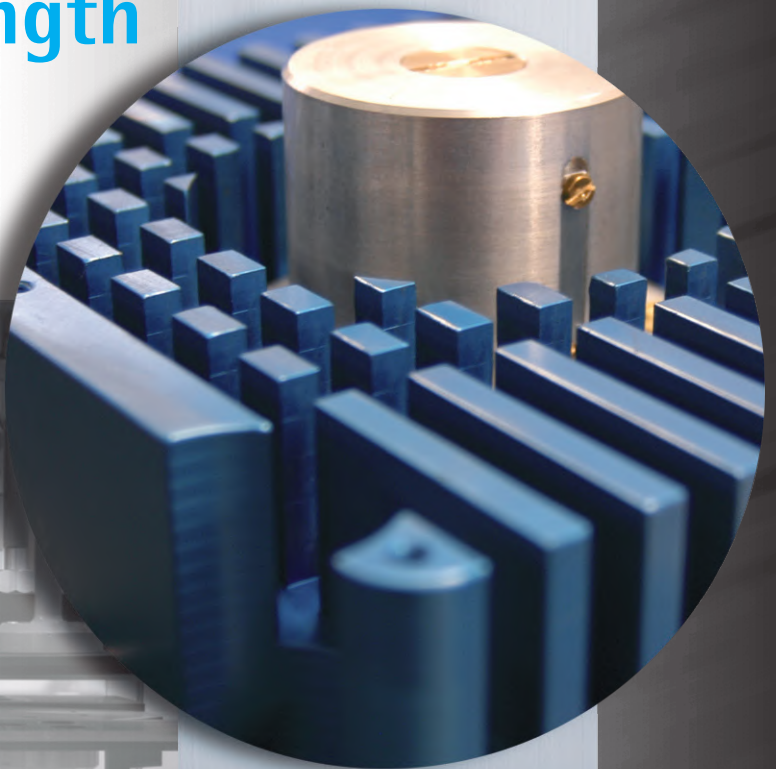
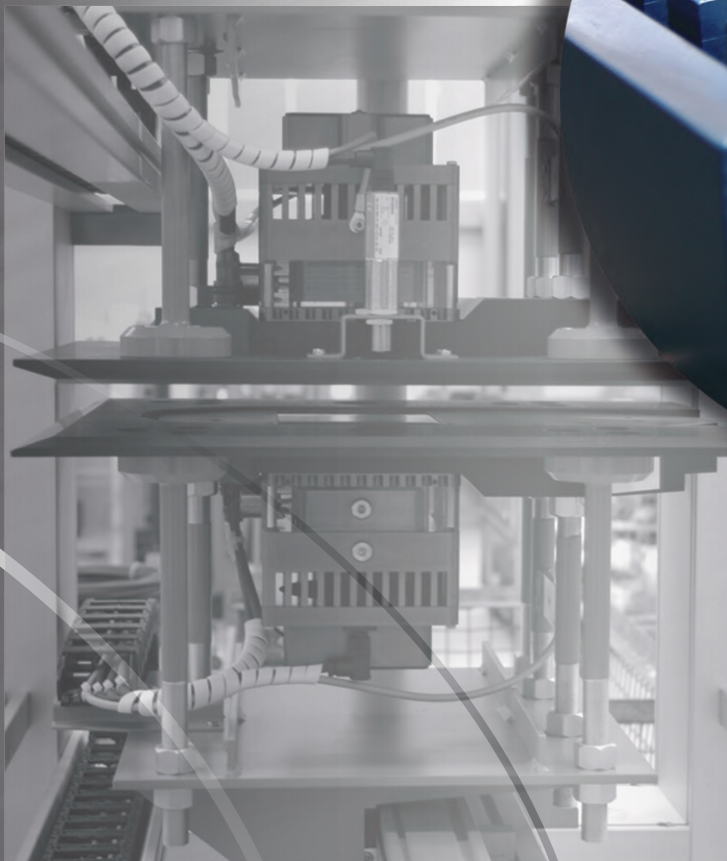


Online measurement of tensile and yield strength



- ▶ contact-free
- ▶ non-destructive
- ▶ low maintenance

IMPOC

Operating principle:

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. 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*

*on request

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

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 electro-magnetic disturbances
- ▶ insensitive to strip vibration via active averaging procedure
- ▶ insensitive to strip raving
- ▶ 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 IMPOCpro or Power IMPOC

EMG Automation GmbH specialises in the automation of continuous production processes in the metal, paper and plastics industries as well as in the foil and tyre industries. The company, which was established in 1946, is a leading provider of electro hydraulic control systems. Furthermore, EMG provides quality assurance systems for the manufacturing industry.

