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ANDRITZ METALS

# HEAVY-PLATE LEVELER

SETTING NEW STANDARDS IN PRECISION LEVELING  
FOR PLATES

**ANDRITZ**

ENGINEERED SUCCESS

# Innovation in hot and cold leveling of heavy plate

The demand for plate with increasingly higher strength will continue to rise over the next few years. The challenge we have accepted is to produce high-precision plate with less internal stress. With the latest heavy-plate leveler design, we combine decades of experience in precision leveler manufacturing with state-of-the-art technology.

## MANUFACTURING PROCESS

Flatness defects and internal stresses cannot be avoided in the manufacture of hardened and tempered plates, even with the most up-to-date line technology. Thus, it is essential to level the plate after heat treatment, reducing internal stresses at the same time. ANDRITZ Metals has overcome this problem with the newly developed precision leveler, manufacturing plates of quality levels that were so far unattained. Cross-bows, longitudinal waves, or edge and center waves occur due to non-uniform deformation during hot rolling and, above all, during cooling. The plates to be leveled may have a high temperature of up to 700°C after tempering.

## OUR STRENGTH

- Tailor-made line concepts according to customers' requirements
- Highest quality because we manufacture our own core components and carry out pre-assembly and pre-commissioning in our workshops
- Future-oriented technologies as a result of continuing development
- Turnkey solutions including erection work, commissioning, training, and after-sales service
- High product quality and highest throughput rate at the same time
- Modernization of existing production equipment

## CONCEPT AND DESIGN OF THE ANDRITZ METALS HEAVY-PLATE LEVELER

Plates to be leveled can have thicknesses from 2.0 to 80 mm and yield points of up to 1,800 N/mm<sup>2</sup>. Until now, it has not been possible to process such plates with the conventional plate levelers available on the market. In general, plate levelers are equipped with a block-type hydraulic adjustment system or a means of adjusting the top and bottom leveler rolls individually. A complex and delicate hydraulic control system is necessary to stabilize the adjusting process in the event of load changes.

For this purpose, ANDRITZ Metals has enhanced the well-proven design of precision levelers that operate entirely mechanically. The leveler consists essentially of a bottom part, which accommodates the bottom rollers, and a top part for the upper rollers. Both parts are connected by four columns. The entire top part can be adjusted lengthwise and transversely towards the bottom part by means of 4 individual worm gear units.



Main operator room

### CHANGE SYSTEM

The number of rolls, the roll diameter, the roll spacing, and the stability of the entire machine, especially the leveler rolls support, are decisive criteria in leveling. The number of rolls depends on the material thickness and the yield point. In principle, a large number of rolls – up to 21 – are used for thin material; while fewer rolls – as little as nine – are required for thicker plates. The patented, cassette-type change system for the ANDRITZ METALS leveler allows the use of roll sets with different numbers of rolls and different roll diameters. The diameters and spacing between the rolls are adapted to the thickness and yield point of the material. A fully automatic cassette change in less than 15 minutes ensures a smooth process flow.

### 6-HIGH DESIGN FOR LONG LIFETIME

The 6-high design means that intermediate rolls are installed between the work and back-up rolls. Experience from the construction and operation of precision levelers has shown that a 6-high arrangement prolongs the service life of leveler rolls many times over.

### ROLL BENDING

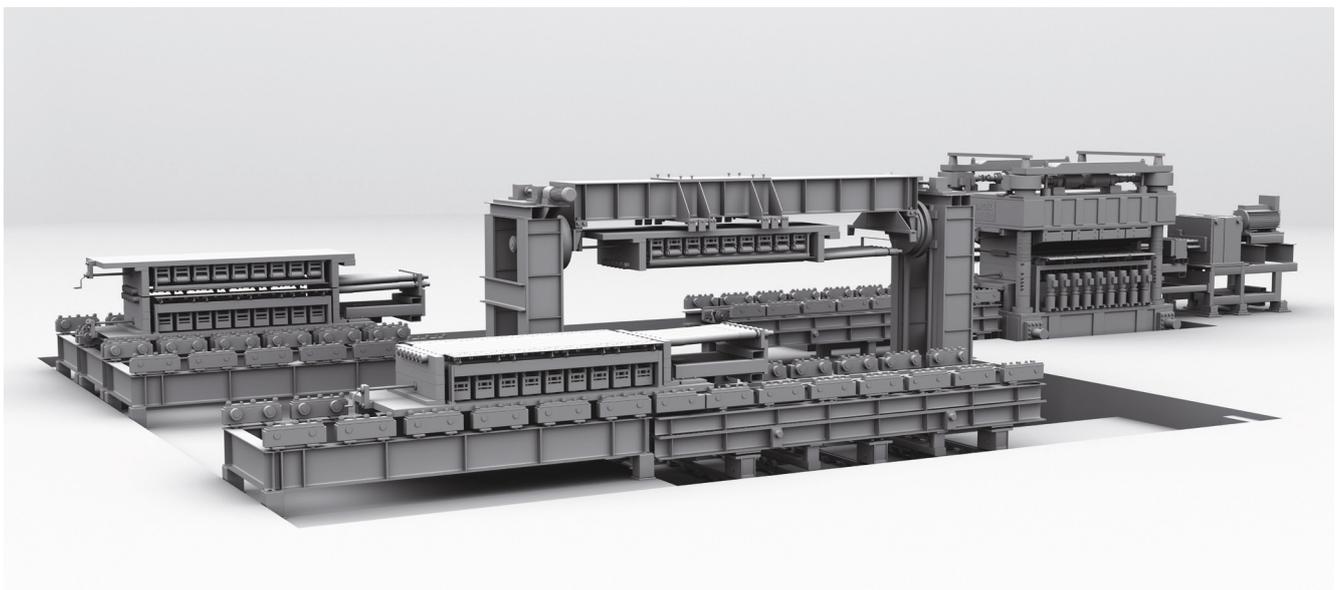
The bottom leveler rolls can be crowned. For this purpose, all supports on the bottom roll level are vertically adjustable by means of sliding keys. This function is used in case of asymmetrical defects, such as center waves.

