

Great Designs in

STEEL



Press Hardening Furnaces with Integrated Flexible Tailored Tempering

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EBNER Industrieofenbau GmbH

Introduction: Press Hardening

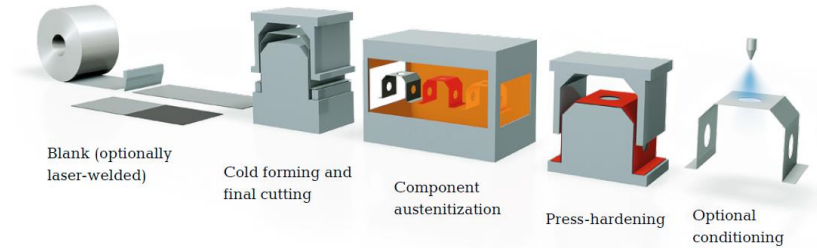
Press Hardening, hot forming:

- **Lightweight** body-in-white parts (reduce weight and increase safety)
- **High strengths** up to 2000 MPa
- **No spring back**
- Complex geometries
- Coated/uncoated material
- Tailored property parts
- Corrosion resistance, crash performance, weldability

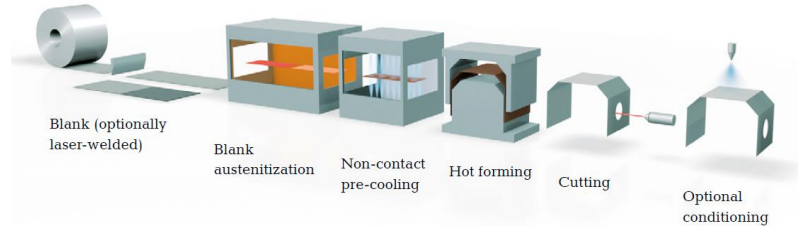


http://automotive.arcelormittal.com/products/By_region/2genphs
04/16/2018

Indirect press hardening

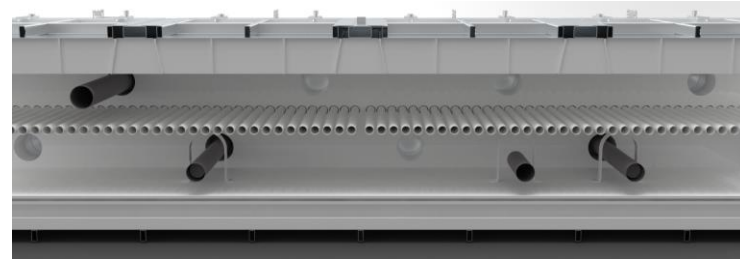


Direct press hardening



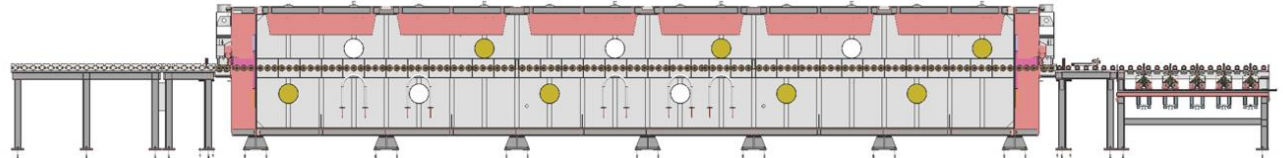
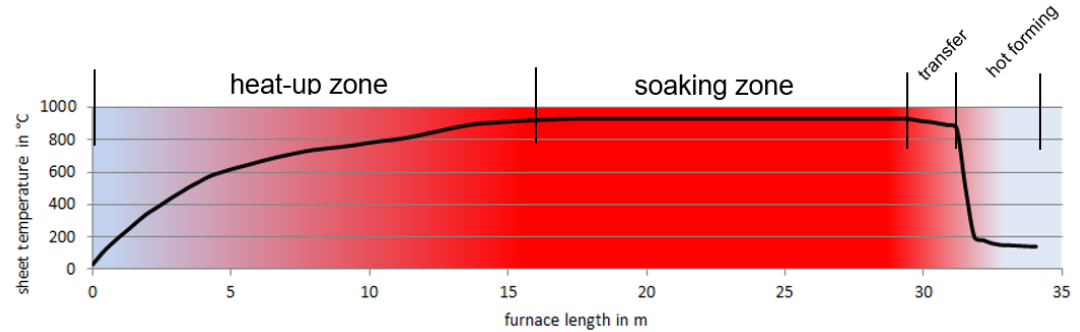
<http://www.voestalpine.com/thinkzinc/Mediathek/Downloads>
04/16/2018

