CONTINUOUS FURNACE SYSTEMS
FOR KNIVES, BLADES AND BAND SAWS
The hardening and tempering of thin strip material imposes special requirements on the process and the plant technology. We at Eisenmann Thermal Solutions have decades of experience in the development and construction of customer-specific plants for continuous hardening and tempering of thin metal strips. Whether these are blade strips, band saw strips or special strips. We look forward to your particular challenge!
CONTINUOUS HARDENING AND TEMPERING OF BAND SAW STRIPS

PLANT DESCRIPTION

Our pull-through hardening and tempering plant for band saw strips essentially consists of the following components:

1. Unwinder
2. Strip cleaning unit
3. Strip brake*
4. Hardening furnace
5. Cooling section downstream of the hardening furnace
6. Deflection rollers
7. Multiple-tempering furnace
8. Cooling sections downstream of the tempering steps
9. Strip pull-through unit
10. Strip shear
11. Rewinder
12. Welding unit*
13. Measuring and control station*
14. Media panels*

Technical data

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strip height</td>
<td>to 180 mm (7”)</td>
</tr>
<tr>
<td>Strip thickness</td>
<td>to 2.0 mm (0.08”)</td>
</tr>
<tr>
<td>Strip speed</td>
<td>to 10.0 m/min (33’/min)</td>
</tr>
<tr>
<td>Hardening temperature</td>
<td>to 1,300 °C (2,370 F)</td>
</tr>
<tr>
<td>Tempering temperature</td>
<td>to 750 °C (1,380 F)</td>
</tr>
<tr>
<td>Furnace atmosphere</td>
<td>Nitrogen</td>
</tr>
<tr>
<td>Type of heating</td>
<td>Electric</td>
</tr>
</tbody>
</table>

*Not shown

Examples of plant variability

*Example of a plant for the continuous hardening and tempering of bimetal band saw strips
CONTINUOUS HARDENING AND TEMPERING OF BAND SAW STRIPS

YOUR ADDED VALUE

Efficiency
- Delivery of turn-key plants
- Continuous hardening and tempering
- Just one work step for a finished hardened and tempered band saw blade – no rewinding between the tempering processes, and separate pit tempering furnaces are not required
- High strip speeds to 10 m/min (33 ft/min)
- Minimal floor space requirements
- Patented cooling section, exclusively water-cooled – no compressor, no coolant, no gas

Variability
- Customer-specific plants
- Available for bimetal and carbon steel band saw strips
- Variable plant set-up – in-line, S-shaped, L-shaped, U-shaped or in combination
- Single-lane and multi-lane plants available
- Strip guidance on two levels is possible
- Multiple tempering in one furnace, thus lower energy requirements and floor space requirements
- 1 to 4 tempering steps in one multi-muffle furnace or in several single-muffle furnaces
- Cooling sections with liquid nitrogen are also possible
- Modular system for custom plant configuration
- Plant components are available individually
- Different winders available – also for multi-coils

Quality
- A single source for everything – plant and process are ideally matched
- Camber can be specifically influenced
- Real-time measuring of camber and tooth spacing
- Strip tension can be regulated via strip pull-through unit and brake
- Control and visualization can be adapted to the customer’s process and quality assurance system
- More than 150 units have been implemented worldwide
- A strong partner for adjacent manufacturing processes, such as milling, punching, setting, grinding, straightening or labelling

Strip speed up to 10 m/min

Product examples of band saw strips
CONTINUOUS HARDENING AND TEMPERING OF BLADE STRIPS

PLANT DESCRIPTION
Our pull-through hardening and tempering plant for blade strips essentially consists of the following components:

1. Unwinder
2. Strip cleaning unit
3. Strip pull-off and loop control
4. Media panel on the hardening furnace
5. Hardening furnace
6. Cooling section downstream of the hardening furnace
7. Deep-cooling unit (ice hardening)
8. Tempering furnace
9. Cooling section downstream of the tempering furnace
10. Strip pull-through unit
11. Rewinder
12. Welding unit*
13. Measuring and control station*

Technical data

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Strip width</td>
<td>to 100 mm (4&quot;)</td>
</tr>
<tr>
<td>Strip thickness</td>
<td>0.07 to 0.5 mm (0.003 to 0.02&quot;)</td>
</tr>
<tr>
<td>Strip speed</td>
<td>to 40.0 m/min (131'/min)</td>
</tr>
<tr>
<td>Hardening temperature</td>
<td>to 1,200 °C (2,190 F)</td>
</tr>
<tr>
<td>Tempering temperature</td>
<td>to 750 °C (1,380 F)</td>
</tr>
<tr>
<td>Temperature ice hardening</td>
<td>to −160 °C (-256 F)</td>
</tr>
<tr>
<td>Furnace atmospheres</td>
<td>Nitrogen, hydrogen or a mixture</td>
</tr>
<tr>
<td>Type of heating</td>
<td>Electric</td>
</tr>
</tbody>
</table>

* Infeed side of a 4-muffle hardening furnace for razor blades
* Example of a plant for the continuous hardening and tempering of blade strips
* Not shown
CONTINUOUS HARDENING AND TEMPERING OF BLADE STRIPS

YOUR ADDED VALUE

Efficiency
- Delivery of turn-key plants
- Continuous hardening and tempering
- Just one work step for a finished hardened and tempered blade strip
- High strip speeds to 40 m/min (131ʹ/min)
- Minimal floor space requirements

