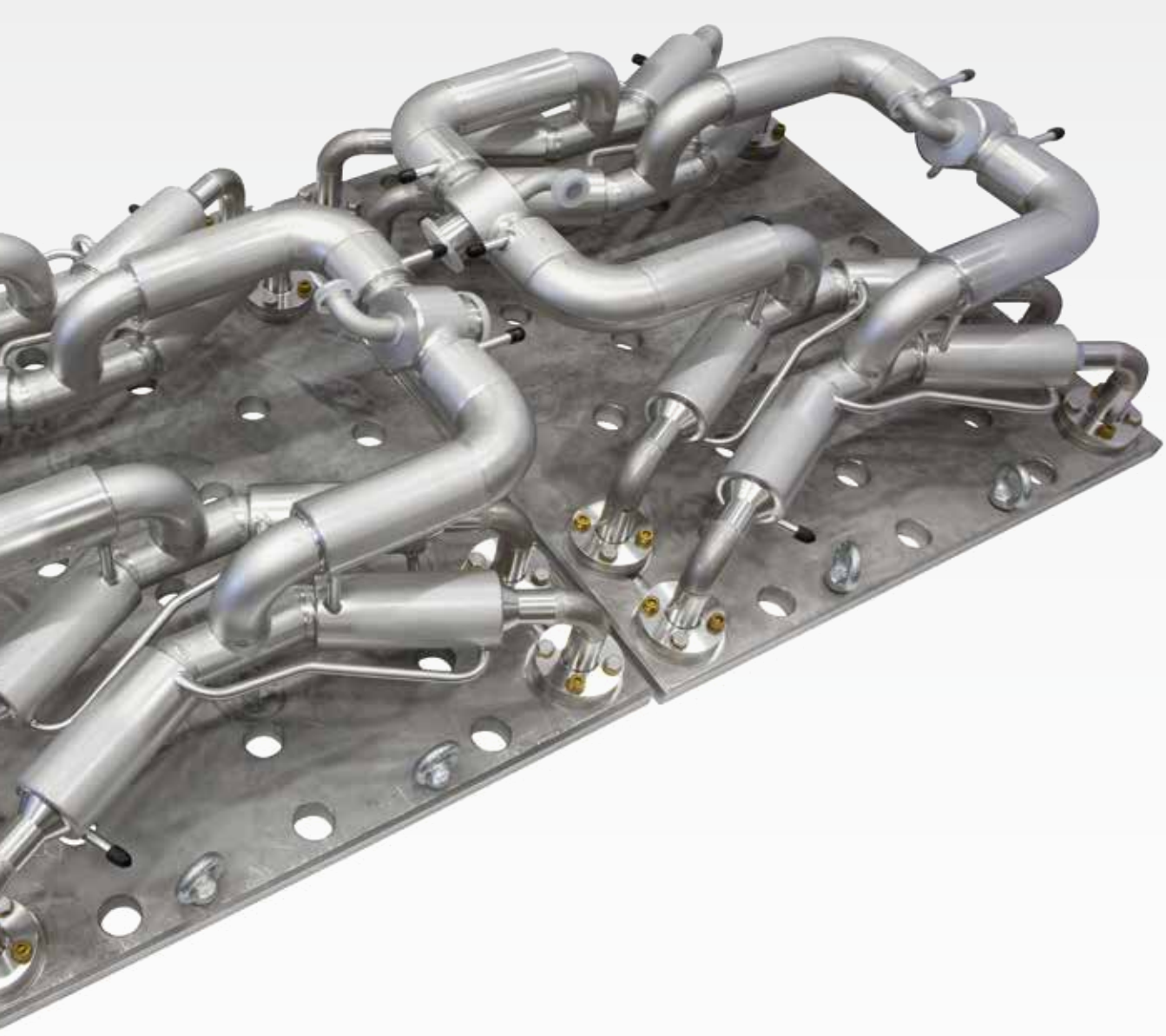
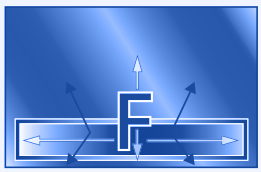
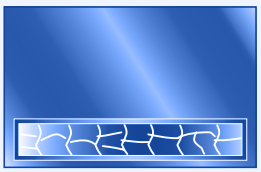


Annealing

Improving mechanical/material properties



Reduction of stresses

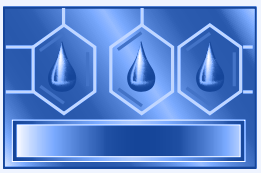


Improved material structure

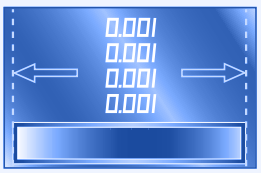
Improved magnetic properties

Reduction of hardness possible

Improved welding properties



Improved corrosion resistance



Good dimensional and shape accuracy

Clean process, parts remain bright

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Annealing

Improving mechanical/material properties

What is Annealing?

