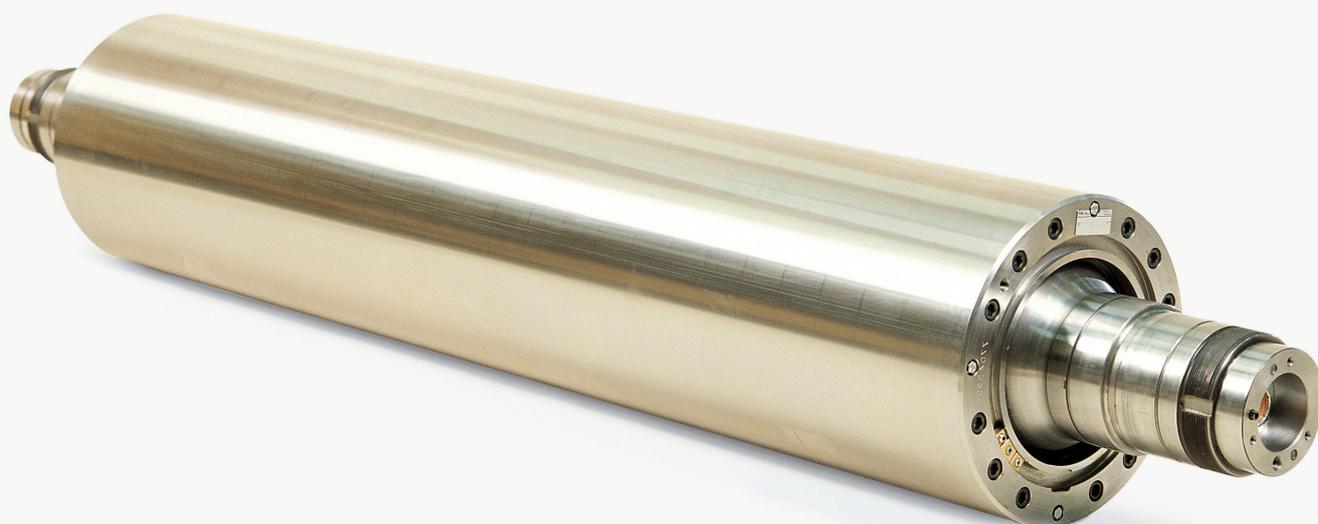

ABB MEASUREMENT & ANALYTICS

Stressometer systems

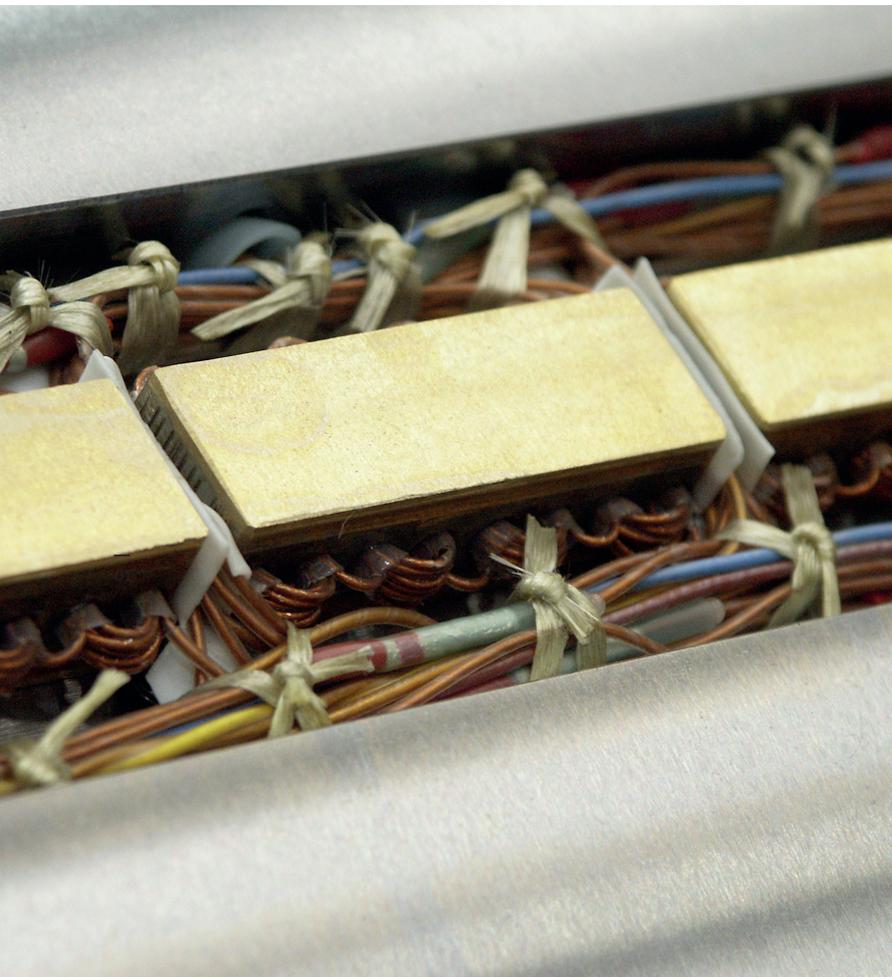
Solid measuring rolls
for every application



