

# WARMWERKSTAAL

## Beschikbare uitvoeringen

Stafstaal

## Product omschrijving

BÖHLER W400 VMR - In vacuüm vervaardigd warmwerkstaal met goede hittebestendigheid en uitstekende taaheid.

## Smeltroute

Airmelted + VAR

## Eigenschappen

- > Taaheid & Vervormbaarheid : zeer hoog
- > Slijtageweerstand : goed
- > Bewerkbaarheid : goed
- > Hete hardheid (rode hardheid) : goed
- > Polijstbaarheid : zeer hoog
- > Warmtegeleidingsvermogen : zeer hoog
- > Microzuiverheid : zeer hoog

## Toepassingen

- > Spuitgieten
- > Algemene componenten voor werktuigbouw
- > Progressief smeedwerk (Hatebur)
- > Dieptrekken / warmvormprocedé
- > Extrusie
- > Zwaartekrachtgieten / lagedruk gieten
- > Werktuigbouw / machinebouw Algemeen
- > Smeedwerk (warm / halfwarm)
- > Spuitgieten
- > Glasfibre reinforced plastics










## Technische gegevens

Materiaal aanduiding		Normen	
1.2340	SEL	#207	NADCA
~T20811	UNS		
~X37CrMoV5-1	EN		
~H11	AISI		
E1810	NADCA		

## Chemische samenstelling

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

## Materiaaleigenschappen

	Hete kracht	Hete taatheid	Weerstand tegen hete slijtage
	★★	★★★★★	★★
	★★	★★★★	★★
	★★	★★★	★★
	★★★	★★★★	★★★
	★★★	★★★	★★★
	★★★★	★★★	★★★★
	★★★	★★★★★	★★★
	★★★★★	★★★★	★★★★★
	★★★★	★★★★	★★★★

## Leveringsconditie

### gegloeid

Hardheid (HB)	max. 205
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## Warmtebehandeling

### Annealing

Temperatuur	800 naar 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.
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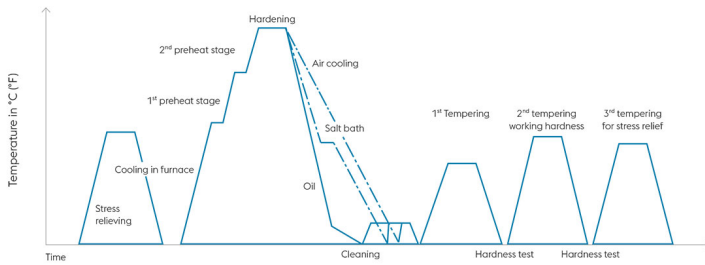
### Stress relieving

Temperatuur	600 naar 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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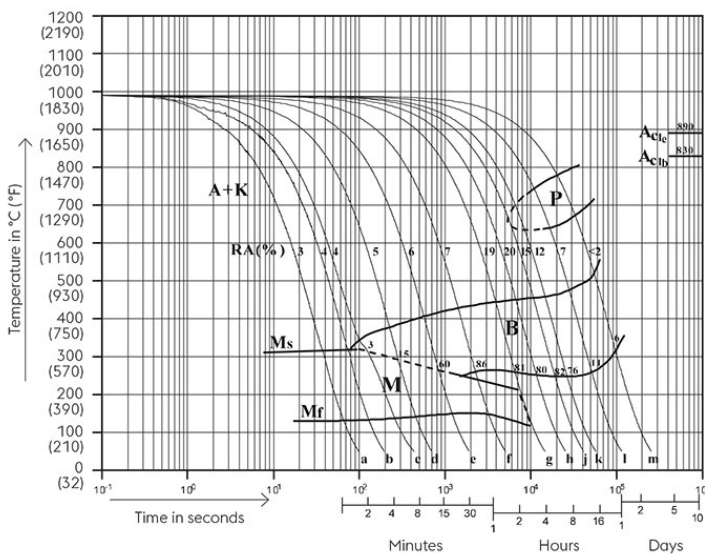
### Harden en ontlaten

