

HOT WORK TOOL STEELS

Available Product Variants

- 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

BÖHLER W302 ISODISC is a 5% chromium steel and corresponds to material number 1.2344 (X40CrMoV5-1). 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 W302 ISOBLOC which is a remelted grade with improved cleanliness, homogeneity and toughness.

Process Melting

- Airmelted

Properties

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

Applications

- > Extrusion
- > Gravity / Low Pressure Die-Casting
- > Injection Molding
- > Press Hardening / Hot Stamping
- > Mechanical Engineering
- > Forging (Hot / Semi-hot)
- > Blow Molding
- > Machine knife (for producers)
- > Progressive Forging (Hatebur)
- > General Components for Mechanical Engineering
- > High Pressure Die-Casting
- > Oth. Automotive components (Turbochargers, Piston Rings, Sensors, etc.)
- > Tool Holders (milling, drilling, turning & chucks)

Technical data

| Material designation | | Standards | |
|----------------------|------|-----------|--------|
| 1.2344 | SEL | 4957 | EN ISO |
| T20813 | UNS | G4404 | JIS |
| X40CrMoV5-1 | EN | | |
| H13 | AISI | | |
| SKD61 | JIS | | |

Chemical composition (wt. %)

| C | Si | Mn | Cr | Mo | V |
|------|------|------|------|------|------|
| 0.39 | 1.10 | 0.40 | 5.20 | 1.30 | 0.95 |

Material characteristics

| | High temperature strength | High temperature toughness | High temperature wear resistance |
|---------------------------------------|---------------------------|----------------------------|----------------------------------|
| BÖHLER W302 ISODISC® | ★★★ | ★★★ | ★★★ |
| BÖHLER W300 ISODISC® | ★★ | ★★★ | ★★ |
| BÖHLER W300 ISOBLOC® | ★★ | ★★★★ | ★★ |
| BÖHLER W302 ISOBLOC® | ★★★ | ★★★★ | ★★★ |
| BÖHLER W303 ISODISC® | ★★★★ | ★★★ | ★★★★ |
| BÖHLER W320 ISODISC® | ★★★ | ★★ | ★★★ |
| BÖHLER W350 ISOBLOC® | ★★★ | ★★★★★ | ★★★ |
| BÖHLER W360 ISOBLOC® | ★★★★★ | ★★★★ | ★★★★★ |
| BÖHLER W400 VMR® | ★★ | ★★★★★ | ★★ |
| BÖHLER W403 VMR® | ★★★★ | ★★★★ | ★★★★ |

Delivery condition

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

Heat treatment

Annealing

| | | |
|-------------|-----------------------------------|---|
| Temperature | 750 to 800 °C 1,382 to 1,472 °F | 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. |
|-------------|-----------------------------------|---|

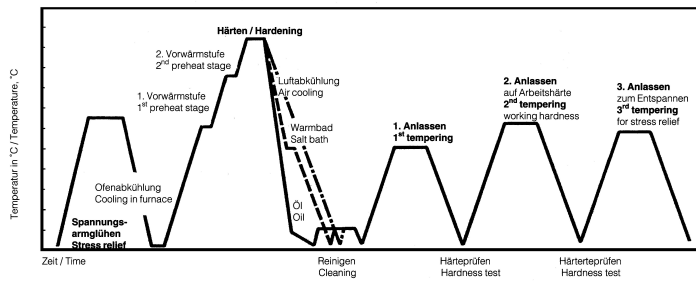
Stress relieving

| | | |
|-------------|-----------------------------------|---|
| Temperature | 600 to 670 °C 1,112 to 1,238 °F | 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. |
|-------------|-----------------------------------|---|

