscillation marks, but increases the positive strip time simultaneously to enhance powder consumption and to reduce sticking tendency.

The controller uses a model-based feed forward control, which allows the desired set points to be reached more quickly than ever before at a minimized phase shift between the cylinders for the double cylinder version. Control is carried out by proven control software. The oscillators can be tested and calibrated in the workshop. Automatic and manual operations are possible.

DynaFlex is designed for increased operational safety and reduced breakout rate even at high casting speeds. The system can be implemented in new or existing continuous casting machines – regardless of the design or manufacturer, even with small strand distances.

OSCIBOY FOR MAINTENANCE OPERATION

To perform test runs of the DynaFlex oscillator on the test stand in the caster maintenance area, a dedicated testing and monitoring device is required. Osciboy is a mobile version of the DynaFlex controller, suitable for use in the maintenance area.

The Osciboy unit features an operation panel with graphic display and function keys (touch sensitive) for local operation. All operation modes as described for DynaFlex Controller are available on the Osciboy Controller. It controls all movements of the cylinders and checks interlocks for correct operation of the hydraulic oscillation cylinders, mechanical assembly tolerances, and automatic run of oscillator units.

PACKAGE TESTER

Osciboy communicates with the optional package tester PC which is used by the maintenance technician to control and document the testing process. The package tester has been developed as an add-on feature to Osciboy and similar maintenance packages - e.g. WamBoy - for usage in the caster maintenance workshop.

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PLANT DATA

<table>
<thead>
<tr>
<th>Type of design</th>
<th>hydraulic drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifting stroke</td>
<td>0 – 12 mm (+/- 6mm)</td>
</tr>
<tr>
<td>Oscillation frequency</td>
<td>0 – 400 strokes/min</td>
</tr>
<tr>
<td>Non-sinus factor</td>
<td>0.5 – 0.7</td>
</tr>
<tr>
<td>Mold water connection</td>
<td>self-connecting</td>
</tr>
</tbody>
</table>

MAIN BENEFITS

- 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.
DynaWidth is the Primetals Technologies solution for fast remote width adjustment of slab caster molds. Width adjustment is done by means of four hydraulic or electric drives per mold, which are directly linked to the narrow faces of the mold. This technical solution can be realized even where space is very limited (e.g. revamps).

**CHARACTERISTICS**

DynaWidth is an online mold-width adjustment technology using high adjusting speeds without any reduction of the casting speed. DynaWidth enables high adjusting accuracy and reduced mechanical backlashes thanks to the use of hydraulic cylinders. Nevertheless, the DynaWidth solution can be used with electric drives as well.

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 DynaWidth system.

During warm adjustment, the S-mode allows large width changes with short tapered pieces at full casting speed. To achieve this algorithm both circular and parallel movement are performed by the narrow side copper plates. This results in a smooth and continuous support of the narrow side strand shell during width change. Throughout the adjustment procedure, both taper and width are continuously changed until final width position and taper is attained.

DynaWidth is geared toward increased operational flexibility when it comes to casting of different casting widths. It further reduces the risk of breakouts during width adjustments by supporting the strand shell in an optimized way.

**FEATURES**

- Easy and quick integration into caster automation system by means of available standardized and tested interfaces
- Optimized solution allowing future expansion with integration of additional or new capabilities

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**WAMBOY FOR MAINTENANCE OPERATION**

To perform test runs of the DynaWidth molds on the test stand in the caster maintenance area, a dedicated testing and monitoring device is required. WamBoy is a mobile version of the DynaWidth controller, suitable for use in the maintenance area.

The WamBoy unit features an operation panel with graphic display and function keys for local operation. All operation modes as described for DynaWidth Controller are available on the WamBoy Controller. It controls all movements of the cylinders and checks interlocks for correct operation of the hydraulic cylinders, mechanical assembly tolerances, and automatic run of molds.

**PACKAGE TESTER**

WamBoy communicates with the optional package tester PC which is used by the maintenance technician to control and document the testing process. Package tester has been developed as an add-on feature to WamBoy and similar Primetals maintenance packages - e.g. OsciBoy - for usage in the caster maintenance workshop.

**PLANT DATA**

- Number of cylinders: 4
- Location of cylinders: On mold
- Mold water connection: Self-connecting

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**MAIN BENEFITS**

- Optimized strand shell support by using S-type width adjustment
- Shortest possible slab transition lengths with high adjustment speed without casting speed reduction
- The system can be implemented in new or existing molds - regardless of the design or manufacturer
- Increased operating range and reduced maintenance expenditures
MOLD EXPERT
AN “INSIDE LOOK” INTO CONTINUOUS CASTER MOLDS

Mold Expert combines state-of-the-art sticker detection algorithms with friction and heat-flux derived analysis tools. It features the Level Expert package, which permits the operator not only to see into the mold but also to look further down the strand in order to detect the effects of strand and roller-related defects.

Sticker detection algorithms are continuously improved in order to reduce sticker breakouts and false alarms to an absolute minimum. Mold Expert gives production managers and metallurgists additional insight into the processes that influence solidification in the mold. Quality production under safe casting conditions is enabled through the installation of an appropriate combination of Mold Expert packages.

BREAKOUT EXPERT
Breakout prediction starting at the first heat thanks to auto-adaptive algorithms based on the Connect & Cast® principle. Auto-adaptive sticker detection and thermal monitoring for reliable breakout prevention
• Successful sticker detection for the very critical corner areas
• Operator warnings in the event of abnormal temperature distribution - such as hot spots and hot areas

HEAT FLUX EXPERT
Online calculation of heat removal for all copper plates and coatings
• Shows important information relating to the solidification process inside the mold
• Immediately indicates cooling problems
• Compares heat fluxes between different mold faces

PROCESS EXPERT
Gives the operator a green band for optimum values of important casting parameters such as heat fluxes or mold friction
• Simple operator guidance for abnormal casting conditions
• Database for green band limits is generated automatically
• Knowledge about current casting conditions
• Better technical capabilities during troubleshooting

ANALYSIS TOOLS
Replay Tool for all experts for detailed review of automatic or on-demand stored data
• Used for investigating critical situations
• Long Time Viewer for analyzing the vast dataset generated by complete casting sequences
• Easy browsing through a sequence
• Individual setting and storage of plot configurations

TECHNICAL DATA
• Different HMI viewing modes are configurable
• Modular configuration possible (installation without thermal package feasible)
• Slab caster:
  One Mold Expert server and HMI per strand
• Billet and bloom caster:
  One Mold Expert server and HMI for all strands

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Mold Expert HMI – slab caster

MAIN BENEFITS
Mold Expert increases plant availability and decreases maintenance time through prompt alarms. Thanks to its superior performance, the Mold Expert system has become the world’s leading system for mold monitoring, with more than 200 installations worldwide.
• Safe casting conditions - thanks to a reduction of sticker breakouts to an absolute minimum
• No manual input necessary - auto-adaptive algorithms independent of absolute temperatures, copper plate thickness, steel grades, and casting powder
• More than just breakout prediction - warnings in the event of abnormal casting conditions and evaluation of mold powder behavior and distribution
• More reliable information - automatic detection and assessment of bad thermocouple readings.
• Offline analyzing - storage and custom analysis of mold-related data in one dedicated system
• Easy integration and upgrades – thanks to modular design and ongoing improvements
• Easy comparison of the process behavior of the different strands
AUTOMATIC THERMOCOUPLE CHECKER
REPRODUCEABLE HEATING AND TESTING OF THERMOCOUPLES

With the Automatic Thermocouple Checker a tool for testing thermocouples is now available which heats the copper plate always at the same position and exactly the same intensity. In this way a damage of the copper plate is impossible and even a bad contact of the thermocouple to the copper plate is detected.

With this computer aided test the quality of thermocouple installation is improved and exchanges of molds due to bad thermocouples are limited to a minimum.

FIELD OF APPLICATION
The Automatic Thermocouple Checker can be used for narrow faces as well as for broad faces. Usable to measure either single mold plates (maintenance area) or mold plates at the assembled mold (in the machine).

FUNCTION
• The measuring arm is positioned manually by the operator to a predefined (lockable) thermocouple column requested by software
• Automatically one thermocouple after the other in a column is heated and temperature reaction of the thermocouple is evaluated
• Open thermocouples, wrong wiring or wrong polarity are shown immediately
• After checking a complete copper plate, thermocouples with bad contact to the copper plate are indicated and a report can be generated

PRODUCT STRUCTURE
• The Automatic Thermocouple Checker is delivered as a transportable unit that is connected to standard thermocouple connectors
• Heating arm on linear guiding
• Measurement and evaluation unit

TECHNICAL DATA

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating power</td>
<td>500 W</td>
</tr>
<tr>
<td>Accuracy of temperature measurement</td>
<td>0,1°C</td>
</tr>
<tr>
<td>Power supply</td>
<td>240 V</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>+5°C to +40°C</td>
</tr>
</tbody>
</table>

MAIN BENEFITS
• Automatic, repeatable heating of thermocouples
• No risk of damaging copper plate by torch
• Bad contact of thermocouples can be detected
• No measurement errors due to wrong heating positions
• Guarantees the use of well performing thermocouples
• Minimizes maintenance work for thermocouples
• Supports the quality-management due to data recording storage
• Can be used for all types of thermocouples
Appropriate mold oscillation is necessary for optimum feeding and lubrication of mold powder and to guarantee best slab surface. Measurement of mold movement in all 3 directions is indispensable for high quality.

**YOUR CHALLENGE**

One challenge in producing high quality products is to operate the oscillator with proper movement. Accurate setting of the oscillator is also an important factor for reducing the factor for producing high quality steel and even to avoid breakouts.

For efficient and predictive maintenance, the service team needs maintenance information about the oscillation system time in order to detect problems early on. Therefore, all available strands should be monitored at the same.

No extra time should be needed to measure oscillator movement, human errors should be avoided and measurement results should be available in an easily interpreted form.

The tool should also be applicable for different types of oscillators.

**OUR SOLUTION**

OsciMon is suitable for measurement of oscillator movement in all 3 directions and for the storage and visualization of the measurement data in 3D. The tool immediately issues a warning in the event of any oscillator set-point deviations.

The equipment can be used for straight and curved oscillations as well as for sinusoidal and non-sinusoidal movements and it is suitable for slab, bloom and billet casting machines.

Additional metallurgical parameters (e.g. non-sinusoidal factor, negative strip time, phase shift) can be calculated.

**TECHNICAL DATA**

**Accelerometer sensor**
- Measuring range: $\pm 20 \text{ m/s}^2$
- Temperature range: $-25^\circ\text{C} \text{ to } +70^\circ\text{C}$
- Dimensions: 60x60x50 mm
- Weight: 0.5 kg
- Degree of protection: IP 67

**Data acquisition unit**
- Measuring range amplitude: ±10 mm
- Measuring range frequency: 50 - 600 strokes/min
- Accuracy of measurement: ±25 µm/ver / ±10 µm/hor
- Accuracy of measurement frequency: ±0.5 strokes/min
- Temperature range: 0°C to +45°C

**MAIN BENEFITS**

- Permanent monitoring of the oscillator movement
- Long-term trend view of oscillation status
- Avoidance of shutdowns and breakouts to predictive maintenance
- Ensured high quality due to known information on the condition of the oscillator guidance
- Intelligent cross check with rigid body model
- Temperature and inclination compensated system

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SEGREGATION CHECKER
RELIABLE AND OBJECTIVE EVALUATION OF CONTINUOUS CAST SLAB INTERNAL QUALITY

FIELD OF APPLICATION
Every steel plant with a continuous casting machine has to check internal slab quality by analyzing the macro graphic cross section of the slabs. Typically this is done by operators' visual inspection using the Baumann test. The Sulphur printed slab cross section is compared to reference sheets and the slab quality is classified, (e.g. Nippon standard, Mannesmann standard).

This process is highly subjective with results depending on operator experience and inherent lack of consistency.

Primetals Technologies solution with the Segregation Checker evaluation, provides reliable and reproducible objective results.

PRODUCT STRUCTURE
Primetals Technologies Segregation Checker consists of evaluation hardware and software. A camera is passed along the cross section of the slab. To guarantee a perfect picture of the Sulphur printing, an optimized lighting control is also provided.

Evaluation software delivers an objective and standardized classification of internal slab quality compared against reference data.

The Segregation Checker can be optionally equipped with an automatic sulphuring, water flushing and drying equipment for the milled slab surface.

COMING SOON
Web-based online evaluation. Here the user can upload pictures of Sulphur prints and immediately gets the resulting inner quality classification.