### NEW DRIVE CONCEPT

In order to improve product quality, a newly developed single-roll drive system is applied. This means that the individual speed and torque of each leveling roll can be controlled, thus avoiding overload and sliding. As a result, the roll wrap differential effect, which has a negative influence on the internal stress in the material, is eliminated. At the same time, all components, such as cardan shafts and connecting couplings, are only subject to the permitted torque, unlike the variant with a power take-off gear where all the shafts operate at the same speed. This generates high stress in the gear, which can result in considerable wear on all components. Thanks to the single-roll drive, the lifetime of the drive rolls is extended several times over and the maintenance costs are thus reduced to a minimum.

### FEATURES

No. of rolls in set:	13/17/21 or 9/13/17 rolls
Roll diameters:	200/180/120/100/72/50 mm
Cassette changing time:	less than 15 minutes

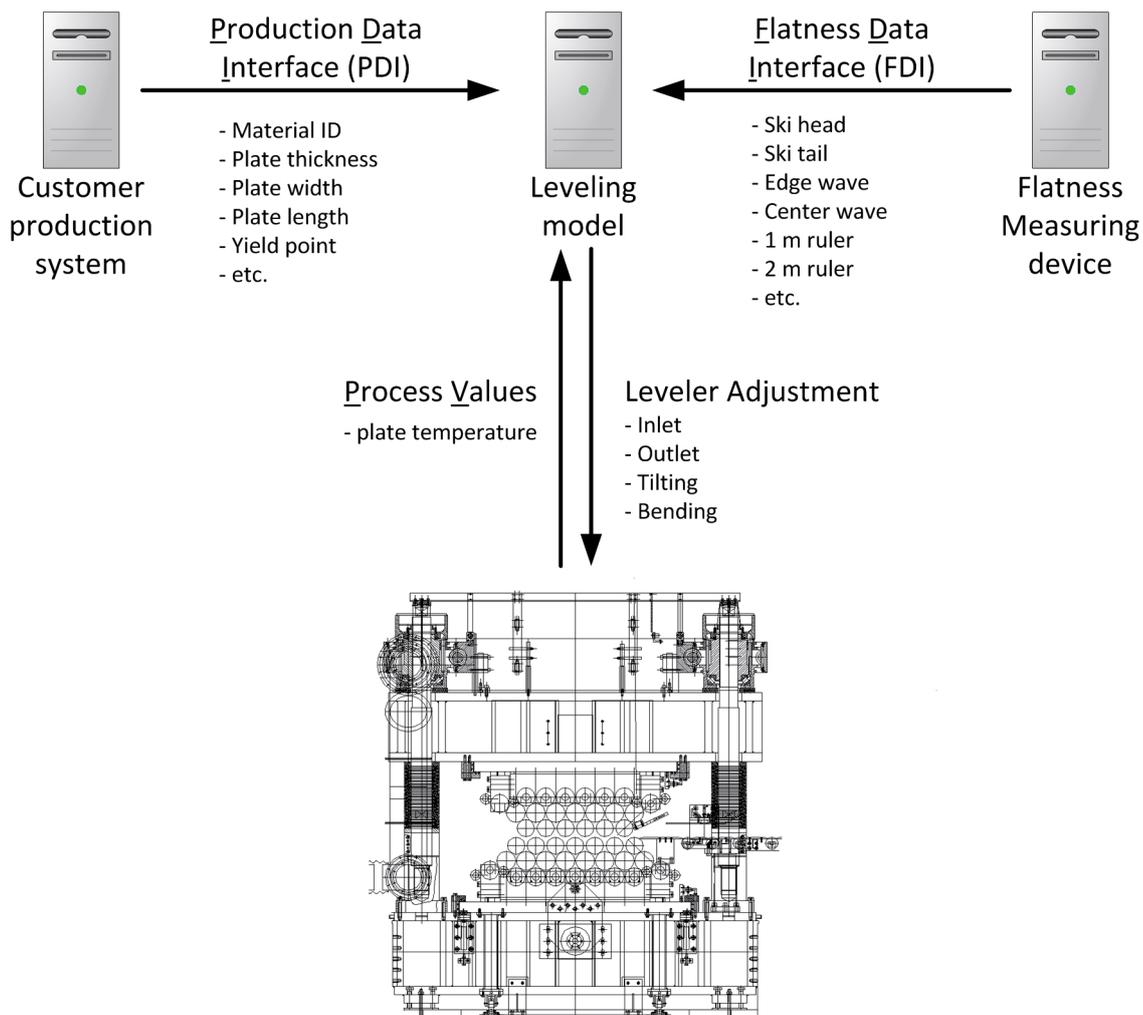


Leveling cassettes with automatic opener

# Fully automatic production sequence

The data necessary for adjusting the leveler (such as thickness, width, yield point, etc.) are sent to the leveling model system via PDI for each plate. Yield point and E-module curves for hot material depend on the plate temperature and material-specific data, and they can be stored in the leveling model system. Depending on the temperature measured at the entry side of the leveler, the model calculates the set points for the adjusting process. Special routines ensure constant plastification of the plates and thus, also an op-