Stressometer systems

The measuring roll family

The Stressometer family of solid flatness measuring rolls for cold rolling mills has three members: Standard roll, Foil roll and Seamless roll. Together these rolls cover all needs of flatness measurement regardless of application and metal type being rolled.



The Stressometer story

Having its roots in a genuine world-class innovation, i.e. the Pressductor® transducer, the first version of the Stressometer® roll was developed in the 1960's. This was done as a response to the growing demand from rolling mills on productivity and strip quality.

The first Stressometer system, in fact the very first flatness system in the world, was delivered to Alcan in Kingston, Canada in 1967. Since then more than 1700 rolls have been delivered to rolling mills all over the world.

Our mission is, and always has been, to assist our customers in achieving the best possible productivity levels. The Stressometer system fulfills all needs for reliability, accuracy, performance, life cycle and return on investment.

The Stressometer story also includes a commitment from our side to support our customers in the long run. In order to do so our philosophy is to build in-house competence in all areas within flatness measurement, control, actuators and target generation. This includes continuous development of sensors, rolls, software, architecture and flatness control strategies and algorithms. In this way we have helped our customers to increase their competitiveness for more than 50 years.

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Our mission is, and always has been, to assist our customers in achieving the best possible productivity levels.

Pressductor technology

ABB has extensive experience in applying the electro-magnetic principle for force measurement. The innovative Pressductor transducer is used in rolling mills for measurement of roll force, strip tension and strip flatness.

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01 The interior of a Stressometer roll.

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02 Pressductor transducer principle.

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03 Roll with four rows of Pressductor transducers.

Pressductor technology – a well-proven innovation

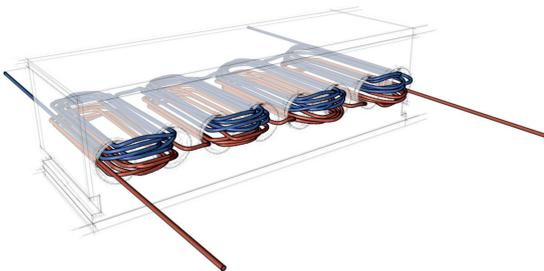
ABB's Pressductor transducer produces a signal as a result of changes in the electromagnetic field when the transducer is subjected to mechanical force. It is an operating principle that has its origin in a metallurgical phenomenon according to which mechanical forces alter the ability of some steels to convey a magnetic field. Unlike other flatness measurement principles, physical movement is not required for signal generation.

A Pressductor transducer has a simple and elegant design. Essentially two windings of copper wire around a steel core combine to provide a measurement signal.