Based on the combination of more than 70 years of experience, the quality of our products and complete solutions as well as our advisory skills, our customer, by his trust, makes us the market leader. In close co-operation with our customers, research facilities and universities we are permanently searching for innovative solutions to promote our new and further developments and therefore to design and form the market as innovation leader actively.

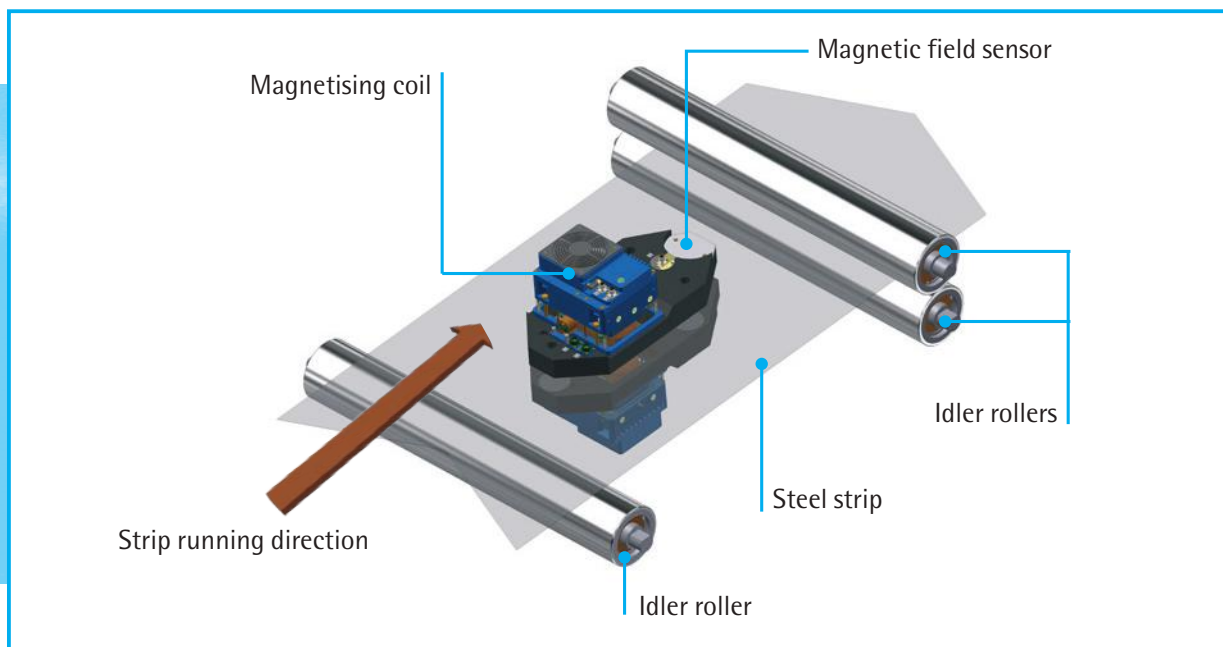
Measuring principle:

The measuring principle of the EMG IMPOC system is on the one hand complex but remains simple in operation. The IMPOC system is based on two identically constructed measuring heads which are placed on the upper and lower side of the strip. Each measuring head comprises of a magnetising coil and a measuring coil.

The measuring cycle consists of a local and periodical 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/m²) on the top and bottom of the strip.

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

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.



Scheme of the operating principle of IMPOC

Process optimising:

An immediate benefit of the 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.