IF INTERESTED, PLEASE ANSWER THE FOLLOWING QUESTIONS
What is the size of the sample you want to assess?
Which standards do you use for comparison? (Mannesmann, Nippon, others) for other standards please send information/specification for rating method
Which chemicals are used for Baumann prints?
In which version of Segregation Checker are you interested:
• A – Web-based evaluation of your images of the slab sample (in this case test pictures are necessary)
• B – Software version of Segregation Checker (Only evaluation software is installed on customer PC)
• C – Full version of Segregation Checker (Customized camera system with illumination and evaluation software)
• D – Complete lab with automatic sulphuring, flushing and drying and full version of Segregation Checker

MAIN BENEFITS
• Evaluation results are independent of operator experience
• Standardized classifications
• Automatic reporting
• Optional connection to quality system
• Evaluation over time supports predictive maintenance
• Assessment of machine condition by continuous evaluation of Segregation Checker results (e.g. gap adjustment)
• Possibility to optimize casting parameters and process

EQUIPMENT DATA
| Sample thickness | up to 800 mm |
| Sample width     | up to 3400 mm |
| Operating temperature | 0-50 °C |
| Typical evaluation time | <10 sec |

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**STRIW WIDTH CONTROL**

Reduction of width deviations and the avoidance of below minimum width after the finishing mill are challenges for today's basic and process automation systems for hot strip mills.

**CHALLENGE**

By default, the strip width in a hot strip mill is determined by edging or rolling the strip in the roughing mill (RM). The width deviation after the finishing mill (FM) arises from the width deviation in front of the FM and from width spread anomaly inside the FM. The behavior of width spread in a finishing mill depends on effects in roll bite and on the creep deformation between the stands, whereby the width spread in roll bite is influenced by e.g. thickness reduction, front and back tension and the change of strip crown ratio. The creep deformation between the stands depends on e.g. yield stress, strip temperature, specific tension, distance between stands and strip speed.

**OUR SOLUTION**

The tension influences the width in the finishing mill. A model-based width control uses this fact to compensate width deviations. Width deviations are measured in front of and after the finishing mill. The entry width deviation and the width deviation due to inhomogeneous temperature distribution along the strip are reduced by a feed-forward width control (FFWC). The residual exit width deviation is reduced by a feedback control (FBWC). Moreover the model-based feed-forward width control considers effects of width spread in the roll bite as well as the creep deformation between the stands.

**PRODUCT FEATURES**

This Width Control (FFWC and FBWC) is an add-on to the standard Width Control of process automation. It consists of a model-based feed-forward- and feedback width control in which the entry width deviation and width deviation due to the inhomogeneous temperature distribution along the strip are reduced by FFWC and the residual exit width deviation is reduced by FBWC. The actuating variables for this control concept are the tensions between the stands of finishing mill. In general the tension between two stands affects the width in the roll bites of both stands and in the area between these stands due to the creep phenomenon. Therefore an effective width deviation compensation using tension control is limited to low-frequency width deviations.

**MAIN BENEFITS**

- Better strip quality - improved productivity due to decrease of overwidth
- Less off-gauge - decreased areas below minimum width by reduction of reference tensions in the FM
- Increased product tonnage

**FIELDS OF APPLICATION**

- Hot Rolling Mills
STEERING EXPERT FOR FINISHING MILLS
NEW VISION BASED STRIP STEERING CONTROL

CHALLENGE
Plant operators are looking for technological solutions to avoid camber that can arise because of numerous uncontrollable factors (temperature profile, unbalanced thickness profile etc.). An uncontrolled camber build up can be the main issue during thread in process that can also cause process interruption and damage the plant equipment.

The main manipulated variables for controlling the shape in the hot strip mill are leveling and bending the work rolls. Leveling is used to influence the thickness wedge, whereas work roll bending and shifting affects the thickness profile of the strip. However for the strip not under tension, changing the leveling of the work rolls influences a camber build up.

OUR SOLUTION
The developed strip steering control solution uses the latest vision based measurement equipment from Primetals Technologies, together with advanced control technology for automatic threading, in bar control and thread out. Main targets of the new control solution are improving the availability of the mill and increasing the productivity by reducing cobble rate. An additional target is to increase the quality of the material, with respect to the thickness wedge.

VISION BASED MEASUREMENT
An essential basis for a reliable control strategy independent of the task to be controlled is a reliable sensor. In the finishing mill section of a hot strip mill the environment is extremely loaded with dust and cooling water. In order to achieve the targets of the described control task, a camber and centerline measurement device is needed.

The measurement devices used by the control system need to be very robust: have the highest availability and accuracy of measurements. To avoid mistakes from incorrect measurement results, a result that could not be correctly calculated, an according error message should be sent to the control unit. This control unit must then be capable of handling unexpected events - even if they are unlikely.

The chosen measurement device is based on optical measurement techniques. It is a combined camber- and centerline measurement device which can additionally measure the width of the strip. This method was chosen after evaluation to be the only reasonable method to retrieve the necessary measurements.

The advantages of this method are the low number of components, the simple arrangement as well as the high distance between strip and sensor. This means a reliable operation with nearly no maintenance.

SENSOR ARRANGEMENT IN FINISHING MILL SECTION

STRIP THREADING CONTROL (STC)
The automatic strip threading control (STC) is active during the thread in process of the first 3 stands. The main objective of STC is to automatically thread the strip into the next stand. The controller uses strip position measurements from vision based measurement equipment, placed after a stand, to generate control action. As a manipulated variable, the leveling of the work rolls (Δs) is used.

The goal of the automatic threading in the controller is to prevent camber build up by holding the following constraints:

• Preventing wedge change and reversion over strip length
• Respecting the actuator boundaries
• Holding strip head position within tolerance range
• Invariant performance for all material types, temperatures and thickness ranges

A suitable controller strategy to deal with these requirements is Model Predictive Control. This control strategy is both an optimal controller and it deals explicitly with the boundary condition for the actuator restrictions.

PERFORMANCE VALIDATION
After finishing the piloting phase, tests with nearly 18,000 rolled coils have been performed, in order to statistically validate the new strip steering control. Each of the rolled strips is statistically described by the absolute mean value μ and the standard deviation σ of the measured thickness wedge over strip length.

The measurement devices used by the control system need to be very robust: have the highest availability and accuracy of measurements. To avoid mistakes from incorrect measurement results, a result that could not be correctly calculated, an according error message should be sent to the control unit. This control unit must then be capable of handling unexpected events - even if they are unlikely.

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Sensor arrangement in finishing mill section

STRIP GUIDANCE CONTROL (STG)
Strip Guidance Control (STG) is activated when the strip is under tension. It is active until the strip unload from the roll gap of the preceding stand. The main objective of STG is to hold the thickness wedge (Δh) constant over the strip length. The controller also uses strip position measurements from vision based measurement equipment, placed after the stand.

Additionally the differential roll force is measured with the help of load cells and is used to generate control actions. To achieve this the leveling of the work rolls (Δs) is used.

The presented controllers STC and STG run independently from each other and are active at different periods in time.

MAIN BENEFITS
• Reducing cobble rate due to automatic strip threading control
• Increase of thickness wedge quality
CHALLENGE
Because of cost pressure the maintenance staff has been reduced. Moreover higher productivity and reduced down time are requested. Therefore the operators and maintenance engineers should be guided in fault analysis and faster problem solving. Based on several feedbacks of the customer’s staff and commissioning engineers and built on new IT features, the HMI framework has been innovated, especially focused on easy access to further information.

The advanced functions submit several advantages for operators and maintenance staff which are not available in the standard PCS7 or WinCC.

OUR SOLUTION
HMI Diagnostics with advanced functions
Some highlights:
• Bypass function: When a sensor is broken (e.g. a limit switch) and the program interlocking prohibits the start of the process, the operator can bypass the broken sensor from HMI. No long searching or replacing is needed. This allows a faster system restart. All operator’s interventions are recorded.
• Direct jump to the PLC program: This feature has been implemented to shorten the time for finding the right CPU and program part which has created the alarm. The function can be invoked via the faceplate or alarm message. User access control grants access to authorized personnel only.
• Direct access to the central plant documentation: In case of an alarm of a defect sensor the maintenance personnel can access the available online plant documentation like circuit diagrams and manuals directly from the HMI terminal. No time is wasted on searching for the plant documentation anymore.
• Ticketing system: The operator can leave a note in the HMI system about what has happened or has to be checked by the maintenance personnel. This information remains in the system and can be a base of the daily meeting of maintenance shift. The requests will automatically be followed up.

HMI FEATURES
• New design based on usability studies
• Bypass functions -> fast & easy bypass of interlocking
• Screen related help
• Innovated message system:
  - Message suppress functionality (series mode rejection)
  - Area based message system
• User and location based configuration
• Ready for touch screen operation

HMI DIAGNOSTICS NEW FUNCTIONS
• Internal diagnostics (Log files) in case of system problems
• Communication & network diagnostics
• Cascading faceplates -> fast diagnostics from alarm indication directly to the alarm cause
• Ticketing System
• Direct jump to the PLC program
• Direct access to the central plant documentation
• Intuitive 3D Diagnostics 3DD (refer to separate flyer)

FIELDS OF APPLICATION
• Revamps and migrations of rolling mills based on PCS7 or WinCC
• New plants
• Hot Mills / ESP
• Plate Mills
• Bar & Wire Rod Mills
• Cold Mills

MAIN BENEFITS
• Intuitive operation
• Faster trouble shooting
• Reduced down time
• Immediate access to software program and plant documentation from HMI
ROLL DATA SERVER (RDS)
COORDINATES ROLL DATA IN ROLL SHOP AND PRODUCTION

In rolling mills, the handling of roll data takes place in several decentralized locations:
• Purchasing takes care of order, receipt, release and scrapping
• The roll shop is responsible for preparation, grinding and inspection of the rolls
• The rolling mill is responsible during production
• Evaluation and analysis are made by technicians
The RDS is a special solution to support an automatic and easier roll data handling in mills without a roll shop server.

FUNCTION
The RDS comprises the following functionalities:
• Creation of roll primary data (such as material and geometrical data) according to customer specific requirements
• Roll release for production after roll primary data have been validated
• Take-over of results from the grinding machine (results to be confirmed manually by the roll shop operator)
• Support of roll data supply to the process computer before rolling (operator may choose roll data from a list supplied by RDS)
• According to feedback from the roll change process the roll will be automatically transferred into status ‘dismounted’ or ‘preliminary locked’
• In case of irreparable damages of the roll or reaching the lower limit of roll diameter the roll will be released for scrapping manually.
• Calculation of cooling behavior of the roll
• Comprehensive customer reports make the history of the roll transparent and evaluable

BENEFITS
• Automatic data transfer from roll shop to production
• Perfect data integrity through automatic coordination of grinding results and roll production data
• Simplification of work flows thanks to automation of several processes in the roll shop

FIELDS OF APPLICATION
• Hot Strip Mills
• Plate Mills
• Cold Rolling Mills

TECHNICAL DATA
• Server based solution
• Server-client-architecture
• Communication to other systems via TCP/IP or database link
• Programming of application software: C++
• Programming of HMI-software: C#
• Data base: Oracle

MAIN BENEFITS
• Automatic data transfer from roll shop to production
• Perfect data integrity through automatic coordination of grinding results and roll production data
• Simplification of work flows thanks to automation of several processes in the roll shop

PRODUCT FEATURES
RDS allows for centralized and automatic roll data handling in rolling mills, including all roll-related data required for the rolling process.
• A comprehensive overview of any roll-related information fosters an efficient work flow:
  • HMI-based roll data administration system
  • Monitoring status of rolls
  • Registration of roll data history
  • Reporting according to customers requirements
  • Data storage after roll is scrapped
  • Monitoring of roll pairs
  • Monitoring and diagnosis of application processes via HMI

PRECONDITIONS
• Process automation from Primetals Technologies or a Level 2 System
• Interface to other systems on request

SERVICES
• Delivery of a separate server incl. development and runtime environment
• Integration into an existing network infrastructure and connection to the communication partner
• Consideration of customer specific data and parameters
• Standardized reports
Rolls in rolling mills are never completely round but have eccentricity which can be caused by:
- grinding inaccuracy
- non-uniform thermal expansion
- asymmetrical adjustment of bearing rolls shell via drive keys

Each eccentricity consists of a base frequency which is the rotary frequency of the roll and several harmonic frequencies. Every roll of each roll stack can show such eccentricities which lead to thickness and tension errors which also lead to disturbances in neighboring stands. The result is a mixture of many cyclic disturbances in the exit thickness that in most plants add up to a significant percentage of the total thickness error.

**CHALLENGE**

The first step is to find out the degree of improvement of the exit thickness which can be expected by installing an eccentricity compensation. This is a challenge due the large number of different eccentricity frequencies which all change with roll speed.

At high rolling speed the frequencies of eccentricities are much too high to be compensated by a closed loop control such as a mass flow control or a strip tension control.

Moreover REC should compensate only roll eccentricities to avoid inappropriate reaction to other kinds of disturbances. This is difficult as all the available measurement signals contain many other disturbances. Moreover there is no possibility of measuring the eccentricity directly.

Therefore the eccentricity needs to be determined by indirect measurement. The best signal for determination of eccentricities is the stand exit thickness. This however is not available for most stands. Therefore a compensation has to use other, less convenient, signals.

Finally filtering a single eccentricity frequency is difficult as a pair of rolls has very similar diameters and therefore very similar frequencies.

**SOLUTION**

Primetals Technologies delivers hard- and software for eccentricity compensation. The REC is a fully digital model based control, which uses the fact that the eccentricity of each roll remains relatively constant during rolling to model its shape over several revolutions. Using an inverted plant model this modelled eccentricity is transformed into a compensation setpoint for the gap control (pre-control) moving the gap in a way that eliminates the influence of the eccentricity on strip thickness or tension.

