

High tech for new aluminum cold rolling stands Shandong Nanshan Aluminium Co., Ltd, Longkou city, China



Advanced drive and automation technology

Based on the latest technologies, ABB has provided a complete solution for electric equipment and automation technology for two new 6-high aluminum cold rolling stands of Shandong Nanshan Aluminium Co., Ltd.

Within the scope of the project, ABB was responsible for project management, engineering, installation, commissioning and training of customer staff.

The ABB scope of supply included:

- Complete process control, incl. technological controls and adaptive preset models for set-point generation
- Production management system
- Main and auxiliary drive systems using the latest AC technologies
- Instrumentation and power supply

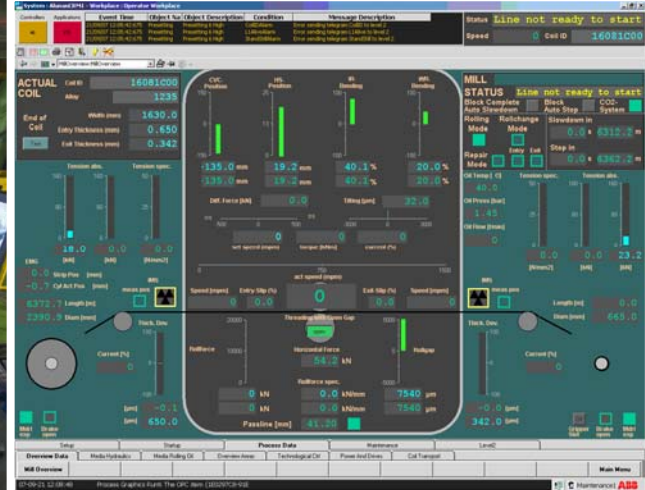
Facilitating maximum product quality

The extremely high level in production quality, which meets international top quality standards, is ensured by ultra modern automation equipment, integrated control models and comprehensive data links.

An ABB team from Germany supported by employees of local ABB specialist departments, which are found throughout the globe, commissioned the plant.

Pre-commissioning took place in autumn 2006, and the actual commissioning was completed in November 2007 by performing the acceptance tests. Within a very short period of time, the ABB team managed to reach the required maximum speeds of 1500 m/min and 1800 m/min for a large variety of material types and alloy groups.

With an annual production of approx. 120,000 t per roll stand produced by this plant, the Nanshan group has one of the most modern and powerful plants of this kind in China.



Shandong Nanshan Aluminium Co, Ltd.

The Nanshan Light Alloy Co., Ltd. of Shandong Nanshan Aluminium Co., Ltd. with an employee base of more than 1000 employees is part of the Nanshan Group, which includes more than 30 enterprises.

The new plants in the industrial park of Nanshan, in the Chinese province of Shandong, form the central line of production in the newly built aluminum rolling mill complex for manufacturing of semi-finished foils and finished materials.

Plant data

Plant	CRM 1	CRM 2
Material	Aluminium Aluminium alloy	
Capacity	approx. 120.000 t/a	
Strip width	max. 2100 mm	
Coil weight	max. 30 t	
Coil diameter	max. 2800 mm	
Entry thickness (mm)	0,36 – 10	0,16 – 3,5
Exit thickness (mm)	0,2 – 0,5	0,1 – 2,5
Max. rolling speed	1500 m/min	1800 m/min
Strip tension entry	max. 160 kN	max. 120 kN
Strip tension exit	max. 160 kN	max. 120 kN
Start up	06/2007	1/2007

The latest automation technology - AC800PEC controller as the core

Automation technology is based on the 800xA concept, and includes six AC800PEC-type high-tech controllers as the core of the plant, in addition to the peripherals, I/O modules and communication modules.

