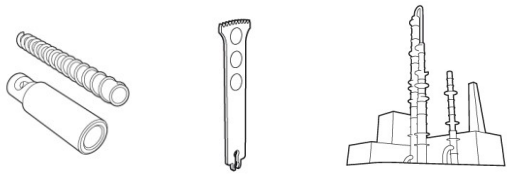
TOOL ALLOYS
DATA SHEET LC 200 N

CERTIFIED TO ISO 9001



Chemical Composition	
Carbon	0.3 %
Chromium	15 %
Nitrogen	0.5 %
Molybdenum	0.95 %
Nickel	0.5 %
Manganese	1.00 %

LC 200 N

is a high nitrogen alloyed tool steel which exhibits superior corrosion resistance combined with high toughness even at hardness up to 60 HRc. Combining PESR-Process (Pressurized Electric Slag Remelting) with a smart forging technology, an amazing increase in cleanliness and structure, which means a very fine and homogenious microstructure, can be achieved. Primary advantage is excellent machinability and polishability as well as a high dimensional stability after heat treatment. For this reason LC 200 N is the high end solution for tools facing high static and dynamical load under a high corrosive environment at higher temperatures.
Compared to standard tool steels like 1.2316, 1.4112 and 1.4125 LC 200 N exhibits higher corrosion resistance and toughness as well as a higher tempering resistance up to 500 °C still at a hardness of 58-60 HRc.

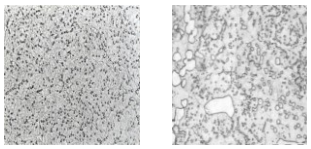
TYPAL APPLIKATIONS

_ Blades, portioner- and filling-units in the food-industry
_ Pumpcomponents, spindles, extrusion- and portioner units for chemical- and pharmaceutical industry
_ Tabletticing tools
_ Mirror-polished dies for plastics industry
_ Shredderknives and granulator and pelletizer for recycling industry

PHYSICAL PROPERTIES

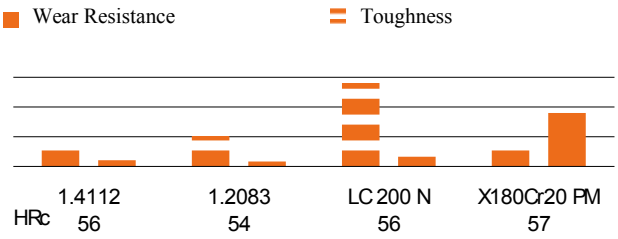
Modulus of Elasticity E [MPa]	214276
Spezific Weight[kg/dm³]	7.72
Thermal Conductivity 20 °C [W/m*K]	14

Structure of LC 200 N compared to 1.4112



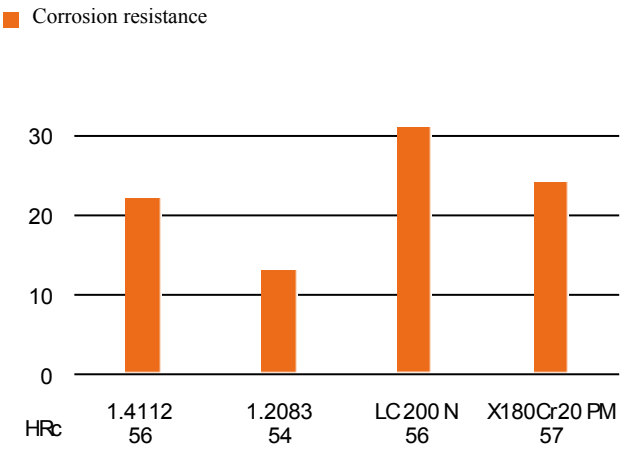
(Magnification 1000 x etched)

WEAR RESISTANCE / TOUGHNESS



Qualitative Comparison

CORROSION RESISTANCE



HEAT TREATMENT

ANNEALING

Heat uniformly to 790 – 820 °C in controlled atmosphere furnaces or with suitable protective media, hold at temperature for two hours, and cool slowly in the furnace to below 500 °C. LC 200 N may then be cooled in air if desired. The annealed hardness is approximately BHN 250-310.

STRESS RELIEVING

After rough machining heat uniformly to 600 – 650 °C and hold 30 minutes for each 25 mm of thickness, one hour minimum, cool in the furnace or in air. A slow cool from the stress relief temperature is preferred.

HARDENING

In order to prevent any possibility of decarburization, denitrization or oxidation, it is desirable to use a controlled atmosphere furnace or vacuum furnace with controlled chamber pressure typically used for high chromium alloyed materials. Chamber pressure should be about 6x10^-6bar or higher (if possible partial pressure of nitrogen should be about 180mbar). Preheat the parts thoroughly to 600 – 650 °C, than to 850 – 900 °C. Raise temperature to the selected austenizing temperature in the range of 985 – 1040 °C Soak time should be max. 40 minutes after through heating (probe 16mm). Massive and complicated dies require accurate controls of steel temperature and holding times. Hardening without nitrogen partial pressure or increased chamber pressure with protection gas requires a higher raw dimension of 2/10 mm (denitriding zone) that has to be removed afterwards.

QUENCHING

Quenching in oil, air or salt bath maintained at 500 – 550 °C. When oil quenching is used, particularly for tools of large dimensions, it is good practice to use an interrupted quench. When air is used, minimum overpressure of 5 bar is necessary until maintaining 500 °C. No matter what method of quenching is used, the tools should be allowed to cool below 40 °C or to a temperature at which the tools may be held comfortably in the bare hands before tempering.

TEMPERING

Temper immediately after quenching and cooling below 40 °C or as soon as the tools can be held comfortably in bare hands. Single Tempering is recommended when using austenizing temperatures up to 1000°C without necessity for sub zero treatment. Austenizing temperatures above 1000°C, double Tempering is recommended, including sub zero treatment (min -120 °C) after quenching. Massive or complicated dies with risk of cracking or abnormal change of shape caused by heat treatment should first be tempered at 180 °C and than sub zero treated. Soak time at sub zero treatment should be min. 60 minutes at -120 °C or min. 30 minutes at -196 °C (liquid nitrogen). Massive and complicated dies require accurate controls of steel temperature and holding times.

RESPONE TO TEMPERING CURVES

INSTRUCTIONS FOR HEAT TREATMENT

1. Preheat	600–650 °C
2. Preheat	850–900 °C
Austenizing	See chart below
Tempering	2 x 2 hours (see chart below)

Quenching in oil, salt baht or air (min. 5 bar overpressure) to 550°C

Hardness HRc ± 1	Austeniz-ing Temp°C	Soak Time Minutes*	Tempering °C
54	985	40	1x2h/280
56	985	40	1x2h/260
58	985**	40	1x2h/250
58	1000	30	180/SZT/ 480
60	1030	20	180/SZT/ 460
61	1040	20	180/SZT/ 480

* Preheating 870 °C. Massive and complicated dies require accurate controls of steel temperature and holding time. Max. Austenizing temperature 1040°C!
** Best combination of toughness/ corrosion resistance
*** Best combination of wear resistance/toughness

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