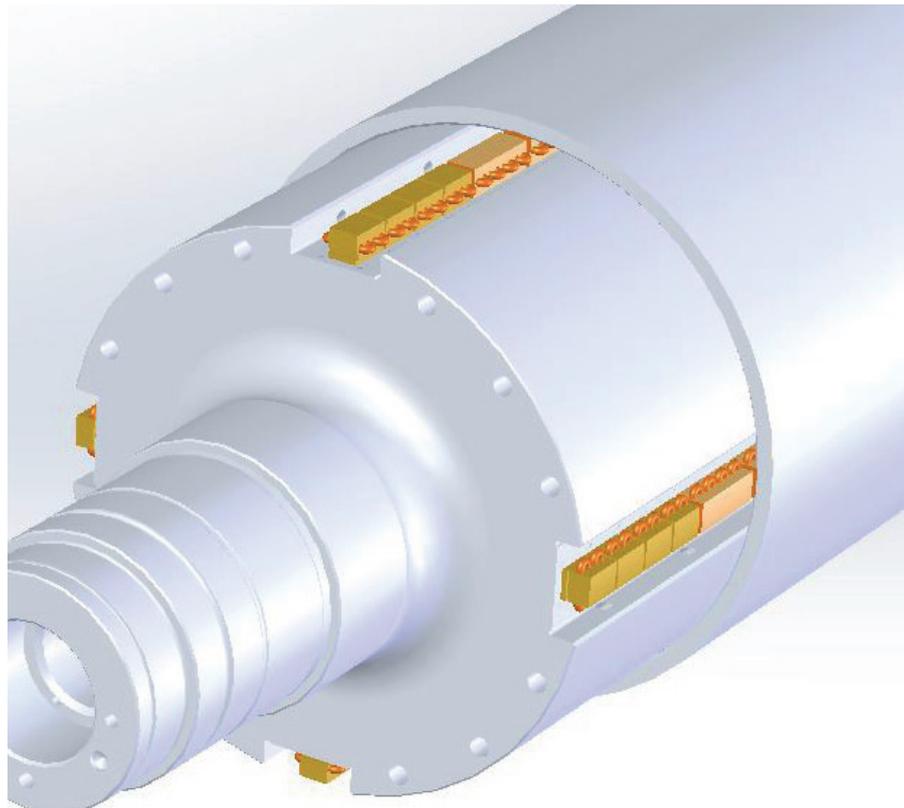
An electromagnetic field is created by continuously feeding an alternating current to one of the windings. The field is positioned in such a way that there is no magnetic coupling between them when the transducer is unstressed.

However, when the transducer is subjected to a force the magnetic field pattern changes. A portion of the field induces an AC voltage in the second winding that is directly proportional to the force applied to the transducer. This voltage – a comparatively strong transducer signal – is converted by the system into a flatness output.

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Common characteristics

All types of Stressometer rolls have a number of unique features

— 01 For a roll with 313 mm diameter the Stressometer can measure up to 260 measurement points per meter strip.

— 02 The 52 and 26 mm wide transducers used in the Standard Rolls and in the Seamless Rolls.

— 03 The 52 mm wide transducer used in the Foil roll.

- Four measurements per measuring roll revolution – from start of rolling up to 4000 rev/min, enable immediate flatness control.
- Supreme accuracy – normally around 0.5 l-units.
- Insensitive to tension transients caused by mill stand rolls or coil eccentricity.
- Unsurpassed parallel resolution – due to low force spread.
- Extreme reliability – MTBF (Mean Time Between Failures) more than 20 years.
- Long term stability – the sensors will not change sensitivity over time, thus eliminating the need for calibration on site.

