

Measurement of tensile and yield strength

# EMG IMPOC

## Online & non-destructive





EMG IMPOC

## Magnet-inductive measuring: 100 % process optimisation

EMG IMPOC is a tried and well introduced magnetic inductive testing system for automatic, non-destructive online determination of the mechanical characteristics tensile and yield strength of ferromagnetic steel strips.

With deployment of the EMG IMPOC system, the evaluation of strip quality is raised and the quality assurance during the production process increases.

With EMG IMPOC a continuous evaluation of mechanical characteristic quality over the entire strip length and strip width is possible.

In the event of one or more mechanical characteristics exceeding their defined limit values pointers are placed on the corresponding strip areas so that optional additional tests can be carried out.

The use of EMG IMPOC makes it also possible to vary the mechanical characteristics process parameters and to ensure strip production at the requi-

red quality already during the production process. An example of this is the optimisation of the skin pass rolling process.

Application areas are the manufacturing of cold-rolled and surface coated steel strips, for example in:

- » hot-dip galvanising lines
- » continuous annealing lines
- » tinning lines
- » continuous pickling lines\*
- » processing lines\*
- » automotive industry

\*on request

### EMG IMPOC variations

Today the EMG IMPOC variations EMG IMPOCpro and EMG PowerIMPOC exist. The EMG IMPOCpro system is optimised for applications in hot-dip galvanising lines and continuous annealing lines. In these lines strips with a maximum strip thickness of 3 mm are typically processed. Furthermore the maximum speed of continuous annealing lines for the EMG IMPOC measurement can reach up to 900 m/min.

Another possible application field of the EMG IMPOC system are pickling lines. This process step follows right after or very close to the hot rolling process. In this way you have the possibility to measure the mechanical characteristics within the pickle very early after the hot rolling process.

The ambient conditions are significantly less critical than in the hot rolling process. Especially the strip temperature is typically clearly under 100 °C.

For this application field the EMG IMPOC system was further developed to EMG PowerIMPOC. EMG PowerIMPOC can be used at a maximum strip thickness of 6 mm and a maximum strip speed of 600 m/min.

# Online measuring in operation: 100 % non-destructive

## Process optimisation

An immediate benefit of the EMG IMPOC system is the advantage to monitor the steel quality online during production.

The traditional way of destructive testing does not allow recognising changes in the material properties on time and the operator cannot directly interact with the process, e.g. react on faulty annealing processes.

## Measuring principle

The measuring principle of the EMG IMPOC is magnetic-inductive and is based on the relation between magnetic and mechanical material properties. The EMG IMPOC system is easy to use. The basic structure is based on two identically constructed measuring heads which are placed on the top and bottom side of the strip. Each measuring head comprises of a magnetising coil and a magnetic field sensor.

The measuring cycle consists of a local impulse magnetisation of the continuous strip by both magnetisation coils. The highly sensitive measuring coils measure the gradient of the remaining residual magnetic field (units  $A/m^2$ ) on both sides of the strip.

The gradient is collated by the correlation relationship of the mechanical characteristics tensile and yield strength of the steel strip.

With EMG IMPOC the operator can block faulty coils or a whole production sequence before they are processed further in the plant or sent to the customer.

