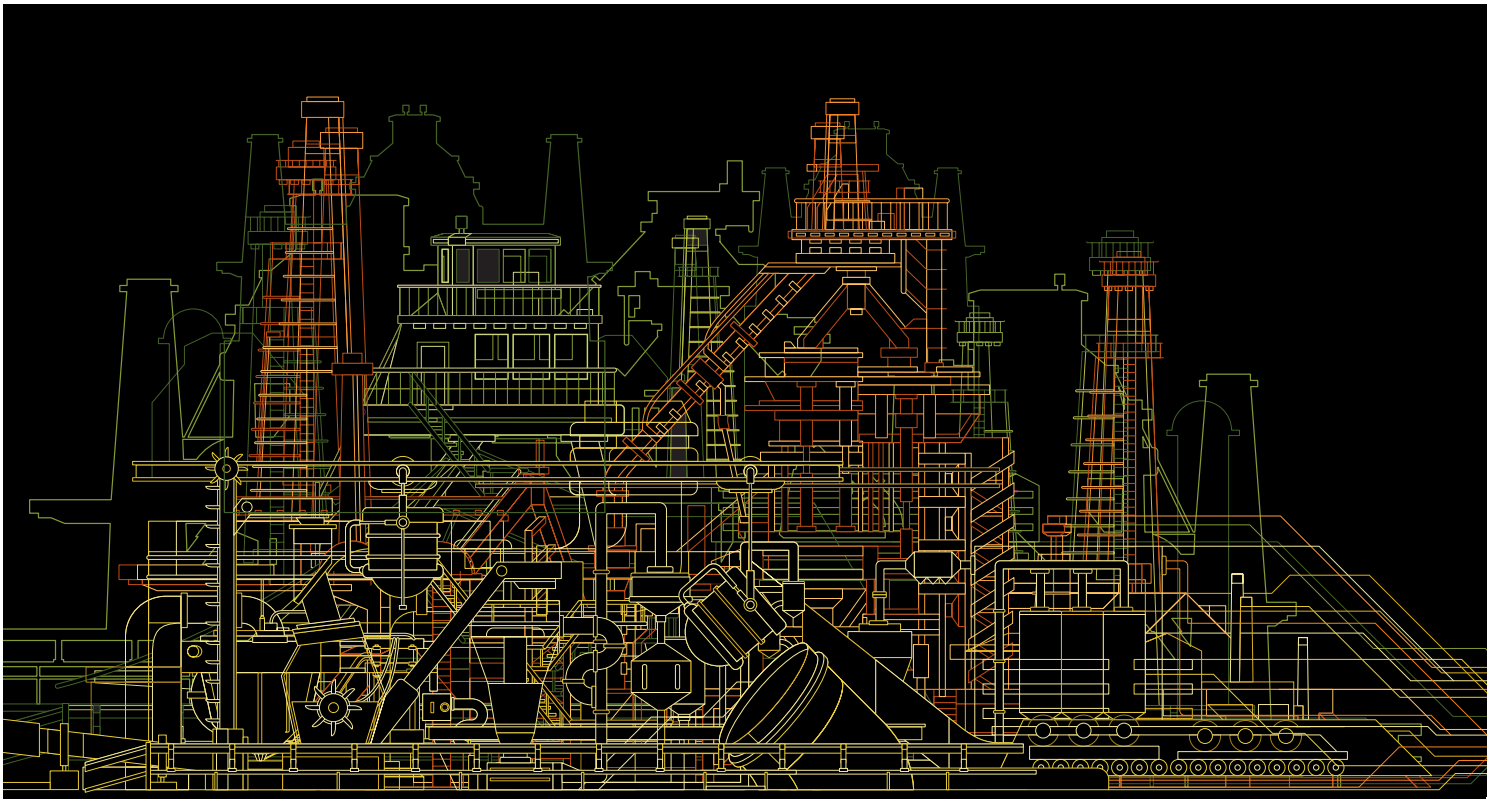


Metallurgy Products

EM Stabilizer
Improved coating quality and zinc savings for galvanizing lines

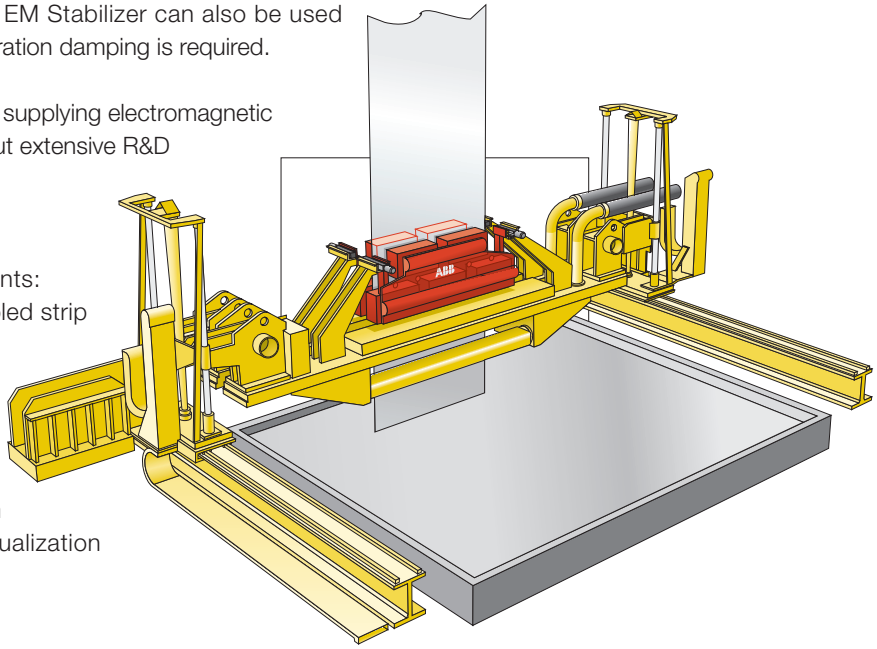
Power and productivity
for a better world™

Non-contact electromagnetic strip stabilizer for galvanizing lines

ABB's EM Stabilizer reduces vibrations and strip shape problems such as cross bow in galvanizing lines. A state-of-the-art control system which is robust and optimal for all strip dimensions enables improved quality of the coating layer and reduced overcoating.

The EM Stabilizer helps the steel industry achieve its objective of higher quality and lower costs. The EM Stabilizer does not interfere with other equipment or processes and can be installed or retrofitted on most galvanizing lines. The EM Stabilizer can also be used for applications in other strip processing lines where vibration damping is required.

ABB has over 60 years of experience in developing and supplying electromagnetic devices for the steel and metals industry. ABB carries out extensive R&D to improve and develop electromagnetic devices.



Equipment

The EM Stabilizer consists of the following components:

- two magnet modules with frame, magnets, air-cooled strip sensors and servo motors
- a power cubicle with frequency converters that supply current to the magnets
- a servo motor control cubicle that controls opening and closing of the magnet module
- a control cubicle for the advanced control system
- ABB Process Monitor for easy operations and visualization of process data such as strip shape
- a cooling water station to cool the magnets.

Customer Benefits

- Improved quality thanks to a more uniform coating layer
- Reduced overcoating of zinc, which corresponds to potential zinc savings of 2–4% of total zinc consumption depending on line conditions
- Increased line speed with maintained or improved coating quality
- A state-of-the-art control system which is robust and optimal for all strip dimensions

The EM Stabilizer Control System – unique technology

The challenge of designing a control system for vibration damping and shape control of a metal strip lies in the complex oscillation behavior and self resonances of the strip. The problem is also that the behavior varies a lot with strip dimensions and strip tension.

ABB has resolved this problem by developing:

- a strip process model that can simulate oscillations and self resonances of the metal strip between the zinc roll and the cooling tower top roll;
- a robust multivariable controller that uses a special concept of signal processing;
- a concept of pre-tuning the controller for all strip dimensions based on customer line data.

