

# WARMWERKSTAAL

## Beschikbare uitvoeringen

Stafstaal\*

Plaat

vrijvormsmeden

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

## Product omschrijving

Hoogbelaste warmwergereedschappen, vooral voor de bewerking van legeringen van lichte metalen, zoals persdoornen, persmatrijzen en blokrecipiënten voor persen van metalen buizen en extruderpersen, gereedschap voor warme extrusie, gereedschap voor de productie van holle voorwerpen, gereedschap voor de productie van schroeven, moeren, nieten en bouten. Gereedschappen voor drukgieten, mallen voor vervormingspersen, inzetstukken voor mallen, warmschaarmessen, kunststofmatrijzen.

## Smeltroute

Airmelted + Remelted

## Eigenschappen

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

## Toepassingen

- > Spuitgieten
- > Zwaartekrachtgieten / lagedrukgieten
- > Bevestigingsmiddelen, bouten en moeren
- > Dieptrekken / warmvormprocedé
- > Gereedschapshouders (frezen, boren, draaien en klauwplaten)
- > Schroeven en vaten
- > Glasfibre reinforced plastics
- > Toepassingen van smeedwerk
- > Progressief smeedwerk (Hatebur)
- > Algemene componenten voor werktuigbouw
- > Walsen
- > Fijn stanswerk / ponsen / stampen
- > Rollen
- > Smeedwerk (warm / halfwarm)
- > Extrusie
- > Spuitgieten
- > Knippen / machinale messen
- > Standaardonderdelen (matrijzen, platen, pennen, ponsen)
- > Hot-runners (nl)

## Technische gegevens

| Materiaal aanduiding |       | Normen |        |
|----------------------|-------|--------|--------|
| 1.2343               | SEL   | 4957   | EN ISO |
| X37CrMoV5-1          | EN    | G4404  | JIS    |
| T20811               | UNS   | #207   | NADCA  |
| H11                  | AISI  |        |        |
| SKD6                 | JIS   |        |        |
| D1830                | NADCA |        |        |

## Chemische samenstelling

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

## Materiaaleigenschappen

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

## Leveringsconditie

| gegloeid              |   |
|-----------------------|---|
| Hardheid (HB)         | max. 229                                      |
| Hardened and Tempered |   |
| Hardheid (HRC)        | 40 naar 55   bars hardened and tempered (BHT) |
| Hardened and Tempered |   |
| Hardheid (HRC)        | 30 naar 44                                    |

## Warmtebehandeling

### Annealing

|             |                 |   |
|-------------|-----------------|---|
| Temperatuur | 750 naar 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. |
|-------------|-----------------|---|

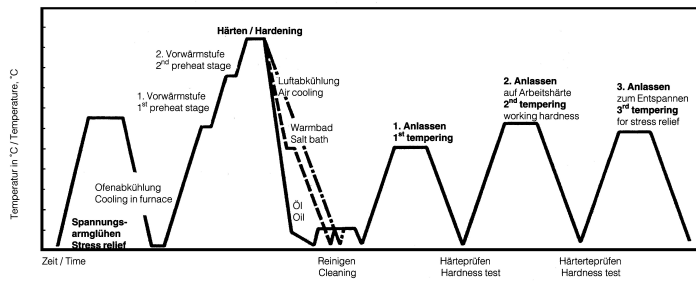
### Stress relieving

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

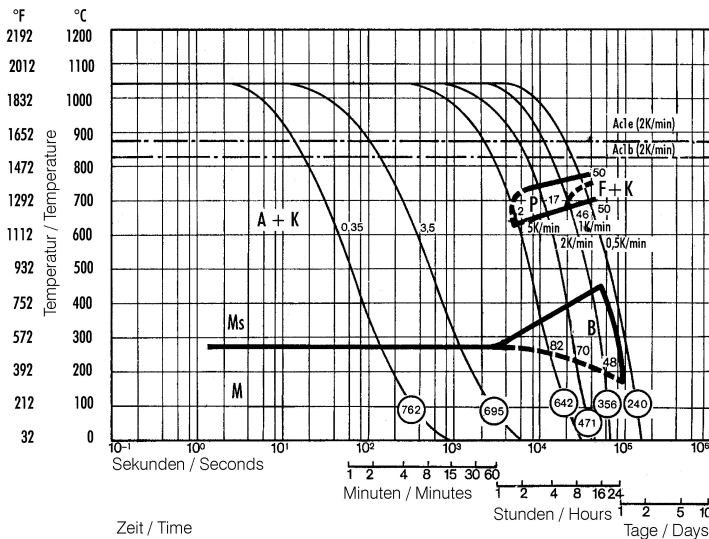
### Harden en ontlaten

|             |                     |   |
|-------------|---------------------|---|
| Temperatuur | 1.000 naar 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). |
|-------------|---------------------|---|

