

ČELICI ZA TOPLI RAD

Dostupne varijante proizvoda

Šipkasti proizvodi*

Ploče

Otvoreno kovanje

*) Presented data refer exclusively to long products. Please observe the detailed explanations at the end of the data sheet (pdf).

Opis proizvoda

Alati i matrice za obradu u toplom stanju za teške uvjete rada, uglavnom za obradu lakih slitina: trnovi, matrice, cilindri za izvlačenje metalnih cijevi i šipkastih profila, alati i matrice za izradu komponenti sa šupljinom, vijaka, zakovica, navrtki i svornjaka. Oprema tlačno lijevanje, matrice za oblikovanje, umetci za kalupe, oštrice za rezanje u toplom stanju i matrice za kalupljenje plastike.

Put taljenja

Airmelted + Remelted

Karakteristike

- > Žilavost i duktilnost : visok
- > Otpornost na habanje : dobar
- > Obradivost : vrlo visoka
- > Tvrdća pri visokim temperaturama : dobar
- > Mogućnost poliranja : vrlo visoka
- > Toplinska vodljivost : visok
- > Mikro čistoća : visok

Korištenje

- > Visokotlačno lijevanje
- > Gravitacijsko / niskotlačno lijevanje
- > Elementi za pričvršćivanje, vijci i matice
- > Tlačno otvrdnjavanje / vruće oblikovanje
- > Držači alata (mljevenje, bušenje, okretanje i stezne glave)
- > Vijci i cijevi
- > Glasfibre reinforced plastics
- > Primjene kovanja
- > Progresivno kovanje (Hatebur)
- > Opći sklopovi za strojarstvo
- > Valjanje
- > Precizno štancanje / štancanje / pečačenje
- > Valjci
- > Kovanje (vruće / poluvruće)
- > Istiskivanje
- > Lijevanje ubrizgavanjem
- > Rezanje / strojni noževi
- > Standardni dijelovi (kalupi, ploče, klinovi, probijači)
- > Sustav za vruće spajanje

Tehnički podaci

Oznaka materijala		Standardi	
1.2343	SEL	4957	EN ISO
X37CrMoV5-1	EN	G4404	JIS
T20811	UNS	#207	NADCA
H11	AISI		
SKD6	JIS		
D1830	NADCA		

Kemijski sastav

C	Si	Mn	Cr	Mo	V
0,38	0,90	0,40	5,20	1,30	0,45

Materijal

	Otpornost na toplinu	Vruća žilavost	Otpornost na vruće trošenje
	★★	★★★★	★★
	★★	★★★	★★
	★★★	★★★	★★★
	★★★	★★★★	★★★
	★★★★	★★★	★★★★
	★★★	★★★★★	★★★
	★★★★★	★★★★	★★★★★
	★★	★★★★★	★★
	★★★★	★★★★	★★★★

Isporuka

Annealed

Tvrdoća (HB)	max. 229
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Hardened and Tempered

Tvrdoća (HRC)	40 do 55 bars hardened and tempered (BHT)
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Hardened and Tempered

Tvrdoća (HRC)	30 do 44
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Toplinska obrada

Annealing

Temperatura	750 do 800 °C	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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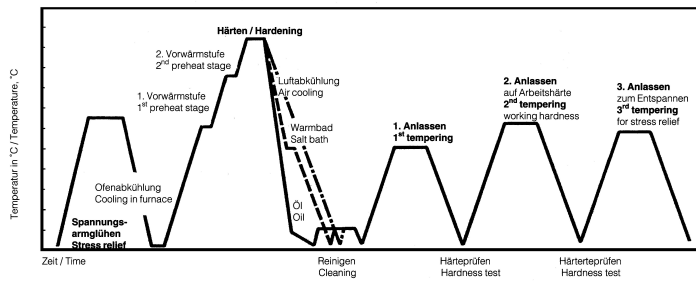
Stress relieving

Temperatura	600 do 670 °C	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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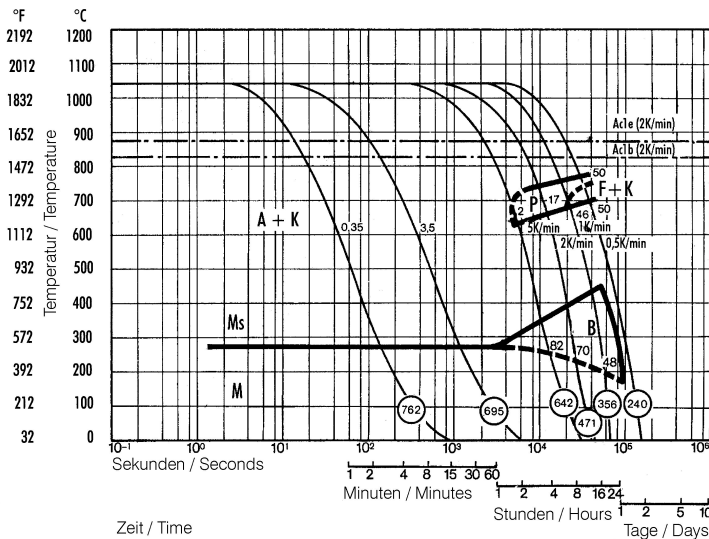
Hardening and Tempering

Temperatura	1.000 do 1.030 °C	(Die casting equipment: 1000 - 1010 °C [1832 - 1850°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