Heating Process



Heating zone
Soaking zone

- Coated Steel (AlSi, Zn) → = dried air
- Uncoated Steel → = N₂ + max. 5% CH₄



Tailored-Property Parts (TPP)

Variants

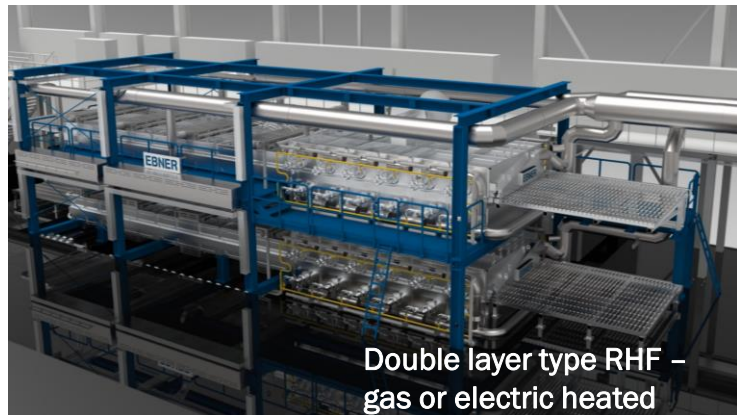
- Tailor-welded blank
- Patch inside/outside
- Tailor-heated
- Tailor-tempered



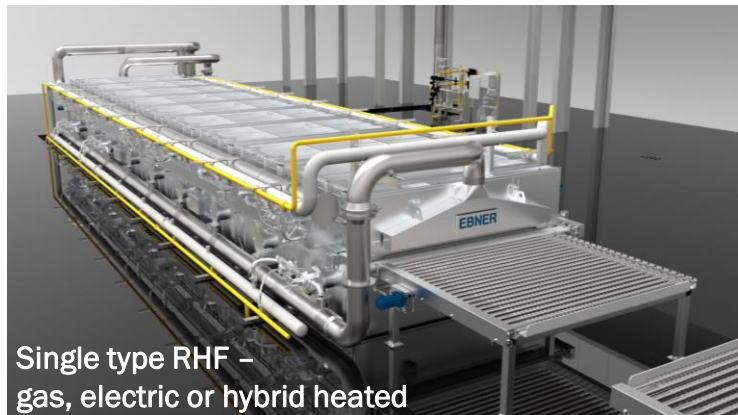
<https://www.voestalpine.com/thinkzinc/Tailored-property-parts-TPP>

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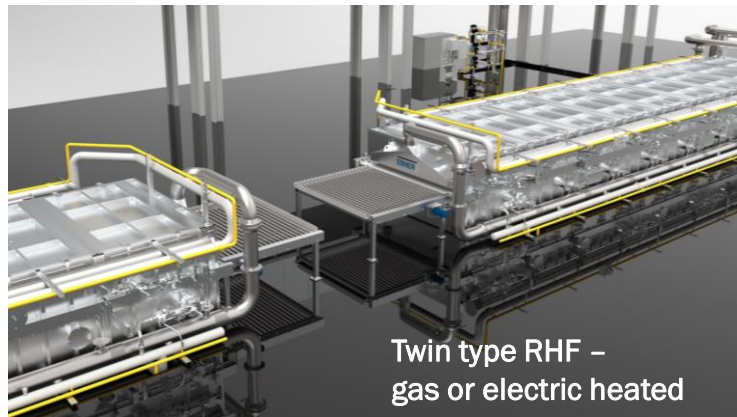
EBNER Press Hardening Furnace Types



