

Heat treatments

Principles

Through-hardening

Principle:

In general, through-hardening consists of exposing the metal to a cycle of high-temperature heating followed by controlled cooling. Through-hardening is often the first step of a more complex treatment in which the metal will subsequently be tempered. The consequence of this treatment is a notable improvement in the hardness of the steel.

Through-hardening is followed by tempering, a process that consists in heating the hardened metal (at a temperature lower than that used in the through-hardening process itself) in order to remove any tensions that may remain in the metal.

This cycle of through-hardening and tempering can only be carried out on steels that contain sufficient carbon, such as 35NCD6. Gears made of 35NCD6 through-hardened to 45-50 HRC have a good resistance to wear.

Case-hardening

Principle:

Case-hardening involves using an appropriate powder, paste, liquid or gas to enrich the carbon in all the surfaces of a material. This process is immediately followed by an oil through hardening. These combined treatments improve the surface and core hardness of the metal, which vary according to the type of steel used. An excellent compromise between high resistance to wear and good malleability is thus obtained.

The depth to which the treatment is effective depends on the length of the heat cycle and the type of material used.

Steel 34C10 can be case-hardened, but hardened gears made from this soft steel are only suitable for light loads. HPC no longer uses this steel, it has been replaced by 20NCD2.

For heavier loads, through- and case- hardened steel 20NCD2 is recommended. The good core resistance and surface hardness (57-62 HRC) obtained after treatment allow gears made of through- and case-hardened 20NCD2 to withstand heavy loads and shocks received during use.

The cost of these treatments depends on the number of parts to be treated and their size. The costs associated with using a treatment bath are fixed regardless of the number of parts to be treated. This cost is therefore divided between the number of parts to be treated. The size and dimension of the parts determine how many can be treated at the same time.

Please contact us for more information.

Processes

This table indicates the various processes that will be used for heat treating gears.

Material	Carbon diffusion	Heating temperature	Cooling method	Hardness obtained	Tempering
Trough-hardening					
60C40		830/860°C	Maintain at 210-230°C in oil bath 1h/25 mm	40-45 HRc	Maintain at 650°C then allow to cool for 1h in open air or in oven
XC38		810/840°C	Maintain at 210-230°C in oil bath 1h/25 mm	40-45 HRc	Maintain at 650°C then allow to cool for 1h in open air or in oven
42 CD4		860/890°C	Maintain at 210-230°C in oil bath 1h/25 mm	40-45 HRc	Maintain at 690°C then allow to cool for 1h in open air or in oven
35NCD6		820/850°C	Maintain at 180-200°C in oil bath 1h/25 mm	40-45 HRc	Maintain at 650°C then allow to cool for 1h in open air or in oven
Case-hardening					
34C10 < Ø100	Maintain at 900-930°C for 1h depth of case-hardening 0.2mm	770/790°C	Maintain at 150-200°C in oil bath 1h/25 mm	55-60 HRc	Maintain at 650°C then allow to cool for 1h in open air or in oven
34C10 > Ø100	Maintain at 900-930°C for 1h depth of case-hardening 0.2mm	900/930°C	Maintain at 150-200°C in oil bath 1h/25 mm	57-62 HRc	Maintain at 650°C then allow to cool for 1h in open air or in oven
20NCD2	Maintain at 900-930°C for 1h depth of case-hardening 0.2mm	820/840°C	Maintain at 150-200°C in oil bath 1h/25 mm	57-62 HRc	Maintain at 650°C then allow to cool for 1h in open air or in oven

**Do not stock or use at 250-450°C.
Values are given as a guide only.*