With 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 leveller, the skin pass mill or the annealing furnace.

check of steel strips

• contact-free

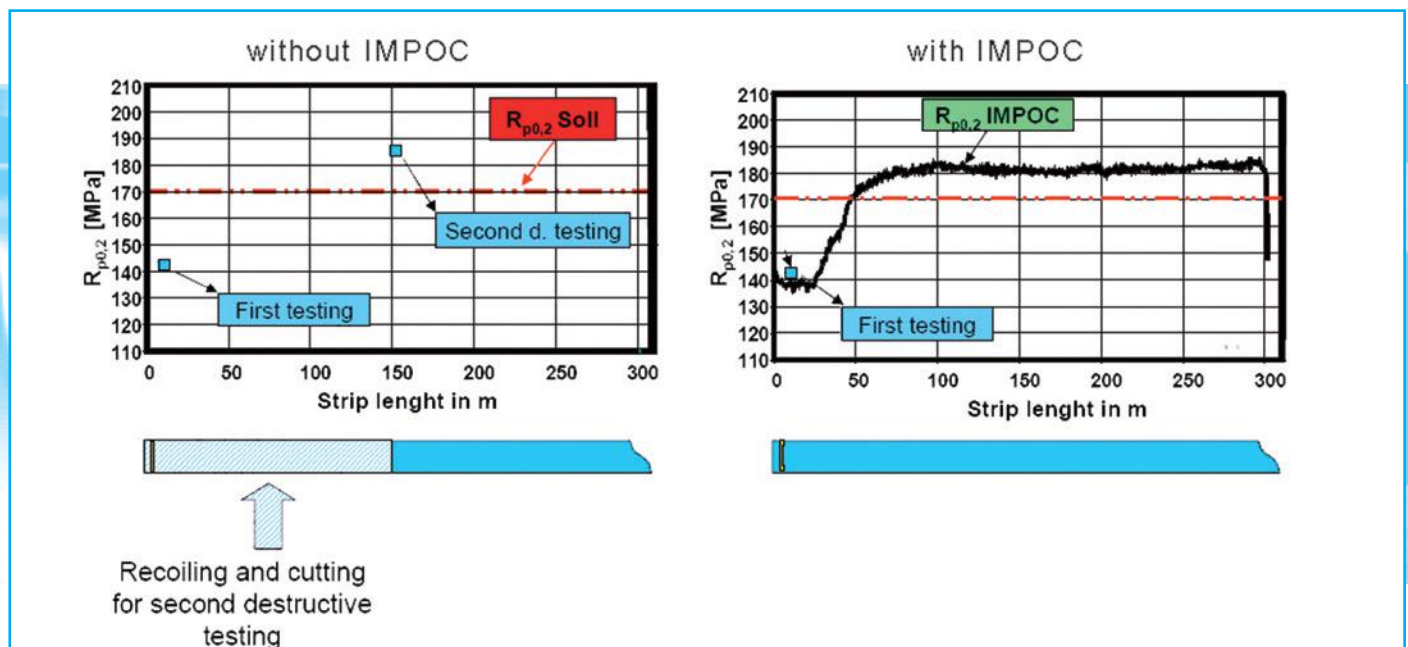
Reduction of coil rework:

An important customer benefit of the 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 and 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



Optimised calibration unit:

The calibration unit consists of calibration electronics and a calibration head. The calibration head is attached to the 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 IMPOC system's magnetic field sensor are then compared with the known values of the magnetic field. The IMPOC magnetic field sensor's linearity, temporal stability and resolution are checked this way. Data communication with the 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 IMPOC system in operation at all times and increasing the process efficiency.

