US 2000^{cold}, Special Tool Steel
Data Sheet – Tooling Alloys

Zapp is certified to ISO 9001

Key features of Zapp's tool steel US 2000^{cold}

- Conventionally manufactured
- > Round 180mm and flat dimensions in ESR quality
- High wear resistance and toughness
- Simple, low-distortion heat treatment
- Upgrade to 1.2379/D2
- Case hardness up to 63 HRC possible

Typical areas of application

- Cutting, punching, and fine blanking tools
- Pressing and forming tools
- Cold-forming tools
- Plastics industry

Physical properties

Modulus of elasticity E [GPa]	220
Density [kg/dm³]	7.78
Thermal expansion coefficient [mm/(mm/K)] in a temperature range up to 20 °C – 200 °C	11.2 x 10^{-6}
Thermal conductivity [W/(m*K)]	23.5

Delivery condition

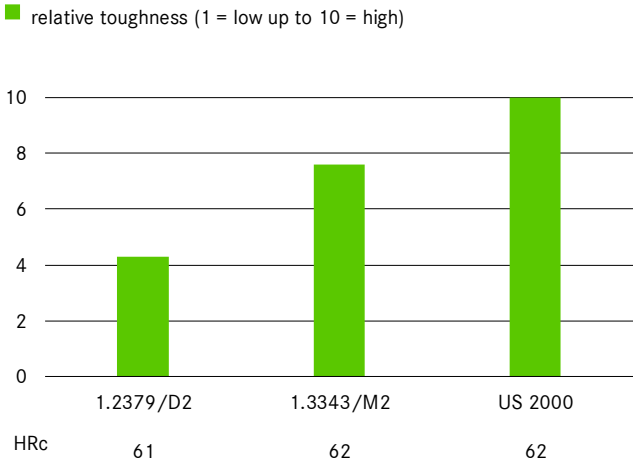
As-delivered condition	Soft-annealed, approx. 230 HB
Product form	Round bars, flat bars
Surface finish	Mechanically machined

Typical chemical composition (weight %)

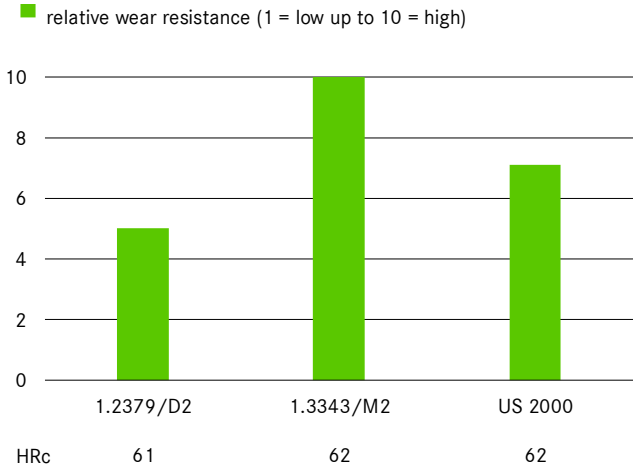
C	Cr	Mo	W	V
1.1	7.8	1.6	1.1	2.4

Qualitative comparison of the most important properties

Toughness



Wear resistance



Heat treatment

Soft annealing

- In neutral atmosphere at ~ 900 °C and ~ 4 h exposure time (after through-heating)
- Followed by furnace cooling (optimum cooling rate max. 15 °C/h up to 540 °C)
- Soft annealing hardness ~ 230 HB

Stress-relief annealing

~ 650 °C/ ~ 2 h exposure time (after through-heating) followed by furnace cooling

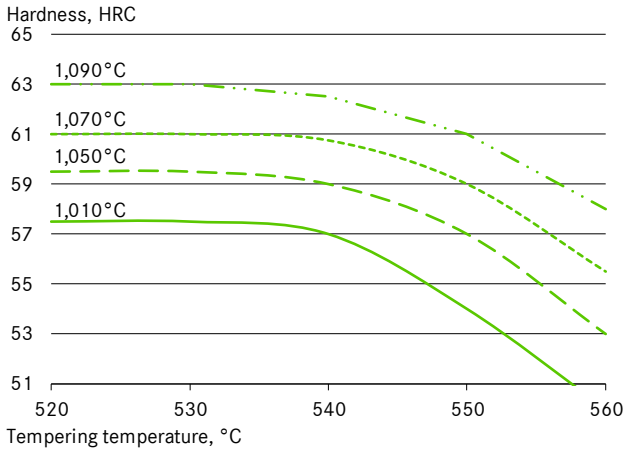
Surface treatments

Tempering temperatures of ≥ 520 °C provide the prerequisite for subsequent nitriding or PVD coating.

You can find more materials at:
www.zapp.com/en-uk/materials/powder-metallurgical-tool-steel

Zapp Precision Metals GmbH ensures professional execution of all heat treatment steps as well as their preparation and post-processing (e.g., charging, hardness testing, straightening processes, etc.) – always with the aim of obtaining the optimum component properties!
We are happy to assist you with constructive advice!

Tempering diagram



Vacuum heat treatment instructions

Pre-heating	professional heating, 3 pre-heating stages recommended
Vacuum heating	from 1,010 to 1,090 °C, see table
Exposure time	of 45 minutes after through-heating, see table
Cooling	in vacuum, a quenching pressure of at least 6 bar is required
Tempering	at least 3 times for 2 hours each according to table, fourth tempering recommended, allow to equilibrate to room temperature in between

Desired hardness HRC ± 1	Hardness temperature °C	Exposure time at hardness temperature minutes	Tempering °C
57	1,010	45	540
59	1,050	45	520
61	1,070	45	520
63	1,090	45	530

The maximum specified hardening temperature of 1,090 °C should not be exceeded.
Hardening with further heat treatment processes is possible, but should be discussed in advance!

TOOLING ALLOYS

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