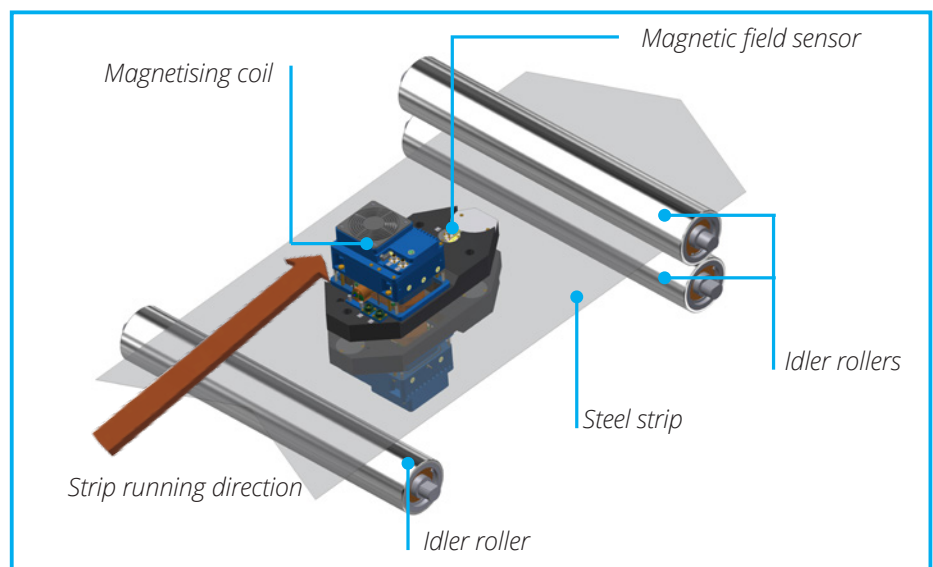
The online data can be used e. g. for the optimisation of the tension leveler, the skin pass mill or the annealing furnace.

The provision and development of appropriate models is part of the EMG service or can be performed by the user on basis of destructive testing results.

EMG IMPOC measured values and data from the line are archived in a database and can be evaluated.

## Characteristic features

- » maximum strip thickness: 0.15 - 6.0 mm\*
  - » strip speed: 6 - 900 m/min\*
  - » pulse repetition rate: 0.05 - 7.5 Hz
  - » insensitive to ambient electromagnetic disturbances
  - » insensitive to strip vibration via active averaging procedure
  - » very low maintenance effort
  - » measurement in different tracks over strip width
  - » automatic strip edge detection
  - » SQL data base
  - » visualisation and model building via LabView®
  - » broad availability of models and applications
- \* depends on variation EMG IMPOC-pro or EMG PowerIMPOC



Scheme of the operating principle of EMG IMPOC

# Less coil reworking

## Huge cost reduction

### Reduction of coil reworking

An important customer benefit of the EMG IMPOC system is the reduction of coil rework. The online monitoring of the coil quality allows the customer to identify coils which show severe deviations from the target values already during the production.

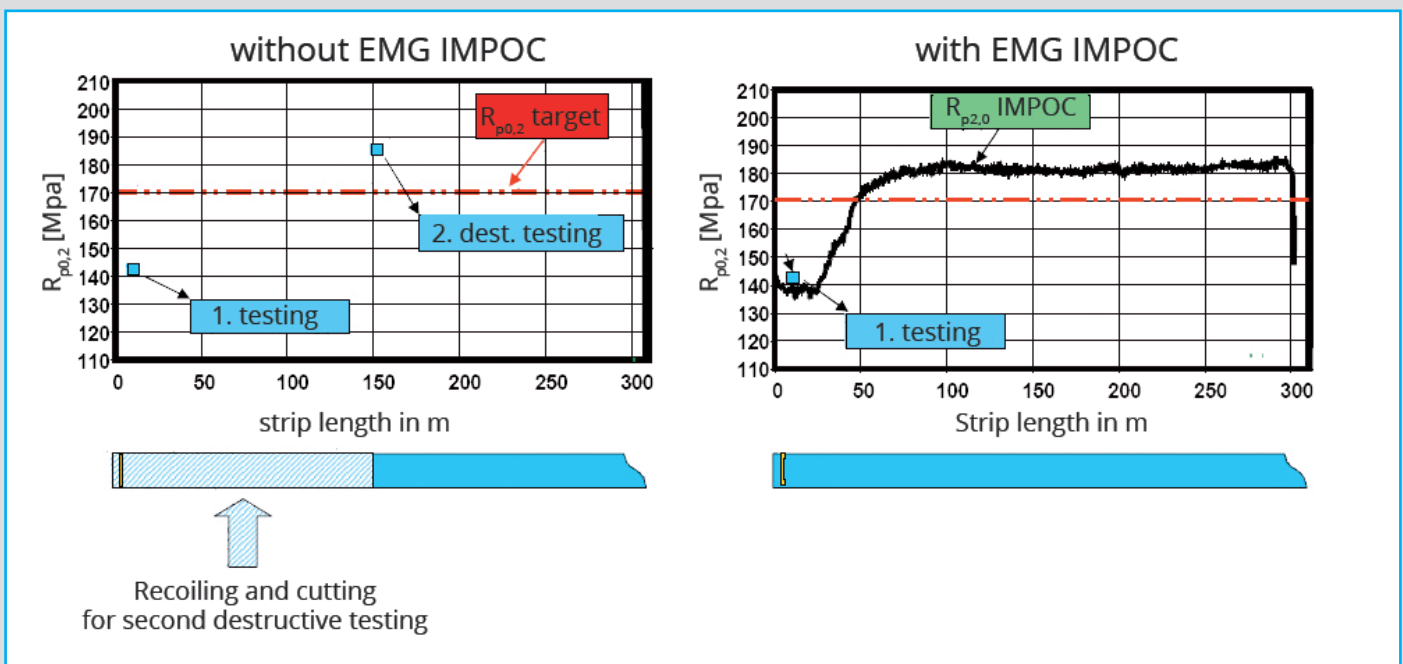
These coils can be immediately identified for further inspection or rework measures.