Double layer type RHF –
gas or electric heated



Single type RHF –
gas, electric or hybrid heated

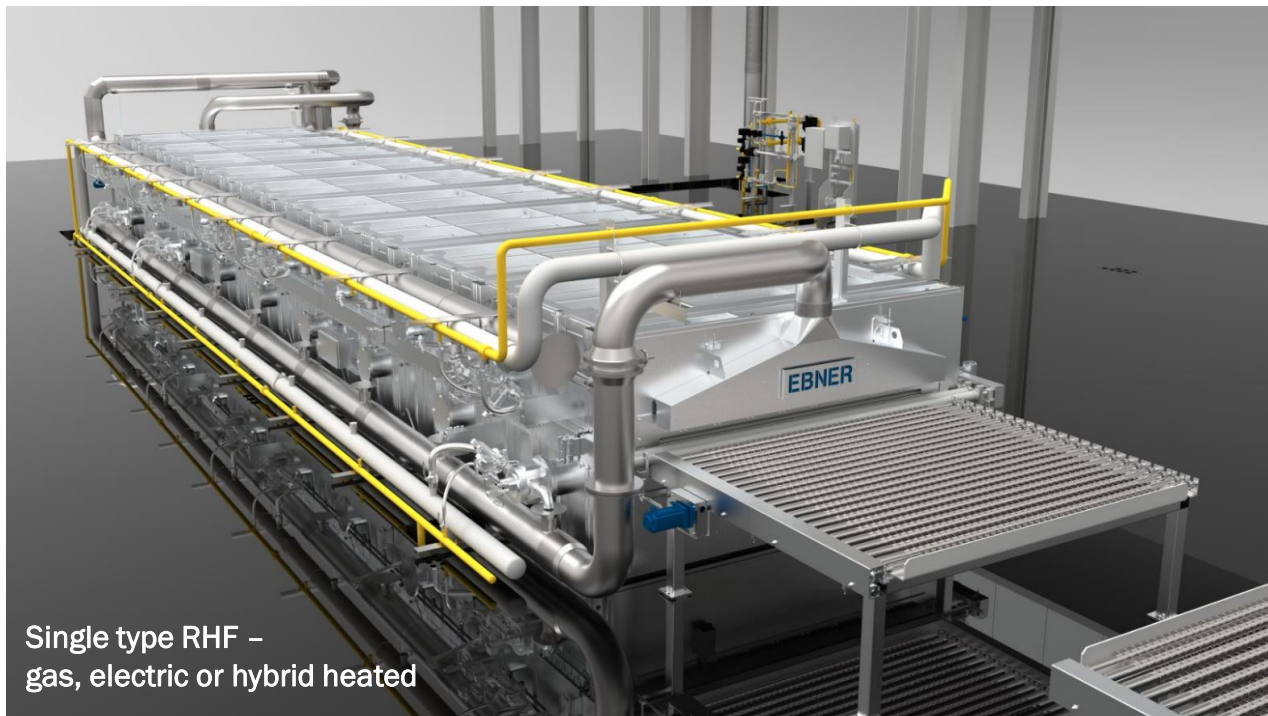


Twin type RHF –
gas or electric heated



Multi-level chamber furnace –
hybrid heated

Single Type Roller-Hearth Furnace



Single type RHF –
gas, electric or hybrid heated

Features

- Automatic roller break detection system
- Protection for radiant tubes
- Easy roller changing
- Centering unit with servomotors
- Protective atmosphere with methane analyzer and mixing station for constant conditions

Rollers and Bearings – Roller Drive Unit

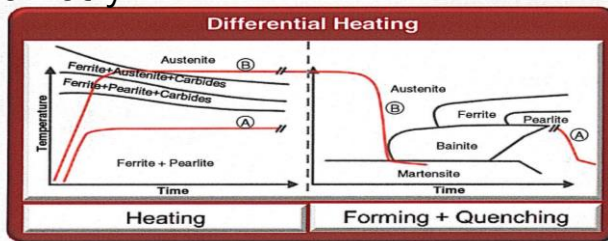
Features

- Easy disconnecting of defective rollers
- Bearings are positioned in a cold area
- Roller break detection system
- Chain adjuster

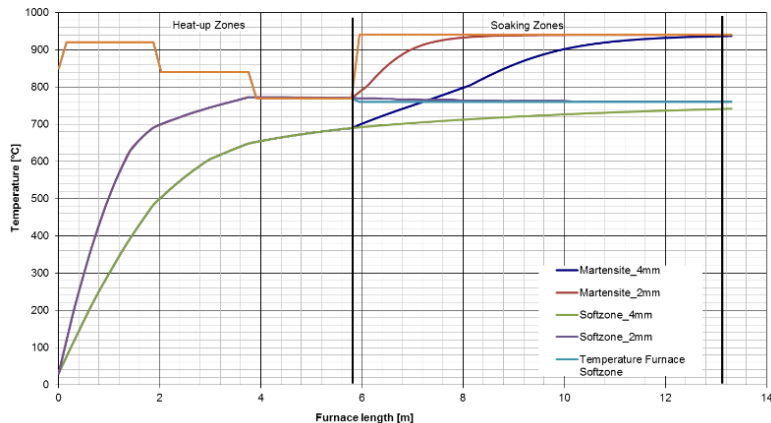


Roller-Hearth Furnace: Differential Heating

- In production for AUDI, VW, Porsche
- Stable mechanical values and geometry
- 80mm transition zone
- 32 temperature zones (width)
- Coating layer on soft side