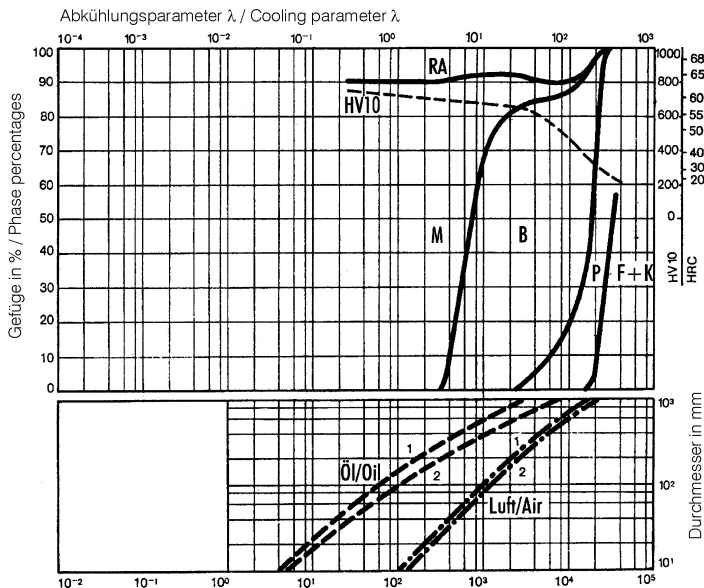


Austenitising temperature: 1030°C (1886°F)
Holding time: 15 minutes

O Vickers hardness
2...46 phase percentages
0.35...3.5 cooling parameter, i.e. duration of cooling from 800 - 500°C (1472-932°F) in $s \times 10^{-2}$
5...0.5 K/min cooling rate in K/min in the 800 - 500°C (1472-932°F) range

Numbers in circles = Vickers hardness

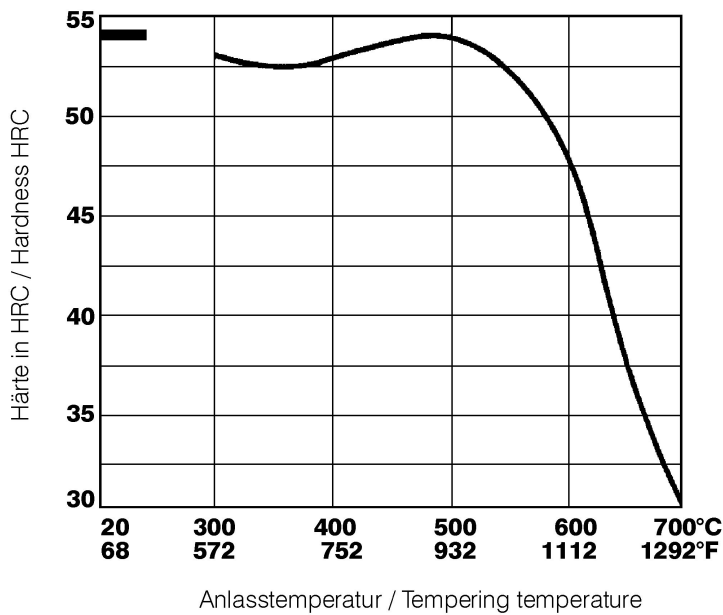
Quantitative phase diagram



- A... Austenite
- B... Bainite
- F... Ferrite
- K... Carbide
- M... Martensite
- P... Perlite
- RA... Retained austenite

- 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.

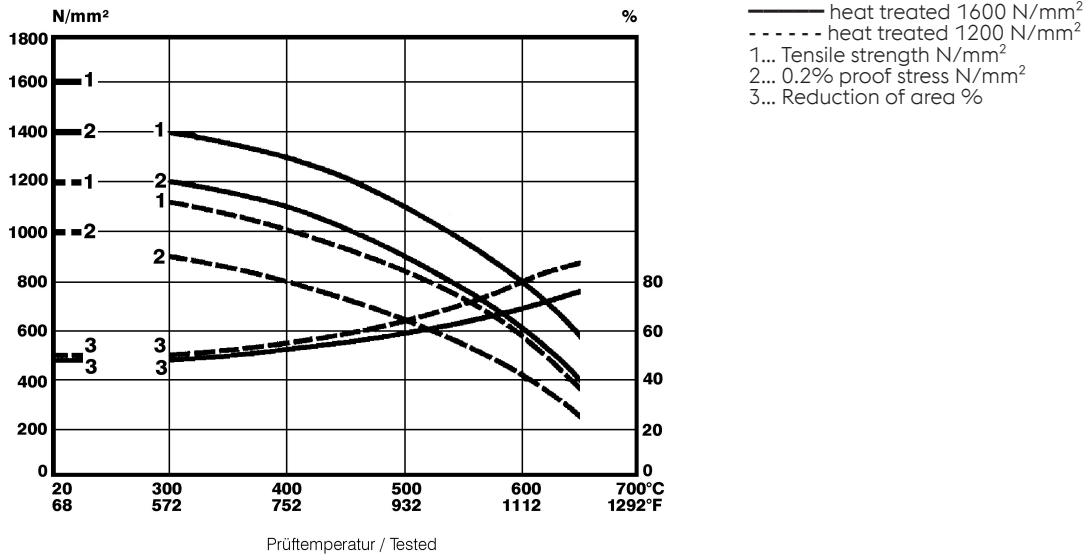
2nd tempering to desired working hardness.

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: 1020°C (1868°F)
Specimen size: square 50 mm

Hot strength chart



Fizička svojstva

Temperatura (°C)	20
Gustoća (kg/dm ³)	7,8
Toplinska vodljivost (W/(m.K))	24,9
Specifični toplinski kapacitet (kJ/kg K)	0,46
Spec. Otpornik (Ohm.mm ² /m)	0,52
Modul elastičnosti (10 ³ N/mm ²)	211

Toplinska ekspanzija

Temperatura (°C)	100	200	300	400	500	600
Toplinska ekspanzija (10 ⁻⁶ m/(m.K))	10,38	10,72	11,86	12,61	13,25	13,64

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ONE STEP AHEAD.