

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

Karakteristike

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

Korištenje

- > Istiskivanje
- > Visokotlačno lijevanje
- > Progresivno kovanje (Hatebur)
- > Primjene kovanja
- > Valjci
- > Sustav za vruće spajanje
- > Kovanje (vruće / poluvruće)
- > Lijevanje ubrizgavanjem
- > Mehanika Inženjerstvo / izrada strojeva Općenito
- > Opći sklopovi za strojarstvo
- > Rezanje / strojni noževi
- > Gravitacijsko / niskotlačno lijevanje
- > Tlačno otvrdnjavanje / vruće oblikovanje
- > Elementi za pričvršćivanje, vijci i matice
- > Strojni mjerni noževi (za proizvodnju)
- > Držači alata (mljevenje, bušenje, okretanje i stezne glave)


Tehnički podaci

| Oznaka materijala | | Standardi | |
|-------------------|------|-----------|--------|
| 1.2343 | SEL | 4957 | EN ISO |
| X37CrMoV5-1 | EN | G4404 | JIS |
| T20811 | UNS | | |
| H11 | AISI | | |
| SKD6 | JIS | | |

Kemijski sastav

| C | Si | Mn | Cr | Mo | V |
|------|------|------|------|------|------|
| 0,38 | 1,10 | 0,40 | 5,00 | 1,20 | 0,40 |

Materijal

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

Isporka

Annealed

| | |
|--------------|----------|
| Tvrdoća (HB) | max. 229 |
|--------------|----------|

Hardened and Tempered

| | |
|---------------|---|
| Tvrdoća (HRC) | 40 do 55 bars hardened and tempered (BHT) |
|---------------|---|

Hardened and Tempered

| | |
|---------------|----------|
| Tvrdoća (HRC) | 30 do 44 |
|---------------|----------|

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. |
|-------------|---------------|---|

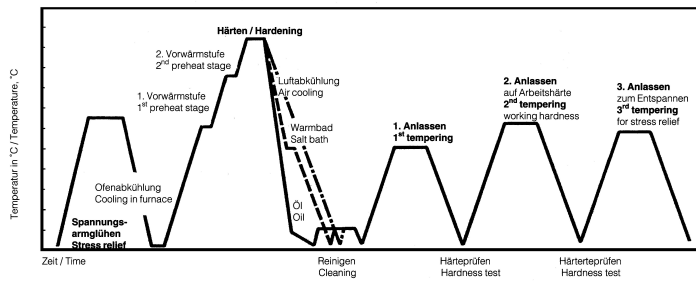
Stress relieving

| | | |
|-------------|---------------|---|
| 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. |
|-------------|---------------|---|

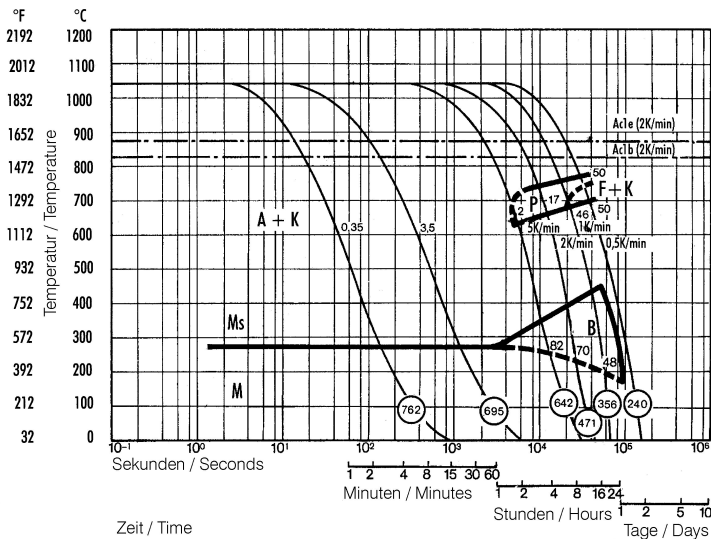
Hardening and Tempering

| | | |
|-------------|-------------------|---|
| Temperatura | 1.000 do 1.030 °C | 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). |
|-------------|-------------------|---|

