

# HOT WORK TOOL STEELS

## Application Segments

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Hot Work

## Available Product Variants

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Long Products\*

Plates

Open Die Forgings

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

## Product Description

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BÖHLER W300 ISODISC is a 5% chromium steel and corresponds to material number 1.2343 (X37CrMoV5-1). This common tool steel has good hot toughness as well as a high hot hardness and a high resistance against heat-checkings. The combination of these properties makes it a standard choice in extrusion, forging and low-pressure die casting. This material is also available as W300 ISOBLOC which is a remelted grade with improved cleanliness, homogeneity and toughness.

## Process Melting

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Airmelted

## Properties

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- > Toughness & Ductility : good
- > Wear Resistance : good
- > English (United Kingdom) : very high
- > Hot Hardness (red hardness) : good
- > Polishability : good
- > Thermal conductivity : good
- > Micro-cleanliness : good

## Applications

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- |                                 |                                                 |                                                      |
|---------------------------------|-------------------------------------------------|------------------------------------------------------|
| > Extrusion                     | > Forging (Hot / Semi-hot)                      | > Gravity / Low Pressure Die-Casting                 |
| > High Pressure Die-Casting     | > Injection Molding                             | > Press Hardening / Hot Stamping                     |
| > Progressive Forging (Hatebur) | > Mechanical Engineering                        | > Fasteners, Bolts, Nuts                             |
| > Forging Applications          | > General Components for Mechanical Engineering | > Machine knife (for producers)                      |
| > Rolls                         | > Shearing / Machine Knives                     | > Tool Holders (milling, drilling, turning & chucks) |
| > Hotrunner systems             |                                                 |                                                      |

## Technical data

| Material designation |      | Standards |        |
|----------------------|------|-----------|--------|
| 1.2343               | SEL  | 4957      | EN ISO |
| X37CrMoV5-1          | EN   | G4404     | JIS    |
| T20811               | UNS  |           |        |
| H11                  | AISI |           |        |
| SKD6                 | JIS  |           |        |

## Chemical composition (wt. %)

| C    | Si   | Mn   | Cr   | Mo   | V    |
|------|------|------|------|------|------|
| 0.38 | 1.10 | 0.40 | 5.00 | 1.20 | 0.40 |

## Material characteristics

|                               | High temperature strength | High temperature toughness | High temperature wear resistance |
|-------------------------------|---------------------------|----------------------------|----------------------------------|
| <b>BÖHLER W300</b><br>ISODISC | ★ ★                       | ★ ★ ★                      | ★ ★                              |
| <b>BÖHLER W300</b><br>ISOBLOC | ★ ★                       | ★ ★ ★ ★                    | ★ ★                              |
| <b>BÖHLER W302</b><br>ISODISC | ★ ★ ★                     | ★ ★ ★                      | ★ ★ ★                            |
| <b>BÖHLER W302</b><br>ISOBLOC | ★ ★ ★                     | ★ ★ ★ ★                    | ★ ★ ★                            |
| <b>BÖHLER W303</b><br>ISODISC | ★ ★ ★ ★                   | ★ ★ ★                      | ★ ★ ★ ★                          |
| <b>BÖHLER W320</b><br>ISODISC | ★ ★ ★                     | ★ ★                        | ★ ★ ★                            |
| <b>BÖHLER W350</b><br>ISOBLOC | ★ ★ ★                     | ★ ★ ★ ★ ★                  | ★ ★ ★                            |
| <b>BÖHLER W360</b><br>ISOBLOC | ★ ★ ★ ★ ★                 | ★ ★ ★ ★                    | ★ ★ ★ ★ ★                        |
| <b>BÖHLER W400</b><br>VMR     | ★ ★                       | ★ ★ ★ ★ ★                  | ★ ★                              |
| <b>BÖHLER W403</b><br>VMR     | ★ ★ ★ ★                   | ★ ★ ★ ★                    | ★ ★ ★ ★                          |

## Delivery condition

|                              |                                             |
|------------------------------|---------------------------------------------|
| <b>Annealed</b>              |                                             |
| Hardness (HB)                | max. 229                                    |
| <b>Hardened and Tempered</b> |                                             |
| Hardness (HRC)               | 40 to 55   bars hardened and tempered (BHT) |
| <b>Hardened and Tempered</b> |                                             |
| Hardness (HRC)               | 30 to 44                                    |

## Heat treatment

### Annealing

|             |               |                                                                                                                                                 |
|-------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature | 750 to 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. |
|-------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------|