As input the REC uses, depending on availability, a combination of the exit thickness, entry strip tension and roll force to extract the eccentricities.

**PRODUCT FEATURES**

Can be installed in:
- Every stand
- For every roll
- All types of Cold and Hot Rolling Mills

Can work with all kinds of measurement setups. The following possible input signals can be combined for better disturbance differentiation:
- Exit thickness
- Entry strip tension
- Roll force

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**MAIN BENEFITS**

- Better strip quality - improved thickness tolerances also at high rolling speeds
- Maintenance friendly - using existing thickness, roll load or strip tension measurements as feedback for control, hence no additional sensors or instrumentation are needed
- Less roll changes - applicable to compensate backup-, intermediate- and work roll eccentricities
- Fast ROI - easy to implement in existing basic automation environments

Stability and high compensation rate:
- For up to 4 harmonic frequencies per roll
- For high speed levels (up to 22Hz)
- For all strip types
- During acceleration
- For changing eccentricities during rolling
- When other disturbances exist

No need for additional sensors, e.g. for synchronizing
When metal sheet is wound on to a mandrel the coil is not completely round. This eccentricity can be caused by:

- the strip head on the mandrel (belt wrapper)
- the strip coming out from the gripper slot
- reversing mills: After several passes there is a thickness step from initial thickness at head and tail to the reduced thickness in the body
- eccentricity of the mandrel itself

This coiler eccentricity causes tension oscillations in the strip which in turn can lead to thickness errors and surface defects.

**CHALLENGE**

Since this tension disturbance is repeated with each revolution of the winder, its frequency depends on the rotational speed of the winder. At high rolling speeds this periodic tension change is much too fast to be compensated by the closed loop tension controller. Moreover the behavior of the system to be controlled changes dramatically with speed, coil diameter, strip geometry and pass reduction.

**OUR SOLUTION**

The coil eccentricity compensator CECO is a model based control which uses the fact that the shape of the eccentricity remains relatively constant during coiling. It can therefore model the eccentricity over several revolutions. Using an inverted plant model this eccentricity is transformed into a compensation torque for the coiler drive (pre-control).

**PRODUCT FEATURES**

The CECO control is designed to adapt to all eccentricities occurring during winding.

- Thanks to the model-based approach the CECO is stable and has a very high compensation rate:
  - For all speeds (up to 22 Hz!)
  - During acceleration
  - For all strip types
  - For all coil diameters
  - For all pass reductions

The CECO is designed to meet the following restrictions:

- No excitation of the winder shaft resonance frequency
- No risk of exceeding the torque limits
- No tooth-flank rattle to protect the gear box
- Maximum compensation frequency
- Maximum compensation amplitude

**SUMMARY**

The winder is accelerated by the CECO in such a way that the fast diameter changes caused by the coil eccentricity have no effect on tension and thickness. The model based approach in combination with the modelling of the eccentricity over several revolutions enables the control to be stable in all situations and to provide high compensation rates up to disturbance frequencies of 22Hz.

**MAIN BENEFITS**

- Better strip quality – stable strip tension leads to better strip thickness tolerances, better strip surface
- Maintenance friendly – using existing sensors and instrumentation for strip tension and coiler rotation, no additional sensors or instrumentation needed
- Fast CAPEX - Easy to implement in existing basic automation environment

**FIELDS OF APPLICATION**

- Unwinder and rewinder of SCM: Improvement of tension and thickness quality
- Unwinder of batch TCM: Improvement of tension and thickness quality
- Rewinder of tandem mill or processing lines: As the coil eccentricity has only a very limited effect on the thickness the CECO can only improve the tension quality

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3D PLANT DIAGNOSTICS (3DD) FOR A NEW LEVEL OF PLANT MAINTENANCE

CHALLENGE
Typical situation...
The production line has been stopped since 3am. The diagnostic information is given at the HMI screen by a text message hidden within a message shower and other information. After a frustrating 15 minutes looking through the messages, the operator discovers that the error is caused by a transducer at the mill cylinder. Subsequently he has to wait another 20 min. for a maintenance person to show up. The first person who turns up is not really familiar with the process. After getting initial information from the operator, he vanishes looking for the drawings he needs to analyze the problem. Another 15 min. later, he is back but has to find out where the faulty part is mounted on site. After identifying the transducer, he analyzes the fault using the drawings he took with him. A transducer is broken and has to be replaced. The technician checks the availability of the replacement in the warehouse and fetches it - another 30 min. lost. The replacement and function test takes another 30 min. 2½ hours later the production continues ...

COMPARE THE ABOVE WITH THE FOLLOWING TYPICAL OFFICE SCENARIO
You are printing out a daily report; management is waiting. While printing out the documents the paper jams in the printer. The printer display gives you help information, but not by means of simple text messages. It shows you step by step each operation by viewing the printer in 3D. Every step is animated showing you precisely what to do, e.g. opening the front cover, unlocking the lever and so on... After 2 min. the jammed paper has been removed and the printer warms up. 1 min later you have the document in your hand.

OUR SOLUTIONS
The prototype version of the new 3D Diagnostic has been presented at the Aluminum world trade fair in Düsseldorf in October 2014. The solution shows the future of fault tracing as part of the HMI ready for your plant today.

NEW INTUITIVE DIAGNOSTICS
A scenario has been shown where a broken sensor has stopped plant production. Compared to existing diagnostics, the new 3DD allows much faster fault identification requiring less detailed knowledge, since the new system gives you higher quality information in a shorter time.

PRODUCT FEATURES
• WinCC based
• 3D pictures based on existing drawings
• 3D animated sequences
• Automatic or manual rotation with zoom function for more precise views
• Clear fault location: automatic or manual zooming from plant overview to sensor level
• Additional information such as hydraulic drawings, circuit diagrams, manuals, is displayed by mouse click
• Possibility to create animated 3D documents for e.g. disassembly directions
• Built-in camera view that allows the maintenance person to see the diagram beside an actual view of the associated component
• Toolbox:
  • Easy to extend by user: add your own information, e.g. reports from previous experience or pictures taken from a special device
  • Start with the base version and upgrade later to the premium version.

FIELDS OF APPLICATION
• Casters
• Rolling mills
• Processing lines
• Finishing lines
• Regeneration plants

MAIN BENEFITS
• Intuitive handling - no special knowledge needed
• Clear information - about the fault or the physical location of equipment, shown in 3D
• Immediate additional information - drawings, diagrams, and other information are integrated and easy to access
• Faster recovery after stoppages after a fault - no time-consuming search for messages or documents
• Animated sequences - information for the operators as it happens on site
The quality package Off-Gauge Optimizer (OGO) focusses on minimizing the head end off-gauge length.

Head end off-gauge length is defined as the strip length from the weld to the strip segment from which the final thickness deviation sustainably stays inside a tolerance band of ½ EN10131 which is approx. ±3% of final thickness.

CHALLENGE

Today’s challenging markets require producers to improve continuously their operations with respect to quality, yield and production costs. The key issue today is to identify the right improvement measures as investment budgets are very restricted. One of the most obvious solutions is to avoid all additional processing costs which have a direct impact on the final cost figure such as the additional reprocessing costs of scrap resulting from off-gauge lengths.

To achieve this target, Primetals Technologies proposes a solution involving low investment costs and a fast ROI derived from the so-called “hidden potentials” of your mill equipment.

OUR SOLUTION

Based on the perfect combination of technology, process control and instrumentation, the OGO features the smart implementation of the control algorithms of a tandem cold mill based on the mass-flow principle. The OGO significantly reduces the average off-gauge lengths to approx. 8 m as verified at our reference plants. For a plant with a production of 1.6 million tons per year, this corresponds to an annual increase in yield of approx. 6,400 tons.

PRODUCT FEATURES

The OGO modules are:

AMFnew: Advanced Mass Flow AMFnew controls the mass flow from the mill entry to the mill exit. AMFnew assures very stable rolling conditions so that the monitored thickness errors can be kept to a minimum. The targeted thickness is achieved immediately after the end of the dynamic rolling-change function.

SST, Soft-Sensor for Strip Thickness: A soft-sensor-based roll-gap-thickness estimator perfects the performance of OGO during weld-seam-transition rolling. Interstand roll-gap thicknesses are modeled by means of the strip speeds and one initial strip-thickness measurement, e.g., behind the first stand.

FFCn-1: Feed-Forward Control at the last but one stand FFCn-1 decreases thickness errors occurring from, for example, tension disturbances during weld-seam rolling. Thickness errors are determined by the SST or an existing gauge in front of the last but one stand (SPM mode).

IMPLEMENTATION

- Recording of actual off-gauge lengths during normal production
- Back-up of existing software
- Installation of OGO productivity tool
- Implementation of OGO during a normal scheduled maintenance standstill
- Implementation of strip-speed measurement devices
- Recording of new off-gauge lengths during normal production
- Common evaluation of the achieved off-gauge reduction

FIELDS OF APPLICATION

- CTCM, PLTCM: Continuous Cold Rolling Tandem Mills

MAIN BENEFITS

- Higher throughput: the off-gauge optimizer reduces the average off-gauge length significantly (approx. 8 m verified at our reference plants)
- Less scrap at strip head end means higher yield
- Energy & environmental savings: due to the avoidance of scrap processing
- Fast ROI: amortization less than 1 year

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**SPEED OPTIMIZATION SYSTEM (SOS) AUTOPILOT FOR MAXIMUM PRODUCTION RATE AT HIGH MATERIAL QUALITY LEVEL**

**CHALLENGE**
Optimizing the whole production of a line starts with maximizing process speeds in all line sections, for example, by defining maximum pickling speeds for individual products, minimizing downtimes required for shearing and welding operations, and maximizing pass schedule rolling speeds, bearing in mind any technological restrictions.

Unfortunately, this is not enough. Depending on product properties, any one of these sections may be a bottleneck for a particular product. Since the critical aggregates (pickling section, tandem mill, …) should operate at fairly constant speeds, a method of speed compensation between sections is necessary. Strip accumulators (loopers) accomplish this function but unfortunately they are not sufficient to guarantee a high throughput.

A conductor with a global overview is necessary to optimize the interaction of all the sections. The dynamic settings and the online management of the different aggregates is essential to optimize the line continuously.

**OUR SOLUTION**

The aim of the Primetals Technologies Speed-Optimization-System (SOS) is to run each part of the plant as fast as possible to increase throughput, while ensuring that the speed of each plant part is kept as constant as reasonable for quality reasons.

The essential objectives of the Speed Optimization System are constant speeds in critical aggregates (pickling section, tandem mill, …) except where special speed profiles are required for weld passing and cutting.

In order to determine the best overall rolling strategy, the following constraints are considered:
- Maximum speed of each aggregate (plant limits or maximum speed for technological models)
- Individual acceleration/deceleration rates
- Available looper capacities
- Planned downtimes for coil change in the entry section and for width change at the side trimmer (if any)
- Individual speed characteristics of each aggregate (reduced pickling speed for the weld seam, cut speed for weld seam in the tandem mill if any, …)

The result is a process that is more homogeneous in operation, has products of higher quality and a maximized throughput.

**PRODUCT FEATURES**
The Speed Optimization System cyclically receives strip data from the basic automation (e.g., occupancy of the entry saddles, strips and remaining lengths at different reference points in the plant, …) and measured values from the process (actual speeds, looper filling levels, …).

Based on the actual values, limits, primary data and pre-calculated set points, the program calculates the optimum speed references for each strip and each aggregate of the line. With the cyclic measured values, the Speed Optimization System continually adapts these reference speeds according to the actual situation.

For optimizing purposes, all the major events are stored in a database. Later, an offline statistical evaluation is triggered to tune all the parameters, especially the downtimes since their correct estimation has a significant impact on the accuracy of the prediction.

**FIELDS OF APPLICATION**
- Processing Lines
- Continuous Cold Rolling Mills

**MAIN BENEFITS**
- Higher yield - the whole process is optimized from the throughput point of view, not only each individual aggregate
- Constant quality - ensures a high product quality by maintaining a constant speed in the critical aggregates
- Less unplanned stoppages - avoids stoppages in the critical aggregates of the line (pickling section, tandem mill, …)
- Flexibility of the optimization strategy taking account of the steel grade features

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Market trends are forcing steel factories to manufacture higher quality products to sell at low market prices by using fewer resources. Carbon steel strip from hot rolling mills must be perfectly pickled before being sold or cold rolled. At the same time regulations are becoming stronger with respect to safety, environment and sustainability.

**Challenge**
Beside quality and production throughput customers also expect minimum operation costs as well as a rapid return of investment. Customers have the following main requirements of a modern pickling line:
- High quality of the pickling process (no under-, or overpickling)
- High and optimized line throughput (high speed)
- Reduced operating costs (energy, maintenance)
- Reduced consumption of media such as acid, water.

**Our Solution**
Primetals Technologies provides an Advanced Pickling Model to optimize your process and to help to increase the plant throughput, reducing the operational cost and therefore reducing the cost per ton of material.

