

HOT WORK TOOL STEELS

Available Product Variants

Plates

Product Description

BÖHLER W500 is a quenched and tempered hot work tool steel with approx. 1% chromium and 2% nickel and corresponds to material number 1.2714 (56NiCrMoV7). This steel has high hot toughness as well as excellent through hardenability and is therefore well suited for dies up to largest dimensions.

Process Melting

Airmelted

Properties

Die block steel for oil and air hardening with excellent toughness and through hardening characteristics.

Applications

- > Extrusion
- > Rolling
- > Forging Applications
- > Rolls
- > Forging (Hot / Semi-hot)

Technical data

Material designation		Standards	
1.2714	SEL	4957	EN ISO
~T61206	UNS	G4404	JIS
55NiCrMoV7	EN		
~L6	AISI		
~SKT4	JIS		

Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	Ni	V
0.55	0.25	0.75	1.10	0.50	1.70	0.10

Material characteristics

	High temperature strength	High temperature toughness	High temperature wear resistance
BÖHLER W500	★★	★★★★	★
BÖHLER W300 ISODISC®	★★	★★★	★★
BÖHLER W302 ISODISC®	★★★	★★★	★★★
BÖHLER W303 ISODISC®	★★★★	★★★	★★★★

Delivery condition

Annealed

Hardness (HB)	max. 248
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Heat treatment

Annealing

Temperature	650 to 700 °C 1,202 to 1,292 °F	Holding time 6 to 8 hours. Slow, controlled furnace cooling at 10 to 20°C/h (50 to 68 °F/hr) to approx. 600°C (1112°F), further cooling in air.
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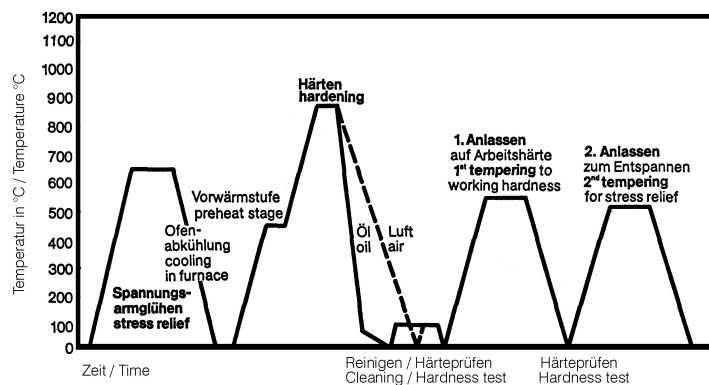
Stress relieving

Temperature	600 to 650 °C 1,112 to 1,202 °F	For stress relief after extensive machining or for complicated tools. Holding time depending on tool size after complete heating 2 - 6 hours in neutral atmosphere. Slow furnace cooling.
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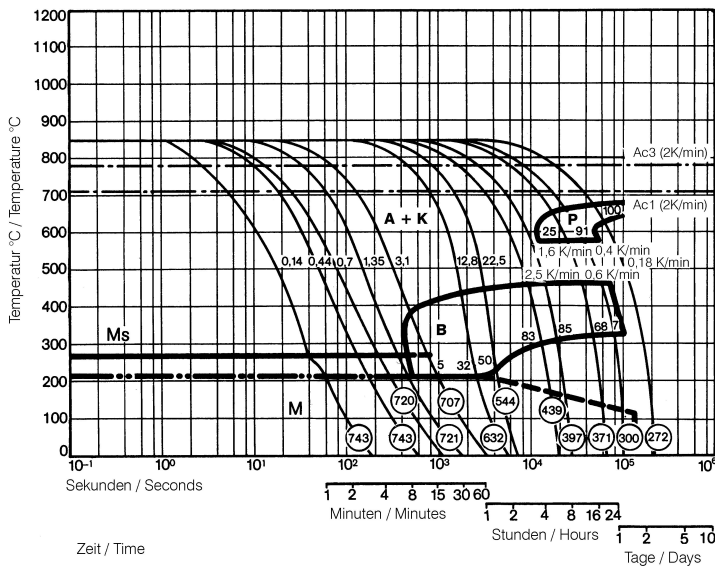
Hardening and Tempering

Temperature	850 to 900 °C 1,562 to 1,652 °F	Holding time after temperature equalization: 15 to 30 minutes; Quenching: Oil, salt bath (500 - 550°C [932-1022°F]), air, vacuum; After hardening, tempering to the desired working hardness (see tempering chart).
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Heat treatment sequence



