EcoTransFlux™

Induction Solutions for Rapid Heating Cycles
Steel Annealing Processes

Basics of a breakthrough solution
Trends, expectations and issues in Annealing processes

RAPID HEATING CYCLES ON CARBON STEELS (200 - 400°C/s):

*EcoTransFlux™ induction enable new annealing processes, due to superior intrinsic abilities:*

- Higher heating density: 2 MW/ sq. meter of steel strip
- Higher treatment temperature: up to 1200 °C mainly 950°C
- Faster temperature increase: up to 400 °C/s

**Direct Benefits:**

...on the products:

- Mechanical resistance improved of the steel by 5 to 10%,
- Preservation of elongation capability.

**Indirect Benefits:**

- Significant weight reduction of steel assemblies like car bodies, and associated benefits for the environment (fuel consumption and CO2 emissions reduction),
Trends, expectations and issues in Annealing processes

RAPID HEATING CYCLES ON SILICON STEELS (200 - 400°C/S),
Decarburisation Lines

*EcoTransFlux™ inductors are complementary to the Gas-Heating furnaces for the Decarburisation lines*

Direct Benefits:
- Better electrical characteristics for the final product
- compact design

Indirect Benefits:
- environmental impacts (CO2 emissions...),
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Longitudinal or Transverse Flux Induction?
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INDUCTION SYSTEMS

Longitudinal Flux

MAGNETIC

20°C-760°C maxi

TFIH

Transverse Flux

MAGNETIC, A-MAGNETIC

20°C-1200°C
Main Advantages of the Transverse Flux Solution:

- Enables to heat Magnetic and Amagnetic products
- Can heat thinner products
- ... over the Curie Point (Up to 1200° C)
- ... with a Constant Inductor efficiency, over the temperature range, regardless the strip format
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a Decade of Progress in Induction Heating
Achievements:

- Transversal heating homogeneity: ± 3 %
- Efficiency: 70 to 80 % for 180 mm mechanical gap
- Power: up to 1 MW
Achievements:

- Transversal heating homogeneity: ± 3%
- Efficiency: 70 to 80% for 180 mm mechanical gap
- Power: up to 3 MW
→ Achievements:
  • Transversal heating homogeneity: ± 1.5 %
  • Efficiency: 70 to 80 % for 180 mm mechanical gap
  • Power: up to 3.4 MW
The Inductor
with mobile actuators
Technical Achievements:

- High Power: > 3 MW within 2 m Inductor Length
- High Temperature Design: up to 1200 °C
- Temperature homogeneity: +/-7.5°C for 250°C temperature increase
- Wide range of strip thickness: 0.35 mm up to 2.5 mm
- Compatible for Carbon, Stainless Steel materials and non-ferrous
EcoTransFlux™

Presentation of the Demonstrating Unit in Lautenbach
Fives CELES TFIH tests facility

**Demonstrations:**
- Efficiency measurements
- Temperature profile optimization
- Demonstration of different strip formats transitions
- Modelling with Flux3D
- Metallurgical pre-tests on various strip samples

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Electrical Power: 900 Kw  
Frequency: 1000 Hz  
Strip Speed: 5 to 150 m/min  
Temperature: 20°C - 850°C
ECOTransFlux™ Demonstrating Unit
ECO TransFlux™ Demonstrating Unit
Conclusions
EcoTransFlux™ enable the emergence of new processes for:

**Stainless Steel Bright Annealing Line**
Fives Celes associated with Fives DMS and Fives Stein Fast cooling offers a new type of high capacity SS CR Annealing Line

**Carbon Steel Annealing Line**
Heating Rate of 200-300°C/s beyond Curie Point enable new annealing thermal cycles of Carbon Steel for improved metallurgical properties

**Silicon Steel Decarburation Line**
Effect of Rapid Cycles for improved electrical & mechanical properties of Silicon Steel