

Measurement & Analytics | Measurement made easy

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 1500 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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Pressductor® Technology

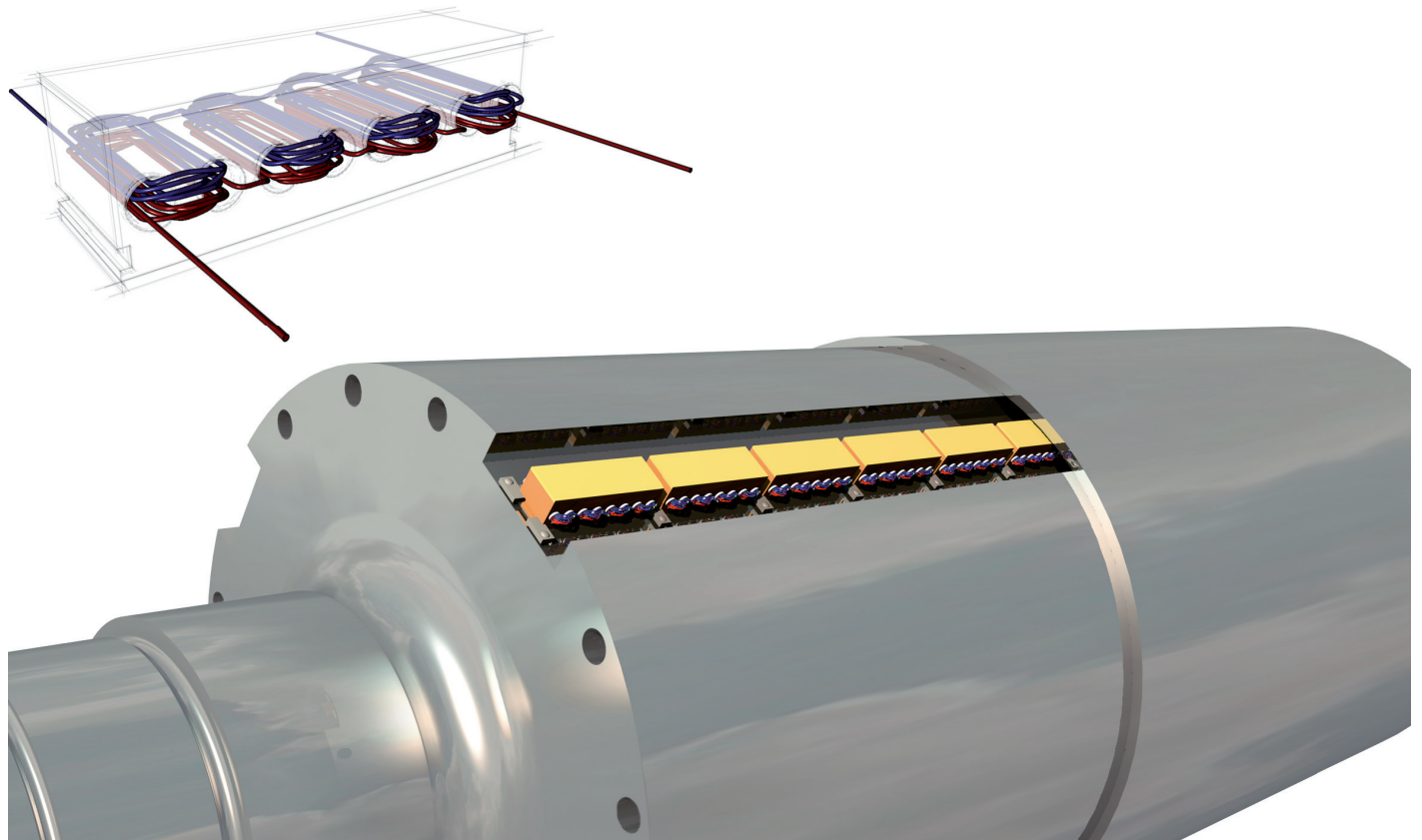
Sixtyfive years ago, ABB succeeded in applying the electro-magnetic principle to force measurement in rolling mills and started to produce the Pressductor® transducer. The transducer in the Stressometer roll is one of them.