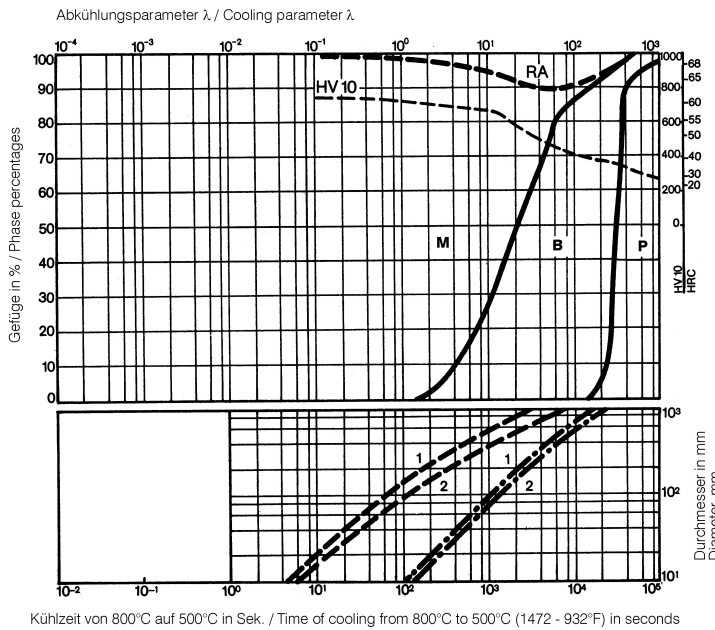
Continuous cooling CCT curves



Austenitising temperature: 850°C (1562°F)
Holding time: 15 minutes

O Vickers hardness
5...91 phase percentages
0.14...22.5 cooling parameter (λ), i.e. duration of cooling from 800 - 500°C (1472-932°F) in $s \times 10^{-2}$
2.5...0.18 K/min cooling rate in K/min in the 800 - 500°C (1472-932°F) range

Quantitative phase diagram

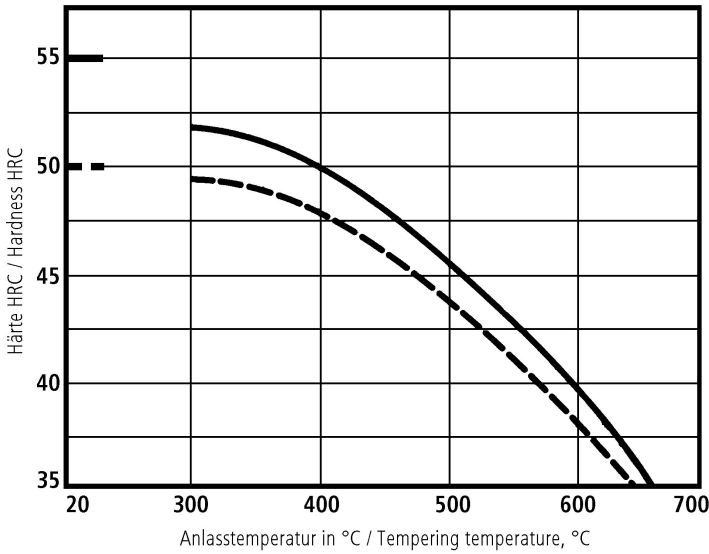


A... Austenite
B... Bainite
K... Carbide
M... Martensite
P... Pearlite
RA... Retained austenite

----- Oil cooling
- - - Air cooling

1... Edge or face
2... Core

Tempering chart



Tempering:

Slow heating to tempering temperature immediately after hardening (time in furnace 1 hour for each 0,787 inch (20 mm) of workpiece thickness but at least 2 hours / cooling in air).

It is recommended to temper at least twice.

A third tempering cycle for the purpose of stress relieving may be advantageous.

1st tempering approx. 86°F (30°C) above maximum secondary hardness.

2nd tempering to desired working hardness. The tempering chart shows average tempered hardness values.

3rd for stress relieving at a temperature 86 to 122°F (30 to 50°C) below highest tempering temperature.

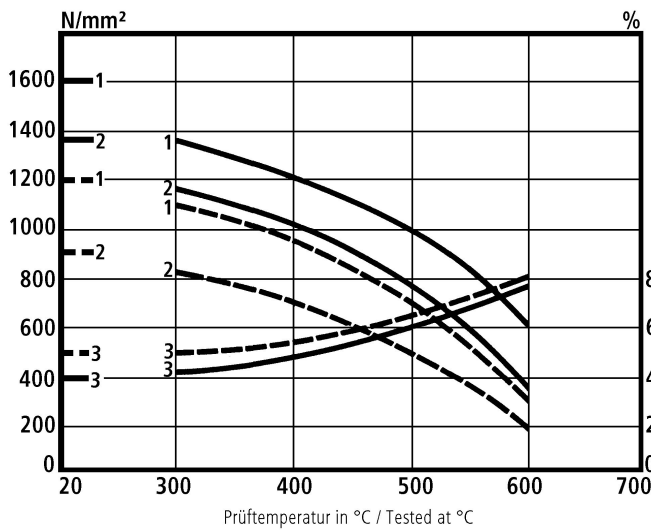
Hardening temperature:

— 850°C (1562°F) / oil

- - - - - 880°C (1616°F) / air

Specimen size: Ø 60 mm

Hot strength chart



— heat treated 1600 N/mm²

- - - - - heat treated 1200 N/mm²

1... Tensile strength N/mm²

2... 0.2% proof stress N/mm²

3... Reduction of area %

Physical Properties

Temperature (°C °F)	20 68
Density (kg/dm ³ lb/in ³)	7.8 0.28
Thermal conductivity (W/(m.K) BTU/ft h °F)	36 20.8
Specific heat (kJ/kg K BTU/lb °F)	0.46 0.1099
Spec. electrical resistance (Ohm.mm ² /m 10 ⁻⁴ Ohm.inch ² /ft)	0.3 1.42
Modulus of elasticity (10 ³ N/mm ² 10 ³ ksi)	215 31.18

Thermal Expansions between 20°C | 68°F and ...

Temperature (°C °F)	100 212	200 392	300 572	400 752	500 932	600 1,112	700 1,292
Thermal expansion (10 ⁻⁶ m/(m.K) 10 ⁻⁶ inch/inch.°F)	12.5 6.9	13.1 7.3	13.4 7.4	13.9 7.7	14 7.8	14.3 7.9	14.5 8.1

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