These controllers are used for all applications in cold rolling mills - for technological controls, drive controls, plant control functions and auxiliaries. A client/server system including operator terminals was installed for visualization and plant operation

Technological controls and mathematical preset models

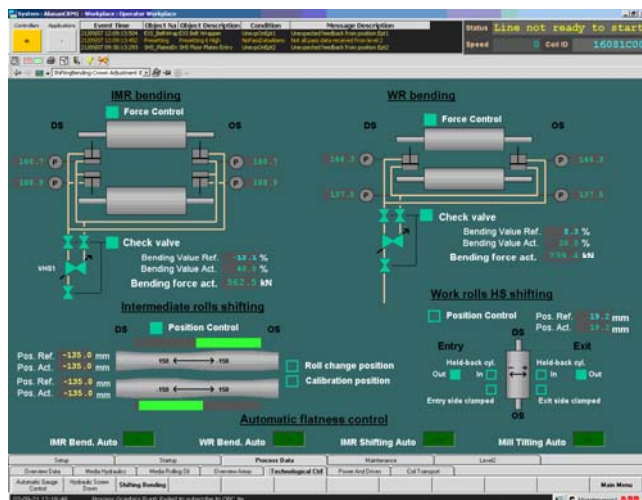
The package solution for both 6-roll stands consists of the technological controls and of an adaptive preset model for determination of preset values for the rolling mill.

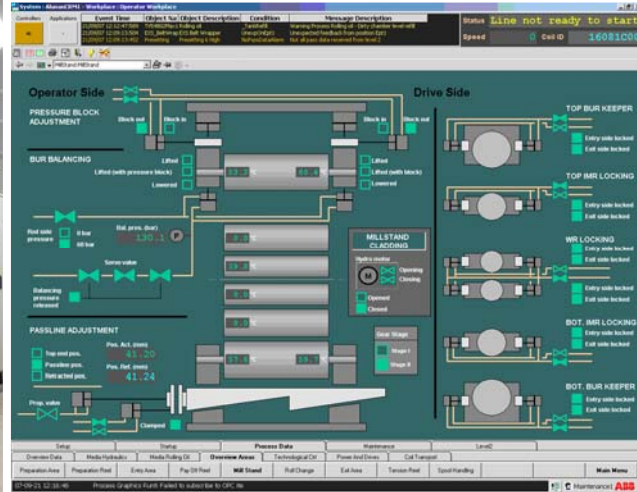
Technologies used for the rolling mill stands:

- Thickness control based on mass flow and speed/tension feed forward control
- Roll gap controls
- Direct tension control
- Flatness control (skewing, roller bending, partial cooling)

These individual control strategies are provided with monitoring functions for secure operation. Should any transducer fail (e.g. a laser transmitter), the control strategy will be switched in order to allow the production to continue.

By using mathematical models for preset calculation, a precise definition of preset values is achieved for the rolling mill based on the actual process conditions and on the properties of the entering material.





Production management

The following functions are implemented in the process control computer:

- Order planning and management
- Material tracking
- Roll management, including data exchange with the robot for roll change and for the roll grinder
- Coil and production reports
- Model-based pass scheduling and set-point calculation
- Interfaces with the process control system, the ERP and the HighBayStorage (HBS) and HotFlatStorage (HFS)

Pass scheduling and set-point calculation for all rolling phases are automatically carried out, and based on the actual coil, roll and adaptation data, as well as on the operator trim values and a product specific roll procedure.

Adaptive models for roll force, torque, forward slip, roll and strip temperature, thermal crown, mill stand module, roll bending and wear are used to predict the expected process behavior in all phases of rolling.

Altogether, more than 300 set-points and control parameters are preset by the model for each coil.

State-of-the-art drive technology

The mill main drives are equipped with IGCT medium voltage frequency converters of ACS6000 type in 3-phase AC technology.

For the auxiliary drives, low-voltage frequency converters of ACS800 type are in use.

Fast direct torque control (DTC) provides for excellent, dynamic torque and speed accuracy, which is of utmost importance in particular for thin roll materials and with extremely small strip tensions.

The drive dynamics have a direct impact on process quality, since they are amongst the most important control variables for strip tension and rolling speed in order to achieve high strip-quality levels.