Heat treatment sequence



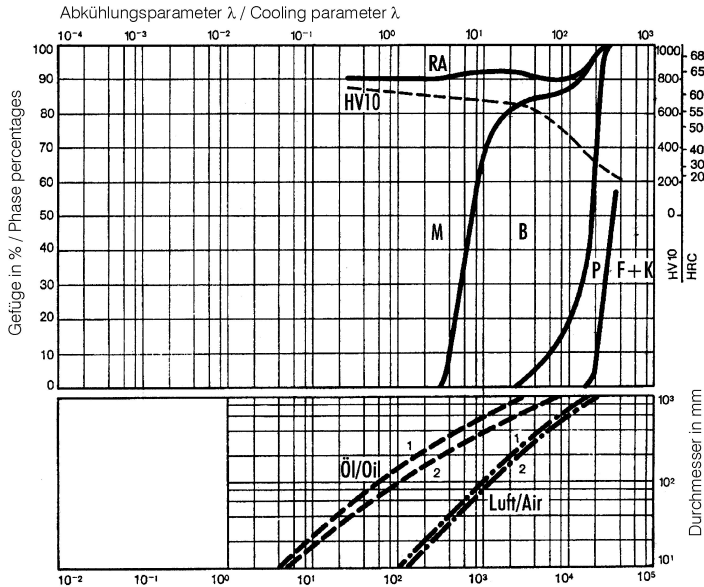
Continuous cooling CCT curves



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

Quantitative phase diagram

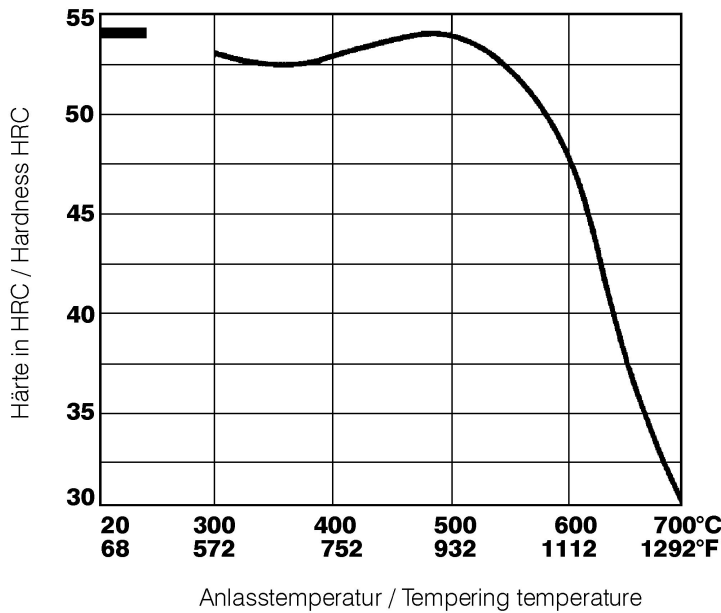


Kühlzeit von 800°C auf 500°C in Sek. / Time of cooling from 800°C to 500°C (1472-932°F) in seconds

- 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.

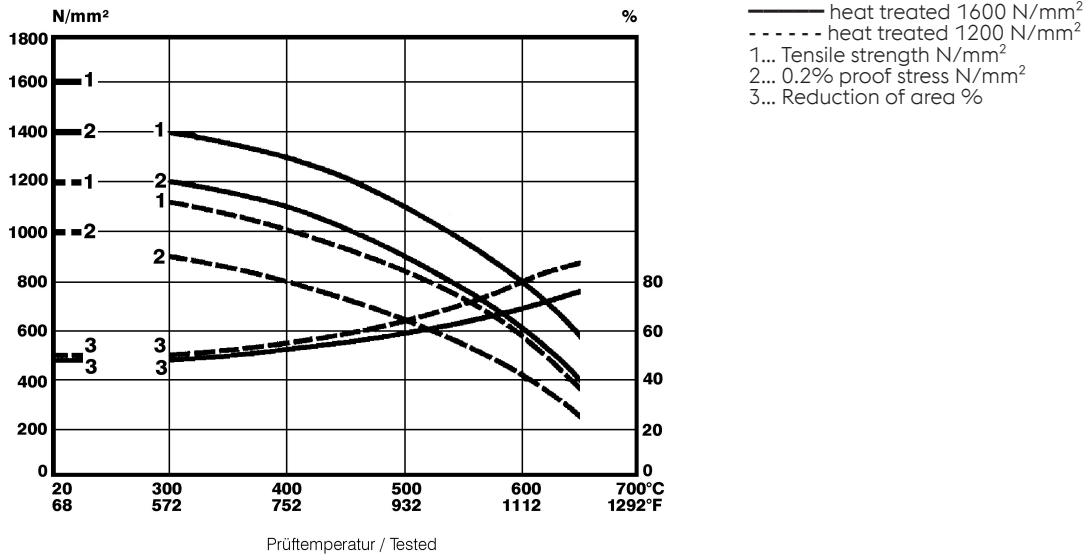
2nd tempering to desired working hardness.

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) | 215 |

Toplinska ekspanzija

| Temperatura (°C) | 100 | 200 | 300 | 400 | 500 | 600 | 700 |
|---|------|-----|------|------|------|-----|------|
| Toplinska ekspanzija (10 ⁻⁶ m/(m.K)) | 11,5 | 12 | 12,2 | 12,5 | 12,9 | 13 | 13,2 |

Long Products: For additional specifications and technical requirements, please contact our regional voestalpine BÖHLER sales companies.

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ONE STEP AHEAD.