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.



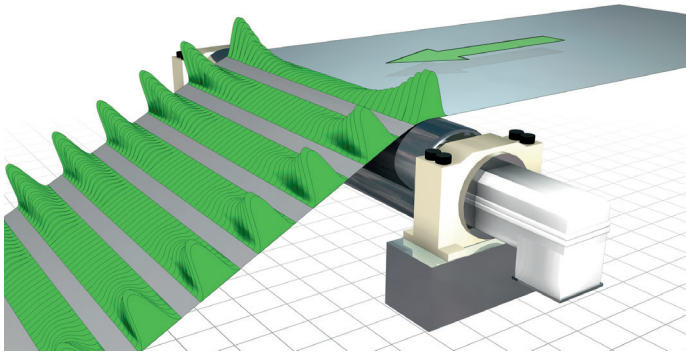
Common characteristics

All types of Stressometer rolls have a number of unique features

- 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 I-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

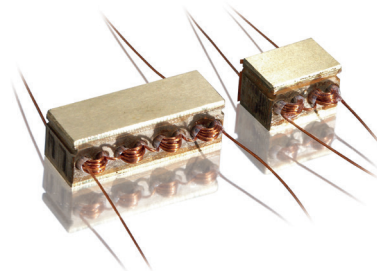
Direct and parallel measurement

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.

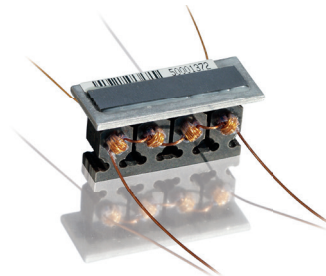


Four measurements per roll revolution

To get the shortest possible system response time, while maintaining the accuracy, it is vital to maximize the measurement density. For a roll with 313 mm diameter the Stressometer can measure up to 260 measurement points per meter strip.



The 52 and 26 mm wide sensors used in the Standard Rolls and in the Seamless Rolls.



The 52 mm wide sensor used in the Foil Roll.

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.