Source: 1st GM supplier forum, Detroit, 2013

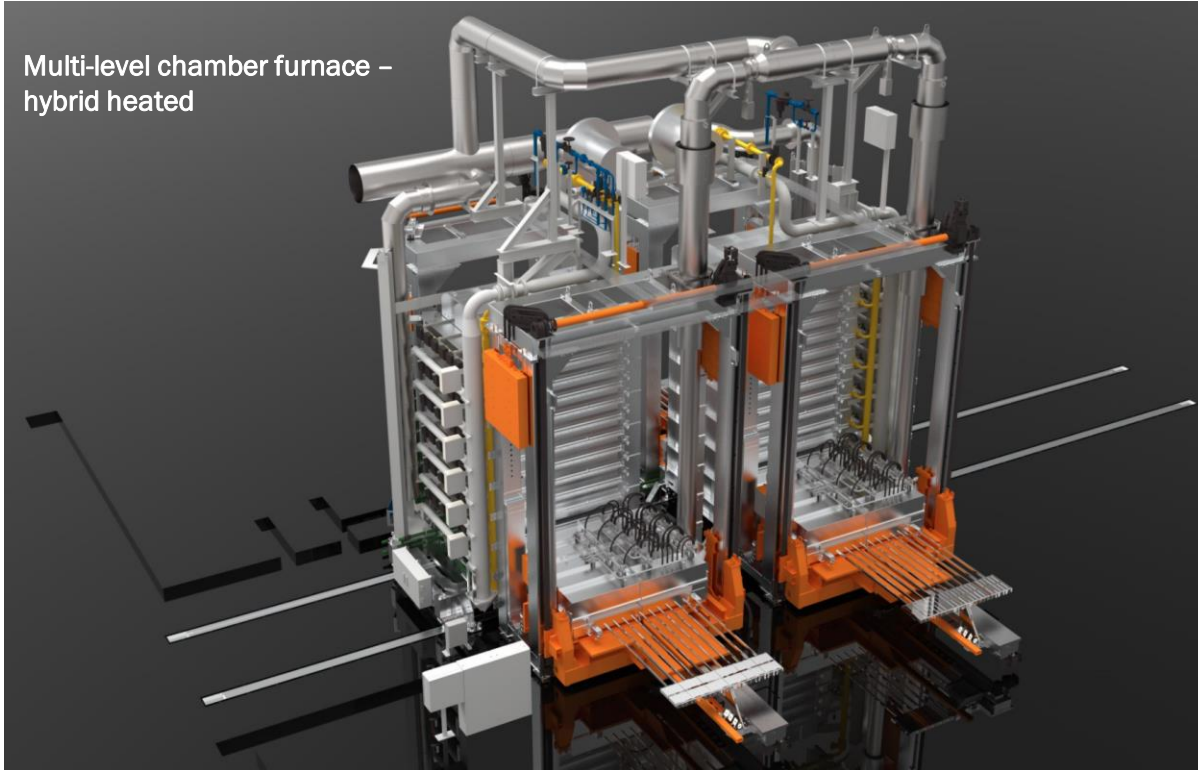


Source: Braun CarTec GmbH, Germany



Multi-level chamber furnace

Multi-level chamber furnace –
hybrid heated



Technical Data:

Usable Width:	2000 mm
Heated Length:	2 x 1900 mm
Heating System:	R-Tube gas / electric
Max. Throughput:	5.1 t/h
Space Needed (incl. maintenance):	140m ²