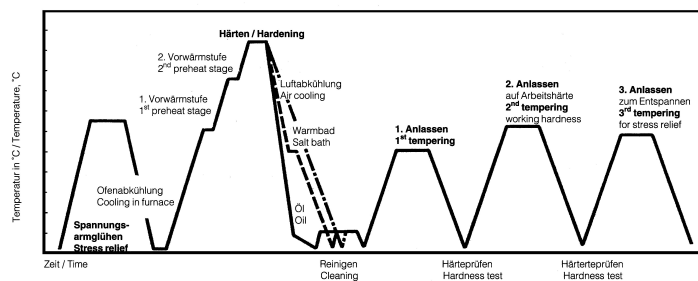
### Stress relieving

|             |               |                                                                                                                                                                                           |
|-------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature | 600 to 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. |
|-------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

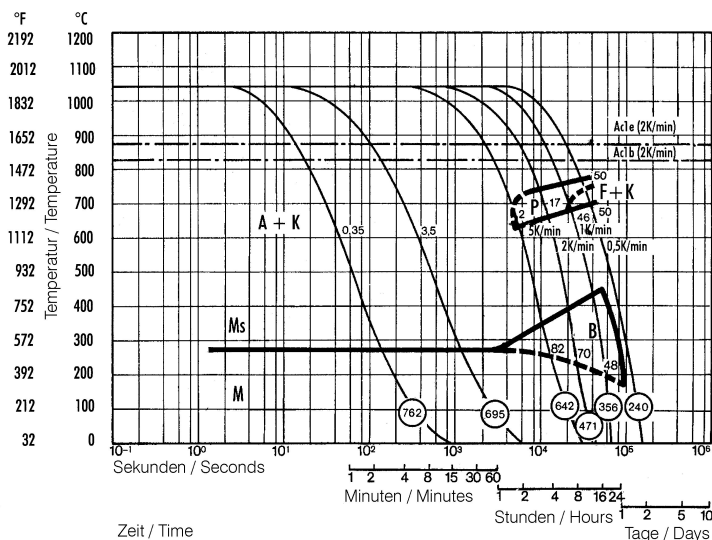
### Hardening and Tempering

|             |                   |                                                                                                                                                                                                                     |
|-------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature | 1,000 to 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