FAPLAC APM is a model based control that takes into account:
1. Calculation of scale thickness and state of iron oxide for different strip segments (head-end, body, tail-end)
2. Optimum strip speed including speed range based on chemical-physical model:
   - Calculated from coil primary data
   - Considering actual bath temperatures
   - Considering actual concentration values in each pickling circuit
3. Forecast calculation, up to 100 coils in advance
   - Temperature gradient in pickling bath
4. Cyclic calculation of pickling rate according to actual context (strip, temperatures...)

**Product Features**
The FAPLAC APM is an innovative package based on advanced physical and chemical process models in connection with long- and short-term adaptation techniques.

To meet such high requirements modern automation systems are used. They work closely together based on defined tasks at each process level, here in the combination of the Level 1 Basic Automation and Level 2 Process automation using well defined interfaces.

Relevant pickling process parameters related to the strip are considered:
- Steel grade incl. alloying elements
- Strip dimension
- Yield strength
- Finishing and coiling temperatures at HSM
- Scale - thickness distribution of iron oxides

Key parameters for FAPLAC APM are:
- Pickling speed
- Bath temperature
- Concentration of acid and iron ions in the pickling liquid for proper discharge/feed of used/fresh pickling liquid
- Elongation at scale breaker
- Intensity of turbulence in the bath

**Fields of Application**
- CPL Continuous Pickling Lines
- PLTCM Coupled Pickling - Tandem Mill Lines

**Main Benefits**
- Improves the quality of your products: by optimizing the actual pickling speed and by supervising under- and overpickling
- Maximizes the overall production throughput of your pickling line by optimizing pickling bath parameters according actual coil schedules (if available)
- Helps to minimize the acid consumption: by avoiding unnecessary over-pickling
- Repeatable results: independent of individual operator experience and habit
- Helps to improve your contribution to environmental protection: by avoiding unnecessary amount of pickling sludge

**Summary**
FAPLAC APM calculates automatically and model based the optimum set points for the pickling process. The results are strips with perfect pickling quality using minimum resources thus generating little waste.

Highest process throughput and minimized operation cost lead to a very fast ROI.
ALU TCS is a technological control system tailored to the demands of today’s market in the aluminum processing industry. It is currently available for – but not limited to – use in aluminum cold rolling mills and foil mills.

YOUR CHALLENGE
Even in economically challenging times, there is a large demand in the market for control systems. In particular, aluminum producers are constantly looking for this kind of investment in order to acquire improved technology for their existing or new rolling mills. Whether it’s about revamping a plant to improve quality and productivity or constructing an entirely new mill, plant operators always face similar challenges: short lead times, a smooth start-up in the shortest possible time frame, and of course achieving the requested product characteristics and quality.

OUR SOLUTION
In order to meet these demands, Primetals Technologies is offering ALU TCS, which is based on the well-known suite of software and system solutions. The hardware backbone is the high-performance SIMATIC TDC system, and all necessary functions are included in the compactly designed hardware and software solution. The amount of reengineering within the basic system for a single application is reduced to a minimum by the design of the I/O environment. Thanks to the highly standardized software and hardware, projects can be accomplished in a very short time. ALU TCS has already proven its practical suitability for achieving excellent results. And more than 120 ALU TCS Systems are currently installed or in various stages of order execution. By choosing to use ALU TCS, customers have chosen high product quality and a stronger competitive edge.

ROLLING OPTIMIZATION
The system includes all the features typically needed for a cold or foil mill technological application, such as:
• AGC automatic gauge control features including tension and speed control for narrowest strip thickness tolerances
• AFC model based automatic flatness control features for closest strip flatness tolerances
• Stand controls for closed-loop control of the mill actuators, such as:
  - Hydraulic gap control
  - Work/intermediate bending control
  - Intermediate roll axial shifting controls
  - Selective roll coolant, including hot edge sprays
• Level 2 features such as pass schedule memory and scheduling system
• Production and quality evaluation
• Roll eccentricity control
• Mill calibration and hysteresis test sequences

The system is able to control mills of various mechanical designs, such as 4-high mills and 6-high mills. The use of special actuators like VC rolls is also possible.

ECONOMIZING YOUR OPERATION
An integrated package of support functions includes everything required for an economical system that is easy to operate and maintain. These system features include:
• Engineering station with all necessary tools
• User-friendly HMI
• Message and alarm system
• Data recording and analysis system – PDA
• Diagnostic system
• Logging functions for the generation of various reports

MAIN BENEFITS
• Short realization time thanks to the use of standardized components with high availability
• Fast start-up due to a field-proven system with references from around the world
• High product quality: ALU TCS offers an integrated suite of quality control functions
• Compact design: Highly integrated components result in a compact cabinet and allow installation even in confined areas
• Simple implementation for new plants as well as for upgrades, extensions and revamps

OUTLOOK
In order to keep ALU TCS at the leading edge, we are constantly refining the technological features, functions and available applications. ALU TCS is a highly cost-efficient solution to meet your requirements.

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Primetals Technologies has developed a control which allows continuous acceleration of foil mills.

**CHALLENGE**
Rolling of aluminum foil is a difficult process. It takes time to speed up and to reach the desired strip thickness. During the acceleration roll bite friction can change suddenly causing higher reduction and leading to a tension drop. The recoiler accelerates to compensate and causes a sudden tension build in the strip which, with thin strips, usually leads to a strip break. A step-by-step acceleration by the operators leads to production loss because of the large off gauge lengths. In case of a strip break scrap removal and restarting the rolling process further reduces the yield of the mill.

**OUR SOLUTION**
Primetals Technologies has developed the patented Acceleration Booster which allows the operator to speed up the mill continuously. The control compensates the negative effects of the tension drop by adding additional motor torque to allow a smooth control of the tension drop thus avoiding strip breaks. The motor and shaft torques are considered in the predictor. The Acceleration Booster thus ensures shorter off-gauge lengths and less strip breaks therefore improving the plant yield.

**PRODUCT FEATURES**
The Acceleration Booster will be applied to the recoiler and the uncoiler drives (i.e. both sides of the mill). It considers the motor / shaft / coil mass oscillation system and causes a damping effect.
The control works fully digitally. It uses and analyses the motor acceleration using different algorithms. The acceleration is unknown so it has to be calculated. Parameters such as mill speed and coiler, mill, motor and material data are considered.
From this information the system calculates additional motor torques for the uncoiler and recoiler drives in order to compensate the tension drops. Primetals Technologies owns the patent for this control.

**FIELDS OF APPLICATION**
- Aluminum Foil Mills

**MAIN BENEFITS**
- Higher yield - continuous speeding up without time consuming “hold-go” commands
- Better strip thickness quality - a result of the dampening of tension peaks
- Less strip breaks - by appropriate measures to compensate the strip tension drop
- Maintenance friendly - reduction of tension peaks plus damping of the mechanical system lead to less wear of the drive equipment
- Fast ROI - easy to implement in existing basic automation environment

Compensation of acceleration torque

Working principle of the Acceleration Booster
GENERAL UPGRADE DELIVERS STATE-OF-THE-ART PERFORMANCE (GU)

The GU package (General Upgrade) provides several improvements, optimizations and new functions. It is the precondition for the installation of packages like DIAG, FPS and others.

**FUNCTION**

The General Upgrade Package contains improvements, optimizations and new functions such as Pathkeeper, Setpoint Watcher, Longterm Adaptation etc, resulting from experience gained during the commissioning of more than 20 plate and steckel mills up to 2017. The rolling process will be stabilized (especially when rolling thin gauges) and the prediction of roll force and roll torque will be improved.

**BENEFITS**

- Improvement of model predictions
- Stabilization of the rolling process
- System ready for further upgrade packages

**FIELDS OF APPLICATION**

- Plate Mills
- Steckel Mills

**TECHNICAL DATA**

- GU is an add-on to the plate mill process automation of Primetals Technologies
- This general upgrade package is a mandatory prerequisite for several other upgrade packages for plate mills
- Interface to basic automation system, graphical user interface and third parties will not be changed

**PRODUCT FEATURES**

GU provides new functions such as:

- Long Term Adaptation
- Path Keeper
- Setpoint Watcher

The Long Term Adaptation improves the force prediction significantly. First of all, this stabilizes pass schedules. Secondly, it facilitates better utilization of the equipment.

The Path Keeper freezes the calculated thicknesses starting at a certain point of the rolling. This immunes the process automation against noise in the measured data and prevents instabilities in the pass schedule calculation (such as adding passes). It turns out to be very helpful for rolling thin gauges.

The Setpoint Watcher makes the rolling more flexible by permanently synchronizing the process and basic automation, for instance after pyrometer adaptations, operator interventions and any unplanned events.

**PRECONDITIONS**

- Plate mill process automation from Primetals Technologies or a Siroil PM Level 2 System

**SERVICES**

- Implementation of the GU package on site
- Adaptation of necessary shared memories
- Training of customer personnel

**MAINT BENEFITS**

- Improvement of model predictions
- Stabilization of the rolling process
- System ready for further upgrade packages

**EXAMPLES**

Example 1: Improvement of roll force prediction by long term adaptation

Example 2: Rolling of 3mm material in a Steckel mill

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EDGEMON
HIGH STRIP EDGE QUALITY THROUGH AUTOMATIC INSPECTION

High precision trimming is decisive for producing high quality strip. The condition of the knife and detection of knife breakouts are two of the most important factors for trimming. Critical conditions should be identified automatically.

YOUR CHALLENGE
In order to maintain high product quality and plant availability, the trimming shear must be set up in a proper way. By reducing the time required for inspection of the edges (prior to and after trimming), plant availability can be extended. The early detection of defects results in less scrap and less damage to rollers. Being able to predict lifetime helps optimize and reduce operator maintenance efforts. Without an automatic inline inspection it is nearly impossible to obtain a complete overview of what exactly happens during cutting processes at the trimmed strip edge. Even changed or modified knife settings have an enormous impact on the edge quality. A simultaneous inspection of both sides of the strip as well as a reduction of knife-parameter optimization-time would increase total plant efficiency.

Today’s strip edge inspection is done by the operator. So the strip accuracy depends highly on the experience of the operator, additionally the manual strip inspection is very dangerous as the operator needs to get very close to the strip. Stopping the line due to inspection activities also influences productivity and increases the risk of additional defects on the knife and the strip.

OUR SOLUTION
EdgeMon enables the simultaneous inspection of the trimming process at both sides of the strip at full plant speed. Magnified images are visualized, knife breakouts are detected automatically and warnings are issued in the event of generally worse edge quality. Cut-break ratio and burr are measured. Inspection results and images can be forwarded to a human-machine interface, TCP/IP or hard disk and stored. EdgeMon is suitable for pickling lines and finishing lines. EdgeMon is available as stand-alone system as well as integrated to PT side trimmer.

INSPECTION TASKS
EdgeMon has been developed for the visualization of strip edge quality. Knife breakouts are detected and other defects are categorized according to their general quality. Burr and cut-break ratios are measured by the tool, and warnings and alarms are issued automatically:

The system collects images from the strip irrespective of the strip speed. With this feature, the recorded and displayed file reflects the current condition of the knife.

Thanks to the image processing algorithm, the images can be inspected and evaluated with respect to strip edge quality. Based on this evaluation, decisions can be made regarding knife changes in case of breakouts or knife setting adjustments.

FEATURES
• 0.3 – 6.5 mm strip thickness
• Up to 750 m/min strip speed
• Working distance up to 800 mm
• Synchronization with knife circumference
• Detection of burr from 0.3 to 3 mm
• Knife breakouts > 2 mm+/-20 MPa
• Relative accuracy 0.1 to 0.2 %

MAIN BENEFITS
• Avoids defects on rollers
• Avoids strip breakage due to knife breakouts
• Increases efficiency of the plant through the simultaneous inspection of both sides at full speed
• Reduces time for knife parameter optimization

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Achieving the highest quality, optimizing processes and delivering savings in production costs are among the biggest challenges facing the world’s steel producers today. The inline measurement of mechanical and/or magnetic properties of the steel strip in a processing line using contactless, non-destructive techniques offers considerable potential for further technological optimization and steel grade development. This is where the PropertyMon system comes in, using state-of-the-art methods based on electro-magnetic signals. It is a system that delivers reliable values for properties such as tensile strength, yield strength, specific magnetic losses and magnetic polarization.

Your Challenge

The steel producing industry is driven by ever increasing quality requirements. It is impossible to continuously monitor and guarantee material properties and specifications with standardized laboratory-based destructive tests (e.g. single-axis tensile or Epstein frame tests) of samples taken, for example, at the beginning and end of a coil. Destructive testing needs to be reduced and irregularities identified immediately and throughout the entire production process in order to increase output quality and ensure process optimization and, consequently, reduce costs. Producers also need to have comprehensive strip length-based data records of property values for documentation and analysis. Laboratory tests are a reliable method of determining mechanical or magnetic steel properties, but delivering the results is a slow process and there is no margin for quick process adaptations. Furthermore, the results are only valid for the sampled position, and properties can vary greatly over the entire strip length.

Our Solution

PropertyMon is a quality monitoring system for the online detection of mechanical or magnetic properties of the steel strip. The system performs a continuous, inline and contactless inspection over the whole strip length based on an electromagnetic measurement principle. The results are immediately available, visualized for the benefit of the operator and stored in PropertyMon’s internal database.