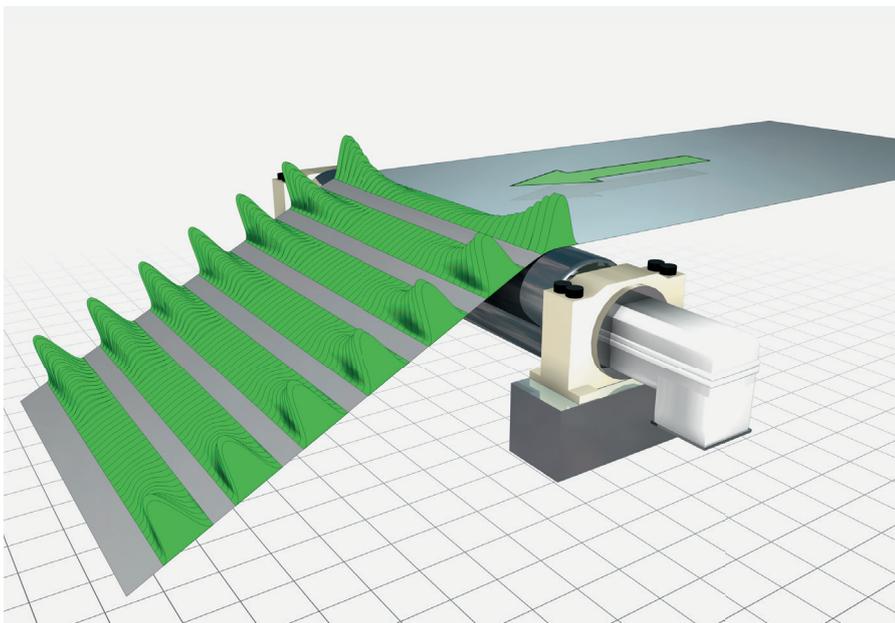
Direct and parallel measurement

It is important that all measurement points are processed in parallel i.e. at the same time. This means that strip tension variations will influence all measurement points in the same way and thus will not influence the actual flatness measurement.

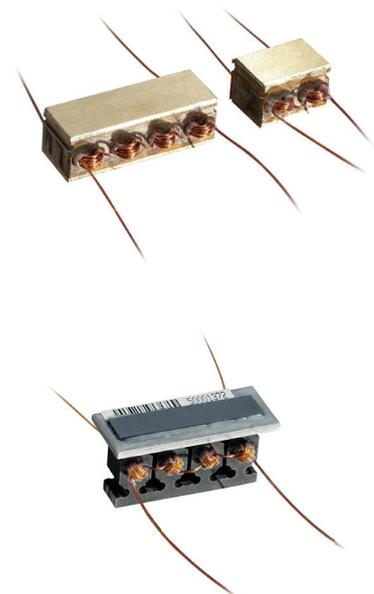
Four measurements per roll revolution

To get the shortest possible system response time, while maintaining the accuracy, it is vital to maximize the measurement density.

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 04 All Stressometer rolls have a very low force spreading value, thereby creating an unsurpassed parallel resolution which equals the measurement zone width.
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 05 Soft edge control.

Parallel resolution

Measurement resolution across the strip width is normally defined as the distance between measurement points in the measured force profile. This number is often used as a way to quantify a flatness measurement system’s ability to measure flatness gradients across the strip. However, the distance between measurement points is not in itself sufficient for this purpose. The reason is that force spreading or cross-talk can exist between the measurement values in the force profile.

A comparison can be made with photography where the pixel resolution in itself is not sufficient as a quality measurement, also the blur between pixels has to be considered.

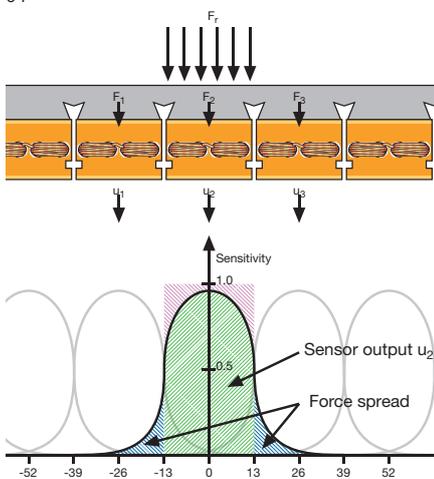
Edge stress measurement

The Stressometer measures the edge stress even with a small coverage of the edge transducer. Typical values are 1–5 mm.

