Uddeholm
Alvar 14

UDDEHOLM
a voestalpine company

This information is based on our present state of knowledge and is intended to provide general notes on our products and their uses. It should not therefore be construed as a warranty of specific properties of the products described or a warranty for fitness for a particular purpose.

Classified according to EU Directive 1999/45/EC
For further information see our “Material Safety Data Sheets”.

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GENERAL

Uddeholm Alvar 14 is a chromium-nickel-molybdenum-vanadium alloyed steel which is characterized by:

- Good toughness
- Good resistance to high thermal stresses
- Good stability in hardening
- Good through-hardening properties

Typical analysis %	C	Si	Mn	Cr	Ni	Mo	V
	0,55	0,3	0,7	1,1	1,7	0,5	0,1
Standard specification	W.-Nr. 1.2714, DIN 56 NiCrMoV7						
Delivery condition	1. Soft annealed to max. 250 HB. 2. Hardened and tempered to 330–400 HB (36–43 HRC; 1100–1350 N/mm^2).						
Colour code	White/black						

APPLICATIONS

Uddeholm Alvar 14 is ideally suited for hot working tools such as:

- support parts for extrusion tooling, e.g. backers, bolsters
- hot forging tools
- die for tin, lead and zinc alloys
- tools for hot shearing

PROPERTIES

PHYSICAL DATA

Hardened and tempered to hardness 40 HRC. Data at room and elevated temperatures.

Temperature	20°C (68°F)	200°C (390°F)	400°C (750°F)
Density kg/m^3 lbs/in^3	7 800 0,281	7 740 0,279	7 680 0,277
Coefficient of thermal expansion per °C from 20°C per °F from 68°F	 – –	 13,1 x 10^{-6} 7,3 x 10^{-6}	 13,9 x 10^{-6} 7,7 x 10^{-6}
Modulus of elasticity N/mm^2 psi	215 000 31,2 x 10^6	202 000 29,3 x 10^6	185 000 26,8 x 10^6
Thermal conductivity W/m°C Btu in(ft^{2}h°F)	36 254	36,5 258	36,8 260

HEAT TREATMENT

SOFT ANNEALING

Protect the steel and heat through to 700°C (1290°F). Then cool in the furnace at 10°C (20°F) per hour to 650°C (1200°F), then freely in air.

STRESS RELIEVING

After rough machining the tool should be heated through to 650°C (1200°F), holding time 2 hours. Cool slowly to 500°C (930°F), then freely in air.

HARDENING

Pre-heating temperature: 600–700°C (1110–1290°F).

Austenitizing temperature: 830–870°C (1525–1600°F) in oil, 860–900°C (1580–1650°F) in air.

Temperature °C	Temperature °F	Soaking time* minutes	Hardness before tempering
850	1560	30	approx. 58 HRC (Oil)
880	1620	30	approx. 56 HRC (Air)

* Soaking time = time at hardening temperature after the tool is fully heated through

Protect the part against decarburization and oxidation during hardening.

QUENCHING MEDIA

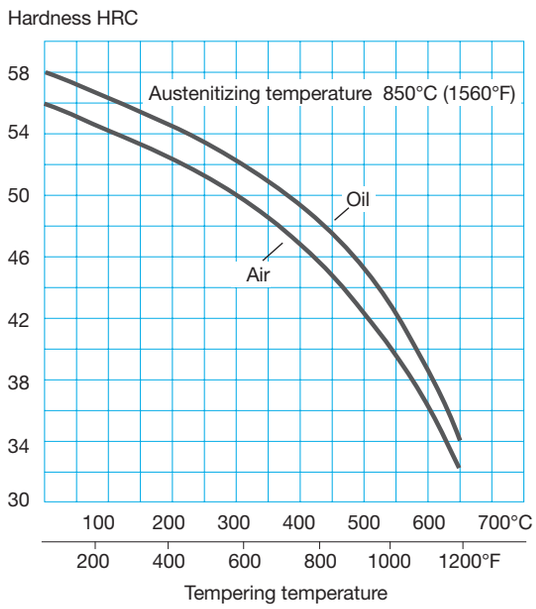
- Air blast/vacuum
- Martempering bath. Temperature 250°C (480°F) for max. 15 minutes, then cooling in air
- Warm oil

Note: Temper the tool as soon as its temperature reaches 50–70°C (120–160°F).

TEMPERING

Choose the tempering temperature according to the hardness required by reference to the tempering graph on next page. Temper twice with intermediate cooling to room temperature. Lowest tempering temperature 180°C (360°F). Holding time at temperature minimum 2 hours.

TEMPERING GRAPH



NITRIDING

Nitriding will give a hard surface layer which is very resistant to wear and erosion.

MACHINING RECOMMENDATIONS

The cutting data below are to be considered as guiding values which must be adapted to existing local conditions. More information can be found in the Uddeholm publication "Cutting data recommendation".

Condition: Soft annealed to max. 250 HB.