The main system components are the sensor heads, a traversing unit, distance control, and an electrical cabinet. The material is inspected at full plant speed by distance-controlled sensor heads above and below the strip. The horizontal traversing unit can vary the measurement position across the strip width and transfer the sensor heads to the test sample desk or park position beside the line.

All electrical components required for the power supply, signal processing and control of the measurement device are integrated within a single electrical cabinet located near the traversing unit. An integrated HMI visualizes measurement and system status and allows for full manual control of the measurement device.

Measurable steel grades are hot- and cold-rolled ferromagnetic steel strips including micro-alloyed steel, IF steel, dual-phase steel and TRIP steel.

Fields of Application

- Annealing lines
- Galvanizing lines
- Various processing lines (pickling, etc.)
- Skin pass mills, etc.

Function

The PropertyMon system measures electromagnetic values (hysteresis curve) of ferromagnetic materials and exploits the interrelationship between mechanical, material and magnetic properties. Output values with an accuracy in the range of corresponding destructive tests are calculated by applying multiple linear regression. The calibration can be obtained from test measurements and corresponding laboratory samples without the use of online process parameters from the plant.

The system is directly connected to the Level 1/2 automation system of the processing line via TCP/IP so that all relevant information, such as strip identification, grade, thickness, strip position, etc., can be obtained and the results sent back and stored in the PropertyMon database synchronized to the measurement position.

Main Features

- Simultaneous detection of mechanical and magnetic properties
- Reliable differentiation between related materials even with similar remanence
- Directional measurements for anisotropic properties
- Compact industrial sensor heads for local measurements and width-traversing
- Test sample desk beside line for offline measurements
- Automatic or manual operation from local cabinet
- Long-term data storage in internal database
- Easy-to-use software with GUIs for offline data visualization and analysis and simple calibration of steel grade classes

Main Benefits

- Advanced inline measurement
- Detection of mechanical and magnetic properties
- Material properties evaluation and documentation over whole strip length
- Reduction of customer claims
- Process optimization with respect to quality, capacity, output, energy
- Reduction in number of destructive laboratory tests
- No special plant parameters required

Technical Data

- 0.25 mm - 5 mm strip thickness
- 0 - 800 m/min strip speed
- Up to 1600 MPa (tensile strength and yield strength)
- Working distance 6 - 12 mm (application-dependent)
- Up to 100°C strip temperature
- Accuracy (one sigma standard deviation):
  - tensile strength <± 5%
  - yield strength <± 7%
  - magnetic losses or polarization <± 5%

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SHAPEMON
PRECISE INLINE SHAPE MEASUREMENT FOR HOT STRIPS

During the rolling process of slabs in heavy plate mills, the shape of the slab changes with every pass. At the end, the geometrical dimensions of the plate must correspond with the target values. It is essential to have information about the actual geometrical dimensions of the rolled material for the rolling process.

A tool to measure the shape of hot material on the roller table after the stand between passes is needed in order to evaluate the exact geometrical parameters of the plate.

OUR SOLUTION
An optical sensor based on the self-radiation principle is installed safely above the roller table at a height where it disturbs neither the rolling process nor the movement of the crane. When passing the field of view, the sensor automatically detects the plate and starts the measurement procedure. The results are visualized and transferred to Level 1 and/or Level 2 for use in rolling process optimization. This system can also be used for camber measurement at roughing mills and centre line measurement at finishing mills.

YOUR CHALLENGE
For quality purposes plate records must be archived, the rectangularity must be optimized during the rolling process and the plate geometry must be documented. Maintenance efforts must be low, remote maintenance should be possible via modem or network and the tool must be easy to adjust and calibrate in order to meet the requirements of the plant operator.

Due to disturbances like steam, water and scale, a high availability of shape measurement is also required. At hot rolling mills, even good rolling models are often overstrained by obtaining accurate strip profiles and flatness. Among others, the camber (mainly at the roughing stand) and the position of the strip between the finishing stands are important parameters for obtaining a high repeatability of the strip geometry. High temperatures, high speeds as well as cooling water and water vapor at the rolling mill make it difficult to take accurate measurements.

ShapeMon constantly collects pictures of the plate. Depending on the length of the plate, it operates in two modes:

Block mode: For blocks and plates smaller than the field of view. The shape is measured with one single image of the sensor.

Plate mode: If the plate exceeds the length of field of view, the sensor collects several images of the strip during its pass through the field of view and combines them to form a complete shape.

Additional features for hot strip mill (HSM): This system optimizes measurement results for rolling process improvement and enables redundant measurement with high availability even under the influence of cooling water and steam.

FEATURES
- Sensor 2,400 x 2,000 pix
- In PM: working distance 17-24m
- In HSM: working distance 5-10m
- In PM: field of view 6x9m
- In HSM: field of view 2.5x2m
- Up to 50 measurement per second
- Temperature range > 700°C edge temperature

MAIN BENEFITS
- Minimization of crop losses through crop and camber geometry optimization (in combination with PT rolling model)
- Increase in throughput thanks to rolling control optimization (avoidance of cobbles in combination with PT rolling model)
- Reduced scrap at head and tail end

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Dynamic torque measurement plays a decisive role in monitoring the systems of rolling plants. Problems appearing during the production process or in the drive train components express themselves predominantly in the form of torque fluctuations. Torque observation can lead to the prevention of breakdowns, to the effect that maintenance times can be planned and production increased. Torque observation prevents breakdowns, makes maintenance times projectable and increases productivity.

YOUR CHALLENGE
In order to achieve high product quality, homogeneous rolling parameters must be attained in the rolling process. From this point of view, incorrect torque may lead to flatness defects on the product resulting in additional defects during the rolling process. Furthermore, from a point of reliability, fluctuating torque can lead to an overload, thus damaging bearings and motors and in the worst case resulting in breakage of the chocks. In most cases, the causes of these damages are related to the torque and the difference in speed between the rollers and the roller table.

Speed measurements and current measurements at the motor are influenced by inertia and damping at the gearbox. In comparison, measurements taken directly at the shaft can easily and reliably identify the speed and current values.

Furthermore, differences in torque may lead to a deformation of the rolled material - in particular to front end bending. In order to avoid production standstills resulting from the strip end bending down into the roller table, as a precaution, the operator often bends the strip end up. This is somewhat safer, but by no means perfect. This can all be avoided with a reliable torque measurement.

FUNCTION
The torque measurement system, TorqueMon, is a reliable method of measuring the torque of rolling mill shafts. It offers a permanent, real-time measurement based on the principle of strain gauge measurement. Sensors mounted on the rotating parts send the measurement signals to a rotary antenna. Without any wiring, a stationary antenna supplies all rotary parts with power and receives the measurement signals. A calibratable telemetry converts measurement results into analogue or digital signals. An optional PC can be used for data access and storage as well as for the evaluation of the data. These results can be easily used to verify and detect variations and overloads in the rolling torque during the whole rolling process.

PRODUCT FEATURES
The measurement of torques is possible under nearly all environmental conditions. All sensor-positions can be calibrated by remote control and measurement data transfer system can also be adapted to other sensors. The whole range of amplification and offset is completely adjustable. The contactless transmission method uses inductive couplings between measurement and transmission devices.

TECHNICAL DATA
- Rotational acceleration up to 100 g (optionally higher)
- Maximum shaft temperature of 100 °C (optionally up to 220 °C), max. surrounding temperature of 100 °C
- Measurement of dynamic torque up to 1 kHz
- Adjustable measuring and zero point range
- Frequency range 0 to 1 kHz
- Temperature range -20 ° to +70 °C

MAIN BENEFITS
- Prevention of unplanned production stops
- Exact knowledge of system condition
- Industrial, very robust system
- High temperature stability (up to 100 °C)
The Long Rolling Process Expert is a cost-efficient process automation system for continuous mills, mono blocks, reversing mills, and flat blocks. The system performs a wide range of tasks for optimized operation - from suggesting pass schedules to calculating and downloading mill settings according to the availability of rolls. Our Long Rolling Process Expert also helps manage and track material yards and orders. It delivers valuable mill reports to the operator staff and management so they can easily assess your plant's performance and optimize production. KPIs help them compare different plant locations around the world.

**YOUR CHALLENGE**

Managing your plant in the global markets means continuously optimizing your plant's performance - by measuring, comparing, and enhancing both production and business processes. To successfully achieve this, you need both reliable data and accurate reporting. Product quality and quantity are just two of the key issues. You also need comprehensive reports on your mill, production efficiency, equipment utilization, downtimes, energy and media consumption, tool stand times, and much more. All of these data can show you how to make your plant more competitive and more profitable. Convenient tools should be available to support you in processing data and allow you to manage and track material yards and orders. It helps you seamlessly follow all material flows from the yard to the charging grid to the outgoing yard - including processing, compacting, weighing, and tagging. The Long Rolling Process Expert also facilitates quality management. With its online quality monitoring, you can easily derive inspection results for your products. Interface modules to Manufacturing Execution Systems (L3 and L4) and plant automation system (L1) ensure safe communication. You also get analysis and report modules, a report editor, and a label editor. With all your data archived, you can always track your production history - even years later.

**OUR SOLUTION**

The Long Rolling Process Expert provides a modular range of basic functions for managing orders, assets, and qualities. Just choose the functions you need. For example, yard inventory modules for incoming and outgoing materials always provide the current status of stock materials. The Process Expert's production sequence module allows higher flexibility when fulfilling production orders, while its tracking module helps you seamlessly follow all material flows from the yard to the charging grid with the outgoing yard - including processing, compacting, weighing, and tagging. The Long Rolling Process Expert also facilitates quality management. With its online quality monitoring, you can easily derive inspection results for your products. Interface modules to Manufacturing Execution Systems (L3 and L4) and plant automation system (L1) ensure safe communication. You also get analysis and report modules, a report editor, and a label editor. With all your data archived, you can always track your production history - even years later.

**OPTIONAL MODULES EXTEND LONG ROLLING PROCESS EXPERT'S FUNCTIONALITY**

- Production program module helps with sequencing production throughput
- Product genealogy module tracks material history, providing an overview of the relationship between all material process steps from the melt shop to the final product
- Offline sample and laboratory module attaches results of offline tests and chemical analysis to the material at a later stage
- Roll and Guide Management module
- Roll Master

**ROLL AND GUIDE MANAGEMENT**

Roll and Guide Management helps monitor and manage your roll shop. Available tools (rolls, calibers, guides) are located in the roll shop stock and plant, tonnage and rolling time are tracked, and based on production requirements, tool change lists are created to shorten product change time on the one hand and to maximize tool utilization time on the other.

**LONG ROLLING ROLL MASTER**

Roll Master extends your automation with computer-based pass schedule calculation. Rolling requirements for new products and grades can be pre-calculated and checked before they enter the "real world" of your plant, and there is a much lower risk of damaging your machine or of a long trial- and-error procedure. Depending on your specific mill design, plant and drive limits are analyzed to create and optimize pass schedules based on a built-in material database that contains, among other things, more than 200 steel grades and alloys as well as rolling temperature models.

**MAIN BENEFITS**

- High cost efficiency - based on a modular client-server architecture
- Exactly the data security you need - with a system that can be expanded to a high level of redundancy
- Easy upgrades in running plants and for new applications - by "grabbing" current data from virtually all PLCs
- High process transparency - through in-depth analysis and reporting functions based on real-time data tracking
- Fast management overview - with powerful reporting functions
- Easy comparison of your workshops all over the world - with KPIs
- High flexibility - for any kind of long rolling plant
- Proven track record - more than 25 installations worldwide with high customer satisfaction

The Long Rolling Process Expert is part of the worldwide electrical and automation concept of Primetals Technologies for the long rolling industry. It can be supplied stand-alone or seamlessly integrated into Long Rolling automation concepts.
The Long Rolling Roll Master provides advanced pass scheduling for continuous mills, monoblocks, reversing mills, and flat blocks. With this powerful and easy-to-use tool, you can increase both plant flexibility and performance. Calculations include pass schedules for grooves and guides as well as set-up data based on material database, specific mill design, mill load conditions, and available rolls. By tracking tool and mill conditions during operation, the Long Rolling Roll Master enhances your plant’s availability and supports your maintenance routines.

**YOUR CHALLENGE**
Increasing productivity and flexibility are crucial for staying competitive in the steel market. However, it’s not always easy to synthesize these objectives. When changing dimensions or steel grades, high productivity can only be maintained with a fast and secure production restart. In order to reduce the cobble rate, mill settings need to be accurate right from the start. And because of groove wear, it can also be challenging to repeat rolling schedules. In general, it is difficult to make precise calculations for the implementation of new dimensions and steel grades. Tests are time-consuming and require in-depth knowledge of the rolling process. Grooveless flat rolling offers high flexibility, but pass schedule creation and the calculation of mill set-up data are difficult to calculate and confirm.

**OUR SOLUTION**
Long Rolling Roll Master helps you to precisely manage your rolling mill. It allows you to easily create pass schedules, including the calculation of the mill load, spread, and bar temperature. The tool also calculates set-up data for smooth mill start and restart. When you want to switch to new steel grades or dimensions, Primetals Long Rolling Roll Master supports you with a database of more than 200 steel grades and special alloys. Another database for rolls, grooves, guides, and other components contains your mill-specific data. The system always tracks current conditions and takes them into account when providing pass schedules.