• non-destructive

• low maintenance

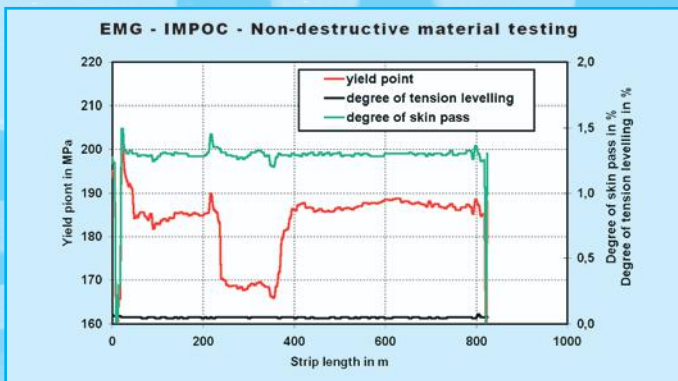
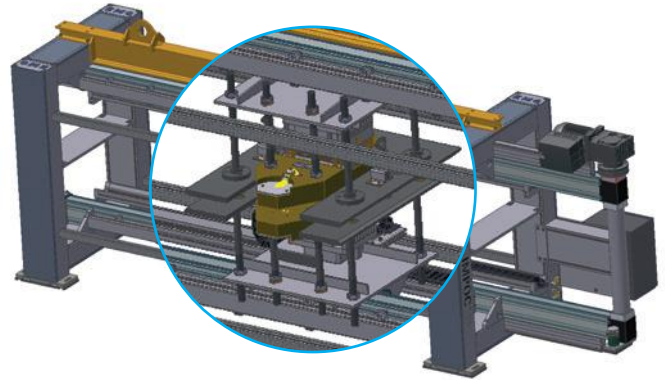
IMPOC variations:

Today the IMPOC variations IMPOCpro and Power IMPOC exist. The 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 can reach up to 900 m/min.

Another possible application field of the 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 IMPOC system was further developed to Power IMPOC. Power IMPOC can be used at a maximum strip thickness of 6 mm and a maximum strip speed of 600 m/min.



Optimising of the operating process with IMPOC



System check unit (on request)

Customer's benefit:

- ▶ ensuring product quality
- ▶ reduction of material rework
- ▶ 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

System check unit:

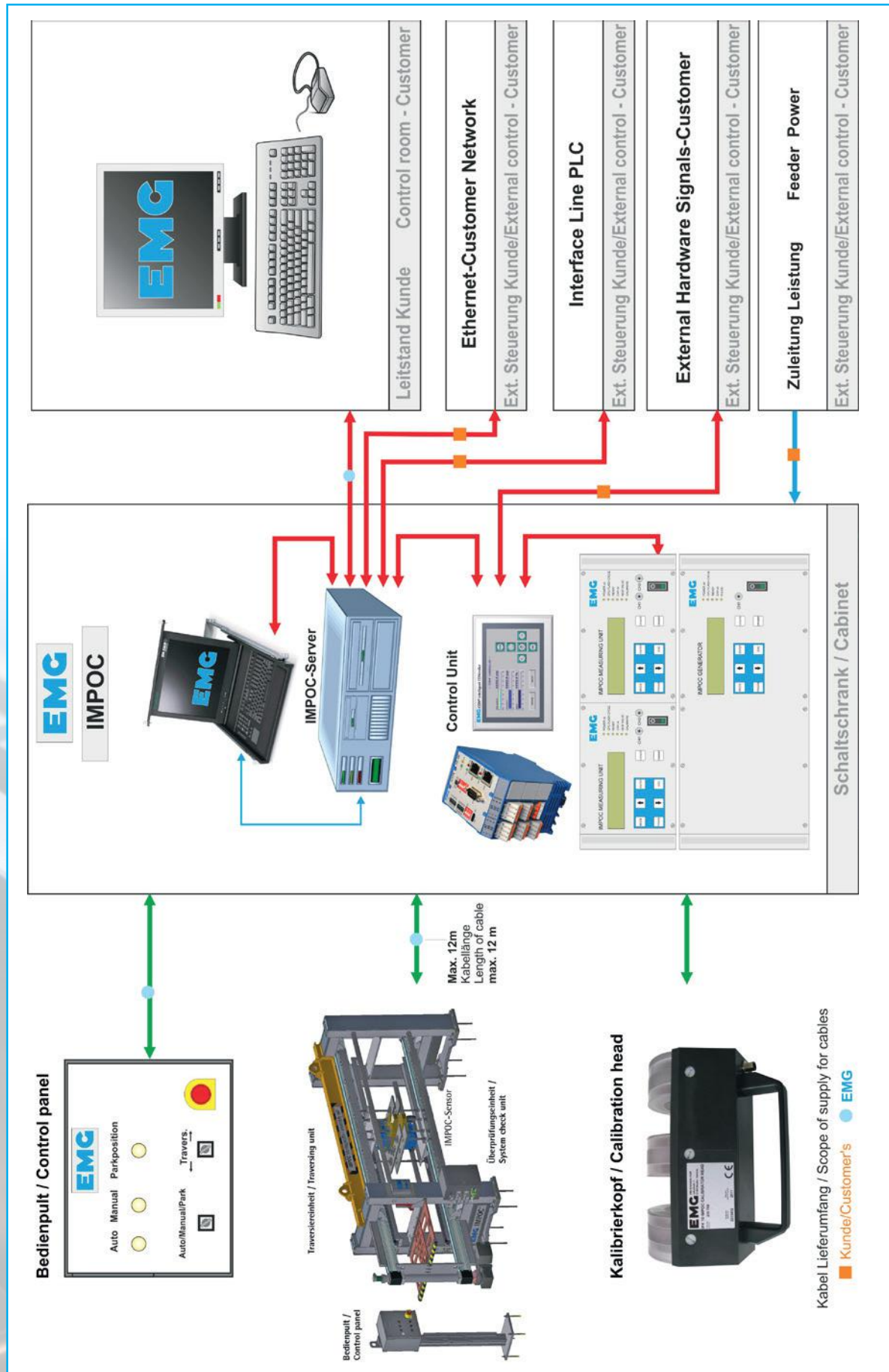
- ▶ fast and easy check of the complete system via sample sheets
- ▶ comparison of the sheet measuring values with the measuring results of the line
- ▶ sample sheets can be used in different lines to compare the line values
- ▶ easy administration of different samples
- ▶ values can be imported manually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

