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## **THROUGH-PROCESS OPTIMIZATION**

A KNOW-HOW BASED DIGITAL  
SOLUTION FOR THE ENTIRE STEEL  
PRODUCTION CHAIN

# THROUGH-PROCESS OPTIMIZATION (TPO)

## KNOW-HOW, QUALITY CONTROL, CONSULTING

### WHAT ARE YOUR NEEDS?

How long does it take to find the root causes for quality rejects and unstable processes?

What do you need to get a faster time to market of new products?

Do you need external know-how and expert service to get maximum benefit from your plants?

Do you want to have all your process and quality data from all your production units archived in one system?

### THROUGH-PROCESS OPTIMIZATION

is an integrated know-how based concept developed by Primetals Technologies to improve efficiency and quality across all your plants, accelerates your time to market for cutting edge high value products supported by the Through-Process Quality Control software solution.

**The TPO solution of Primetals Technologies is a powerful enabler for the digital advancement of steel production.**

### ADVANTAGES OF THROUGH-PROCESS OPTIMIZATION

- Sustainable overall quality and efficiency
- Increased through-process product and process development capabilities
- Knowledge management and increased own know-how build up
- Efficient development of new steel grades
- Increased EBIT
- Max out the capabilities of your equipment
- Stabilized product characteristics like mechanical properties, surface quality
- Reduced rejection rates

Through-Process Quality Control

**THROUGH-PROCESS OPTIMIZATION**

Through-Process Know-How



# THROUGH-PROCESS QUALITY CONTROL (TPQC)

## ANY DATA ANY TIME



TPQC - clients

Through-Process Quality Control is a quality system intended to cover the entire production line from the liquid phase to the finishing and packaging lines of the final end product. For this reason the term Through-Process has been coined to emphasize this idea.

The TPQC system is based on a central database of quality- and process-relevant production data from all production units via Level 1 or Level 2 automation systems. Additionally, laboratory measurements and data from all types of automatic inspection system equipment are centrally stored. TPQC creates an information-rich genealogy of each individual product that is processed, and makes it possible to retrieve process data from all production steps for the entire length of the product. This allows TPQC users to track quality issues in very little time and analyze them by reviewing process data for all relevant production steps, which allows for fast troubleshooting and claim management.

To ensure a continuous increase in achievable quality levels, the TPQC system allows for the implementation of freely editable rules, which are used for the execution of conformance checks during production. In the event of deviations, TPQC supports operators and quality engineers with root-cause analyses and automatically generated suggestions for corrective and compensational actions.

### FEATURES

- Product Explorer: in depth analysis of process data based on time or length of product