The Long Rolling Roll Master is a proven solution at more than 25 mills worldwide.

If you order the Long Rolling Roll Master with a new long rolling plant from Primetals, we will manage all the details, including automatically modifying LR Roll Master to the mill design and production targets you’ve chosen. When upgrading your existing plant, we will begin with a deep analysis of your mill to learn about the specific mill layout, design limits, and drive systems and to integrate all available tools (including rolls, grooves, and guides) in the database. We will also evaluate potential interfaces to your automation systems already in place. Your materials and steel grades will be added to our database to extend its comprehensive selection of more than 200 alloys and grades. In the following weeks, our technology and software specialists focus on programming – which includes customizing the calculations and models in LR Roll Master’s software to the processes in your plant. Interfaces will be engineered and the HMI system will be designed to the processes in your plant. Interfaces will be engineered and the HMI system will be designed for easy operator input. Next we concentrate on site optimizations like shortening the system start-up and ensuring properly working interfaces and data exchange. With no need to stop your mill, we then work with your technology specialists and mill operators to commission LR Roll Master. Intensive training on the system and its functions will give you the knowledge necessary for modifying existing pass schedules or creating new ones on your own. In case you need help, we are available – either via remote link or by visiting your plant to offer direct support.

**OPTION: LONG ROLLING ROLL SHOP MASTER**
LR Roll Master’s functionality can be enhanced with the Roll Shop Master. It provides extended roll and groove management (shape, size, groove position on roll), which includes continuous evaluation of the roll diameter from the roll shop as well as tracking the actual wear of grooves.

**MAIN BENEFITS**
- Greater flexibility and optimized production – thanks to computer-based pass scheduling
- Minimized time and risks – when you’re inventing new products
- Smooth scheduling – with a material database that contains more than 200 steel grades
- For retrofits and upgrades, too – because the tool is also available as a stand-alone product
- Precise integration with our advanced LR process automation systems – when you purchase it with your new mill
- Easy adaption to your plant – thanks to the modular design based on an Oracle database and a C# front end

**MORE OPTIONS FOR THE PRIMETALS LONG ROLLING ROLL MASTER**
- Cooling as a separate sequence depending on the steel grade, with calculation of temperature profiles during the process
- Creation of pass schedules for grooveless rolling
- Automatic wear compensation based on actual rolled length of bar per groove and roll hardness
- Automatic modification of pass schedules based on actual speeds and roll gaps set on the mill

The Long Rolling Roll Master can be supplied stand-alone or seamlessly integrated into Long Rolling automation concepts.
The Long Rolling Compact Speed Master is a one-step solution containing everything you need to run and control a wire rod mill. It supports up to 18 stands and includes several technological highlights, like our proven minimum tension control, individual speed adjustments, loop controls, and material tracking. In addition, it allows pass schedules to be saved, modified, and recalled easily via the HMI terminal. 

**YOUR CHALLENGE**

Your wire rod or bar mill has been running for years now, and it still fulfills all the requirements of both your markets and your customers. You still are able to perform all necessary repairs by yourself. But as the electrical system becomes more and more obsolete, maintenance is beginning to get inefficient and expensive. For a legacy system like yours, spare parts and expert knowledge are hard to find – and your budget does not allow you to buy a completely new mill. It would be great to find a reliable and cost-efficient solution for gradually transforming your electrical and automation system in a quick, risk-free, and economical way. It includes:

- Basic automation PLC cube with and applied application software
- Field I/O modules to connect the plant’s sensors, actuators, and drives
- Compact operator desk designed to control up to 18 mill drives and to contain up to two HMI stations
- All the necessary technological controls essential to operating your mill – like r-factor settings and minimum tension control
- Shear extension and pass schedule table are optionally available via HMI, to improve operational comfort

**OUR SOLUTION**

The Long Rolling Compact Speed Master is our well-proven technology package for replacing and upgrading your obsolete electrical and automation system in a quick, risk-free, and economical way. It includes:

- Basic automation PLC cube with and applied application software
- Field I/O modules to connect the plant’s sensors, actuators, and drives
- Compact operator desk designed to control up to 18 mill drives and to contain up to two HMI stations
- All the necessary technological controls essential to operating your mill – like r-factor settings and minimum tension control
- Shear extension and pass schedule table are optionally available via HMI, to improve operational comfort

**HOW WE CAN DELIVER THE LONG ROLLING COMPACT SPEED MASTER**

The package is either available “Made in Germany” - designed, engineered, manufactured, and tested in Germany - or we assemble the hardware at one of our Primetals regional companies in your vicinity according to the drawings and circuit diagrams provided. Our experts will advise you during the sales process so you can find the perfect solution for your project.

**LONG ROLLING CUSTOMER OR OEM**

Whether you are already a long rolling customer and have your preferred OEM for mechanical equipment, or you are an OEM and would like to sell your products in combination with our world-class automation solutions: Primetals Long Rolling Compact Speed Master is very likely the best way to complete your customer’s project cost-efficiently and with all essential automation functions, services, and support.

**HOW TO ORDER THE LONG ROLLING COMPACT SPEED MASTER**

After an initial project consultation with the local office near you, you can order the Primetals Long Rolling Compact Speed Master automation hardware in one of two simple ways: “Made in Germany” or manufactured locally and supplied by the nearest Primetals regional office.

**HOW TO INSTALL THE LONG ROLLING COMPACT SPEED MASTER**

If you prefer to install the hardware yourself, we’ll offer you supervision and assistance from one of our experts - or our team of specialists will manage everything for you.

**HOW TO GET THE LONG ROLLING COMPACT SPEED MASTER STARTED**

Based on your production requirements, our specialists will assemble and start up the Long Rolling Compact Speed Master in the shortest possible time. After initial commissioning, our service team is available on a daily on-demand basis to support you with any technical and technological matters.

**MAIN BENEFITS**

- Cost-efficient, easy-to-implement, and trouble-free solution – because this technological package comes to you premanufactured and thoroughly tested
- Perfect for legacy systems – because we provide a risk-free and safe replacement of existing, obsolete automation systems
- Also perfect for new long rolling projects – thanks to a standard technological approach
- Short delivery time, easy installation, and simple commissioning – by parameterizing of most software functions
- Fits smoothly in almost any long rolling scenario – because of its flexible, modular design with standard interfaces
- World-class equipment, worldwide support – only with Primetals Technologies you can find both state-of-the-art automation solutions for industrial environments and an unrivalled global service network

**LONG ROLLING COMPACT ROD OUTLET**

Long Rolling Compact Rod Outlet is the perfect addition to the LR Compact Speed Master because it was designed with the same goals as well as a smooth integration in mind.

Long Rolling Compact Speed Master can be supplied as a stand-alone system or seamlessly integrated with other Long Rolling automation concepts.

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LONG ROLLING LASER MEASUREMENT
RELIABLE DETERMINATION OF LENGTH AND SPEED TO IMPROVE YOUR MILL PROCESSES

The Long Rolling Laser Measurement is a non-contact gauge specifically developed for long rolling products. It reliably measures a product’s linear speed as well as its length and incorporates this information into the Long Rolling control system – enabling a superior level of control never before seen in a Long Rolling facility.

YOUR CHALLENGE
To succeed in today’s highly competitive rod market and satisfy that market’s requirements, you are forced to improve product quality, increase productivity, and ensure high machine utilization. Long rolling mill equipment and processes need to deliver tight finished tolerances and improved metallurgical properties, while also reducing operating costs.

OUR SOLUTION
Our Long Rolling Laser Measurement lets you consistently determine any product’s true forward velocity instead of having to rely on calculations. This ensures that your control system always has accurate information available regardless of your mill’s settings. This data paves the way for an automatic optimization of mill production rolling, mill setup, and product quality, which means a far superior automation and control system for your long rolling applications.

THE LASER
Robust and compact design especially developed for the long rolling industry and a steel plant environment.

FEATURES
• Easy installation and set up
• Dust protection of lens by air blade, if required
• Standard interface to PLC system
• Processing of measurement values to improve and optimize control performance
• Trigger for plant monitoring/trouble shooting/status information to mobile

LASER MEASUREMENT APPLICATIONS
The ability to reliably measure product speed and length has led to applications specifically designed for the long rolling market. These tools improve the functionality of your plant, the stability of your production processes, and therefore the overall quality of your products.

Minimum-tension rolling
Measuring a product’s speed after it leaves the no-twist mill contributes to minimizing the tension between the No-Twist® Mill and the reducing/sizing mill – billet to billet and shift to shift.

Shear control and optimization
Laser measurement of the actual product speed means enormous improvements in the cutting process. With dynamic adaption, the shear control program compensates for the product speed – and this enhances cutting accuracy while maximizing the yield.

Morshor laser measurement
The laser measurement of speed at specific points before the Morshor® permits more precise control over the coil during collection and pay off.

Pinch roll and laying head control
Measuring a product’s speed before the pinch roll ensures optimal control over the pinch roll and laying head.

Billet length measurement
Before the billet enters the furnace, a precise measurement of its length improves the accuracy of its positioning in the furnace – and also optimizes productivity calculations of the mill process.

Cut length optimization (bar mill)
Detecting the material speed and length with the laser measurement unit improves cutting accuracy and optimization of the cut length and rest length calculations.

MAIN BENEFITS
• Accurate measurement of product speed and length instead of using calculation – provided by a stand-alone non-contact gauge
• Straightforward setup and installation – even in existing mills and while maintaining the laying head’s coil shape
• Easy handling – with simplified crop optimization as well as shear position and cut length control
• Versatile operations – because it also controls inter-stand tension and pinch roll closing

Braking pinch roll control
Measuring the true product speed supports the braking pinch roll in braking the material – resulting in more accurate material positioning on the cooling bed, especially in high-speed applications.

Product measurement for mill setup
The dynamic and consistent measuring of the actual product speed facilitates mill setup and enables automatic online adjustment.
The Long Rolling Non-Contact Bar Counter (BCNT) provides an accurate method of counting across the entire range of bar products.

**YOUR CHALLENGE**

Conventional solutions for bar counting are for the most part based on expensive, failure-prone mechanical equipment containing electronic counter units. This equipment and its surroundings require extensive maintenance at high cost. If installed in a working plant, these standard solutions also entail significant installation effort and expense.

**OUR SOLUTION**

Our low-cost, non-contact bar counting system BCNT automatically counts the number of rod or bar pieces using a high-speed optical analysis of data from an intelligent camera. This solution can be easily adapted to existing installations and requires no mechanical parts except for a mounted camera and lights. The system can be integrated into existing controls and HMIs or utilized as a stand-alone configuration. Live video images from the camera can be incorporated into HMIs. Data is transferred either via Ethernet or over a serial connection between the camera and controller.

**MAIN BENEFITS**

- No need for a complete overhaul of your mill systems – the BCNT works as a stand-alone component
- Low on maintenance and extremely durable, thanks to the non-contact design
- Flexibility to meet all production rates and quantities for the entire product range
- Reliable results enabled by highly accurate and repeatable readings
- Easy on the budget – low-cost installation and service

The Long Rolling Non-Contact Bar Counter can be supplied as a stand-alone component or seamlessly integrated into Long Rolling automation concepts.

**FEATURES**

- Low-cost counting solution
- Intelligent camera and high-speed image algorithms
- Non-contact, eliminating the need for expensive, complex, and failure-prone mechanical equipment
- Accurately counts the full range of rod and bar products
- Minimal alteration of existing mechanical transfer bed systems
- Counting unaffected by stopping, starting, or speed of transfer chain
- Direct digital hard-wired output to the bundler, which straps the bars at the end of the batch
- Counts multi-piece layers
- Integrates easily into existing control systems and HMIs
- Dynamic camera image can be displayed remotely
- Stand-alone system – setup data transmitted automatically from mill controller
The Long Rolling Enhanced Temperature Control System (ETCS) provides monitoring and control of stock temperature, ensuring that the required metallurgical properties are obtained accurately and consistently throughout the process. The system is designed to be used on the full range of rod and bar products, including HYQST®.

**YOUR CHALLENGE**
To succeed in today’s highly competitive rod market and satisfy its requirements, you are compelled to improve your product quality, increase productivity, and ensure high machine utilization. Rod mill equipment and processes need to deliver tight finished products, including HYQST®.

**OUR SOLUTION**
Throughout the process, the Long Rolling Enhanced Temperature Control monitors all relevant variables – like product speed and temperature, but also flow, pressure and temperature of the cooling water. This data is used to provide real-time feedback for closed-loop control of cooling zones, from furnace exit to reform tub or cooling bed. Individual zone control allows precise temperature regulation of the product throughout the mill line, ensuring a specified temperature with less than a 10° Celsius variation at the exit of the last cooling zone. This is achieved through the use of water boxes to chill the product as it passes from the last working mill stand to the Stelmor conveyor. Modulating valves adjust the flow and pressure of the cooling water as it leaves the optimally designed nozzles. By controlling the amount and distribution of water applied to the product at the nozzle, the ETCS can achieve the desired product temperature at the exit of each temperature zone.