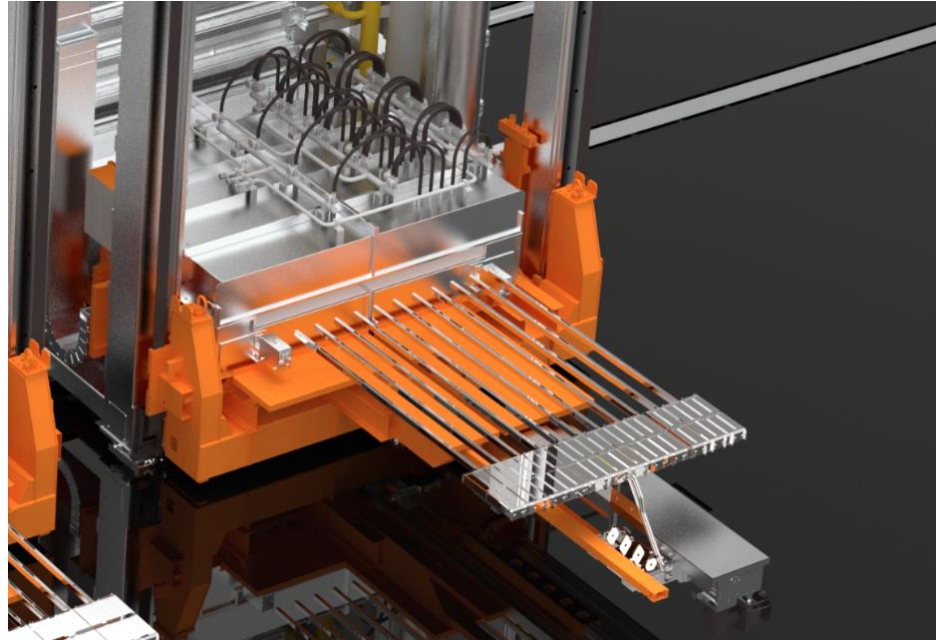
Differential Cooling Air/Jet-System

Features

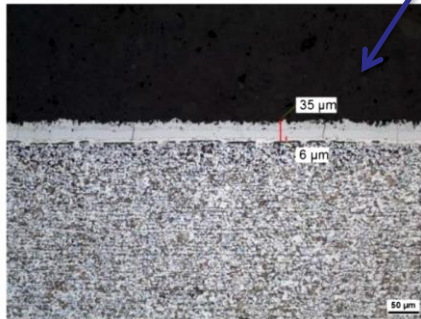
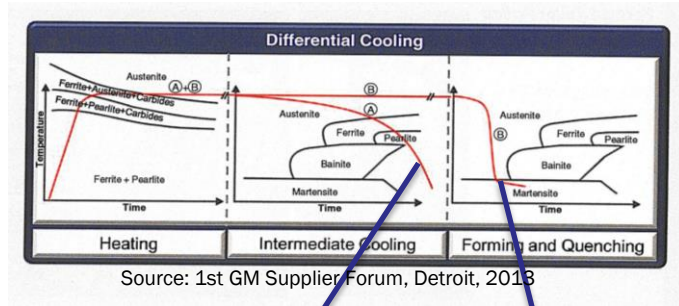
- Transition zone <60mm
- Shortest cycle times
- Weldability approved
- Paintability approved
- According to TL4225
- Patented technology



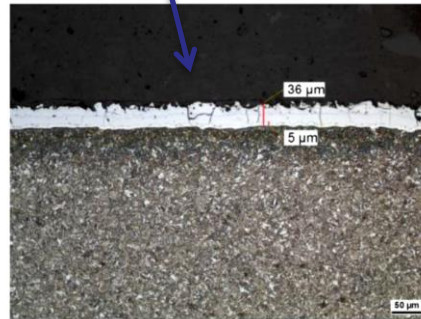
Heating box with tailored tempering function



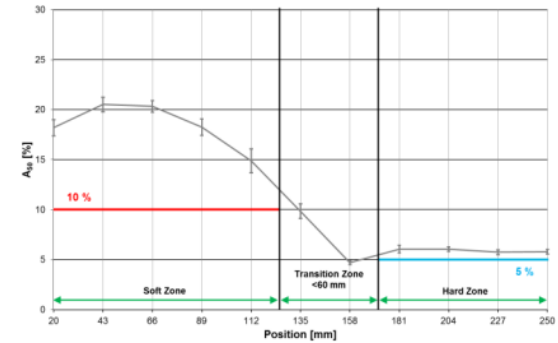
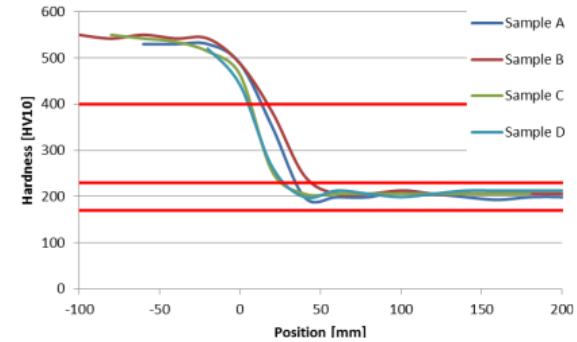
Differential Cooling Air/Jet-System



Soft Side: Ferritic-Perlitic-(Bainitic)