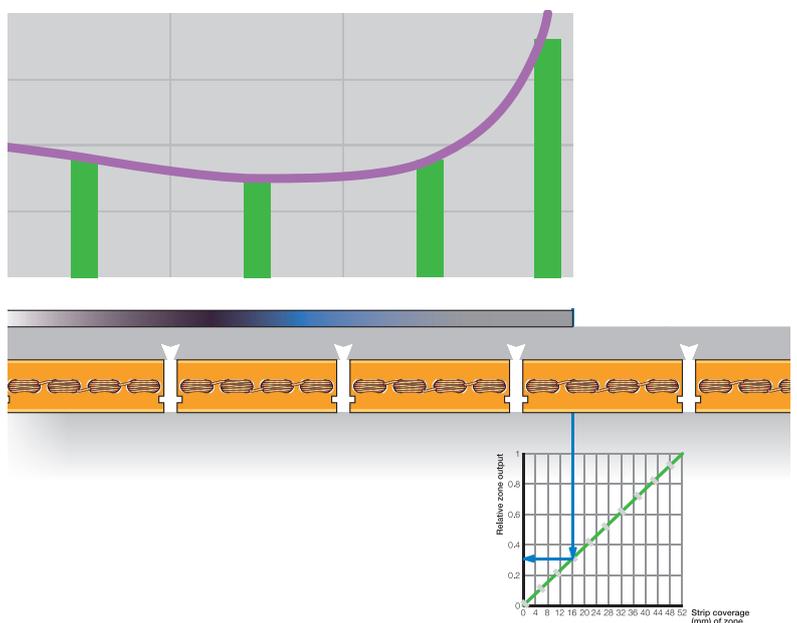
Sensor linearity

The output from a measurement zone is a completely linear function of the strip coverage of the zone. This means that compensation of partly covered zones can be done with high accuracy.

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Measuring roll types and coatings

Standard roll

The well-proven standard roll uses 26 or 52 mm wide transducers for measuring flatness. The transducers are protected by shrink-on rings. Roll diameter, ring material, surface material and surface hardness are adapted to demands of each specific application.

Seamless roll for special applications

The seamless roll is used where quality of the strip surface is of particular importance. The roll has a completely seamless surface – there is nothing that can mark the strip.

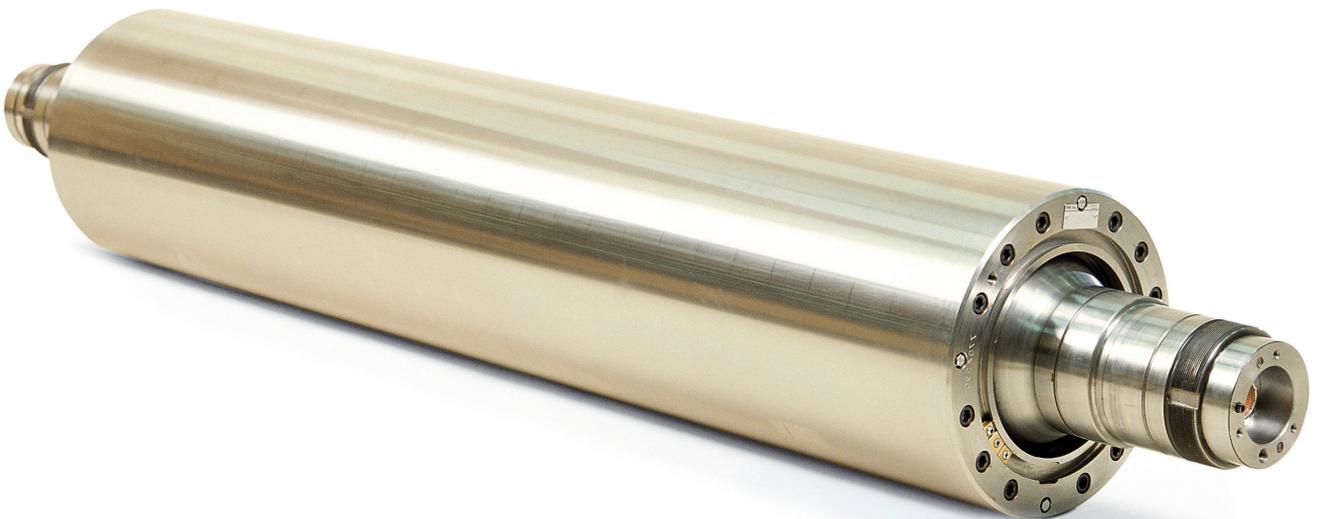
The surface is adapted to the actual application and is typically made of tungsten carbide but other materials can be selected. Material and surface roughness is optimized in order to minimize wear and to prevent material pick-up.

