Press Hardening Furnaces with Integrated Flexible Tailored Tempering

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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
Process Variants

Indirect press hardening

Direct press hardening

*source: [http://www.voestalpine.com/thinkzinc/Mediathek/Downloads](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
04/16/2018
EBNER Press Hardening Furnace Types

- Double layer type RHF – gas or electric heated
- Twin type RHF – gas or electric heated
- Single type RHF – gas, electric or hybrid heated
- Multi-level chamber furnace – hybrid heated
Single Type Roller-Hearth Furnace

Features

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

Single type RHF – gas, electric or hybrid heated
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
Multi-level chamber furnace

**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):** 140 m²
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

Source: 1st GM Supplier Forum, Detroit, 2013

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

- Softzone
- Hardzone
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 and 550HV
- Transition zone between 30mm and 1
- Tensile tests

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<tr>
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<th>Yield Strength in MPa</th>
<th>Tensile Strength in MPa</th>
<th>Ductility in %</th>
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<tr>
<td>Sample 1</td>
<td>505</td>
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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.
Presentations will be available May 21 at www.autosteel.org