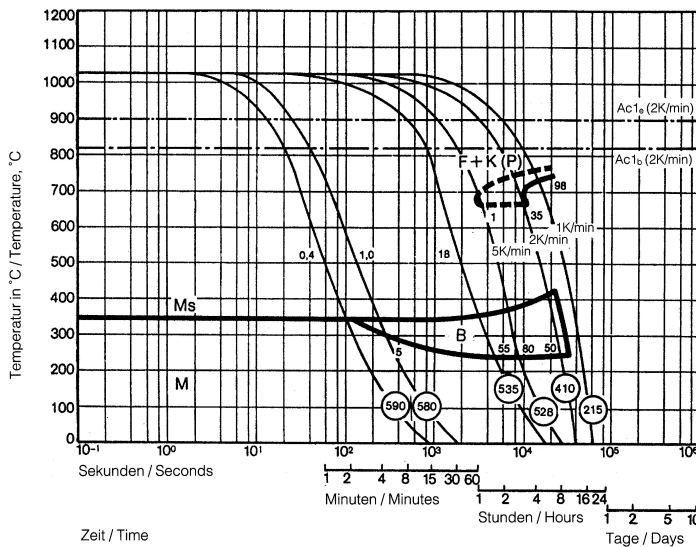
Hardening and Tempering

| | | |
|-------------|---------------------------------------|---|
| Temperature | 1,020 to 1,080 °C 1,868 to 1,976 °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



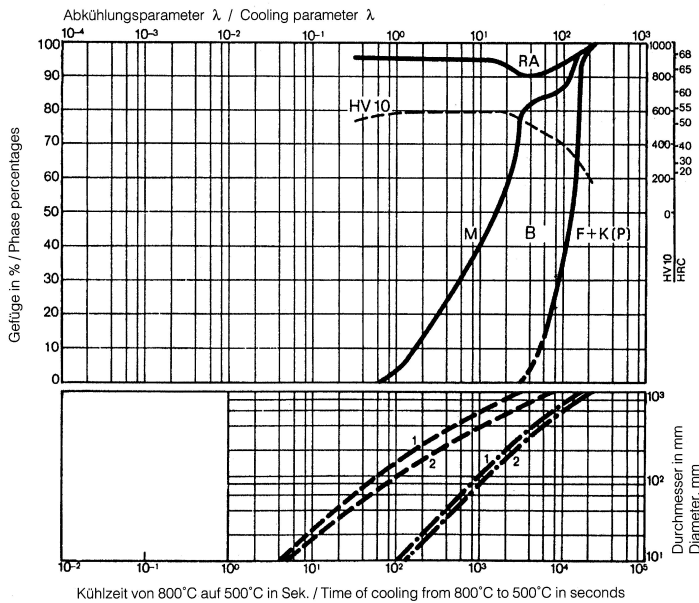
Continuous cooling CCT curves



Austenitising temperature: 1020°C (1868°F)
Holding time: 15 minutes

O Vickers hardness
1...35 phase percentages
0.4...18 cooling parameter, i.e. duration of cooling from 800 - 500°C (1472-932°F) in $s \times 10^{-2}$
5...1 K/min cooling rate in K/min in the 800 - 500°C (1472-932°F) range

Quantitative phase diagram

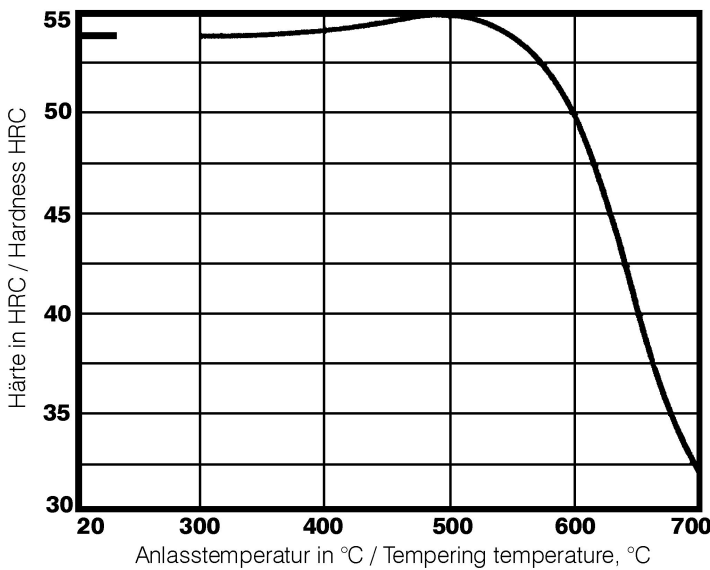


B... Bainite
F... Ferrite
K... Carbide
M... Martensite
P... Perlite
RA... Retained austenite

----- Oil cooling
- · - Air cooling

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.