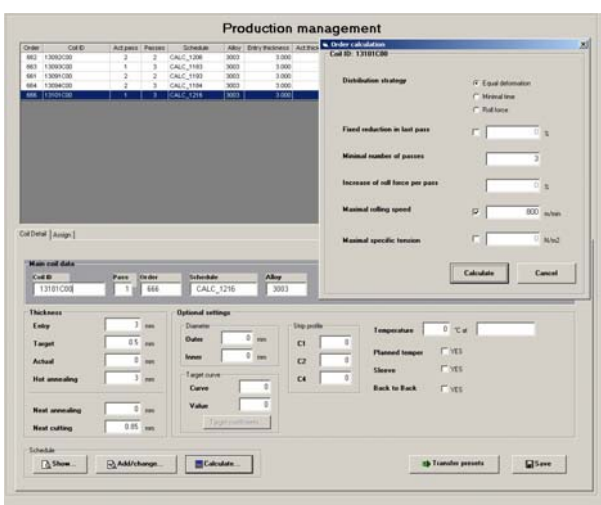
As a result, a quick response to torque variations allows a higher accuracy in strip tension control at the reels. The high torque accuracy and dynamics of the drives used in combination with mass flow control lead to extremely fast correction times of process disturbances and hence to exceptional thickness quality.

Controlled roller conveyor motors were implemented for logistic purposes between CRM1 and CRM2 and between HighBayStorage and HotFlatStorage.

Results

The following characteristics are ensured by closely integrating all closed-loop control functions and by the ABB automation concept:

- Outstanding quality tolerances for all products
- Reproducible quality
- Minimized off-gauge lengths
- Increased productivity thanks to higher rolling speeds and improved availability



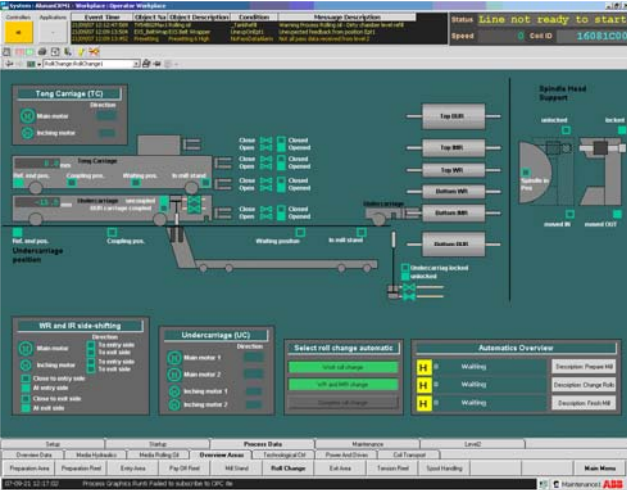


ABB scope of performance

ABB has designed and delivered the following equipment and was responsible for project management, engineering, training, installation and commissioning.

Power system

- DS motors and IGCT medium voltage inverters ACS6000 with Direct Torque Control (DTC) and common busbar for all main drives
- DS drive units ACS800 and MCCs for auxiliary drives

Main drive characteristics

Mill stand	5000 kW (593 min ⁻¹)
Uncoiler	2560 kW (331 min ⁻¹)
Tension reel	1707 kW (326 min ⁻¹)

Automation system

Total integration of automation functions in ABB 800xA control system based on AC800PEC controllers.

- Drive control
- Pilot control
- Technological controls
- Unified system for human-machine communication
- Connection with existing PLCs e.g. for auxiliary drives

Technological controls

- Thickness control
- Direct tension controls
- Roll gap controls
- Flatness controls
- Coil eccentricity compensation

Process control computer

- Process data management
- Order management
- Material tracking
- Roll management
- Presets
- Adaptive rolling model for pass scheduling and set-point calculation
- Interface with HighBayStorage und HotFlatStorage

Instrumentation

- Thickness measurement devices
- Laser based speed-measuring instruments
- Tensiometer devices
- Flatness measuring roll
- Strip centering device

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