Technical data:

Fields of application	<ul style="list-style-type: none"> ferro-magnetic steel grades hot or cold rolled incl. surface coated steel grades 		
Steel grades	<ul style="list-style-type: none"> initially there will be a classification into groups of different steel grades for the regression analysis, e.g.: <ul style="list-style-type: none"> IF steel (e.g. DX53D, DX54D) basic steel grades (e.g. unalloyed steel DX51D, DX52D) structural steel (e.g. S220GD - S350 GD) micro alloyed steels with higher tensile strength (e.g. steel grades H220LAD - H340LAD) the final classification will be developed during commissioning 		
Lines	<ul style="list-style-type: none"> hot-dip galvanising lines continuous annealing lines tinning lines continuous pickling lines* skin pass lines* strip and (sheet) steel cutting lines* inspection lines* 		
Line features		IMPOCpro	Power IMPOC
	<ul style="list-style-type: none"> strip thickness strip width strip speed 	0.15 - 3.0 mm > 500 mm 6 - 900 m/min	0.15 - 6.0 mm > 500 mm 6 - 600 m/min
Processing condition of the steel	<ul style="list-style-type: none"> recrystallising - annealed resp. normalised 		
Measuring cycles	<ul style="list-style-type: none"> synchronous in length or in time 		
Measuring accuracy	<ul style="list-style-type: none"> IMPOC value: +/- 5 % [A/m²] tensile strength: +/- 5 % of measuring value [MPa]** yield strength: +/- 10 % of measuring value [MPa]** **this accuracy will be reached at 90 % of the measured values		
Max. strip oscillation	<ul style="list-style-type: none"> +/- 5 mm (fault influence max. +/- 2 %) max. +/- 20 mm (fault influence max. +/- 5 %) 		
Availability	<ul style="list-style-type: none"> > 99 % / year 		
Distance to strip	<ul style="list-style-type: none"> 25 mm per side protection of sensor heads is ensured by suitable non-metallic plates 		
Measuring position on the strip	Free choice of measuring position via traversing unit		
Ambient temperature (sensor)	<ul style="list-style-type: none"> +5 °C to +40 °C (other temperatures on request) 		
Humidity (sensor)	<ul style="list-style-type: none"> max. 80 % 		
Transformer supply	<ul style="list-style-type: none"> 3 x 400 V; 50/60 Hz; 5 kVA 		

*on request

System configuration:



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