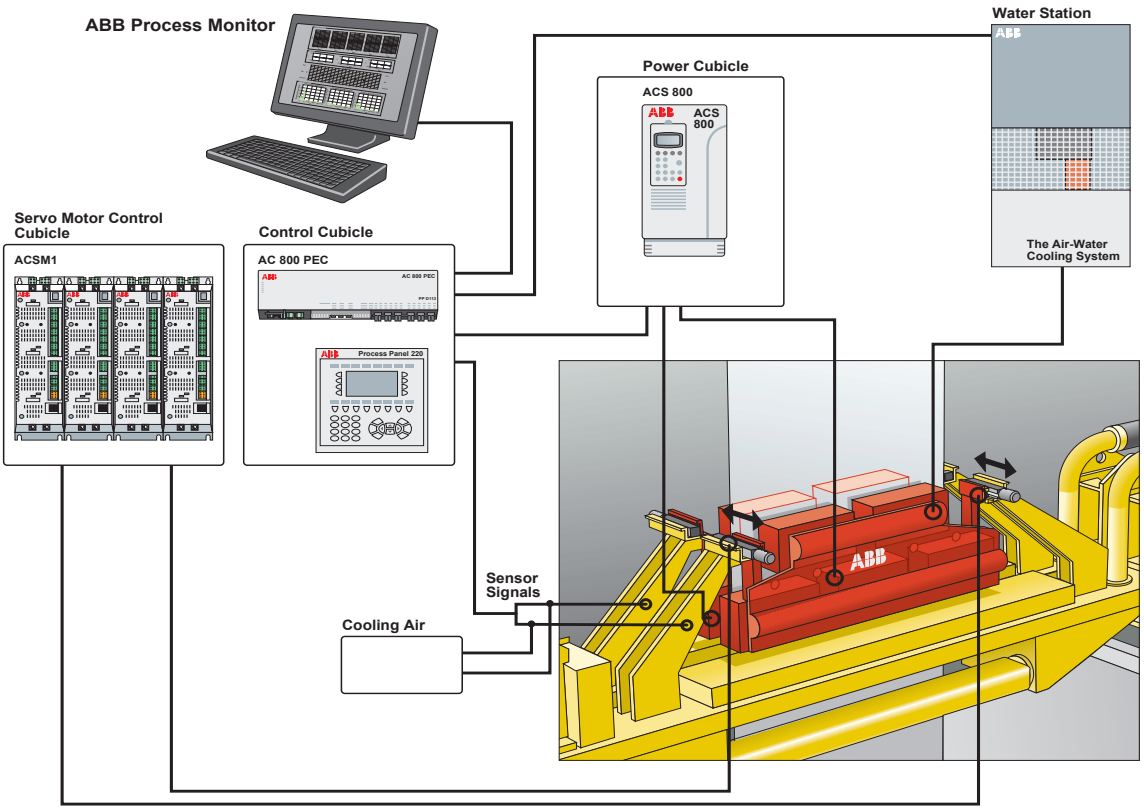
The result is that ABB delivers:

- a very fast control system that is robust and optimal for all strip dimensions and which minimizes the risk of self vibrations that can result in surface defects;
- a flexible system optimized for each galvanizing line. Based on line requirements and strip dimensions, the number of strip sensors and magnets as well as their relative positioning are decided;
- a system where shape control and vibration damping is seamlessly integrated into the same unit. This means that when the EM Stabilizer is active, the zinc-coating variation in length and width is reduced at the same time.

Magnet Module Design

The EM Stabilizer has three, five or seven pairs of magnets. Each magnet pair has one magnet on the front and one on the back of the strip. The configuration is determined in the design phase, taking into account line and strip data and requested performance. For a system with 5 magnet pairs, there are two pairs at the top and three pairs below the top pairs. This configuration effectively removes planar vibrations, left-right vibrations (twisting) and flapping, while being able to reduce cross bow, S and W shape problems.

System overview



Plant Results

Evaluations of plant trials show large vibration damping and excellent shape control:

- Strip vibration can normally be reduced by a factor of 2–3. Also, a much more stable pass line is achieved. (Fig 1)
- Coating thickness variation along the strip length undergoes a drastic reduction by a factor of 2 or more. This clearly shows the potential for reducing zinc overcoating. (Fig 2)
- By reducing shape problems such as cross bow, a significantly more uniform thickness over the strip width can be achieved. A major evaluation of 474 coils with a set point of 55 g/m^2, shows that the standard deviation is reduced by 2.2 g/m^2. Large zinc savings are achieved by lowering the overcoating set point by 2.2 g/m^2. (Fig 3)

All of the excellent results indicated above are with the EM Stabilizer equipment positioned at approximately 1.8 m above the air knife nozzles. With the magnets positioned closer to the air knife even better results are expected.