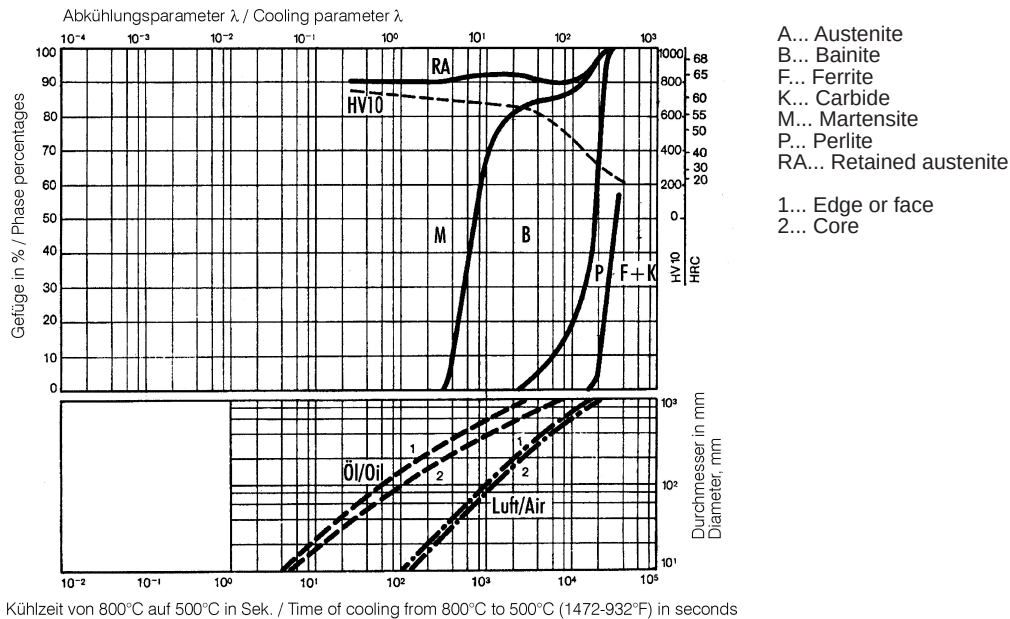
○ Vickers hardness

2...46 phase percentages

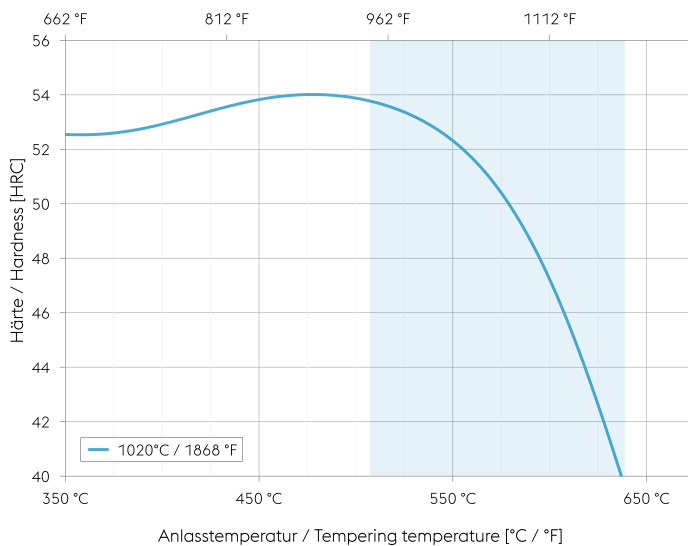
0.35...3.5 cooling parameter, i.e. duration of cooling from 800 - 500°C (1472-932°F) in  $s \times 10^{-2}$

5...0.5 K/min cooling rate in K/min in the 800 - 500°C (1472-932°F) range

## Quantitative phase diagram



## 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.

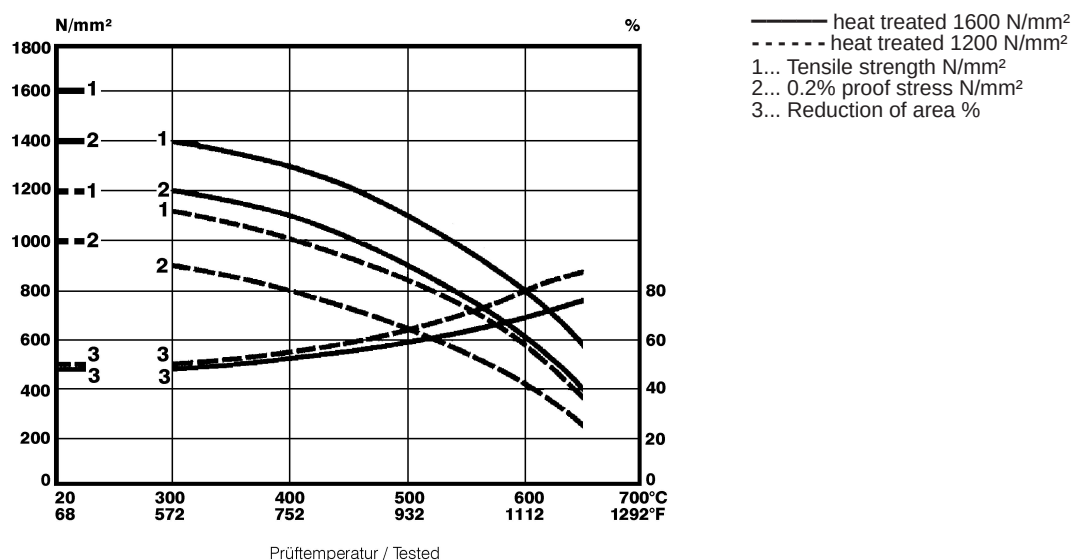
The tempering chart shows average tempered hardness values.

3rd for stress relieving at a temperature 86 to 122°F (30 to 50°C) below highest tempering temperature.

Recommended tempering temperature range is indicated by the blue area in the chart.

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

## Hot strength chart



## Physical Properties

| Temperature (°C)                                           | 20   |
|------------------------------------------------------------|------|
| Density (kg/dm <sup>3</sup> )                              | 7.8  |
| Thermal conductivity (W/(m.K))                             | 24.9 |
| Specific heat (kJ/kg K)                                    | 0.46 |
| Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)       | 0.52 |
| Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup> ) | 215  |

## Thermal Expansions between 20°C | 68°F and ...

| Temperature (°C)                             | 100  | 200 | 300  | 400  | 500  | 600 | 700  |
|----------------------------------------------|------|-----|------|------|------|-----|------|
| Thermal expansion (10 <sup>-6</sup> m/(m.K)) | 11.5 | 12  | 12.2 | 12.5 | 12.9 | 13  | 13.2 |

If other available product variants are listed in addition to long products, please note that these may differ in terms of melting process, technical data, delivery and surface condition as well as available product dimensions. For mandatory technical specifications, other requirements and dimensions, 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.

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ONE STEP AHEAD.