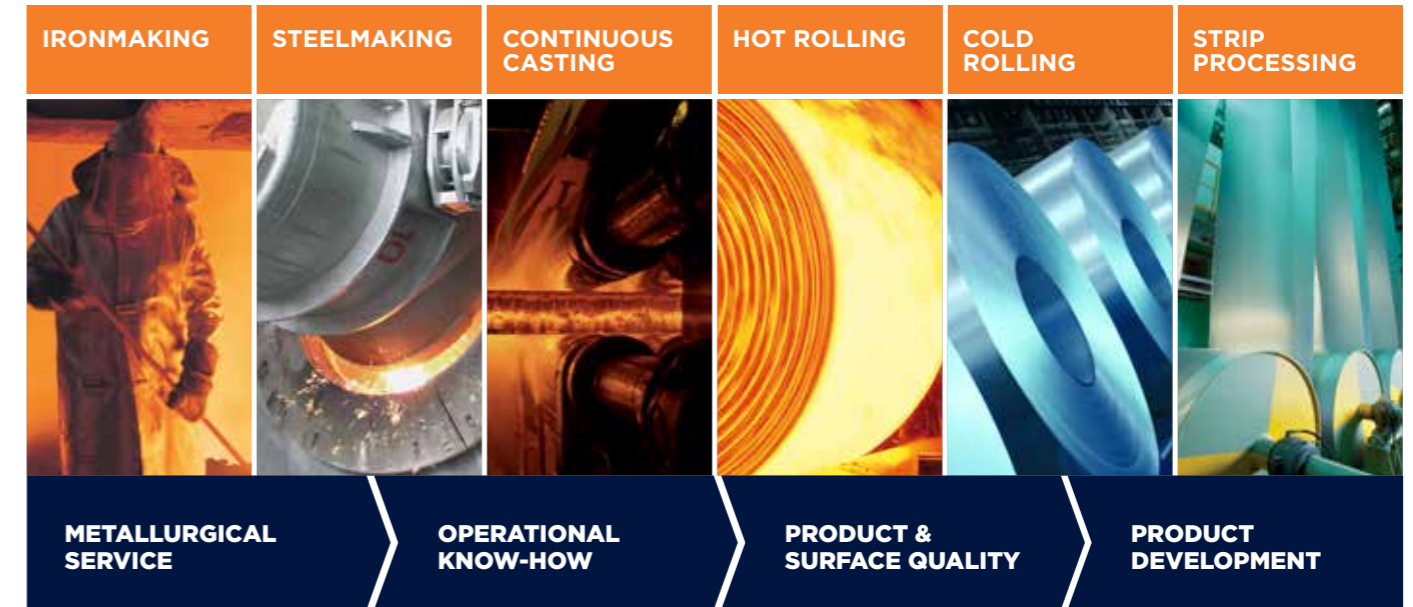
- Quality and process assistance: rule based quality checkpoints, root cause analyses and suggestions of corrective actions; automatic rule based surface grading
- Surface defect density map generated by the integration of surface inspection systems
- Tailor made reporting
- Long term data storage
- Statistical Process Control (SPC) & Key Performance Indicators (KPIs)
- Data Analysis: TPQC data can be accessed using datamining tools to deepen the knowledge about quality & process stability
- Primetals Technologies provides training and service packages for the different TPQC features

### BENEFITS OF TPQC SYSTEM

- Efficient troubleshooting and fast access to the required information at one system
- Quality managements & quality certification support
- Reduce manual product inspection, rework and downgrades
- Reduce influence of human-factor
- Create benefit out of your own production data due to direct integration with machine learning tools.
- Suggestions of root causes, corrective and compensational actions

# THROUGH-PROCESS KNOW-HOW (TPKH)

## DON'T START AT ZERO



We have tremendous knowledge capital within our company. This knowledge covers every stage of the value chain - from innovation, sales and project execution to commissioning, best practice operation and service. Now we use this knowledge to develop new business models in order to help our customers master their problems.

For the implementation of TPO and in order to resolve specific problems, Primetals Technologies supports its customers with its own experts and with external consultants. These specialists are highly experienced and cover various disciplines, acting as consultants for a wide range of topics; for example, plant operation, quality management, maintenance, or end-customer qualification.

Primetals Technologies also provides training sessions for steel producers who decide to implement TPO. In close cooperation with the respective customer, the team of experts devises and incorporates an optimal set of rules into the customer's TPQC system. These rules ensure better control of the steel production process, optimize product-quality consistency, and improve general plant operation.

The setup and tracking of process and quality related Key Performance Indicators generated within the TPQC system allows the customer continuously to monitor effectiveness of measures implemented by our experts.