timum leveling result. If some defects in the flatness, such as ski head or tail, edge waves, etc., appear after the first leveling process, the operator can decide whether the plate should be leveled again or not. If additional leveling is needed, the plate moves back and the leveling model system re-calculates the settings according to a special fault compensation system. Practical experience has shown that over 90% of the plates achieved the desired flatness after one leveling pass.



Overview of leveling model



# Flatness measuring

The basic principle of flatness measuring is a non-contact, optical measurement of the plate's absolute height. This uses the laser triangulation method combined with high-resolution matrix cameras. A combination of these two systems is necessary to achieve the most accurate image of the plate.

## THE FOLLOWING ARRANGEMENT IS USED TO MEASURE THE PLATES:

A continuous laser line and high-precision laser points are projected vertically onto the plate. The distance between the laser and the points on the plate is measured using the triangulation method. Additionally, two matrix cameras are used, viewing the laser line and the laser points at an angle of approx. 45 degrees. An angle of 45 degrees gives the highest measurement resolution. Only this measurement geometry allows high measuring frame rates, which are mandatory for flatness measurement.

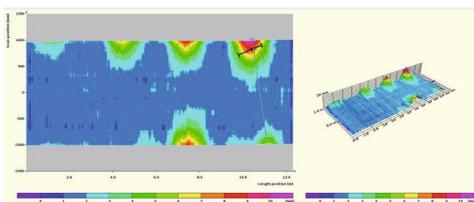
The laser line measurement is calibrated continuously with the point laser measurement. The camera signals are transferred to and processed by a separate computer. Digital Signal Processors in real time with a gray level image processing technique are used in order to

detect the laser spots on the plate with high accuracy and reliability under non-ideal environmental conditions.

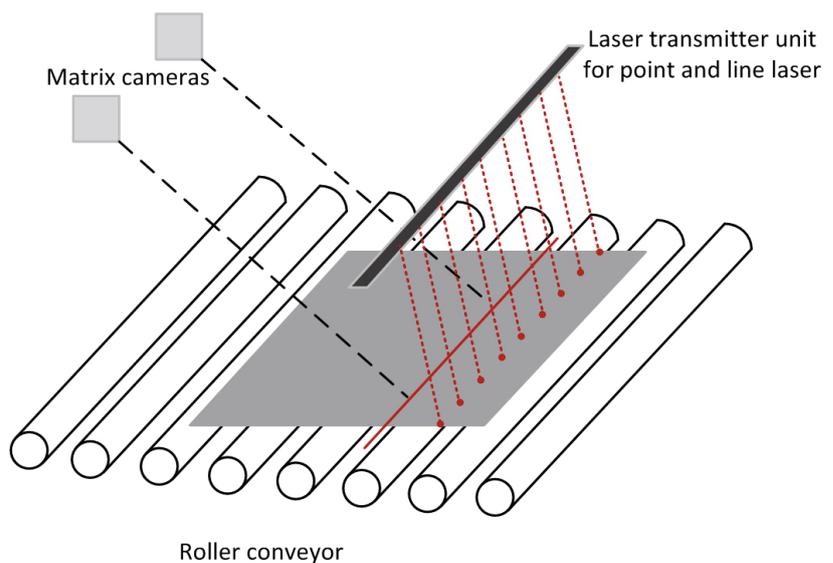
A three-dimensional profile of the strip surface is generated from the distance measurement values. The gauge is able to cope with thickness variations, tilt, lift, and bounce of the material to be measured.