Variability
- Customer-specific plants
- Suitable for all types of blade strip:
  - Razor blades
  - Surgical blades, e.g. scalpels
  - Technical blades, e.g. hook blades
  - Industrial blades, e.g. slitting blades
  - Special applications
- Available for blade strips of stainless steel and carbon steel
- Single-lane and multi-lane plants available
- Operation with flammable gases and non-flammable gases
- Modular system for custom plant configuration
- Plant components are available individually
- Different winders available – also for multi-coils

Quality
- A single source for everything – plant and process are ideally matched
- Strip tension can be regulated via the strip tension units
- Pitch control available
- Control and visualization can be adapted to the customer’s process and quality assurance system
- More than 150 units have been implemented worldwide
- A strong partner for adjacent manufacturing processes, such as punching, grinding or labelling
SPECIAL SOLUTIONS:
PLANT EXAMPLE – COATING OF BLADES

PLANT DESCRIPTION

PTFE-coating of razor blades

The plant is suitable for thermal cleaning and for the PTFE-coating of razor blades, and essentially consists of the following components:

1. Charging station and infeed purge lock
2. Pusher-type furnace for thermal cleaning and sintering
3. Cooling zone
4. Discharge purge lock and removal station
5. Spray booth with infrared drying unit
6. Measuring and control station, media panels

Technical data for the plant example

<table>
<thead>
<tr>
<th>Type of coating</th>
<th>PTFE-coating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant temperature</td>
<td>to 450 °C (842 F)</td>
</tr>
<tr>
<td>Furnace atmosphere</td>
<td>Nitrogen or hydrogen or mixture</td>
</tr>
<tr>
<td>Type of heating</td>
<td>Electric</td>
</tr>
<tr>
<td>Transport of the blades</td>
<td>On carriers – blades on coils or swords</td>
</tr>
<tr>
<td>Dimensions of the carriers</td>
<td>approx. 430 × 430 mm (17 × 17”)</td>
</tr>
<tr>
<td>Throughput</td>
<td>approx. 300,000 blades per hour</td>
</tr>
</tbody>
</table>

YOUR ADDED VALUE

- Clean blades through thermal cleaning
- Better slide characteristics of the cutting edges
- Other coatings on request, e.g. PVD
PLANT DESCRIPTION

Hardening and tempering of knife blanks

The plant is suitable for the hardening and tempering of knife blanks and essentially consists of the following components:

- Loading station
- Hardening furnace (continuous chain furnace)
- Transfer station 1
- Press quenching system
- Transfer station 2
- Tempering furnace (continuous chain furnace)
- Cooling zone downstream of tempering
- Measuring and control station, media panels

<table>
<thead>
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<td>Hardening temperature</td>
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</table>

YOUR ADDED VALUE

- Automatic plant
- Integration of the plant in the overall process chain
- Hardening of different blanks on one plant
- No warpage of the blanks when quenching
- Blanks are not damaged
YOUR ADDED VALUE:

Experience
- More than 115 years of experience
- Qualified specialists
- Training and apprenticeship facility
- A single source for everything: plants and processes are ideally matched
- Project implementation worldwide
- Certified in accordance with ISO 9001
- Member of the German Electrical and Electronic Manufacturers’ Association (ZVEI)

Concept / development
- In-house research and development
- Risk assessment in accordance with DIN EN ISO 12100:2010
- Close collaboration with institutes and universities
- Strong partner for adjacent processes, such as punching, milling, setting, grinding, straightening, labelling, and painting

Engineering
- In-house electrical and mechanical design
- 3D design
- In-house programming
- Low surface-temperature of the furnaces
- Design in accordance with international standards

Manufacturing
- In-house manufacturing with high vertical integration
- In-house control cabinet construction
- Comprehensive quality assurance

Installation / commissioning
- Professional installation and commissioning – worldwide
- Training courses

Service
- Fast service response times
- Extensive after-sales support, also for third-party products:
  - Maintenance, inspection, repair
  - Maintenance contracts
  - Repairs
  - Plant and process optimization
  - Alterations and adaptations
  - Conversion of plants
- Guaranteed long-term spare parts supply
- Execution of trials in our own technical centre
- Measurements

In 1896, Ruhstrat in collaboration with Professor Walther Nernst of the University of Göttingen, who would later win the Nobel Prize, developed the first resistance-heated high-temperature furnace, with which temperatures of up to 3,000 °C (5,432 °F) could be achieved.

Two years later Ruhstrat received orders from the industry for development and construction of customer-specific high-temperature furnaces. The activities of Ruhstrat be continued and expanded after the change of name in Eisenmann Thermal Solutions. In this regard, we support our customers as a competent partner from concept to design and manufacturing, extending to commissioning.
PROJECTS IMPLEMENTED FOR THE HARDENING AND TEMPERING OF METAL STRIPS

We have implemented more than 150 hardening and tempering plants for saw blades, and more than 150 hardening and tempering plants for blade strips around the world.

For example, we have installed our plants in the following countries:
Algeria, Brazil, China, Germany, France, Greece, India, Italy, Japan, Jordan, Mexico, Pakistan, Poland, Sweden, Switzerland, Tanzania, Thailand, Turkey, Great Britain, USA.

Some of our satisfied customers:*