

Advanced workflow in quality assurance for stainless steel

The implementation of a new QuinLogic quality assurance system in a hot annealing pickling line brings improved benefits

Coil grading in today's rolling processes is getting more and more automated. Quality parameters are checked and verified and a decision for the respective coil is taken supported by software. Automotive and specialty steel producers cannot rely on manual grading any more.

Automated quality grading

A manual grading process is often influenced by the people on shift. This so called human variation is no longer acceptable in high end quality products. A lack of complete information regarding the context of the produced coil or coil segments results in incorrect decisions.

Automatic grading improves this situation and the result is a stable and homogenous decision. The result guarantees the delivery of products in accordance with the specification. In addition the decision process is documented according to ISO 9000 rules. It is also available for communication and interaction with customers within seconds.

Improved reliability

The quality of products isn't always a direct correlation of actions and reactions. The impact of a blocked nozzle, an open door in the oven, delayed maintenance work, lack of cleaning and similar, will only be visible later. Sophisticated process supervision ensures that proactive corrective actions can be taken before a slab/coil is negatively impacted.

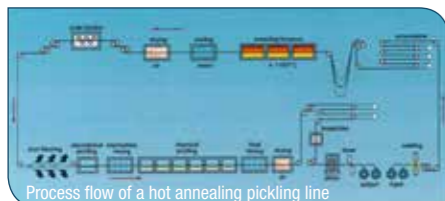
Proactive quality assurance in combination with automatic slab/coil grading is a clear trend in the industry. Furthermore statistical process control, fuzzy controls, automatic rule creation and other topics will speed up the improvement cycle in stainless steel.

QuinLogic is investing in R&D with BFI and major steel companies to develop innovative solutions for those quality related challenges.

Proactive process supervision

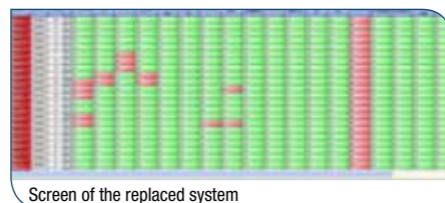
Our customer decided to purchase a Proactive Process Supervision System (PPS) as part of a Quality Execution System (QES) project to be implemented on a hot annealing pickling (AP) line (see pic below).

The AP line is very complex and



approximately 900m long, so it must be divided into nine sections to make it easier to survey at a glance. Each section allows a dedicated rule set to supervise the set of variables and parameters needed to ensure the right quality.

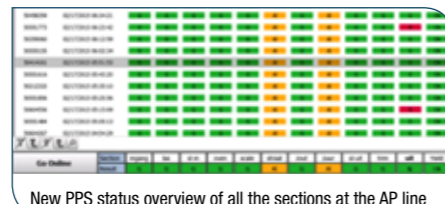
The QuinLogic PPS system replaced a solution that was developed in 2005. It was sufficient for the production process at that time, because only a few major stainless steel grades had been produced.



The implementation of old system was time-consuming because all requirements had been hard coded in their good coil programme code. After the implementation phase the system was reliable and worked well. It changed when the market situation became more demanding with the introduction of new steel grades. The requirements were reflected in modifications or upgrades of the existing steel grades and many new parameters and settings needed to be included.

This resulted in an increased workload for the IT department as it needed to modify the programme frequently. In time adaptation of this system was no longer realistic.

To improve the situation, the customers quality department evaluated alternative solutions and selected QuinLogic's PPS as a product fulfilling their needs concerning flexibility, features and speed of implementation.



A trial installation proved that all the required features and several additional ones were integrated in the PPS modules. The ability to apply modifications within minutes in a very user friendly manner convinced the customer.

Today the PPS system can be adapted to a completely new steel grade within a few hours. This is done by copying the existing rule set to a different grade and simply

changing the parameter settings by moving a slider. This helped to cope with daily changing requirements to qualify and deliver for premium customers.

A supervision system which certified and fully documented the coils quality was set up. Communication between the different departments like management, production and quality could be improved. Fact based reports now underline improvement ideas.

