LC 200 N^{resist}, Special Tool Steel

Data Sheet – Tooling Alloys

Zapp is certified to ISO 9001

Key features of Zapp's nitrogen-alloyed PESR tool steel LC 200 N^{resist}

- nitrogen-alloyed and highly corrosion-resistant martensitic PESR tool steel
- outstanding toughness with high tensile properties
- highest level of purity with fine, homogeneous microstructure
- High-gloss polishable
- Very good PREN corrosion resistance
- Case hardness up to 58 HRC possible
- Food safety

Typical areas of application

- Mechanical engineering
- Food industry
- Plastics industry
- Medical Technology

Typical chemical composition (weight %)

C	Cr	Mo	N
0.3	15.0	1.0	0.4

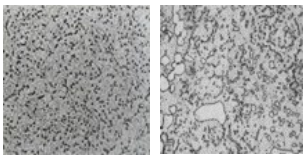
Physical properties

Modulus of elasticity E [GPa]	214
Density [kg/dm³]	
Soft-annealed	7.72
Hardened	7.67
Specific heat capacity [kJ/(kg*K)]	
-196 °C	17.2 x 10^{-2}
10 °C	48.6 x 10^{-2}
120 °C	54.0 x 10^{-2}
Thermal expansion coefficient [mm/mm/K]	
20 – 120 °C	10.8 x 10^{-6}
Thermal conductivity [W/(m*K)] at	
10 °C	13.8 (58 HRc) 20.8 (32 HRc)
120 °C	15.0 (58 HRc) 21.8 (32 HRc)

Delivery condition

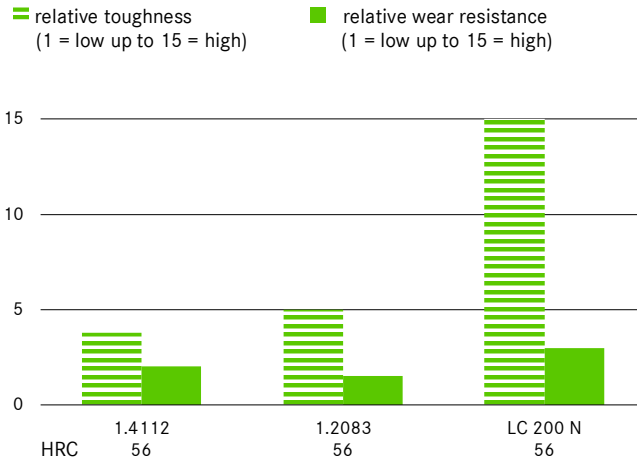
As-delivered condition	Soft-annealed, approx. 300 HB
Product forms	Round bars, flat bars, sheets
Surface finish	Mechanically machined

LC 200 N^{resist} microstructure compared to conventional microstructure

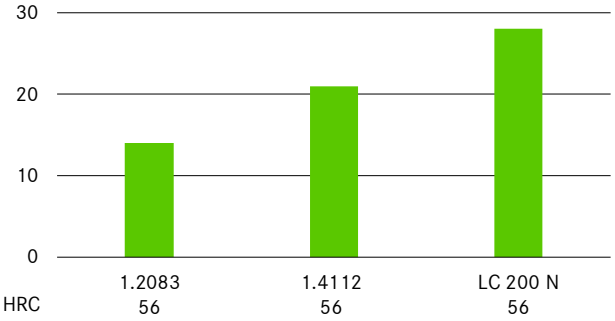


The homogeneous PERS microstructure compared to the coarse carbide structure of a conventionally produced steel (1.4112 right)

Qualitative comparison of the most important properties



Corrosion resistance according to PREN (the higher the PREN value, the more corrosion resistant the steel).



Heat treatment

Soft annealing

- In neutral atmosphere at ~ 800 °C and ~ 4 h exposure time (after through-heating)
- Followed by furnace cooling (optimum cooling rate max. 15 °C/h up to 540 °C)
- Soft annealing hardness ~ 300 HB

Stress-relief annealing

~ 650 °C/ ~ 2 h exposure time (after through-heating) followed by furnace cooling

Additional information on hardening and tempering

- A grinding allowance on all sides must be taken into account (nitridation or denitrification)
- Hardening in vacuum under adjusted partial pressure is recommended
- Highest corrosion resistance is achieved with low tempering temperatures (160 to 300 °C)

You can find more materials at:
www.zapp.com/en-uk/materials/powder-metallurgical-tool-steel

Zapp Precision Metals GmbH ensures professional execution of all heat treatment steps as well as their preparation and post-processing (e.g., charging, hardness testing, straightening processes, etc.) – always with the aim of obtaining the optimum component properties!
We are happy to assist you with constructive advice

TOOLING ALLOYS

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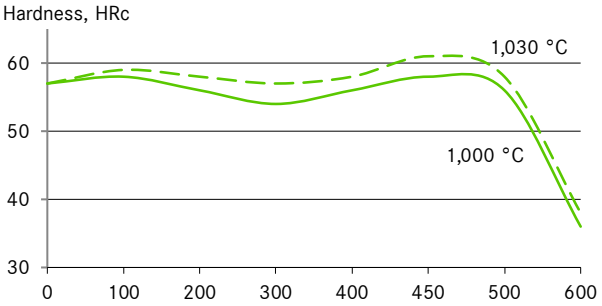
Tempering diagram



Vacuum heat treatment instructions

Pre-heating	professional heating, 2 pre-heating stages recommended
Vacuum heating	1,000 °C to 1,030 °C, see table
Exposure time	20 to 40 min. after through-heating
Cooling	in vacuum, a quenching pressure of at least 6 bar is required
Tempering	at least 2 times for 2 hours each according to table, allow to equilibrate to room temperature allow to equalize, observe instructions for freezing

Heat treatment instructions to achieve different properties

Desired hardness HRC	Hardening temperature °C*	Tempering °C	Corrosion resistance	Toughness
>58	1,030*	160 – 180	++	0
55 – 58	1,030*	220 – 300	++	++
>58	1,030*	460 – 475	+	+
30 – 40	1,000	550 – 620	+	+++

*Freezing, -80 °C, 60 min., air

*Freezing must be performed immediately after quenching (room temperature). Here, at least -80 °C should be reached and maintained for at least 60 minutes after complete cooling. Subsequently, anneal for 2 x 2 hours at adjusted temperature (according to table) to achieve target properties.

The maximum permissible hardening temperature of 1,030 °C should not be exceeded! See additional information on hardening and tempering.
Hardening or annealing with further heat treatment processes is possible, but should be discussed in advance!

Further information regarding our products and locations are available in our image brochure and on our homepage at www.zapp.com