By this way additional efforts can be avoided and costs can be reduced.

Further by comparison of the IMPOC values with the results of potentially additional destructive testing (see fig.), the finishing department can easily decide where to cut the material or whether the coil needs to be downgraded in its qualities.

The resulting cost reduction comprises the following main elements:

- » reduced yield loss
- » reduced inspection line utilisation costs
- » reduced packaging costs
- » reduced storage costs
- » reduced delivery time
- » abandonment of additional destructive measurements



Comparison of the IMPOC values and the results of the possible additional destructive test methods

# Increasing efficiency in the process

## Optimised calibration unit

The calibration unit consists of calibration electronics and a calibration head. The calibration head is attached to the EMG IMPOC sensor and wired to the electronics. The calibration then runs itself fully automatically. The calibration head produces a deterministic, stable magnetic field.

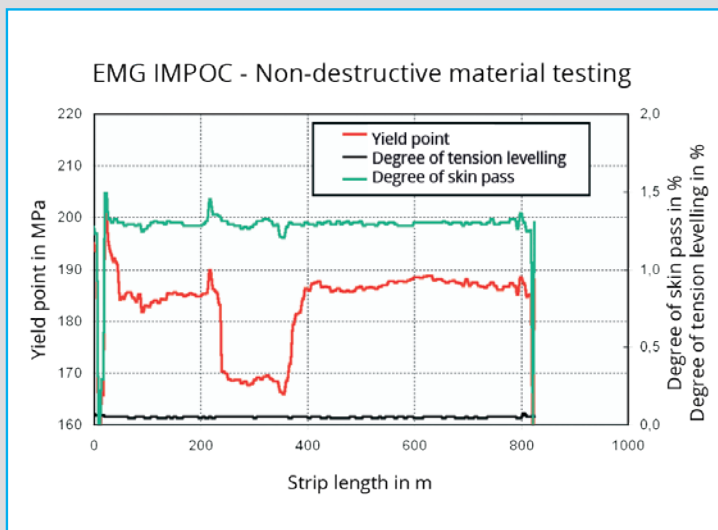
The values measured at the EMG IMPOC system's magnetic field sensor are then compared with the known values of the magnetic field.

The EMG IMPOC magnetic field sensor's linearity, temporal stability and resolution are checked this way. Data communication with the EMG IMPOC control takes place via CAN bus.

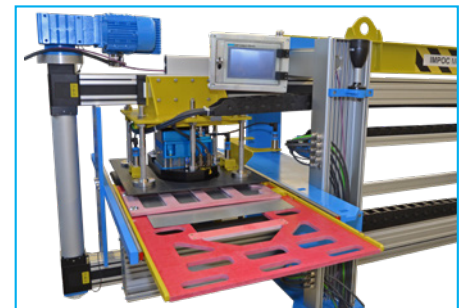
With the software package included in delivery, all measurement results can easily be evaluated. Simply, quickly and fully automatically, EMG customers receive the security of having a perfectly tuned EMG IMPOC system in operation at all times and increasing the process efficiency.