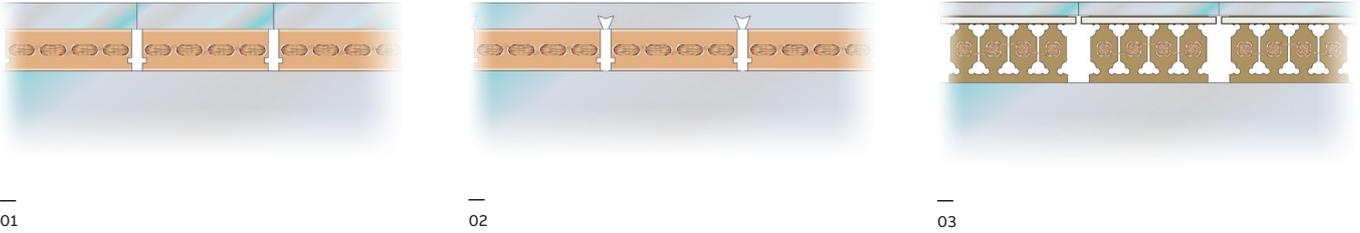
The roll body is completely sealed and no dirt or liquid can enter into the body. This makes the roll exceptionally reliable. The roll has 26 or 52 mm wide transducers enabling parallel resolution of 26 or 52 mm.

Foil roll for low-tension applications

The foil roll has a Pressductor transducer with a somewhat different design compared to the standard transducer.

While sharing long-term stability e.g. no sensitivity drift and other important Pressductor characteristics with the standard transducer, the foil transducer has a better signal to noise ratio. This makes the transducer extremely well suited for low-tension applications like aluminium and copper foil.





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01 Standard roll with 52 mm wide Pressductor transducers covered by steel rings.

02 Seamless roll with 52 mm wide Pressductor transducers covered by a seamless steel ring.

03 Foil roll with 52 mm wide Pressductor foil transducers covered by steel rings.

ABB has developed a series of different types of roll surfaces meeting most requirements

Type of roll surface	Surface hardness (± 2 HRC)	Surface life cycle	Regrinding
Hardened steel	54 HRC	>20 years	after 2–3 years ¹⁾
High speed steel (HSS)	60 HRC	>25 years	after 3–5 years ¹⁾
Seamless roll coating	66–70 HRC ²⁾	>5 years	recoating and grinding after 5–10 years

1) Depending on application.

2) Depending on material composition in coating layers.

Roll data

Features	Standard roll	Seamless roll	Foil roll
Roll life cycle	More than 20 years	More than 20 years	More than 20 years
Strip thickness range	0.1 to 10 mm or 0.02 to 2 mm ¹⁾	0.1 to 10 mm or 0.02 to 2 mm ¹⁾	0.005 to 0.5 mm
Typical accuracy (installation dependent)	0.5 I-units	0.5 I-units	0.5 I-units
Parallel resolution ²⁾	26 and/or 52 mm	26 and/or 52 mm	52 mm
Measurement zone width	26 and/or 52 mm	26 and/or 52 mm	52 mm
Minimum edge zone coverage for measurement	1 mm	1 mm	1 mm
Measurement range, tension/zone	10 to 60000 N 5 to 10000 N ¹⁾	10 to 60000 N 5 to 10000 N ¹⁾	1 to 1000 N
Maximum mechanical load, without need for recalibration of the roll	120000 N 2000 N ¹⁾	120000 N 2000 N ¹⁾	2000 N
Dynamically measurable force change per zone	0.7 to 1 N ³⁾ 0.3 to 0.5 N ¹⁾	0.7 to 1 N ³⁾	0.02 to 0.03 N ³⁾
Maximum measurement density (number of measurement points/meter strip)	320 ⁴⁾	320 ⁴⁾	290 ⁴⁾
Maximum strip temperature	240°C ⁵⁾	240°C ⁵⁾	180°C
Minimum wrap angle	4 degrees	4 degrees	10 degrees
Roll diameter	313, 400 mm	313, 400 mm	200, 303 mm

Coatings

Hardened steel	•	–	•
High speed steel	•	–	–
Seamless roll coating	–	•	–

1) Semi foil design.

2) Resolution with max. 2 x 12.5% force spreading to adjacent measurement zones.

3) Wrap angle dependent.

4) 4 measurement points per zone and roll revolution.

5) Without airknives or other cooling systems. Several installations in aluminium hot rolling mills have been made.



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