### KNOW-HOW PORTFOLIO

- Excellence in process and metallurgical assistance for the entire steel production route
- Product development of AHSS grades tailored to the plant capability
- Achieving and stabilizing the best surface for exposed applications
- Implementation of rule based quality judgements and root cause analysis
- Specific expertise for process optimization supported by internal and external experts
- Assistance for production planning and trial runs and continuous process optimization
- Setup of Statistical Process Control charts to monitor process stability

# CONSULTING STUDIES, TRAININGS AND ANALYSIS



Expert consulting supported by TPQC

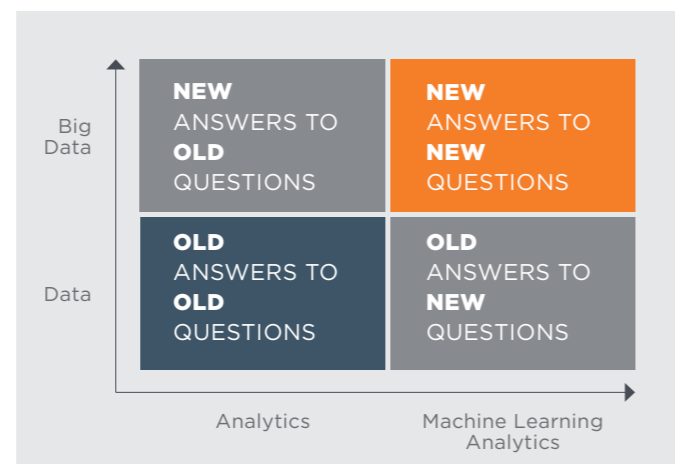
Primetals Technologies has developed a portfolio of consulting services and trainings executed by experts to improve the capability of analyzing, operating and improving process units and quality of products along the whole production chain. Consulting and trainings are conducted by a selected pool of experts with long term experience from working at international leading steel producers.

## CONSULTING PORTFOLIO

- On-site and classroom trainings for operation and quality engineers for product development, operations excellence, maintenance, quality management, surface quality and innovation management
- Studies to improve throughput or quality performance
- SWOT analyses
- Process FMEA analyses
- Metallurgical process modeling for optimizing process parameters
- Root cause and fault tree analyses for specific problems
- Organization and daily management consulting

## DATA ANALYTICS

Primetals Technologies is offering data analytics services for our customers as support for product development, resolving quality problems or improving process models. We are using latest data analytics platforms to generate actionable insights across your entire production route. Using complex rule-based algorithm and machine learning, we bring into life predictive and prescriptive analytics, forecasting an opportunities or a threats well in advance.



# TPO PILOT PROJECT HBIS TANGSTEEL TANGSTEEL & PRIMETALS TECHNOLOGIES – TRUSTWORTHY PARTNERS



Tan Wenzhen, Vice President of THSAS at Tanggang Steel

Primetals Technologies supplied a Through-Process Optimization package to Tangsteel of HBIS Group covering all process units from steel plant to annealing and galvanizing.

## KEY FACTS

- The Through-Process Quality Control System was implemented at two plant locations of Tangsteel (TSS & CRM2)
- Product development – the CGL produced grades with a tensile strength of up to 980 MPa within one year
- 20 process units and systems have been connected to TPQC
- TPQC receiving approx. 8000 signals; 132 KPIs are continuously monitored, 395 rules have been developed
- Automatic quality judgement by using a set of know-how and surface rules
- Online SPC charts for every control room developed
- Installation of cube data base for fast evaluation of process data
- Integration of Big Data Analytics tool
- Numerous trainings for Tangsteel employees have been conducted

## A DEPENDABLE RELATIONSHIP

Tangshan Iron and Steel Group Co. Ltd. (Tanggang) has developed a close relationship with Primetals Technologies over the years. In 2013, Tanggang signed a contract for the supply of a new cold-rolling mill complex, including a pickling line coupled with a tandem mill, a continuous annealing line, and a continuous galvanizing line. In 2015, another order was placed for two additional galvanizing lines.

## CUSTOMER VOICES

“After the installation of new equipment, our product development gained high attention from other domestic steel producers, which I think is a good sign. It is worth mentioning that with joint efforts from both parties, the pickling line with tandem cold mill as well as the continuous annealing line were started up just 21 months after the contract was signed, which broke a world record. Furthermore, the continuous galvanizing line successfully processed high-strength steel with a tensile strength of up to 980 MPa.”

**Tan Wenzhen,**  
Vice President of THSAS at Tanggang Steel

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