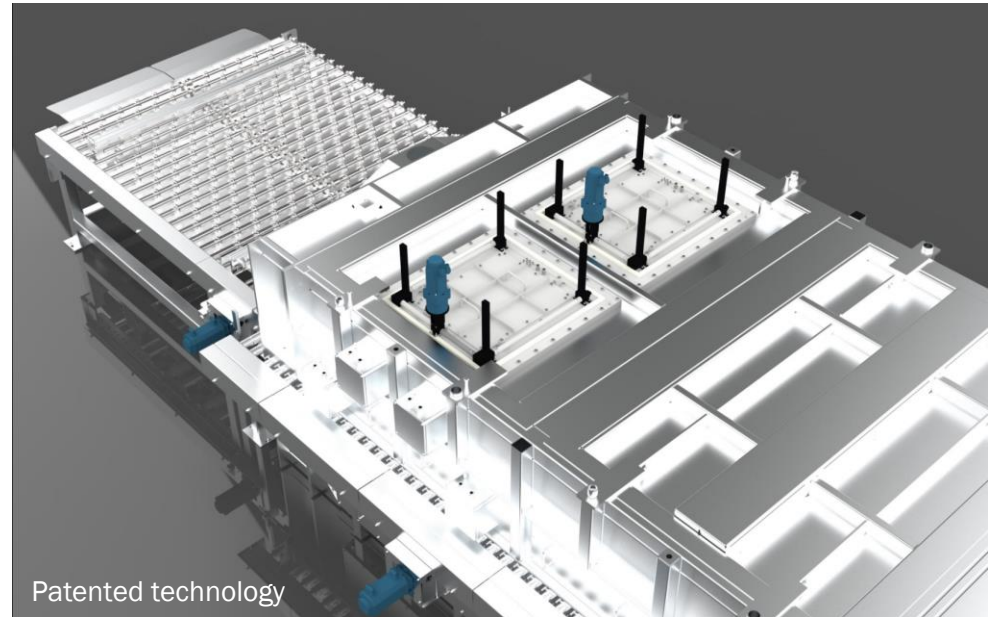
Hard Side: Martensitic Structure



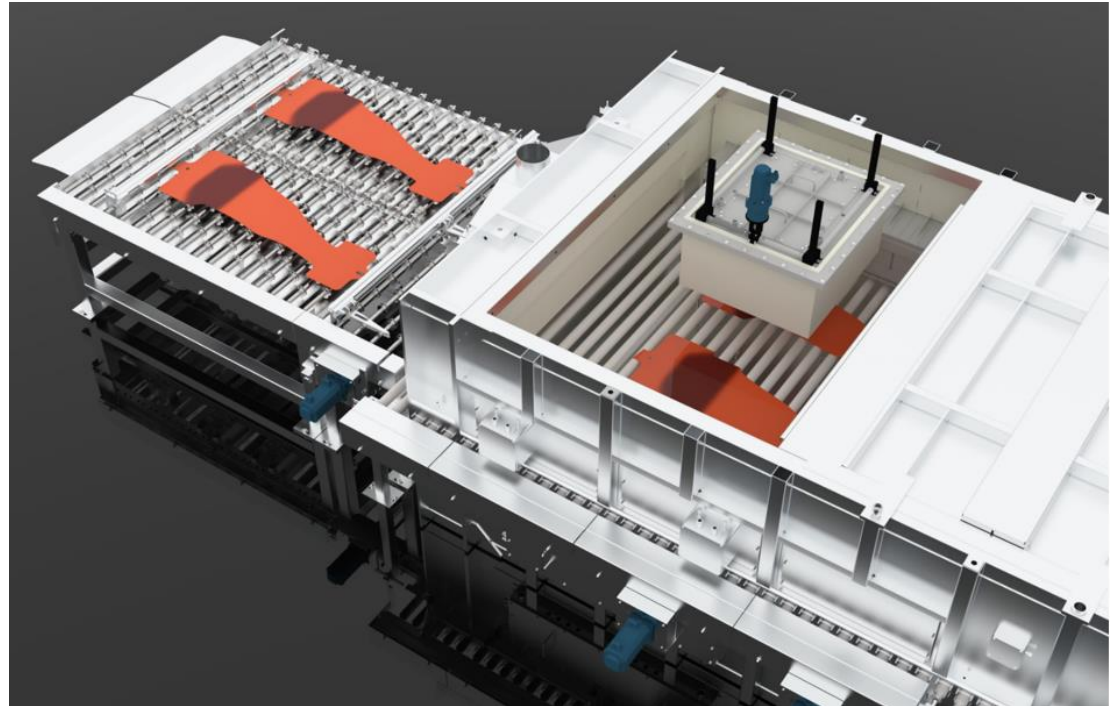
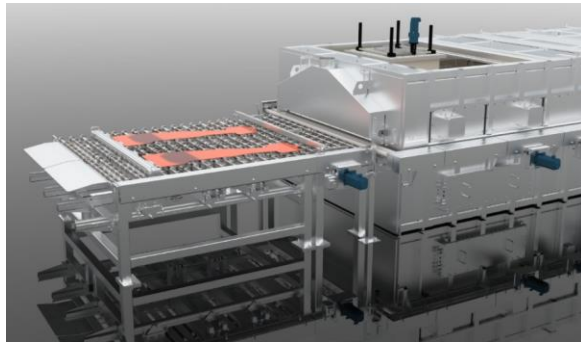
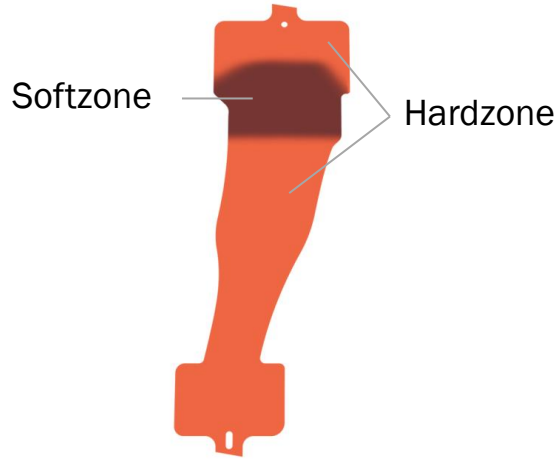
Flexible Tailored Tempering