**PRODUCT FEATURES**
- **Automatic sequencing**
  Controls the on/off status of all water valves according to your demands for front and tail end – including delays based on either speed or time as required.
- **Closed-loop flow control**
  Automatic regulation of water flowing to the water box, interstand cooling, or flume by controlling the position of the modulating valves. Reference data comes from the stored schedule/temperature controller.
- **No-Twist Mill entry temperature control**
  Automatically controls the temperature of the bar at the entrance to the No-Twist® Mill by adjusting the flow reference of any boxes selected in the temperature control interface. Temperature setpoints are determined by the stored schedule, the operator, or the temperature regulator.
- **Finishing product temperature control**
  Automatically controls the temperature of the rod exiting the laying head by adjusting the flow reference of any boxes selected in the temperature control interface. The temperature setpoint is determined by the stored schedule, the operator, or the temperature regulator.
- **Mid-billet reset**
  The flow requirements are stored upon achieving the target temperature and are used to modify the setpoint for the next billet, assuming that there is no change in product.
- **Control modes**
  The operator can change the mode of operation of each control loop by using the HMI. Typical control mode options are flow, temperature, and manual.
- **Recipe managementsystem**
  The built-in recipe management system maintains a library of predefined setups that can be loaded instantly upon product change. They also can be edited using operatorsupplied or system-derived values.

**MAIN BENEFITS**
- Maximized uniformity and consistency of product properties – thanks to uniform strand-to-strand, billet-to-billet, and heat-to-heat temperature profiles
- Optimized yield by attaining product temperature more efficiently when there are order changes and by minimizing head and tail end scrap losses
- Guaranteed +/- 10° Celsius accuracy at laying head or last cooling zone (after equalization)
- Precise management of transition rings – enabled by sequentially arranged water boxes which can be turned on and off as needed
- High accuracy with minimal manual work and maximal yield – provided by automatic water box sequencing, cooling strategy control, and adaptive water pressure and flow control
- Minimized setup time, maximized uptime, and enhanced standard operation thanks to the recipe management system

**PROCESS VARIABLE TRENDING**
Real-time and historical trending features supply configurable sets of system variables to the HMI display and/or external devices. Featuring an easy-to-use navigation display, it provides full control over water box pressure and flow to ensure the desired product temperatures and properties. The Long rolling Enhanced Temperature Control can be supplied as a stand-alone system or integrated into Long Rolling automation concepts from Primetals Technologies.

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MULTI-APPLICATION PACKAGES
A wide variety of equipment is used in metals production. This equipment has to be checked and maintained continuously, which requires a great deal of effort and a solid maintenance strategy to guarantee proper function throughout the devices’ lifecycle. In addition to the usual sensor setup for equipment monitoring, analysis of the typically emitted sounds allows a more detailed insight to the actual equipment condition.

With Acoustic Expert, plant monitoring enters a new dimension. In addition to all other sensor strategies we provide, our automation solutions now have ‘ears’ for comprehensive sound analysis.

FUNCTION
The Acoustic Expert system is always active and continuously checks the sounds in the surrounding area. The soundscape is recorded for several seconds and then followed by a detailed analysis of the captured stream. Finally, a short report is generated with an equipment classification whether the equipment is working well within specified parameters or not. Provided that the Acoustic Expert detects an acoustic situation that is outside normal operating limits, the system reports which malfunction has occurred based on the captured soundscape.

The Acoustic Expert analysis is very stable and reliable because the influence of the disturbing background sound is almost eliminated entirely by advanced calculation tools. The most important factor is mounting the microphone in an appropriate position where the entire soundscape can be observed.

FIELD OF APPLICATION
All areas in an industrial plant

MAIN BENEFITS
• Adaptable to a wide spectrum of applications in metals production
• Continuous equipment diagnosis and trend reporting for maintenance support
• Fast installation and easy to use
• Installation with no disruption to ongoing production
• Cost-effective investment with short Return-of-investment time

PRODUCT FEATURES
• Continuous equipment and process monitoring including trend analysis for the entire operations process
• Installation during ongoing production process possible
• Sound analysis is possible within a wide field of applications in metal production
• Implementation of new customer-specific solutions
• Stand-alone package for autonomous operation available
• Attractive Online Services and Remote Service Support for Acoustic Expert System

EXAMPLES
• Monitoring of Jet Pulse bag-filter cleaning
• Supervision of material transport and conveyer belts
• Monitoring of torch cutting at continuous casting machines
• Monitoring of spray nozzles for lubrication and cooling
• Other applications with characteristic sound emissions possible

ACOUSTIC EXPERT
NOW OUR AUTOMATION SOLUTIONS HAVE EARS

SERVICES
• Hardware and software engineering and equipment supply
• Integration engineering
• Interface coordination
• Advisory service for installation and commissioning
• On-site training for operation and maintenance personnel
• Spare parts

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ADVANCED TRACKING SYSTEM
RELIABLE TRACKING OF METALLURGICAL VESSELS THROUGHOUT THE PLANT

The most common method for identification of metallurgical vessels in a melt shop is visual recognition performed by the operating personnel. Due to the harsh environment in steel plants it can be difficult to distinguish vessel IDs because the identifying characters become unrecognizable or disappear during regular use. The failure to manually enter the vessel ID or incorrect data provided to the automation system can lead to incomplete lifecycle information for the vessels, or, even worse, to ladle breakout during treatment or transport due to thin lining. The selection of the wrong vessel may cause major delays in tight production schedules or result in faulty steel grades.

FUNCTION
Advanced Tracking System (ATS) is the missing link for fully automatic equipment-tracking in steel plants. It features automated identification and localization. Errors due to incorrect manual input are completely eliminated.

ATS provides complete status and information on all ladles and vessels at any time: Where they are, at what time, and which vessels are in use at any given time. The number of vessels that can be tracked is unlimited. Additional vessels or other equipment can be added at a later date.

All vessels are equipped with passive long-range UHF-RFID transponders that are detected with antennas. Reader stations are placed at locations where vessels need to be identified and tracked with the highest possible reliability. This unique hardware-based identification in combination with a clearly defined software environment provides comprehensive vessel management with identification, visualization, tracking, and information exchange with the automation system.

FIELD OF APPLICATION
ATS is able to include the entire mobile equipment in a steel plant:
Torpedo ladles, hotmetal ladles, teeming ladles, slag pots, tundishes, sintering belts, scrap chutes, scrap baskets, etc.

MAIN BENEFITS
• Passive RFID technology
• Long-term availability of all components due to broad industrial standard
• Reliable and economical solution, also for upgrading existing systems
• High connectivity
• Self diagnosis of ICE-TAG for predictive maintenance

PRODUCT FEATURES
• Well-established industrial UHF long-range technology in heat-resistant ICE Tag design (Intelligent Contained Electronic Tags) for rough environments
• Robust housing to withstand slag and steel splashes
• Exchangeable tags with integrated damage detection
• Easy on-site teach-in for new tags with handheld device
• Heat-resistant housings for UHF antenna allows equipment tracking in charging and tapping area

PLANT DATA
Long-term operating temperature for ICE Tag
≤ 250°C
Read/write distance
≤ 3.5 m
Damage detection integrated in transponder
✓
(only for RFID technology)
Different mechanical protective and heat-resistant housings for antenna
✓

SERVICES
• Hardware and software engineering and equipment supply
• Integration engineering
• Interface coordination
• Advisory service for installation and commissioning
• On-site training for operation and maintenance personnel
• Spare parts

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In today’s steelmaking plants, high availability and the reliable measurement of process data are key to improving consistent peak performance production. The elimination of time delays reduces idle times in production, while fast and accurate measurements make it possible to precisely plan, control, coordinate, monitor and optimize metallurgical processes.

FUNCTION
It is essential to monitor, control and coordinate all relevant processes in order to ensure peak performance of the steel plant. Crucial data have to be transmitted from the core equipment to the process execution system, but sometimes design aspects, moving equipment or limited access to certain parts can hinder the economic implementation of a technical solution. As a result, the measured data can be incomplete or there can be delays in receiving the data. Wiplant eliminates these limitations altogether. A wireless, self-organizing network facilitates wide area data transmission in previously inaccessible areas and opens up a wide range of new possibilities. The modular system allows for the reliable measurement of single values, entire states, conditions, etc. across the entire plant. Wiplant realizes a secure, encrypted data connection between the auxiliary systems and the automation system for advanced process control - even in harsh environments.

FIELD OF APPLICATION
All areas in the steel plant.

MAIN BENEFITS
- Greater transparency throughout the steel plant thanks to the acquisition and transmission of reliable measurement data
- Increased plant performance thanks to improved planning and control of processes and logistics
- Easy installation and implementation without disruption of ongoing production
- Precise tracking of scrap input and raw material costs

PRODUCT FEATURES
- Extend automation system beyond wired networks to capture process data from mobile equipment
- Based on established industrial wireless technology
- High network coverage throughout the whole plant area based on a dynamic network concept
- Access to crucial process data to enable planning, control, coordination and monitoring of the steel plant without time delays
- Customer-specific modernization solutions

FIELDS OF APPLICATION
- Ladle transfer cars and scrap chutes with integrated weighing systems tailored for BOF steelmaking
- Integrated weighing system in EAF scrap carrier cars, leading to elimination of delays caused by weighing, scrap load-ing/unloading and transportation
- Wireless temperature measurement system on a converter where the signals are transferred from rotating elements
- Wireless connection for vessel tracking locations

OTHER RELATED PRODUCTS
- Converter Steelmaking
- EAF Steelmaking
- BOF Optimization
- Vaicon Car - Transfer cars for metals industry

SERVICES
- Plant engineering and system integration
- Modernization solutions
- Design, software engineering and supply
- Manufacturing
- Advisory service for erection and commissioning
- Spare parts
- On-site training for operation and maintenance

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The precise measurement of liquid metal parameters such as temperature, carbon content, and oxygen activity is one of the most important requirements for high-quality steelmaking. Therefore, the measurement equipment has to meet the highest standards for precision and reliability. Since measurement lances are exposed to high thermal and mechanical stress, the condition of the lances and the wiring needs to be given special attention. Dust, contamination, wear and tear or faulty electrical insulation of the contact block can lead to serious deviations in measurement results. In general, this deviation has a direct influence on product quality, productivity, and process efficiency. Periodic tests and calibration of all measurement lances are essential in order to detect and fix measurement deviations as quickly as possible.

**FUNCTION**

Lance Guard is a fully automatic diagnostic system for a quick test and scrutiny of the lance measurement equipment. A special adapter is attached to contact block of the lance. Lance Guard simulates a typical cycle of a one-way TCO measurement probe. In combination with collected results of the automation system it is possible to immediately verify all measurement parameters. Lance Guard recognizes any deviations in the measurement results and quantifies the violation of specified limits. It provides a seamless quality record of all components within the measurement chain. Lance Guard can be used for all type of lance systems - permanently installed lance measurements systems as well as manually-operated hand lances.

**FIELD OF APPLICATION**

Any type of measurement lance can be checked: Vertical sublance systems, horizontal measurement manipulators, automatic probe sampling devices with temperature measurement as well as hand lances. The latest version of Lance Guard can also be integrated in a fully automated robotic system (e.g. LiquiRob), in order to combine automatic probe handling with lance diagnosis.

**MAIN BENEFITS**

- Fully automatic test procedure for all lance measurement parameters
- Increased reliability of all measurement results contributes to improved process stability
- Systematic deviations and violations of specified limits are identified in the entire measurement chain
- Reduced maintenance efforts and increased lance availability with trend evolution and preventive maintenance strategy
- Cost-effective investment with high impact on product quality
- Short implementation and commissioning time

**PRODUCT FEATURES**

- Applicable for all lance types
- Fully automatic closed-loop test device for the selected physical measurements parameters
- All components of the measurement chain are checked
- Easy integration into existing automation
- No shut-down required during setup and configuration phase
- Equipment condition is displayed with signal lights (green, yellow, and red)
- Seamless recording and reporting of the entire test cycle and documentation for quality control systems
- Automatic docking procedure for lance adapter in combination with LiquiRob application (The lance diagnosis is scheduled during equipment idle time of the ongoing production)

**SERVICES**

- Hardware engineering and supply
- Integration engineering
- Interface coordination
- Advisory service for installation and commissioning
- On-site training for operation and maintenance personnel
- Spare parts

**OTHER RELATED PRODUCTS**

- Vaicon Sublance
- Horizontal Measuring Manipulator
- LiquiRob
- BOF Optimization
The steel industry is under pressure to provide products that meet increasingly stringent quality and safety standards. In order to match demand while conforming to the relevant national legislation, steel producers are obliged to deploy safety equipment to prevent any damage. Fluid Guard provides an automatic self-diagnostic system for monitoring and controlling the cooling circuits in steel plants according to the highest safety levels.

The exposure of steel production equipment to high temperatures is one of the major issues; within steel plants, cooling by water is the most common method for preventing system components from overheating. In BOF converter plants, for example, cooling water is pumped through oxygen blowing lances and sublances. Meanwhile any water leakage within the cooling circuit can cause considerable damage and result in costly delays. Fluid Guard allows for fully automatic monitoring and controlling of the water cooling circuits, ensuring the highest levels of safety. Any variations in process conditions are detected and appropriate measures are taken immediately. The safety-relevant part of the system is designed in accordance with EN ISO 13849. The Fluid Guard also includes an automatic self-diagnostic system.

