

# SICAK İŞ TAKIM ÇELİKLERİ

## Mevcut Ürün Şekilleri

Uzun Ürünler

## Ürün Tanımı

BÖHLER W400 VMR is a vacuum remelted material specially developed for tools with complex structures. The steel can be assigned to the 5% chromium steels and has a very high purity due to the special manufacturing technology. Because of its high degree of purity, the excellent homogeneity and the special alloying concept, BÖHLER W400 VMR is one of the hot work tool steels with the highest reachable toughness values. Therefore, this material is a problem solver in many areas when standard grades are no longer sufficient. In addition, Böhler W400 VMR has outstanding polishability. For this reason, the steel is also popular as a molding material for plastic injection molds.

## Erime rotası

Airmelted + VAR

## Özellikler

- > Tokluk ve Süneklik : çok yüksek
- > Aşınma Direnci : iyi
- > İşlenebilirlik : iyi
- > Sıcak Sertlik (kırmızı sertlik) : iyi
- > Cilalanabilirlik : çok yüksek
- > Termal iletkenlik : çok yüksek
- > Mikro temizlik : çok yüksek

## Uygulamalar

- > Yüksek Basıncılı Döküm
- > Makine Mühendisliği için Genel Parçalar
- > Progressive Forging (Hatebur)
- > Pres Sertleştirme / Sıcak Damgalama
- > Ekstrüzyon
- > Yerçekimi / Düşük Basıncılı Döküm
- > Makine Mühendisliği / Makine İmalatı, Genel
- > Dövme (Sıcak / Yarı Sıcak)
- > Enjeksiyon kalıplama
- > Glasfibre reinforced plastics

## Teknik veriler

Malzeme Tanımı	Standartlar
1.2340 SEL	#207 NADCA
~T20811 UNS	
~X37CrMoV5-1 EN	
~H11 AISI	
E1810 NADCA	

## Kimyasal Bileşim

C	Si	Mn	Cr	Mo	V
0,37	0,20	0,30	5,00	1,30	0,50

## Malzeme özellikleri

	Sıcak güç	Sıcak tokluk	Sıcak aşınma direnci
	★★	★★★★★	★★
	★★	★★★★	★★
	★★	★★★	★★
	★★★	★★★★	★★★
	★★★	★★★	★★★
	★★★★	★★★	★★★★
	★★★	★★★★★	★★★
	★★★★★	★★★★	★★★★★
	★★★★	★★★★	★★★★

## Teslimat durumu

Annealed	
Sertlik (HB)	maks. 205

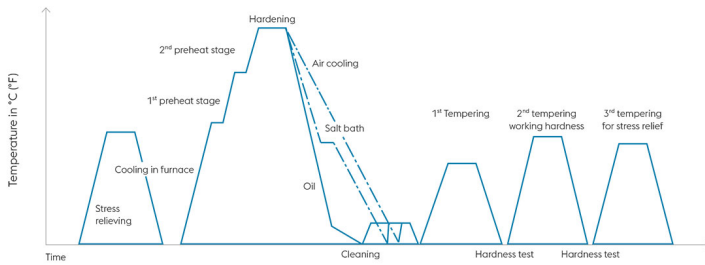
## Isıl işlem

Annealing		
Sıcaklık	800 kadar 850 °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.

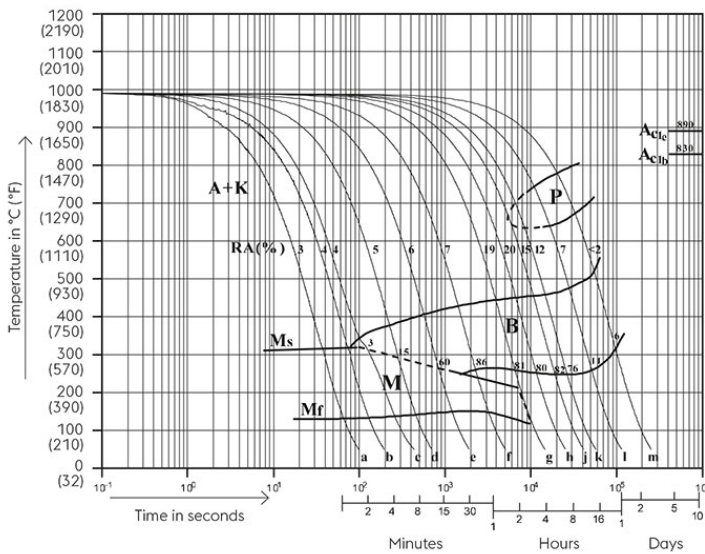
Stress relieving		
Sıcaklık	600 kadar 670 °C	For stress relief after extensive machining or for complicated tools. Holding time depending on tool size after complete heating 2 - 6 hours in neutral atmosphere. Slow furnace cooling.

