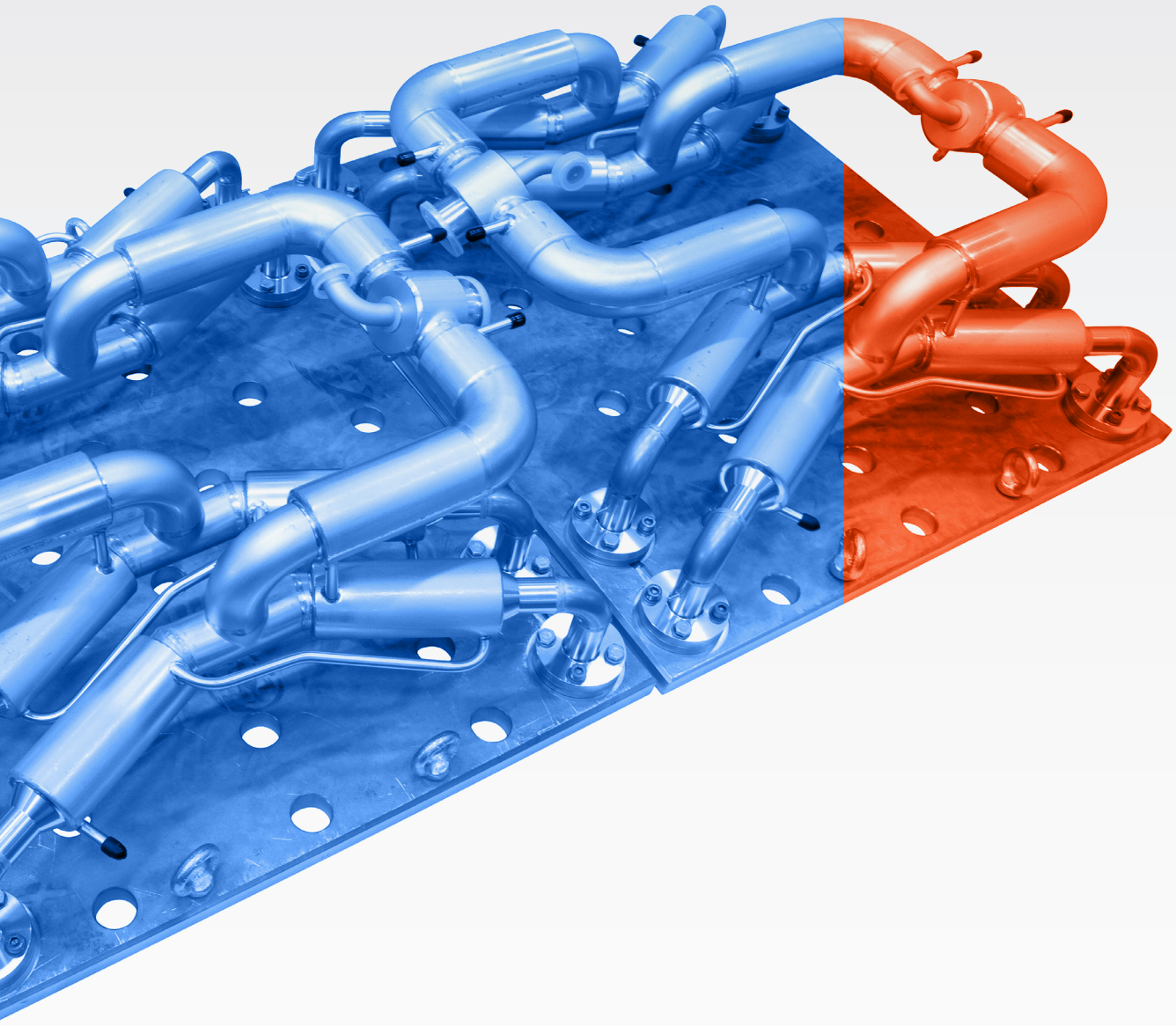
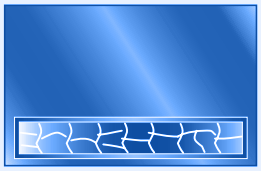


Annealing

Improving mechanical/material properties

Reduction of stresses

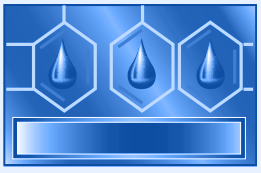


Improved material structure

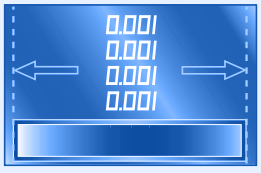
Improved magnetic properties

Reduction of hardness possible

Improved welding properties



Improved corrosion resistance



Good dimensional and shape accuracy

Clean process, parts remain bright

an Aalberts Industries company

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Annealing

Improving mechanical/material properties

What is annealing?

Annealing is heating, next maintaining a certain time at temperature and cool regularly after reaching the desired properties. Cooling should be done at a certain cooling rate, so that the achieved properties are not adversely affected. So it is a process where a work piece is deliberately exposed to a temperature-time-atmosphere process in order to reach certain desired properties.

How does annealing take place?

Annealing of work pieces can be performed in different types of atmospheres: air, protective gas or vacuum. Heat & Surface Treatment and Mamesta 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 even has the advantage that the heating and cooling can be better controlled, which is favourable with regards to 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

The following are frequently applied annealing treatments:

Stress relieving
Hereby internal (peak)stresses are reduced in the material, which, for example are caused by machining, cold working or welding and which may cause problems further on in the production process. The mechanical properties are hardly affected by this treatment.
Stress relieving reduces the risk of size and shape change significantly on work pieces that 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. A special type of soft annealing is GKZ annealing (Glühen nach Kugelformiger Zementit) where glowing is performed to obtain spherical cementite in the material structure.

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 ensures that secretions in the material lattice present in the material are dissolved. This creates a homogeneous structure. After solution annealing, secretion or precipitation hardening is often applied so that the material adjacent to the solution annealing is heated to a temperature where the material elements that are in solution lattice. This improves the mechanical properties.

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