FIELD OF APPLICATION
All water-cooled equipment exposed to high temperatures in steel plants.

e.g. EAF panels, EAF/LF roof, oxygen blowing lance, top cone cooling converter, ...

All water-cooled equipment exposed to high temperatures in steel plants e.g. EAF panels, EAF/LF roof, oxygen blowing lance, top cone cooling converter, ...

MAIN BENEFITS
- More reliable production thanks to safety-oriented detection of water leakages in cooling circuits
- Permanent, automatic diagnostic of system function including leakage simulation
- Meets requirements of latest safety standard (EN ISO 13849)
- Easy system integration into existing cooling circuit ensures short commissioning time
- Short amortization time based on reduced energy consumption

PRODUCT FEATURES
Detecting
- Water leakages
- Pipe/hose break detection
- Excess accumulation and debris in pipes

Monitoring
- Temperature, pressure, flow
- Stability of supply
- Heat transfer

Diagnosis
- Cyclic self-diagnosis of the whole system

Integration
- Easy integration into existing plants

Fluid Guard eco (Optional)
- Dynamic management of cooling capacity
- Cooling in consideration of actual process phase
- Energy management of water supply pumps

Automation
- Modular automation system
- Functional safety implemented

Instrumentation
- Safety certified
- Highest levels of accuracy

Actuation
- Quick actuating valves
- Safety certified

OTHER RELATED PRODUCT
Acoustic Expert

SERVICES
- Risk assessment according to DIN EN ISO 12100
- Hardware engineering and supply
- Integration engineering
- Interface coordination
- Validation in accordance to latest safety standards
- Spare parts
- Logistics
The electrostatic precipitator (ESP) is one of the main consumers of electrical energy in a BOF plant. Based on decades of process and automation experience, Primetals Technologies has introduced Precon (Precipitator Economizer) to the market. The economizer is able to achieve substantial energy savings in ESP operation.

**FUNCTION**

Operators of ESP systems are obliged to ensure that dust concentrations remain at the required levels. The power needed to achieve this is secondary, which means that for most of the time, energy input to the ESP is 100%. This enormous waste of energy negatively impacts operational costs. Technological experience with electrostatic precipitators tells us that maximum energy input is required only during the steel production phases; during non-production phases, energy input can be reduced to a minimum while still reaching the boundary limits of dust concentration in the clean gas.

The Precon system is designed to be implemented either as a fully automatic stand-alone unit or as a package, integrated into the dry-dedusting automation system. Based on the converter phase and actual process conditions, the system controls the level of possible energy reduction without compromising overall dedusting performance. All relevant process data are analyzed during operation, and the power reduction calculation is communicated to the individual high-voltage units of the ESP. The operator can easily switch on automatic energy reduction or use the preselected settings. Furthermore, Precon continuously monitors all discharge electrodes, allowing for individual analysis and condition-based maintenance for each ESP field.

**FIELD OF APPLICATION**

All primary dry-type dedusting systems with electrostatic precipitators in steel plants.

**MAIN BENEFITS**

- Energy savings of up to 60% of present power consumption
- Energy-optimized dedusting control of the electrostatic precipitator
- Dust concentration within the required boundaries
- Automatic filter diagnosis and efficiency determination for each field
- Small outlay with quick Return on Investment
- Easy integration into existing systems

**PRODUCT FEATURES**

- Dynamic control of energy reduction parameters according to environmental compliance based on continuous dust concentration measurements
- Simple switchover from normal operation mode to energy-optimized mode
- Highly accurate power monitoring devices for each field of the ESP
- Integrated energy management algorithms precisely evaluate consumed power
- Continuous monitoring of all discharge electrodes allows for individual analysis and condition-based maintenance for each ESP field
- Information for each ESP field, if intensive cleaning of discharge electrodes is recommended
- Easy integration into existing systems thanks to flexible software design and flexible communication to high-voltage units of various ESP suppliers
- Information for each ESP field, if intensive cleaning of discharge electrodes is recommended
- Easy integration into existing systems thanks to flexible software design and flexible communication to high-voltage units of various ESP suppliers

**ELECTROSTATIC PRECIPITATOR (ESP)**

The electrostatic precipitator is one of the key pieces of equipment in primary dry-type dedusting plants with high electrical energy consumption. Dust particles are negatively charged by high voltage and become electrostatically attracted to the positively charged collecting electrodes.

**OTHER RELATED PRODUCTS**

- Bag Filter Control
- Acoustic Expert

**SERVICES**

- Integration engineering
- Hardware engineering and supply
- Interface coordination
- Calculation of energy reduction parameters
- Advisory service for erection and commissioning
- On-site training for operation and maintenance personnel
- Spare part supply
Competitive steelmaking is all about cost-efficient production in line with environmental requirements. Based on intelligent, fast and robust electronic modules, the Bag Filter Control unit is able to optimize bag filter operation, significantly reduce cleaning air consumption and detect defective cleaning valves. This stand-alone self-monitoring package can be easily implemented in existing plants, thereby ensuring completely automatic operation.

A standard bag filter operates without any kind of energy optimization, based on fixed cleaning cycles where the cleaning valves purge compressed air into the filter bags. Any malfunction of a cleaning valve can only be detected manually by maintenance personnel, which is both time consuming and cost-intensive. Most of the compressed air is wasted, because the cycle time is not adjustable in the system.

OUR SOLUTION
Optimized bag filter control is the key to reducing costs. Using a differential pressure measurement between bag filter inlet and outlet, and the actual volume gas flow, the Bag Filter Control unit can automatically select an optimal cleaning cycle mode. A fast and reliable electronic module featuring MOSFET technology, which also features self-monitoring functions, controls the cleaning valves. The duration of the pulse time for each cleaning valve can be adjusted according to process requirements, thereby reducing compressed air consumption to a minimum.

FIELD OF APPLICATION
All kinds of dusting systems with bag filter cleaning.

MAIN BENEFITS
- Automatic control of the entire bag filter means the bag filter cleaning process is more efficient
- Pre-tested technological package including HMI, software and hardware
- Advanced powerful electronics replaces conventional relays
- Short implementation and commissioning time in new or existing bag filters
- Energy savings thanks to reduced cleaning air consumption and valve monitoring
- Reduction of maintenance costs due to advanced valve diagnostics

PRODUCT FEATURES
- Dynamic pulse length optimization for highest cleaning results along with lowest air consumption
- Three different cleaning modes for offline and online cleaning
- The system adapts the cleaning pulse according to the process requirements
- Reduction of installed electrical equipment
- Self-monitoring of Bag Filter Control (Monitoring of each cleaning valve for reporting of malfunctions)
- Stand-alone package with pre-tested hardware
- Software and HMI are flexibly designed for easy integration into existing systems

OTHER RELATED PRODUCTS
- Precon
- Acoustic Expert

SERVICES
- Integration engineering
- Hardware engineering and supply
- Erection advisory service
- Commissioning advisory service
- Training on site for operation and maintenance
- Spare parts
The fast development of computer techniques and automation systems reduced the life cycle of the products in this field to just a few years. Spare parts for the existing system are no more available and today’s hardware and software are incompatible to the existing environment. Application software has to be adjusted to the Microsoft Operating Systems and spare parts for elder Windows-Versions are not longer available. This trend impacts also the automation hardware and software like SIMATIC PCS7.

**YOUR CHALLENGE**

Today’s fast changing markets generate new requests from your customers. High flexibility and high quality are the key-figures to success and satisfy your customer’s needs.

This leads to following requests to the automation system:

- high availability of the system itself
- fast availability of spare parts
- further extension possible
- implementation of new technological functions
- ability to integrate up-to-date application software

**FIELDS OF APPLICATION**

- All upstream and downstream application from Primetals Technologies

**YOUR ISSUES**

- Spare parts and Hotline-Support for dedicated and discontinued equipment (e.g. CP5OM0, WinNT-based HMI-Server and Engineering Stations) are no more available
- The implementation of new developed technological functions (e.g. Micro Structure Monitor, new Advanced Mass Flow Concept) request state-of-the-art automation equipment
- Based on given system limits further system extensions are not possible (e.g. additional HMI- Clients, additional IO’s)
- You are not able to upgrade your System (e.g. up-to-date Standard Software like Virus Protection and Drivers)

**SOLUTION BY PRIMETALS TECHNOLOGIES**

Upgrade your outdated hardware and software solution together with the original supplier of your automation system to the actual version.

Analyze system and performance

- Check spare parts availability
- Interfaces and bottle necks

Define Migration / Update strategy

- Possibility of Parallel installation
- Definition of fall back strategy

Realize Solution

- Backup and Validation of actual running software on site
- Order new hardware and start Engineering at Primetals Technologies Office
- System Test of upgraded System in Primetals Technologies Test Field

Implement Solution

- System upgrade on site
- Startup-Support by Primetals Technologies-Commissioning Engineers

**MAIN BENEFITS**

- Ensure the availability of spare parts and hotline support
- Life-Cycle of existing Automation System is extended.
- The automation system is open for further integration of actual hardware and software components
- Skilled personal and maintenance trainings are available
The fast development of computer techniques and increasing technological market requirements reduced the life cycle of computer hardware and software to just a few years. Spare parts for the existing system are often not longer available and today’s hardware and software are incompatible to the existing environment. The life-cycle support of Microsoft Operating Systems Windows NT and Windows2000 ended already years ago. In year 2013 the life-cycle support for Windows2003 discontinued too. At the same time many hardware suppliers stops also the production of compatible hardware to these Operating systems.

**YOUR CHALLENGE**

Today’s fast changing markets generate new requests from your customers. High flexibility and high quality are the key-figures to success and satisfy your customer’s needs.

This leads to following requests to the automation system:

- high availability of the system itself
- fast availability of spare parts
- implementation of new technological functions

**FIELDS OF APPLICATION**

- All upstream and downstream application from Primetals Technologies

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**YOUR ISSUES**

- Hotline-Support for dedicated and discontinued equipment are no more available
- Therefore hardware faults on dedicated and discontinued components can cause more and longer line stops
- The implementation of new developed technological functions request state-of-the-art hardware and software

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**SOLUTION BY PRIMETALS TECHNOLOGIES**

Upgrade your outdated hardware and software solution together with the original supplier of your process automation system to the actual version.

**Analyze system and performance:**

- Check spare parts availability
- Interfaces and bottle necks

**Define Migration / Update strategy:**

- Time schedule
- Definition of fall back strategy

**Realize Solution:**

- Backup and Validation of actual running software on site
- Order new hardware and start Engineering at Primetals Technologies Office
- System Test of upgraded System in Primetals Technologies Test Field

**Implement Solution:**

- System upgrade on site
- Startup-Support by Primetals Technologies-Commissioning Engineers

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**MAIN BENEFITS**

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Operational energy management in industry is becoming increasingly important – on one hand, due to the ever increasing energy costs, increasingly stricter environmental regulations and, on the other hand, the necessity of achieving important certification, e.g. according to EN16001. In particular, efficiency in production plays a decisive role in increasing the productivity of plants and systems which in turn improves the degree of competitiveness in all sectors.

**CHALLENGE**

The idea is quite simple: Energy costs can be reduced if unnecessary loads are switched off during production downtimes. Recording energy measurements is a beneficial way to help cutting costs.

Energy consumption is divided into 2 groups:

- Energy consumption during production
- Energy consumption during non-production

**OUR SOLUTION**

GreenButton creates the basis needed to shut down individual devices or even entire production units centrally and in a coordinated manner flexibly, at short notice, and regardless of the manufacturer or device. This results in a significant advantage because it optimizes the switching off and restart procedures and thus saves energy even during short production breaks.

**PRODUCT FEATURES**

GreenButton allows a comprehensible and automated switching off of equipment in a modern plant. At the end of a shut down period GreenButton coordinates the restart of the system.

The system consists of hard- and software. The switch off suggestion will be initialized by process signals or manually detected interruptions.

The customer becomes familiar by training which allows him to operate the system and makes him familiar with methods of adding new switch off scenarios.

All process signals (line stops, switch off scenarios) will be logged. The protocols show the recommended devices for switching off, the saved energy and the reduced production cost.

**FIELDS OF APPLICATION**

- Casters
- Rolling mills
- Processing lines
- Finishing lines
- Regeneration plants

**MAIN BENEFITS**

**Environmental Benefits:**

- Less energy consumption -> CO2 and other emission reductions
- Noise reduction
- Increased equipment lifetime

**Customer Benefits**

- Low investment cost => fast ROI
- Reduced production cost
- Achievement of environmental certificates
- CO2 certificates

2 cases of non-production are defined:

**Case 1:** planned stops, typical scenarios are:
- Maintenance
- Process driven, e.g. roll change, material change
- No production, e.g. during night shift

**Case 2:** unplanned stops like:
- Process delays, e.g. waiting for material
- Process faults, e.g. material defects
- Equipment faults, e.g. oil leakage, broken sensor
- Other reasons, e.g. wrong operation

Example system configuration
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