## System check unit

- » fast and easy check of the complete system via sample sheets
- » comparison of the sheet measuring values with the measuring results of the line
- » sample sheets can be used in different lines to compare the line values
- » easy administration of different samples
- » values can be imported manually or via barcode scanner
- » displaying as single or multiple graphs
- » values can be exported in Excel file



Optimising of the operating process with EMG IMPOC



System check unit (on request)

# Technical data:

## Highest performance in detail

Fields of application	<ul style="list-style-type: none"> <li>» ferro-magnetic steel grades</li> <li>» hot or cold rolled incl. surface coated steel grades</li> </ul>		
Steel grades	<ul style="list-style-type: none"> <li>» initially there will be a classification into groups of different steel grades for the regression analysis, e.g.:             <ul style="list-style-type: none"> <li>› IF steel (e.g. DX53D, DX54D)</li> <li>› basic steel grades (e.g. unalloyed steel DX51D, DX52D)</li> <li>› structural steel (e.g. S220GD - S350 GD)</li> <li>› micro alloyed steels with higher tensile strength (e.g. steel grades H220LAD - H340LAD)</li> </ul> </li> <li>» the final classification will be developed during commissioning</li> </ul>		
Lines	<ul style="list-style-type: none"> <li>» hot-dip galvanising lines</li> <li>» continuous annealing lines</li> <li>» tinning lines</li> <li>» continuous pickling lines*</li> </ul>	<ul style="list-style-type: none"> <li>» skin pass lines*</li> <li>» strip and (sheet) steel cutting lines*</li> <li>» inspection lines*</li> <li>» automotive industry</li> </ul>	
Line features		EMG IMPOCpro	EMG PowerIMPOC
	strip thickness	0.15 - 3.0 mm	0.15 - 6.0 mm
	strip width	> 500 mm	> 700 mm
	strip speed	6 - 900 m/min	6 - 600 m/min
Max. strip oscillation	<ul style="list-style-type: none"> <li>» +/- 5 mm (fault influence max. +/- 2 %)</li> <li>» max. +/- 20 mm (fault influence max. +/- 5 %)</li> </ul>		
Processing condition of the steel	recrystallising - annealed resp. normalised		
Measuring cycles	synchronous in length or in time		
Measuring accuracy	<ul style="list-style-type: none"> <li>» IMPOC value: +/- 5 % [A/m<sup>2</sup>]</li> <li>» tensile strength: +/- 5 % of measuring value [MPa]**</li> <li>» yield strength: +/- 10 % of measuring value [MPa]**</li> </ul> <p>**this accuracy will be reached at 90 % of the measured values</p>		
Availability	> 99 % (excluding downtime caused by customers)		
Distance to strip	<ul style="list-style-type: none"> <li>» 25 mm per side</li> <li>» protection of sensor heads is ensured by suitable non-metallic plates</li> </ul>		
Measuring position on the strip	Free choice of measuring position via traversing unit		
Ambient temperature (sensor)	+5 °C to +40 °C (other temperatures on request)		
Ambient humidity	max. 80 % (non-condensing)		
Transformer supply	3 x 400 V; 50/60 Hz; 5 kVA		