Temperatuur	980 naar 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).
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## Heat treatment sequence



## Continuous cooling CCT curves

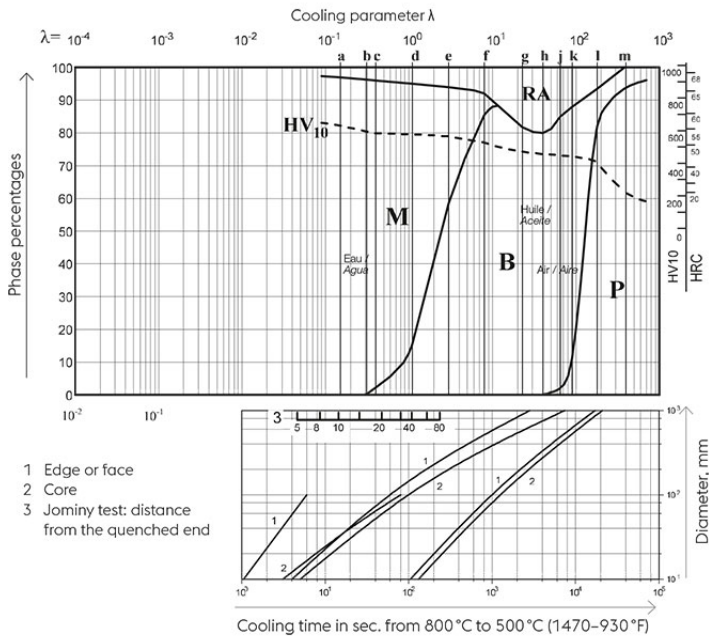


Austenitising temperature: 990°C (1814°F)  
 Holding time: 15 minutes  
 5...100 phase percentages  
 0.15...400 cooling parameter, i.e. duration of cooling  
 from 800 - 500°C (1472-932°F) in  $s \times 10^{-2}$

Table:  
 Sample  $\lambda$  HV10

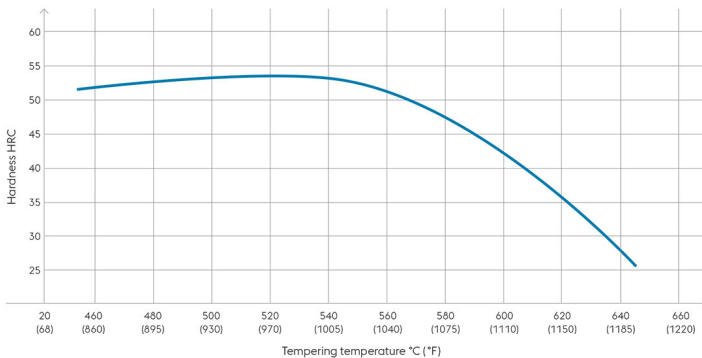
a	0,15	647
b	0,31	619
c	0,40	590
d	1,10	595
e	3	582
f	8	546
g	23	478
h	40	462
j	65	462
k	90	454
l	180	434
m	400	226

### 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

## Fysische eigenschappen

Temperatuur (°C)	20
Soortelijk gewicht (kg/dm <sup>3</sup> )	7,8
Thermische conductiviteit (W/(m.K))	31,5
Soortelijke warmte (kJ/kg K)	0,46
Specifieke elektrische weerstand (Ohm.mm <sup>2</sup> /m)	-
Elasticiteitsmodus (10 <sup>3</sup> N/mm <sup>2</sup> )	211

## Thermische expansie

Temperatuur (°C)	100	200	300	400	500	600
Thermische expansie (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.

*The data contained in this brochure is merely for general information and therefore shall not be binding on the company. We may be bound only through a contract explicitly stipulating such data as binding. Measurement data are laboratory values and can deviate from practical analyses. The manufacture of our products does not involve the use of substances detrimental to health or to the ozone layer.*