Heat treatment solutions.  
Hightech by Gerster.
There are thousands of products made of forged or cast steels or non-ferrous metals. Their standards with respect to security, reliability, corrosion resistance and durability are extremely diverse. Since 1950 Härterei Gerster has been a recognised specialist for technical heat treatments with an international clientele. A comprehensive service package based on qualified consulting and a great variety of installations provides customised solutions for each kind of heat treatment need. The size range starts with smallest pieces for watches and instruments for ophthalmology and ends with large components for heavy equipment. Available installations provide efficient heat treatment of single pieces up to several tons as well as automated heat treatment solutions for smaller pieces in a series of millions. Gerster Technical Heat Treatments is certified according to ISO 9001:2000 (Quality Management Standard), ISO 14001:2004 (Environmental Management Standard) and ISO/TS 16949 (Automotive Quality Standard).
Component, which is partially surface-hardened at various positions. It demonstrates effective hardening of a complex-shaped component without any significant distortion. Microstructure and hardening depth are examined and documented in the company's own laboratory.
Surface hardening is a heat treatment method, which is based on microstructure transformations during heating and quenching. The chemical composition of the alloy remains unchanged. Various surface hardening methods are available. The choice depends on size and shape of the component to be hardened as well as on its chemical composition and its requirement with respect to the hardening depth.

Induction hardening/annealing
In induction heating heat is directly generated within the workpiece. An electro-magnetic field, which is generated by an inductor, can be used to induce an electrical current in those regions of the workpiece that are intended to be hardened. This process provides very fast heating and hence enables very localised hardening or annealing of the workpiece. Induction hardening is subdivided into four different methods:
- High frequency hardening (HF)
- Mid frequency hardening (MF)
- Dual frequency hardening (HF/MF)
- High frequency impulse hardening

Impulse hardening
This method belongs to the induction hardening methods. Heating is realised within milliseconds by means of square-wave impulses with a very high peak power and a frequency of 27,12 MHz. Impulse hardening is predominantly used for small pieces.

Flame Hardening
Heat is supplied by special burners. Quenching is realised by the same methods as in induction hardening using water, polymer solutions, oil or compressed air. However, much greater hardening depths up to 40 mm can be realised by flame hardening.
Horizontal flame hardening equipment,
max. length: 10000 mm
max. diameter: 800 mm

Flame hardened, irregularly shaped
disc (hardened without gap).
Laser Technologies.

Laser hardening
A high-power diode laser is used to generate a precise, high energy laser beam. The impact of the laser beam on the metal surface is a fast heating (>1000 °C/second) of the workpiece up to a depth of about 1.5 mm. Heat conduction into the metal provides fast self-quenching. As a result hardened traces with finest grained martensitic microstructure are produced. The risk of cracking is effectively mitigated by the minimal heat input needed for hardening. For the same reason there is no need for a stress relief treatment after laser hardening.

Laser hardened running surface with a minimum of distortion.

Cross-section and longitudinal cuts prepared for examination of laser hardening.
Inert gas laser-hardened sealing surfaces (material: spheroidal graphite cast iron).

Laser-hardened edges of an injection moulding extruder.
Through hardening/annealing treatments are realised in modern, process-controlled equipment without affecting the chemical composition of the components.

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Hardening of tool steels, vacuum hardening with gas pressure quenching
Medium and high alloy tool steels, hot working and high speed steels as well as martensitic stainless steels are typically hardened in vacuum furnaces. Vacuum treated parts keep their bright surface.

Heat treatment of hardenable steels
Heat treatment of hardenable steels consists of a quenching treatment from austenitising temperatures and a tempering treatment in an upper temperature range. This quench and tempering treatment is applied to low-alloyed and un-alloyed steels with a carbon content in the range between 0,2 and 0,6%.
This type of heat treatment provides the best combination of toughness and tensile-strength.

Annealing with inert gas
Annealing is the generic term for various treatments. Temperature, holding time and cooling speed are fixed to meet specified material properties. Annealing with inert gas prevents or restricts chemical reactions like for example oxidation of the metal surface.

Deep-freezing treatments (cryogenic treatments)
Deep-freezing treatments are performed to transform retained austenite in steel components for which highest dimensional stability over its foreseen lifetime is demanded.

Heat treatment of Aluminium and Aluminium alloys
By means of a soft annealing treatment optimal conditions are provided for cold working of aluminium. The process of soft annealing is controlled by the annealing temperature and by the cooling velocity. In a precipitation hardening treatment the soft structure is transformed into a hard structure with maximum strength properties. This is achieved by:
- solution annealing
- quenching
- ageing
The solution annealing temperature is in the range between 480 and 550 °C. Quenching is performed in water. The ageing treatment can be performed at ambient temperature or at elevated temperatures.
Vacuum hardened, corrosion resistant rasp for surgical applications

Deep-frozen components.
Thermochemical diffusion processes are performed in computer controlled furnaces in order to provide optimised heat treatment conditions and reproducibility.

**Carburising**
Enrichment of the surface of a workpiece with carbon by a thermochemical treatment.

**Carbonitriding**
Enrichment of the surface of a workpiece with carbon and nitrogen by a thermochemical treatment.

**Case Hardening**
This means carburising or carbonitriding with subsequent heat treatment for hardening. Carburising and carbonitriding are realised at high temperatures (> 800 °C). As a result of the subsequent hardening treatment the carbon/nitrogen enriched surface provides higher hardness with improved wear resistance.

**Gas Nitriding**
This is a process for the enrichment of the surface with nitrogen in the temperature range between 480 and 550 °C within a process time of 12 to 96h.