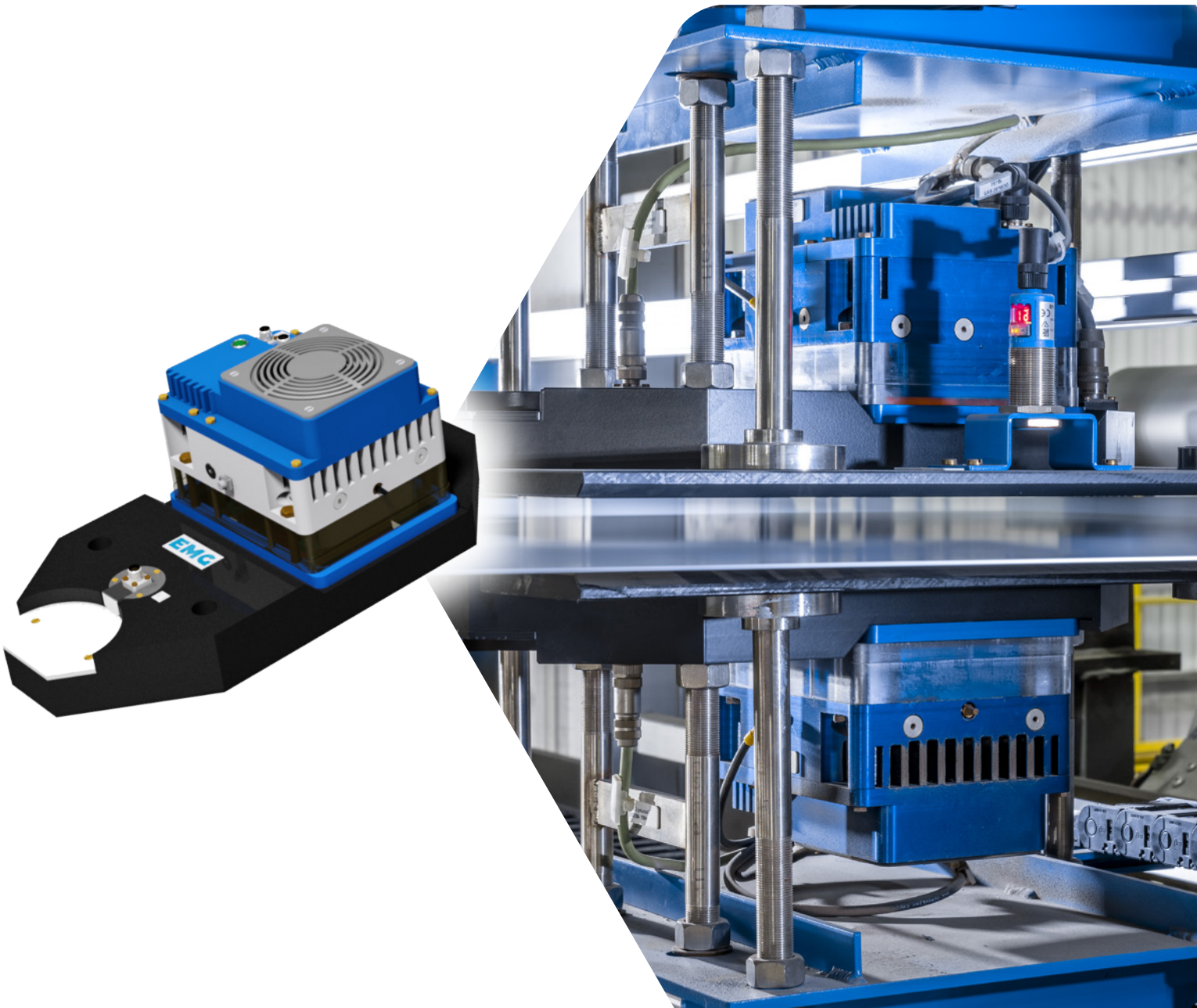
\*on request

EMG IMPOC

# Guaranteeing your product quality: 100 % competent & effective

## Customer benefits

- » ensuring product quality
- » material savings due to pruning optimisation
- » increased yield
- » reducing the number of destructive sample tests
- » material selection according to quality criteria
- » optimisation of the annealing process
- » optimisation of the rolling process
- » statements about the degree of recrystallisation
- » support in material development



The logo for EMG, consisting of the letters 'EMG' in a bold, white, sans-serif font. The background of the entire page is a blue-tinted photograph of industrial machinery, with large circular components and a metal structure visible. A white line graphic starts from the left edge, goes down, then curves around the right side of the text area, and goes back up to the left edge.

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