Measurement output is:

- Flatness faults (such as ski head, ski tail, edge waves, etc.)
- 3-D height profile
- 1 and 2 m ruler according to DIN standard



Screenshot of flatness result



Measurement system

# Special features

Our leveler combines state-of-the-art technology with the full scope of fundamental attributes. It combines the features of a precision leveler for cold-rolled strip with those of a heavy-plate leveler:

- High range of thicknesses covered (up to 1:30) with one leveler results in low investment costs
- Modular design with patented, fast exchange of leveling cassettes with various numbers of rolls and various diameters
- Option to upgrade with additional leveling cassette keeps you flexible for further material requirements
- "Six-high" roll arrangement ensures long lifetime of leveling rolls and best surface quality
- Purely mechanical adjustment ensures highest flatness
- Four-column design for spherical tilting of upper leveling cassette ensures best flatness. Also for

"complicated" material (edge waves)

- Individual bending system for leveling rolls
- Automatic pre-selection of setting values by means of a model calculating device with level 2 connection
- Special safety couplings avoid damage to cardan shafts and gearbox, wear- and maintenance-free
- Hot material up to 700°C can be leveled without water cooling
- Double pinch rolls at entry
- Integrated scale transport
- Flatness measurement
- Incoming thickness control by means of a thickness gauge

## INSPECTION EQUIPMENT

- Inspection and cleaning device for cassettes
- Fully automatic cassette opener



Automatic cassette changing

# A few of our references

## TECHNICAL DATA

	Type: 200.3800/13	Type: 150.2000/13	Type: 200.2600/13
Scope	Cassette 1 with 13 rollers with diameter 200, cassette 2 with 17 rollers with diameter 100, entry roller table with centering device, double pinch roll at entry side, exit roller table with laser flatness measuring, fully automatic cassette changing device, scale exhaust system, complete automation with automatic setting	Cassette 1 with 13 rollers with diameter 150, cassette 2 with 19 roller with diameter 100, entry rollers table with centering device, double pinch roll at entry side, exit roller table with laser flatness measuring, fully automatic cassette changing device, scale exhaust system, complete automation with automatic setting, cassette opener for maintenance	Cassette 1 with 13 rollers with diameter 200, cassette 2 with 17 rollers with diameter 100, entry roller table with centering device, double pinch roll at entry side, exit roller table with laser flatness measuring, fully automatic cassette changing device, scale exhaust system, complete automation with automatic setting, cassette opener for maintenance
Material	High tensile strength steel	High tensile strength steel	High tensile strength steel
Line capacity	144,000 t/year	100,000 t/year	150,000 t/year
Dimensions	Plate width: 700–3,800 mm Plate thickness: 2–60 mm Plate length: 4,000–16,500 mm Yield limit: 1,800 N/mm <sup>2</sup> Sheet temperature: 700 °C max. Leveling force: 120,000 kN max.	Strip width: 900–1,900 mm Strip thickness: 3–12 mm Plate length: 2,000–12,800 mm Yield limit: 1,500 N/mm <sup>2</sup> Sheet temperature: cold Leveling force: 24,000 kN max.	Strip width: 1,000–2,600 mm Strip thickness: 7–40 mm Plate length: 2,000–13,800 mm Yield limit: 1,500 N/mm <sup>2</sup> Sheet temperature: cold Leveling force: 60,000 kN max.
Start of operation	2010	2013	2013



Precision leveler for plates



Precision leveler for plates



## ANDRITZ METALS

ANDRITZ Metals is the technology and global market leader in forming equipment through the Schuler Group, in which ANDRITZ has a stake of more than 95 percent. Schuler offers presses, automation solutions, dies, process know-how, and services for the entire metal forming industry. Its customers include car manufacturers and their suppliers, as well as companies in the forging, household appliance, packaging, energy, and electrical industries. Schuler is also the market leader in minting technology and offers system solutions for various high-tech segments.

In addition, ANDRITZ Metals is one of the leading global suppliers of complete lines for the production and processing of cold-rolled strip made of carbon steel, stainless steel, aluminum, and other non-ferrous metals. The lines comprise equipment for pickling, cold rolling, annealing and heat treatment, surface finishing, strip coating and finishing, punching and deep drawing, and regeneration of pickling acids. The business area also supplies turnkey furnace systems for the steel, copper, and aluminum industries, burners and refractory products, welding systems, as well as comprehensive services for the metal working industry.

### ENGINEERED SUCCESS FOR FLAT PRODUCT PROCESSING

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# ANDRITZ

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