



Heat treatments

Quench-hardening

Principle:

In general, quenching consists in exposing the metal to a cycle of high-temperature heating followed by controlled cooling. Quenching 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.

Quenching is followed by tempering, a process that consists in heating the quenched metal (at a temperature lower than that used in the quenching process itself) in order to remove any tensions that may remain in the metal.

This cycle of quenching and tempering can only be carried out on steels that contain sufficient carbon, such as 35NCD6 for example. Gears made of 35NCD6 quench-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-quenching. 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 depths to which the treatment is effective depend on the length of the heat cycle and the type of material used.

Steel 34C10 can be case-hardened. Treatment of this soft steel suits gears that are only subject to fairly light loads.

For heavier loads, quench and case-hardened steel 12NC15 is recommended. The good core resistance and surface hardness (57-62 HRc) obtained after treatment allow gears made of quench and case-hardened 12NC15 to withstand heavy loads and shocks received in use.

The cost of these treatments depends on the number of parts to be treated. The price of a bath is fixed and does not change, whether there are 1, 10, or 20 parts. The cost of the treatment is therefore divided between the number of identical parts to be treated. This price also depends on the dimensions of the parts.

Please contact us for more information.



Heat treatments

The table below shows the procedures used when heat-treating gears.

MATERIAL	CARBON DIFFUSION	HEATING TEMPERATURE	COOLING METHOD	HARDNESS OBTAINED	TEMPERING
QUENCHING					
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
12NC15	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.
All these values are given as an indication only.



Standard and special materials

STANDARD MATERIALS																			
GEARS:	<table border="0"> <tr> <td>12NC15</td> <td>34 C10</td> <td>Delrin</td> </tr> <tr> <td>35NCD6</td> <td></td> <td>Brass CuZn40P63</td> </tr> <tr> <td>60C40</td> <td></td> <td>Celeron</td> </tr> <tr> <td>Stainless steel</td> <td></td> <td>Z10 CNF 18.09 (303)</td> </tr> <tr> <td></td> <td></td> <td>Z6 CND 17.12 (316)</td> </tr> </table>	12NC15	34 C10	Delrin	35NCD6		Brass CuZn40P63	60C40		Celeron	Stainless steel		Z10 CNF 18.09 (303)			Z6 CND 17.12 (316)			
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WORMWHEELS:	Phosphor Bronze CuSn12 Delrin Celeron Cast Iron																		
WORMS:	34 C10 Delrin Brass																		
CHAINS AND SPROCKETS:	34 C10 Delrin Steel Stainless steel																		
PULLEYS:	Aluminium 6082 34 C10 Stainless Z10CNF 18.09 (303)																		
BEVEL GEARS:	60 C40 Delrin Stainless Z10 CNF 18.09 (303)																		
RACKS:	60 C40 34 C10 Delrin Brass Stainless steel Z10 CNF 18.09 (303)																		
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