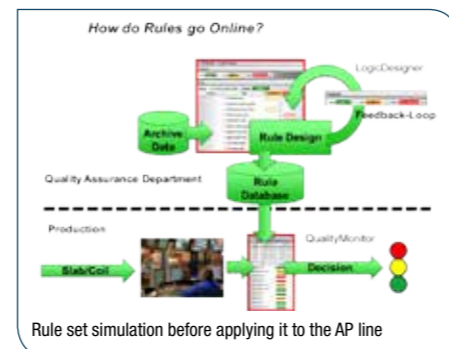
The understanding of process behaviour is dependant on the experience and the know-how of people. It is always difficult to have the solution or counter measure for a process problem available when it appears. Maybe a certain problem occurred in the past, was solved in the past, but the solution wasn't documented and isn't accessible anymore.

To make things easier QuinLogic has developed The Expert Shell module. This module allows for access and storage of process know-how.

QuinLogic's Expert Shell module allows for the access and storage of process know-how

Before the PPS installation, the quality engineers had to look up the information needed in many different systems/screens. This way of working includes a high risk of errors, with non-synchronised and therefore misleading data that can lead to inaccurate grading decisions and risky shipments.

Another issue is the fast changing requirements like new applications of forming and prefabricating coated parts, stamping of painted parts and others. Ultimately those ongoing changes define the need for an easy adaptable rule set, which is used for process supervision, automatic or semi-automatic grading or to get expert advice.



Changes of rules can now be executed and simulated on the quality engineer's level within minutes.

Why is the simulation of new or modified rule sets so crucial?

An operator's acceptance of a system is in question, if false alarms continue to happen. It only takes a short time until the system loses its credibility. Fast acceptance of a new system is achievable if all modifications are simulated offline and only proven rule sets are activated for the operation. This guarantees smooth and trusted operation.

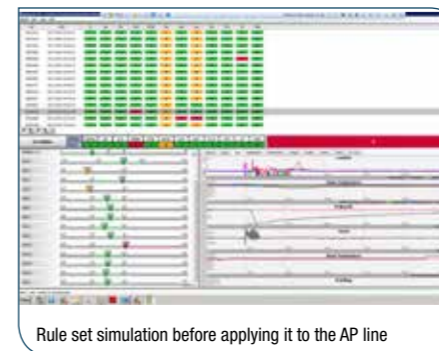
Results

At the customer's plant a complete AP line was equipped with a PPS system that was up and running after six months. Tuning, learning and fine tuning was a process of 12 more months. After that a very efficient rule set was achieved for all the different sections.

Major goals and achievements of the project:

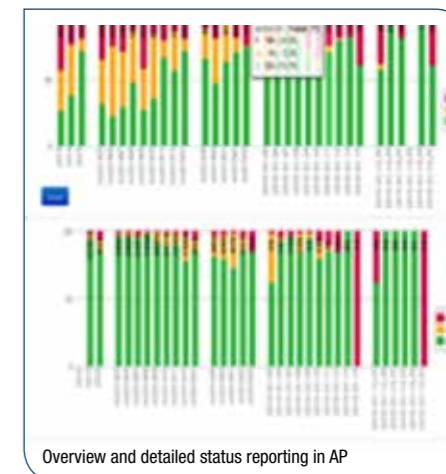
- Fast modification of line parameters for new stainless steel grades
- Reduction in downgraded material through fast interaction with production function
- Easy to use rule design allowed a lot of new evaluation by QA department
- PPS improved communication between production operators and QA department

- Reporting on section results and parameter details
 - The installation of the PPS project was completed in a very short time frame and support afterwards remains excellent
 - Project costs did not exceed the budget
- The PPS has been implemented on a centralised server with a data integration module. All the results and aggregated data sets are stored on the PPS database. The raw measurement data remains in the original database to avoid data duplication.



Outlook

This project confirmed that implementing a PPS software application and switching it online quickly has a positive impact on the workflow of the whole steel mill. A professional, proactive quality improvement programme can be initiated and driven



forward. The flexible and easy to use features are essential when faced with fast changing market conditions.

The overall QA process throughout the complex AP line is now consistent and predictable. This was achieved with a closed feedback loop from all nine sections concerning quality deviations. In addition PPS improved the fact-based communication of the quality assurance department with the operation department. It enables prioritised improvement actions to be decided on facts, rather than educated guesses.

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