Features

- Technology **inside** the furnace, retrofit of existing furnaces possible
- Flexibly adjustable soft zones
- No tool change needed
- Any soft zone geometry possible
- No furnace extension required
- Contact cooling with uniform mechanical properties
- Contact cooling for coated and uncoated blanks
- Adjustable hardness transition zone down to 30mm
- Maximum soft zone 500x600mm, bigger sizes possible
- Centering device inside the furnace for 2-out or 4-out

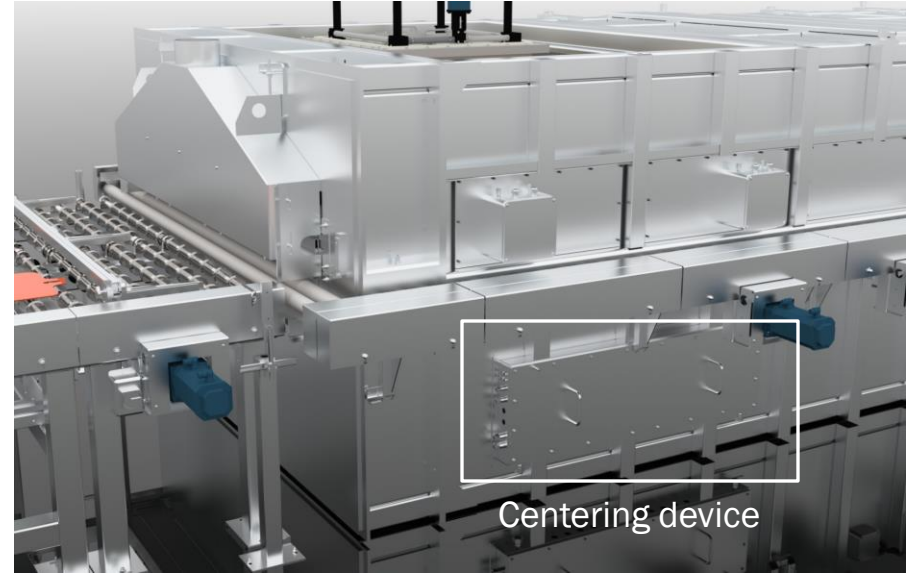
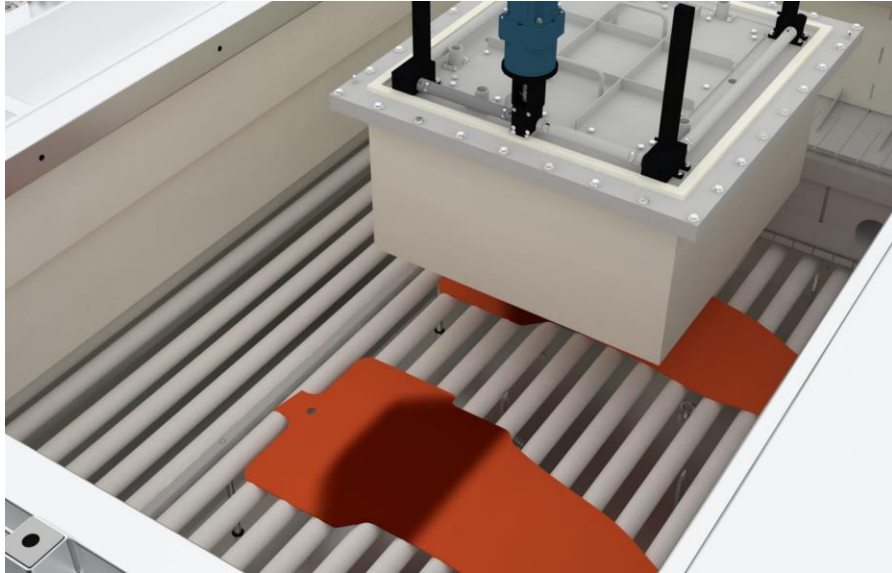