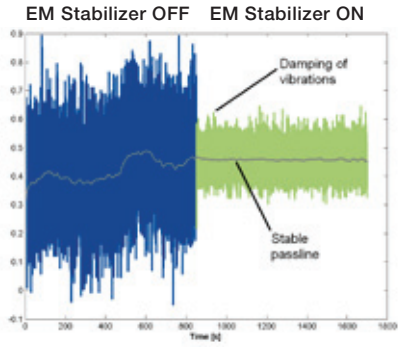


Fig. 1: Vibration damping with and without EM Stabilizer.

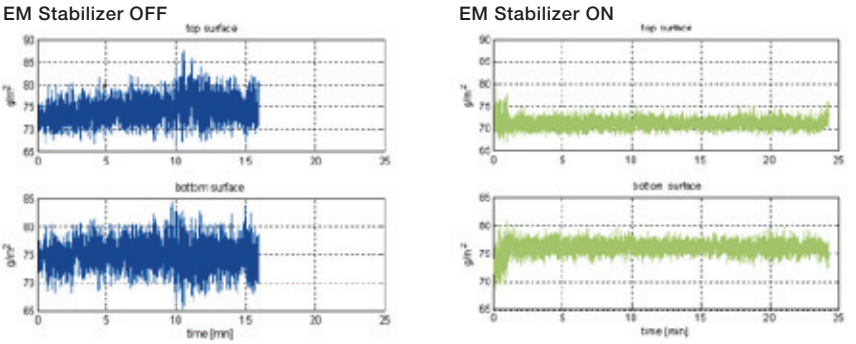


Fig. 2: Coating thickness variation along the strip length.

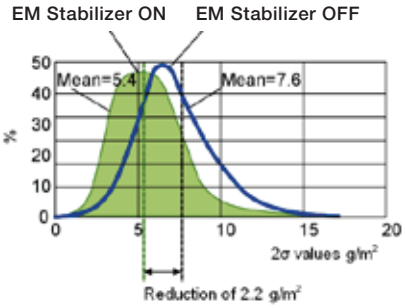
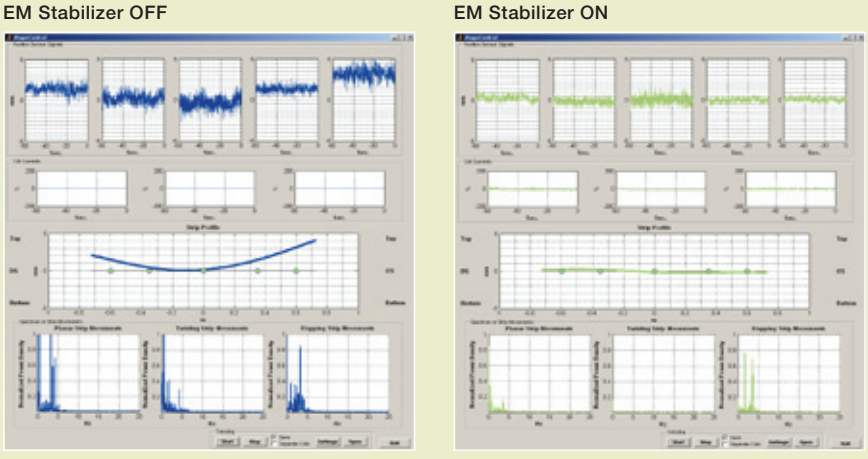


Fig. 3: Reduced 2 sigma value of 2,2 g/m^2, side for 474 coils.

ABB Process Monitor



The ABB Process Monitor showing excellent shape control and vibration damping.

Operation

The system is easily operated either from the customer's system or from the ABB Process Monitor which also offers:

- strip shape display in real time;
- performance visualization by real-time updated frequency spectrums, sensor signals and magnet currents;
- process data logging that is possible to use for line optimization.

EM Stabilizer – less zinc consumption and better product quality

EM Stabilizer advantages:

- no physical contact with the strip
- simple and reliable operation
- low energy consumption
- zinc savings as a result of reduced vibrations and cross bow
- more consistent coating thickness
- improved productivity as a result of increased line speed
- available in strip widths of up to 2,100 mm
- suitable for installation in most existing lines
- payback often in less than one year.