**Oxinitriding**
This is a process that uses the same process parameters as in classical gas nitriding but adds some oxygen to the nitriding process.

**Gas Nitrocarburising**
This is a process for the enrichment of the surface with nitrogen and carbon at a temperature of 570 to 580 °C within a process time of 2 to 10h.

**Post oxidation of one of the three processes mentioned above**
Controlled oxidation of the surface can be realised immediately after a nitriding or nitrocarburising process. An improvement in corrosion resistance and a reduction of the coefficient of friction can be achieved by means of post oxidation. Depending on the chosen alloy, post oxidised parts can have a dark-grey or black colour.

**Pronox**
This is the trademark for nitrocarburising with controlled post oxidation.

**Plasox-Treatment**
This means a controlled post oxidation treatment immediately after a Micro-pulse-Plasma nitriding or Micropulse-Nitrocarburising treatment. In addition to a decorative, black appearance, a significantly improved corrosion resistance as compared to a simple nitrocarburising treatment can be realised.

**Boronising**
This is a process for the introduction of boron and the formation of a closed layer of boron compounds on the metal surface. Effective process temperatures are in the range between 800 and 1000 °C. The hardness depends on the base alloy and is typically in the range between 1500 and 2100 HV. The high level of hardness along with the particular microstructure of boron compound layer provides an extraordinarily high wear resistance.

**HARD-INOX®-P Process**
This is a high temperature nitriding process that aims to introduce maximal amounts of dissolved nitrogen. Typical depth of the nitrogen enriched zone is in the range between 0,2 to 0,5 mm. It is a new technology that aims to enhance surface hardness and corrosion resistance of stainless steels while maintaining high toughness in the core. HARD-INOX®-P can be applied to austenitic stainless steels (e.g. 1.4301, 1.4404, 1.4435) and to duplex stainless steels (e.g. 1.4162, 1.4362, 1.4462). The resulting microstructure on the surface is an interstitially strengthened austenitic structure with high toughness. HARD-INOX®-P can be also be applied to martensitic and ferritic stainless steels (e.g. 1.4016, 1.4021, 1.4104). The resulting microstructure on the surface is martensitic characterised by enhanced hardness and corrosion resistance.
**Brazing under vacuum conditions**
High temperature brazing under vacuum conditions is used for joining of precise and highly stressed parts. Various kinds of steel alloys can be joined among each other or with non-ferrous alloys, high alloyed metals or hard metals. Brazes used are based on copper, nickel or precious metals. Vacuum brazed parts keep their bright appearance. Of particular commercial interest are combined brazing/hardening or brazing/solution annealing treatments.

**Brazing under inert gas conditions**
Serial parts can be brazed on the conveyor belt within a continuous annealing furnace under inert gas conditions without any flux.

**Inductive Brazing**
In an inductive brazing process heat is generated within a workpiece by an induced alternating current. This method bears the advantage of a very short heating time. Heated zones can be kept within a narrow band. Strength values and microstructure characteristics out of the brazed zone are not affected.

**Brazing with a flame**
Brazing of bigger parts can be realised with a flame. The use of multiple burners enables an optimal, shape adapted heating of the workpiece.
Lever with a brazed in pin. Both parts are soldered with copper under inert gas conditions. The new part is subsequently case hardened.
Hightech by Gerster: Consulting, Quality Management and Additional Services

In 1987 Gerster Technical Heat Treatments was certified as the first company offering heat treatment services. Their modern Quality Management Standard according to ISO 9001:2000 is characterised by a mentality of mutual trust, appreciation, partnership and positive thinking.

Gerster uses the Quality Management System as a strategic, comprehensive management system (organisation – and information system) in order to achieve high customer satisfaction based on the involvement of all employees for continuous improvement of all processes with optimal economy.

- Microstructure investigations
- Laboratory investigations on steel parts
  - Metallographic investigations
  - Chemical analysis (spectral- and infrared C-analysis)
  - Corrosion testing
- Hardness profiles
- Measurement of cooling curves (oil – and polymer solutions)
- Crack inspection by qualified staff based on magnetic particle testing and dye penetrant testing
- Fully automated part sorting based on multifrequency eddy-current testing
- Straightening (up to 200 tons press force)
- Fully automated straightening press
- Blasting processes based on steel balls, corundum or aluminium oxide
- Steam degreasing
- Non-destructive measurement of hardening depth following surface hardening
- Measurement of coercive field strength
- Training/courses on the diverse areas of heat treatments
- Failure analysis


- Non-destructive chemical analysis with a mobile spark spectrometer for the determination of element concentration including carbon, sulphur and phosphorus.
Cut prepared with random samples of boronised, quenched and tempered screws. It provides an assessment of the microstructure along with the measurement of the thickness of the boronised layer.
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Quality Management System
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Surface hardening
- Induction hardening
- Dual frequency hardening
- Flame hardening
- Non-destructive determination of hardening depth

Laser technology
- Laser hardening

Through hardening/annealing
- Hardening under inert gas conditions
- Vacuum hardening with pressurised gas quenching
- Tempering
- Annealing under inert gas conditions
- Stress relief treatments
- Cryogenic treatments down to –180 °C
- Precipitation hardening of aluminium alloys

Brazing
- Under vacuum conditions
- Under inert gas conditions
- Inductive
- With flame

Thermochemical diffusion methods
- Carburising
- Carbonitriding
- Case hardening
- Gas nitriding
- Oxinitriding
- Gas nitrocarburisation
- Pronox
- Plasma nitriding
- Plasox
- Boronising
- Performance enhancing treatments for stainless steels SolNit-A®, SolNit-M®, HARD-INOX®

Consulting and additional services