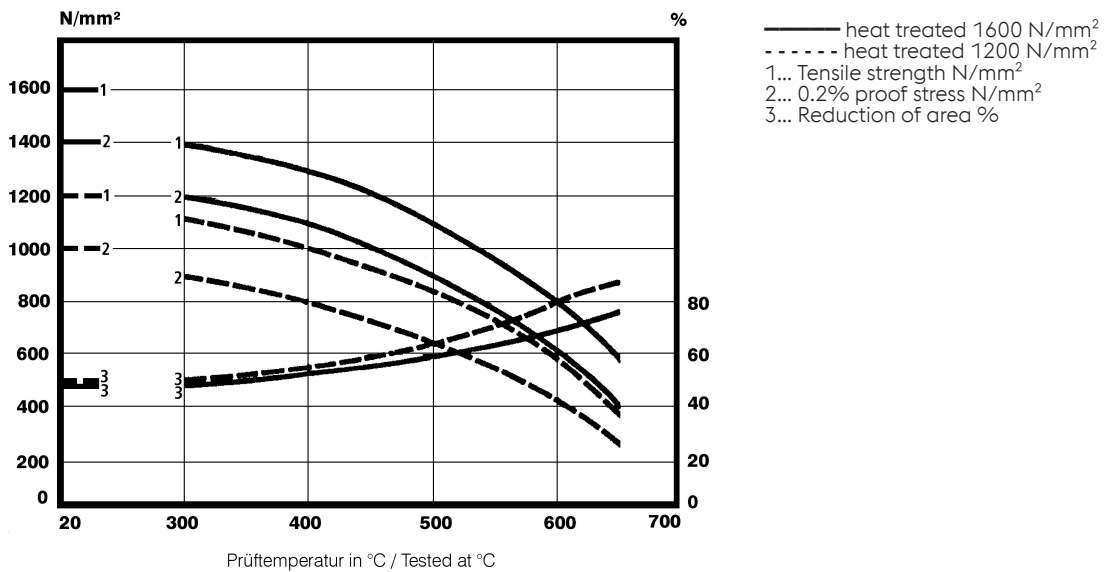
1st tempering approx. 86°F (30°C) above maximum secondary hardness.

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: 1050°C (1922°F)
Specimen size: square 50 mm

Hot strength chart



Physical Properties

| | |
|---|---------------|
| Temperature (°C °F) | 20 68 |
| Density (kg/dm ³ lb/in ³) | 7.8 0.28 |
| Thermal conductivity (W/(m.K) BTU/ft h °F) | 24.3 14.04 |
| Specific heat (kJ/kg K BTU/lb °F) | 0.46 0.1099 |
| Spec. electrical resistance (Ohm.mm ² /m 10 ⁻⁴ Ohm.inch ² /ft) | 0.52 2.46 |
| Modulus of elasticity (10 ³ N/mm ² 10 ³ ksi) | 215 31.18 |

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

| Temperature (°C °F) | 100 212 | 200 392 | 300 572 | 400 752 | 500 932 | 600 1,112 | 700 1,292 |
|--|------------|-----------|------------|------------|------------|-------------|-------------|
| Thermal expansion (10 ⁻⁶ m/(m.K) 10 ⁻⁶ inch/inch.°F) | 11.5 6.4 | 12 6.7 | 12.2 6.8 | 12.5 6.9 | 12.9 7.2 | 13 7.2 | 13.2 7.3 |

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.

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