## Heat treatment sequence



## Continuous cooling CCT curves

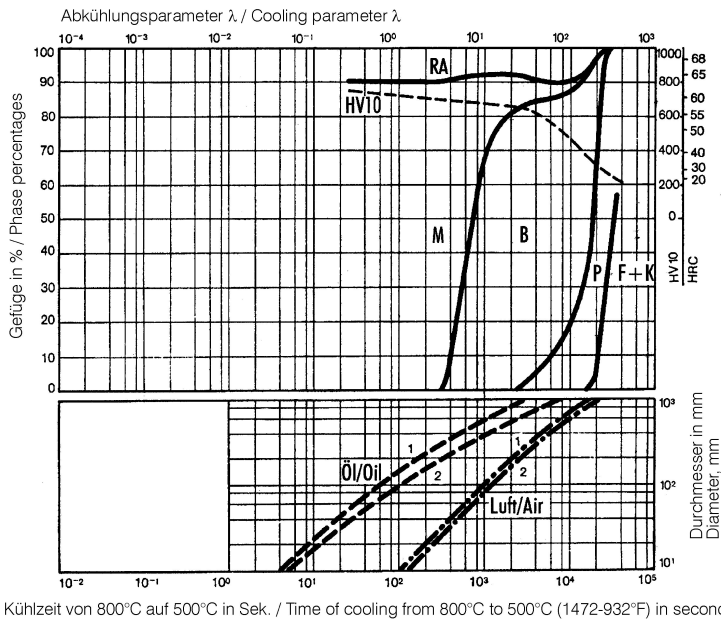


Austenitising temperature: 1030°C (1886°F)  
Holding time: 15 minutes

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

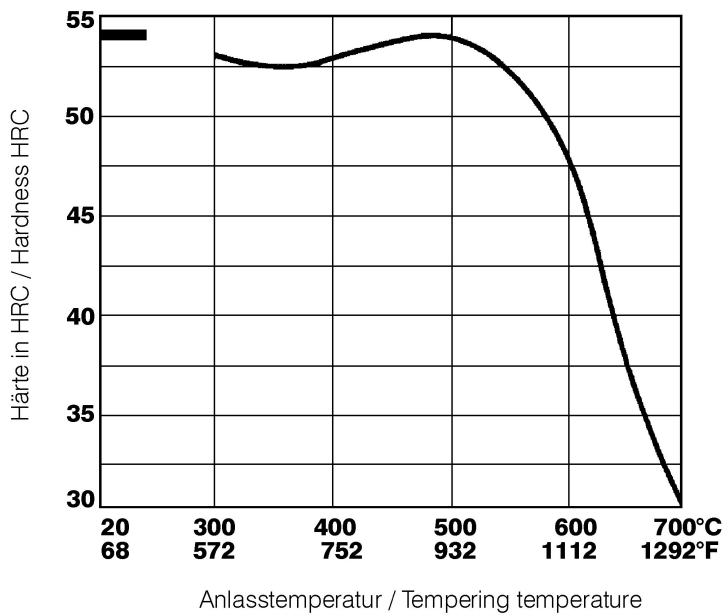
**Quantitative phase diagram**



- 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.

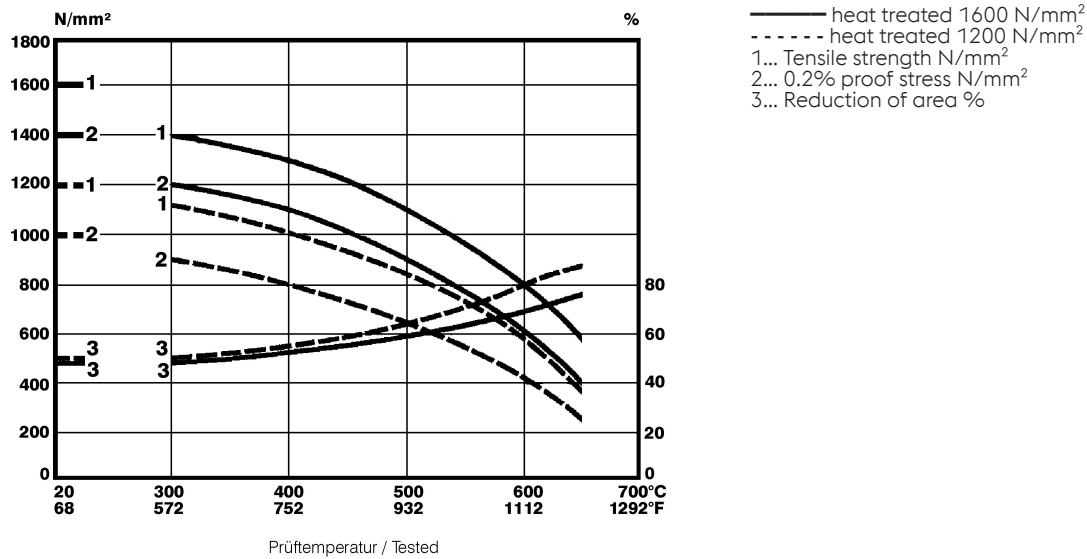
2nd tempering to desired working hardness.

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



## Fysische eigenschappen

|   |      |
|---|------|
| Temperatuur (°C)  | 20   |
| Soortelijk gewicht (kg/dm <sup>3</sup> )                  | 7,8  |
| Thermische conductiviteit (W/(m.K))                       | 24,9 |
| Soortelijke warmte (kJ/kg K)                              | 0,46 |
| Specifieke elektrische weerstand (Ohm.mm <sup>2</sup> /m) | 0,52 |
| 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)) | 10,38 | 10,72 | 11,86 | 12,61 | 13,25 | 13,64 |

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

**Open Die Forgings:** Product Variant may differ in terms of melting process, technical data, delivery, and surface condition as well as available product dimensions. Please contact the business unit Open Die Forgings of voestalpine BÖHLER Edelstahl GmbH & Co KG.

**Sheet & Plates:** Product Variant may differ in terms of melting process, technical data, delivery, and surface condition as well as available product dimensions. Please contact voestalpine BÖHLER Bleche GmbH & Co KG.

*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.*

voestalpine BÖHLER Edelstahl GmbH & Co KG  
 Mariazeller Straße 25  
 8605 Kapfenberg, AT  
 T. +43/50304/20-0  
 E. info@bohler-edelstahl.at  
<https://www.voestalpine.com/bohler-edelstahl/de/>

ONE STEP AHEAD.