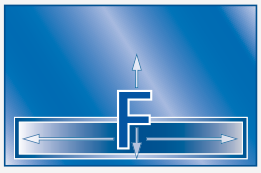
Carburising / Carbonitriding

Surface hardening of Steel

High wear resistance

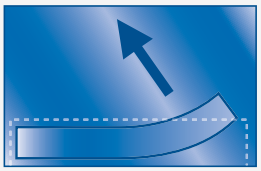


Increased mechanical properties

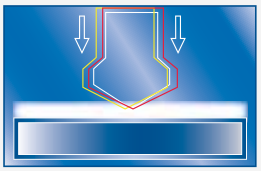
High stability

Improved fatigue strength

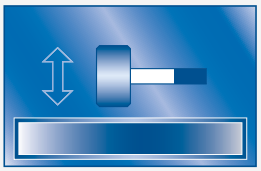
High surface hardness



Improved ductility



Increased impact resistance



High resistance against impacts

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Carburising / Carbonitriding

Surface hardening of Steel

What is Case Hardening?

Carburising and Carbonitriding are "thermochemical" treaments carried out in the temperature range 800°C to 950°C. These processes change the chemical composition of the surface of a steel component so that subsequent fast cooling by "quenching", produces a hard "case" combined with a softer/tougher core.

How does Case Hardening take place?

Case Hardening typically consists of three steps
In the first step, components are exposed to a carbon and/or nitrogen emitting environment. This increases the carbon and/or nitrogen percentage at the edge of the component. The carbon profile and the penetration depth depend on the time at temperature, the amount of supplied carbon, the temperature and the kind of steel used.

In the second phase, quenching (hardening) takes place. This can be performed directly from the carburising temperature, or after an interstage cooling or new heating to a new material-specific curing temperature. In order to minimise distortion, it is also possible, instead of directly quenching in cold oil or water, to quench in hot oil or in a warm salt bath.

The third step is tempering and mainly serves to reduce the stresses in the structure and to diminish the grinding crack sensitivity. In certain instances, a subzero freezing treatment is possible. In this case, the component is cooled to temperatures far below zero (at least below -80 °C) in order to reduce the residual austenite percentage and thus improve the dimensional stability after hardening.

Process Variations

In both Carburising and Carbonitriding, the chemical composition and the structure of the surface layers is altered.
Carburising and Carbonitriding can be performed in both liquid and gaseous media. For both variations, different techniques are available such as batch furnaces, conveyor-belt furnaces, low pressure installations, and salt baths. It is also possible to selectively Case Harden by using appropriate masking techniques. The repeatability of the processes is achieved through continuous monitoring of the process parameters.

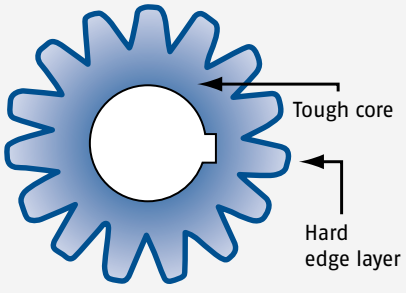
Case Hardening Depth

The Case Hardening Depth, is the distance from the surface, where hardness has decreased to a defined value (core hardness + 50, HV1, for example). The case hardening depth with its corresponding core hardness, and the test load of the consequent, must be agreed between the customer and the heat treatment company, depending on the material and the application, in conformity with the applicable standard.

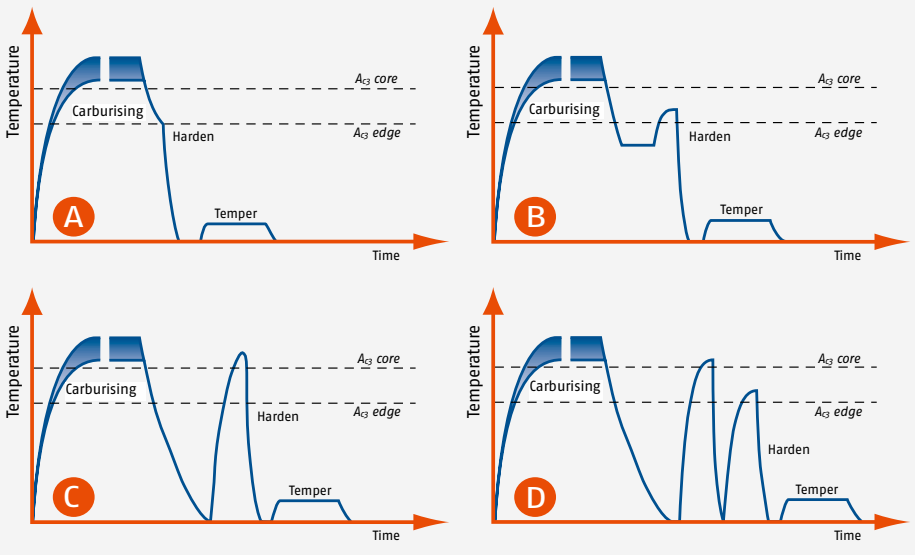
Hauck HT offer extensive capacity in gaseous, salt bath and vacuum / low pressure atmospheres for Carburising and Carbonitriding, at multiple locations, under Aerospace, Automotive and Commercial approvals.

Properties

- Higher wear resistance
- Higher surface hardness
- High toughness
- Improved resistance against fraction
- Improved fatigue strength
- Selective/partial hardening possible



Graphical representation of a case-hardened component



Possible temperature-time paths when carburising

A *Direct hardening*
B *Single hardening*
C *Hardening after isothermal transformation*
D *Dual hardening*