Flexible Tailored Tempering: Design 2-out



Flexible Tailored Tempering: Centering

- Centering inside the furnace
- Exact cooling position
- Centering 2-out or 4-out possible

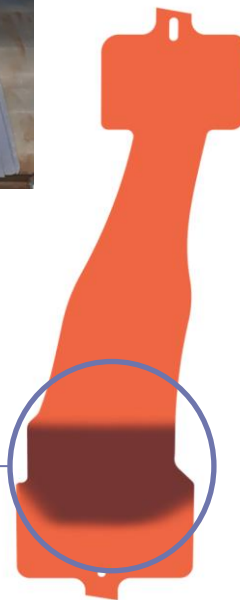
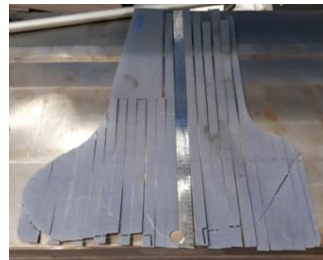
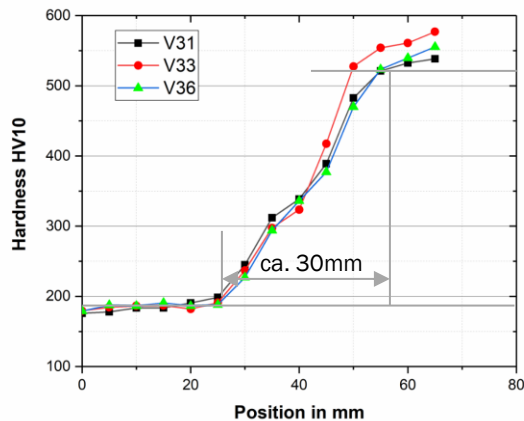


Centering device

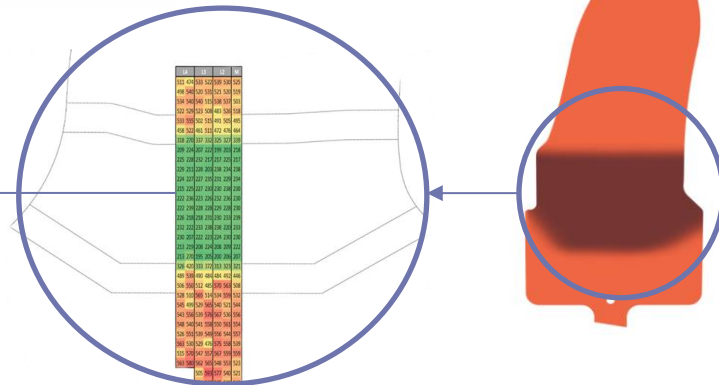
Flexible Tailored Tempering: Results

Mechanical Properties

- Hardness values between 180
- Transition zone between 30mm
- Tensile tests

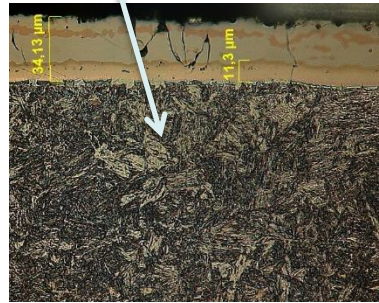
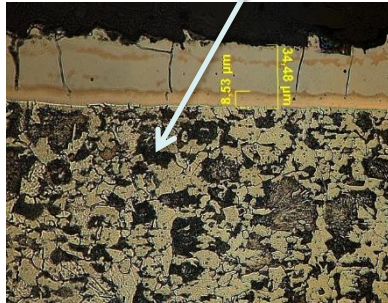


	Yield Strength in MPa	Tensile Strength in MPa	Ductility in %
Sample 1	505	704	11,4
Sample 2	492	730	8,7
	499	717	10



Flexible Tailored Tempering: Results

- Microstructure base material/coating
- Diffusion layer thickness



Flexible Tailored Tempering: Video Prototype



For More Information

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Thank you for your attention.



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STEEL

**Presentations will be available May 21
at www.autosteel.org**