The primary purpose of an Annealing treatment is to reduce the hardness of a material and facilitate the progress of subsequent manufacturing operations. Annealing is commonly used after casting, forging or rolling to soften materials and minimise residual stresses, improve machinability, and increase ductility by carefully controlling the microstructure. Steels in strip form are Annealed, as are tool steels and stainless steels. Non-ferrous alloys are also Annealed. There are a number of process variations that qualify as Annealing treatments.

How does Annealing take place?

Annealing of work pieces can be performed in different types of atmospheres: air, protective gas or vacuum. Hauck HT apply Annealing processes in all these atmospheres, and can execute both standard and customer specified Annealing processes.

Annealing in air is usually the cheapest option, but the disadvantage is that the surface of the work pieces will oxidize. In general, this means discoloured work pieces.
By Annealing under protective gas or vacuum, no oxidation or other undesirable surface reactions come about and the surface remains bright (bright Annealing).

Annealing in vacuum has the advantage that the heating and cooling can be controlled more accurately, which is improves results in terms of the dimensions (shape and dimensional stability) of the products. Furthermore, after Annealing in vacuum, it is possible to cool with overpressure nitrogen or argon so that a faster cooling compared to the Annealing under protective gas or Annealing in air can be realised.

Frequently applied Annealing treatments

Full Annealing
This process is performed on steels by heating to a high temperature (typically 830-950°C) then cooling slowly to ambient temperature. Non-ferrous materials are softened and refined at temperatures appropriate for each alloy.

Stress relieving
Internal (peak)stresses are reduced in the material, which may have been caused by machining, cold working or welding and which may cause problems further on in the production process. The mechanical properties are little affected by this treatment.
Stress relieving significantly reduces the risk of size and shape change on work pieces which in a later stage will be hardened or high-temperature brazed.

Soft Annealing
This Annealing process softens the material or makes it easier to be machined. Moreover, soft Annealing can be applied to further reduce stresses in the material if stress relieving is not sufficient and to reduce the possibility of cracks during potential hardening treatments.

Re-crystallisation Annealing
Work pieces created with imperfections in the crystal lattice and in which the material became harder e.g. by cold working, are often re-crystallisation Annealed to be able to improve or continue the material deformation. By re-crystallisation Annealing new undeformed (soft) crystals are originated. The process temperature depends on the material used and the deformation ratio can be performed on all metals and alloys. Re-crystallisation Annealing is also called soft Annealing.

Standardised Annealing
This Annealing process is applied to improve irregular, inhomogeneous and coarse grained structures in for example, castings, forgings or rolled sheet. This improves the mechanical properties of the material by obtaining a fine-grained structure with grains of roughly equal size and a round shape.

Solution Annealing
Solution Annealing is applied commonly to austenitic stainless steels, typically at 1010-1150C. For unstabilised grades it must be followed by fast cooling or quenching. It is applied as a softening process during manufacture or to optimise corrosion resistance, for example after welding.

Stabilisation Annealing
This treatment is applied on RVS that is not easy to weld, but still needs to be welded. The welding creates an undesirable structure in the material, also known as weld decay. The structure can be restored through this Annealing, by cooling the material slowly after solution Annealing and thus secreting or dissolving secretions.

Magnetic Annealing (Permeable Annealing)
This is an Annealing treatment to optimize the (soft) magnetic properties of the material. The aim is to maintain as much as possible an even atomic lattice with as little disruptions as possible, so that the material is magnetically homogeneous.

Properties

- Reduction of stresses
- Improved material structure
- Improved magnetic properties
- Reduction of hardness possible
- Improved welding properties
- Improved corrosion resistance
- Good dimensional and shape accuracy
- Clean process, parts remain bright