

lasertronic®  
SAO x.x/6D

Core loss improvement  
of silicon steel

Task

The magnetic properties of grain oriented high permeable silicon steel, used for transformer cores, can decisively be improved by a laser treatment. A local- and time limited heat treatment refines the domain structure and reduces the core loss. The worldwide growing energy consumption and the ambitions of efficient energy usage result in a rising demand of high quality materials.

Therefore a technological and system engineering solution is required, which can be integrated into already existing production processes and lines. Furthermore, the motivation of energy saving necessitates technologies with highest possible improvements of magnetic properties to reduce losses and to increase the efficiency.

The laser beam optical deflection system lasertronic® SAO x.x/6D has been developed for laser domain refinement of continuously moving grain oriented silicon steel coils. The laser radiation of two beams is focalized on the coil surface. The laser spot is moved over the material with velocities up to 250 m/s. The light energy absorbed by the metal sheet generates the thermal stress at the structure of the material. As a result the magnetic domains are refined. The system lasertronic® SAO x.x/6D consists of 6 galvanometer scanners. Two independent laser beams are deflected one-dimensionally. The coil is treated by each laser over the full width. Coils with 1 m width can be treated with a line scribing frequency of more than 300 Hz.

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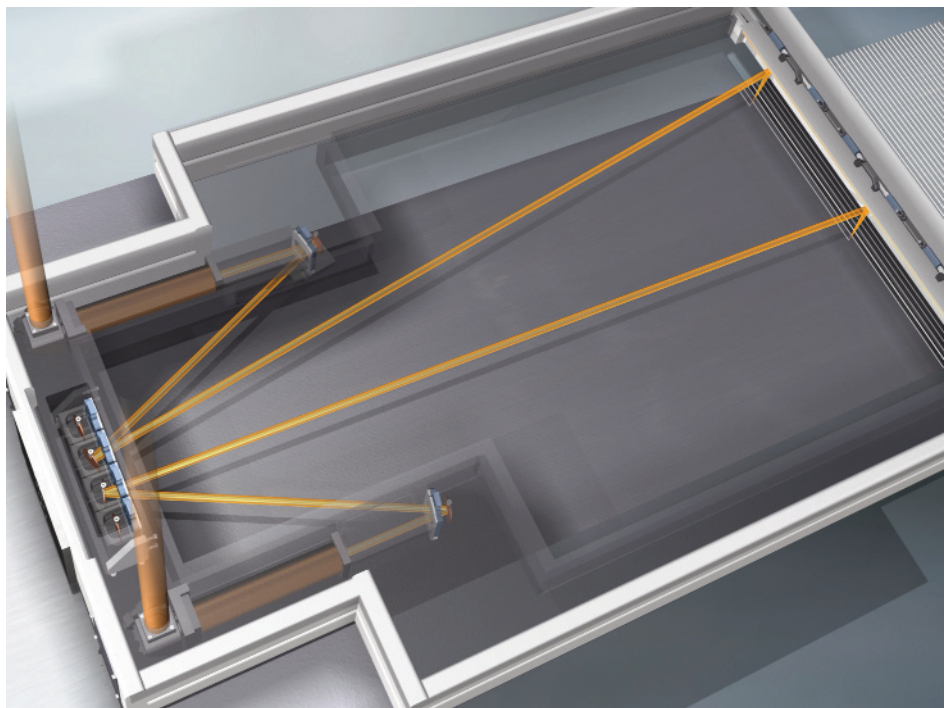
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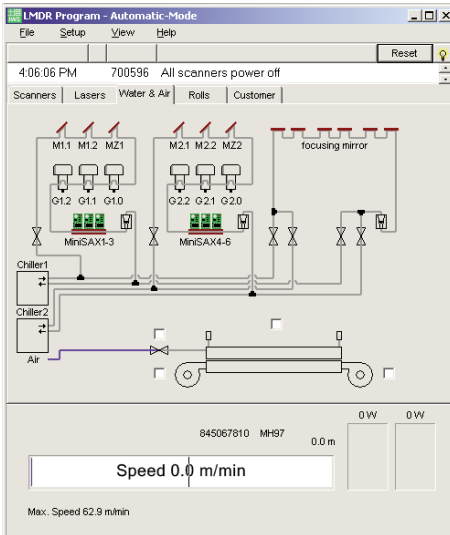
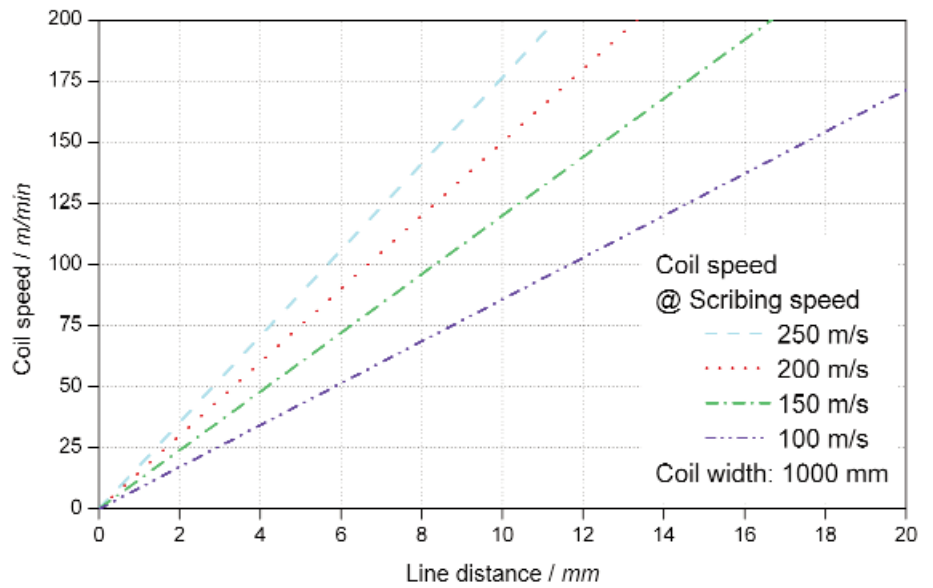
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## Results

The core loss of grain oriented high permeable silicon steel can be decreased with the system lasertronic® SAO x.x/6D up to 10% (dependent on material). The software, which controls the system, enables the independent adjustment of the following parameters:

- Laser power (individual for each laser)
- Laser spot velocity
- Line distance



The maximal possible coil speed is calculated according to the treatment parameter set and is transferred to the superior line control. The diagram shows the possible coil speeds for different line distances and scanning speeds. The usage of the patented beam deflecting sequence guarantees constant treatment parameters even if the coil speed changes. The single lines are scribed with the set line distance and laser spot velocity.

The variation of one treatment parameter does not effect the others. Each laser beam is scribing the full width of the coil. The system is designed with a redundancy. If one path brakes down the treatment can be continued by the second. The system performance is reduced, but the process continues.

### System benefits

- High flexibility
- High performance
- Simple adjustment of working parameters
- Constant treatment conditions at different coil speeds – high production quality
- Automatical parameter adjustment depend on coil speed
- One running section – no divided working field
- Redundancy - emergency running properties
- Utilization of standard components
- Simple replacement of wear parts