Sertleştirme ve Temperleme		
Sıcaklık	980 kadar 990 °C	Holding time after temperature equalization: 15 to 30 minutes; In order to prevent coarsening of the grain, hardening must be carried out at the recommended temperature; Quenching: oil, salt bath (500 - 550°C [930 to 1020 °F]), air, inert gas in vacuum; After hardening, required tempering treatment to achieve desired working hardness (see tempering chart).

## Heat treatment sequence



## Continuous cooling CCT curves

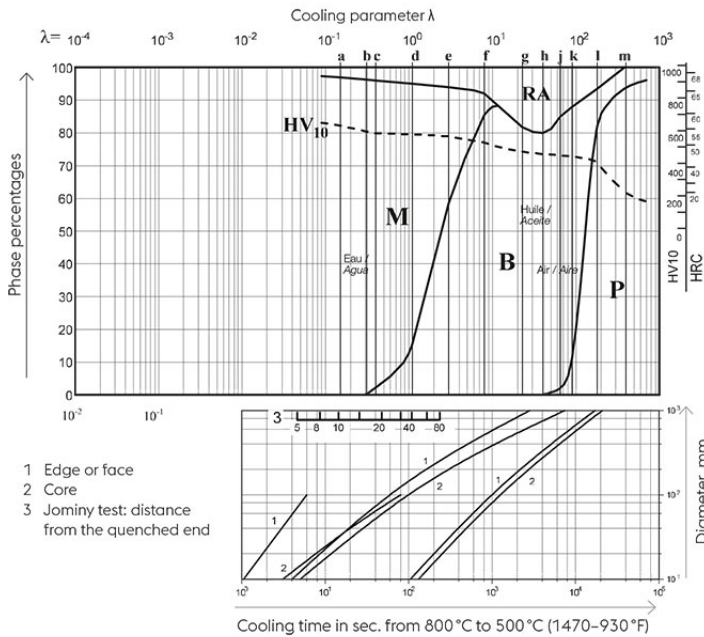


Austenitising temperature: 990°C (1814°F)  
 Holding time: 15 minutes  
 5...100 phase percentages  
 0.15...400 cooling parameter, i.e. duration of cooling  
 from 800 - 500°C (1472-932°F) in  $s \times 10^{-2}$

Table:  
 Sample  $\lambda$  HV10

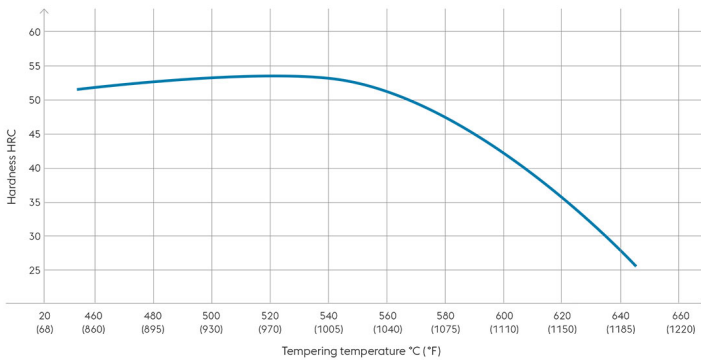
a	0,15	647
b	0,31	619
c	0,40	590
d	1,10	595
e	3	582
f	8	546
g	23	478
h	40	462
j	65	462
k	90	454
l	180	434
m	400	226

**Quantitative phase diagram**



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

**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: 990°C (1814°F)  
Specimen size: square 20 mm

## Fiziksel özellikler

Sıcaklık (°C)	20
Yoğunluk (kg/dm <sup>3</sup> )	7,8
Termal iletkenlik (W/(m.K))	31,5
Özgül ısı kapasitesi (kJ/kg K)	0,46
Spes. elektrik direnci (Ohm.mm <sup>2</sup> /m)	-
Elastikiyet modülü (10 <sup>3</sup> N/mm <sup>2</sup> )	211

## Termal genleşmeler

Sıcaklık (°C)	100	200	300	400	500	600
Termal genleşme (10 <sup>-6</sup> m/(m.K))	11	11,17	11,93	12,68	13,98	14,34

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

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