

1.4614, UNS 46500, Precipitation Hardening Steel

Datasheet | Medical Alloys



Zapp is certified to ISO 9001

Zapp® 1.46 14 Precipitation Hardening Steel

Zapp® 1.4614 is a precipitation hardening stainless chromium-nickel steel that offers excellent corrosion resistance, high hardness, and mechanical strength. Hardness of up to 57HRC* can be achieved. Higher values with cold deformation can achieve strengths up to greater than 2000MPa*.

* Maximum achievable values under ideal hardening conditions.

Corresponding Standards

- 1.4614
- UNS S46500, acc. to ASTM F899 and ASTM A564/A564M

Typical Applications

Medical and instruments, e.g. drills

Polishability

Zapp® 1.4614 is suitable for high gloss polishing.

Magnetism

Zapp® 1.4614 is magnetizable.

Weldability

Zapp® 1.4614 shows good weldability with the shielded fusion and resistance welding processes. Preheating is not necessary.

For most applications best results are achieved in the solution-annealed condition.

Approximately Chemical Analysis (%)

C	Mn	P	S	Si	Cr
0.02	0.250	0.015	0.010	0.250	11.0-12.5
Ni	Mo	Ti	Co		
10.75-11.25	0.75-1.25	1.5-1.8	0.1		

* Limits are in percent maximum unless shown as a range or stated otherwise.

Delivery Condition *

Condition	Tensile Strength TS [MPa]	Yield Strength YS [MPa]	Elonga- tion 50 mm [%]	Reduc- tion of Area [%]	Hardness HRC/ HB
A	-	-	-	-	≤ 36/331
A + CW	-	-	-	-	≤ 40/380

* Acc. to ASTM A564/ A564M

Mechanical Properties* (after Age Hardening out of Condition A)

Condition	Tensile Strength TS [MPa]	Yield Strength YS [MPa]	Elonga- tion 50 mm [%]	Reduc- tion of Area [%]	Hardness HRC/ HB
H950	≥ 1655	≥ 1515	≥ 10	≥ 45	≥ 47/444
H1,000	≥ 1515	≥ 1380	≥ 10	≥ 50	≥ 45/430
H1,025	≥ 1450	≥ 1345	≥ 12	≥ 50	≥ 44/415
H1,050	≥ 1380	≥ 1280	≥ 13	≥ 50	≥ 43/400

* Acc. to ASTM A564/ A564M

Mechanical Properties*

(after Age Hardening out of Condition A + CW)

Condition	Tensile Strength TS [MPa]	Yield Strength YS [MPa]	Elonga- tion 50 mm [%]	Reduc- tion of Area [%]	Hardness HRC/ HB
H900	≥ 1755	≥ 1620	≥ 7	≥ 44	≥ 49/455
H950	≥ 1720	≥ 1585	≥ 8	≥ 45	≥ 48/450
H1,000	≥ 1620	≥ 1480	≥ 9	≥ 50	≥ 46/435
H1,025	≥ 1550	≥ 1410	≥ 10	≥ 50	≥ 45/425
H1,050	≥ 1450	≥ 1310	≥ 10	≥ 50	≥ 44/415

* Acc. to ASTM A564/ A564M

Cold Working

To perform massive cold working, please order the solution annealed condition (Condition A).

Hot Working

Forging temperature is 1010 – 1.090 °C (1,850-2,003 °F).

Cool the material gradually to room temperature (e.g. in air).

Solution annealing is recommended to obtain the best properties.

Heat Treatment

Solution Annealing

- Temperature: 980 ± 15 °C
- Cooling: oil, water
- Optimal annealing treatment: Solution annealing + cryogenic cooling <-73 °C/ ~8h.
- Cryogenic cooling should be performed within 24 hours after solution annealing.

Precipitation Hardening

- Temperature: 482 - 565 °C (H900- H1050)
 - Hold time: ~4h (thickness dependent)
 - Cooling: Air

Physical Properties

	Short symbol	Test result at 20 °C	Unit
Density	ρ	7.82	$\frac{\text{kg}}{\text{dm}^3}$
Specific heat 20 °C	c	0.45	$\frac{\text{kJ}}{\text{kg} \cdot \text{K}}$
Thermal conductivity	λ	14	$\frac{\text{W}}{\text{m} \cdot \text{K}^{-1}}$
Specific Electric Resistivity	ρ	0.76	$\frac{\Omega \cdot \text{mm}^2}{\text{m}}$
Modulus of Elasticity 20 °C	E	200	GPa
Coefficient of Thermal Expansion	α		$10^{-6} / \text{K}^{-1}$
		20 – 100 °C	10.3
		20 – 200 °C	10.8
		20 – 400 °C	11.1
		20 – 600 °C	11.4

Corrosion Resistance

Resistance comparable to austenitic grades (e.g. 1.4301). However, thermal treatment can result in the formation of oxide or scale layers that may severely impair surface corrosion.

To ensure long-term corrosion resistance, it is essential to maintain the surfaces in a polished state or to apply a passivation coating.

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