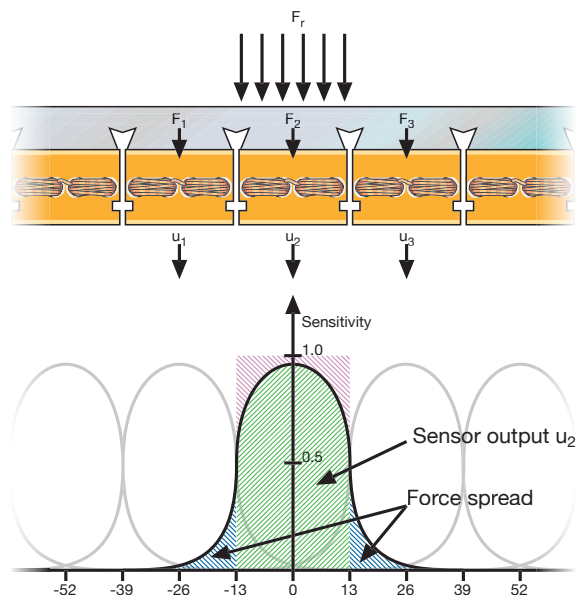
Edge stress measurement

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

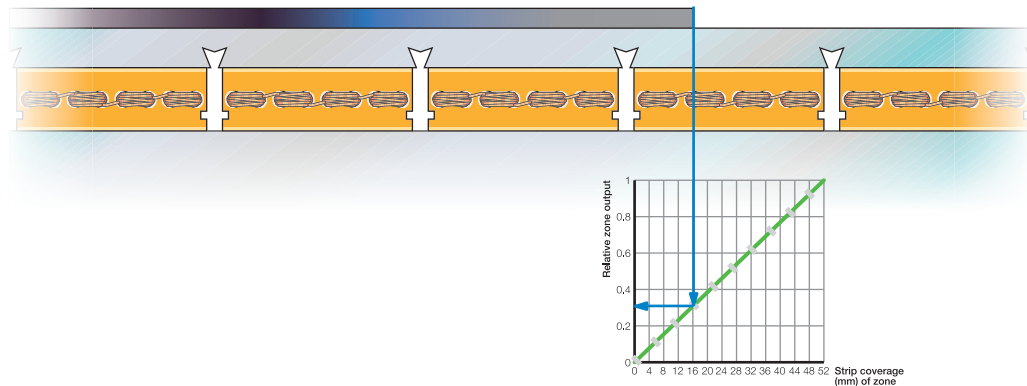
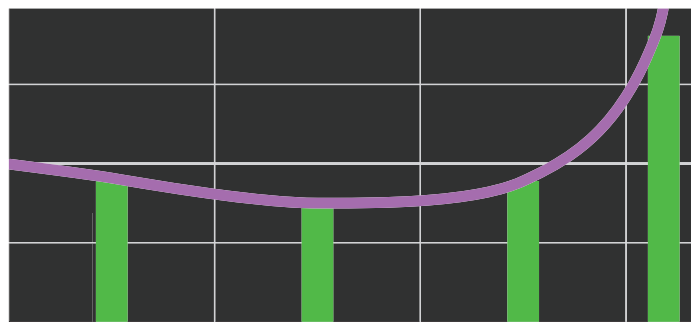
Sensor linearity

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.



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



Measuring roll types and coatings

Standard roll

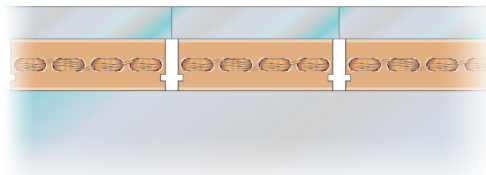
The well-proven standard roll uses 26 or 52 mm wide sensors for measuring flatness. The sensors are protected by shrink-on rings. Roll diameter, ring material, surface material and surface hardness are adapted to demands of each specific application.

Seamless roll for special applications

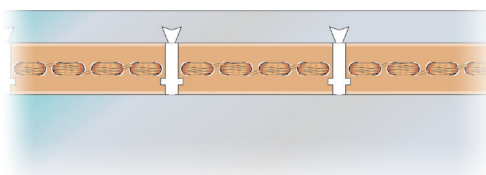
The seamless roll is used where quality of the strip surface is of particular importance. The roll has a completely seamless surface – there is nothing that can mark the strip. The surface is adapted to the actual application and is typically made of tungsten carbide but other materials can be selected. 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 sensors for measuring the flatness.

Foil roll for low-tension applications

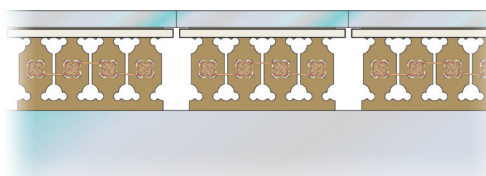
The foil roll has a Pressduktor sensor with a somewhat different design compared to the standard sensor. While sharing long-term stability e.g. no sensitivity drift and other important Pressduktor characteristics with the standard sensor, the foil sensor has a better signal to noise ratio. This makes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



Standard roll with 52 mm wide Pressduktor sensors covered by steel rings.



Seamless roll with 52 mm wide Pressduktor sensors covered by a seamless steel ring.



Foil roll with 52 mm wide Pressduktor Foil sensors covered by steel rings.

ABB has developed a series of different types of coatings meeting most requirements

	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

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	0.1–10 mm or 0.02–2 mm ¹⁾	0.1–10 mm or 0.02–2 mm ¹⁾	0.005–0.5 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	10–60000 N 5–10000 N ¹⁾	10–60000 N 5–10000 N ¹⁾	1–1000 N
Maximum mechanical load, tension/zone, without need for recalibration of the roll	120000 N 20000 N ¹⁾	120000 N 20000 N ¹⁾	2000 N
Dynamically measurable force change per zone	0.7–1 N ³⁾ 0.3–0.5 N ¹⁾	0.7–1 N ³⁾ 0.3–0.5 N ¹⁾	0.02–0.03 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.

Contact us

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