Installation

The EM Stabilizer can be easily installed in new and retro-fitted on most existing galvanizing lines.
The mechanical installation is customized to the line in question. The closer the magnet modules are to the air knife, the better the expected strip stabilization is at the air knife.

The EM Stabilizer can be installed on the air knife structure. Should the air knife not be dimensioned for the additional weight, mounting on an overhead structure or on a free-standing rig can be considered.

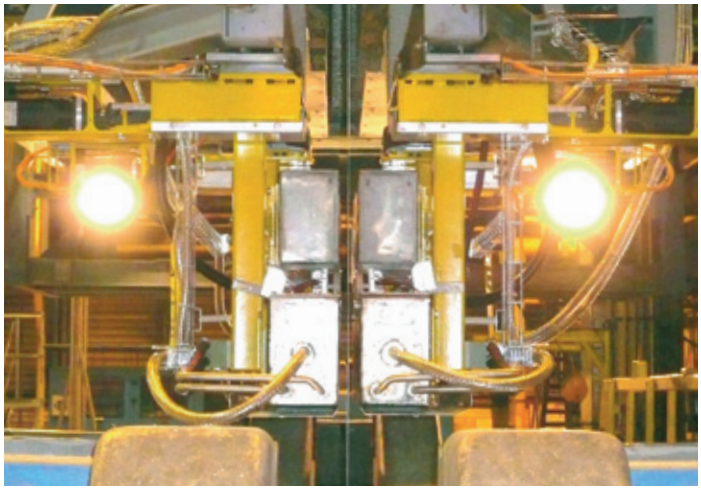
Technical data

General	
For ferromagnetic strips	
Strip temperature	<700ºC
Strip width	200–2,100 mm
Strip thickness	0.2–3.0 mm
Strip speed	0–200 m/min
Magnet Module	
Air gap between magnets	40–60 mm
Max environmental temperature	120 ºC
Dimensions (W x D x H) max	2,200 × 600 × 900 mm
Weight, excluding support	1,400 kg
Cable length	max 50 m
Water cooled magnets	
Flow rate	6 l/min
Eddy current type of position sensors	
Sensing range	4–44 mm
Air for cooling of sensors	500 ml/min
ABB Process Monitor	
Real time visualization of strip shape and vibration frequency	
Logging function of process data	
Easy operations for start/stop and online set point adjustment	

Control cubicle	
PLC programmed with MATLAB®/Simulink® with Real-Time Workshop®	
Cycle time 0.5 ms	
Unique multivariable robust control algorithm	
Cubicle dimensions (W x D x H)	600 x 600 x 2,100 mm
Weight	100 kg
Cooling water equipment	
Type	Air/water heat exchanger
Cooling capacity heat exchanger	6 kW
Pump motor power	1.5 kW
Dimensions (W x D x H)	720 x 720 x 1,375 mm
Weight	120 kg
Servo motor control cubicle	
Type	ABB ACSM1
Cubicle dimensions (W x D x H)	600 x 600 x 2,100 mm
Power cubicle	
Type	ABB ACS 800
Total average power	5 kW
Primary Voltage	400 V
Dimensions (W x D x H)	1,200 x 600 x 2,100 mm
Weight	500 kg

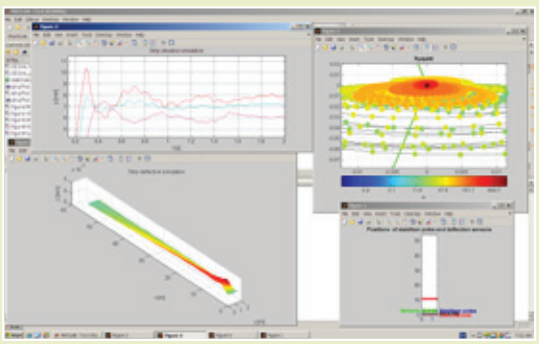
The EM Stabilizer module installed under the hot gauge platform.

The EM Stabilizer module installed under the galvanneal furnace.



Unique know-how in control design

The EM Stabilizer Control System is developed by the Advanced Modeling and Control group at ABB Corporate Research in Sweden. The group has world leading researchers with extensive experience in control system design.



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