TURNING

Cutting data parameter	Turning with carbide steel		Turning with high speed steel
	Rough turning	Fine turning	Fine turning
Cutting speed (v_c) m/min f.p.m.	160–210 525–690	210–260 690–855	20–25 66–82
Feed (f) mm/r i.p.r.	0.2–0.4 0.008–0.016	0.05–0.2 0.002–0.008	0.05–0.3 0.002–0.01
Depth of cut (a_p) mm inch	2–4 0.08–0.16	0.5–2 0.02–0.08	0.5–3 0.02–0.12
Carbide designation, ISO US	P20–P30 C6–C5 Coated carbide	P10 C7 Coated carbide or cermet	–

MILLING

FACE AND SQUARE SHOULDER MILLING

Cutting data parameter	Milling with carbide	
	Rough milling	Fine milling
Cutting speed (v_c) m/min f.p.m.	170–250 560–820	250–290 820–950
Feed (f_z) mm/tooth inch/tooth	0.2–0.4 0.008–0.016	0.1–0.2 0.004–0.008
Depth of cut (a_p) mm inch	2–5 0.08–0.20	–2 –0.08
Carbide designation ISO US	P20–P40 C6–C5 Coated carbide	P10–P20 C7–C6 Coated carbide or cermet

END MILLING

Cutting data parameter	Type of milling		
	Solid carbide	Carbide indexable insert	High speed steel
Cutting speed (v_c) m/min f.p.m.	150–190 490–625	160–220 525–720	25–30[1] 82–98[1]
Feed (f_z) mm/tooth inch/tooth	0.006–0.20[2] 0.0002–0.008[2]	0.06–0.20[2] 0.002–0.008[2]	0.01–0.35[2] 0.0004–0.014[2]
Carbide designation ISO US	K10, P40 C3, C5	P15–P40 C6–C5	–

[1] For coated high speed steel end mill v_c = 45–50 m/min (148– 164 f.p.m)
[2] Depending on radial depth of cut and cutter diameter

DRILLING

HIGH SPEED STEEL TWIST DRILL

Drill diameter Ø		Cutting speed (v_c)		Feed (f)	
mm	inch	m/min	f.p.m.	mm/r	i.p.r.
–5	–3/16	15–17*	49–56*	0.05–0.10	0.002–0.004
5–10	3/16–3/8	15–17*	49–56*	0.10–0.20	0.004–0.008
10–15	3/8–5/8	15–17*	49–56*	0.20–0.25	0.008–0.010
15–20	5/8–3/4	15–17*	49–56*	0.25–0.30	0.010–0.012

* For coated high speed steel drill v_c = 26–28 m/min (85–92 f.p.m.).

CARBIDE DRILL

Cutting data parameter	Type of drill		
	Indexable insert	Solid carbide	Carbide tip[1]
Cutting speed (v_c) m/min f.p.m.	200–220 656–722	110–140 360–460	70–90 230–295
Feed (f) mm/r i.p.r.	0.05–0.15[2] 0.002–0.006[2]	0.08–0.20[3] 0.003–0.008[3]	0.15–0.25[4] 0.006–0.01[4]

[1] Drill with replaceable or brazed carbide tip
[2] Feed rate for drill diameter 20–40 mm (0.8”–1.6”)
[3] Feed rate for drill diameter 5–20 mm (0.2”–0.8”)
[4] Feed rate for drill diameter 10–20 mm (0.4”–0.8”)

Condition: Prehardened to 380 HB.

TURNING

Cutting data parameter	Turning with carbide		Turning with high speed steel
	Rough turning	Fine turning	Fine turning
Cutting speed (v_c) m/min f.p.m.	90–130 295–426	130–180 426–590	8–13 26–43
Feed (f) mm/r i.p.r.	0.2–0.4 0.008–0.016	0.05–0.2 0.002–0.008	0.05–0.3 0.002–0.012
Depth of cut (a_p) mm inch	2–4 0.08–0.16	–2 –0.08	–2 –0.12
Carbide designation, ISO US	P20–P30 C6–C5 Coated carbide	P10 C7 Coated carbide or cermet	–

MILLING

FACE AND SQUARE SHOULDER MILLING

Cutting data parameter	Milling with carbide	
	Rough milling	Fine milling
Cutting speed (v_c) m/min f.p.m.	70–140 230–460	140–170 460–560
Feed (f_z), mm/tooth inch/tooth	0.2–0.4 0.008–0.016	0.1–0.2 0.004–0.008
Depth of cut (a_p) mm inch	2–5 0.08–0.2	–2 –0.08
Carbide designation ISO US	P20–P40 C6–C5 Coated carbide	P10–P20 C7–C6 Coated carbide or cermet

END MILLING

Cutting data parameter	Type of milling		
	Solid carbide	Carbide indexable insert	High speed steel
Cutting speed (v_c) m/min f.p.m.	60–100 200–330	70–110 230–360	8–12[1] 26–40[1]
Feed (f_z) mm/tooth inch/tooth	0.006–0.20[2] 0.0002–0.008[2]	0.06–0.20[2] 0.002–0.008[2]	0.01–0.35[2] 0.0004–0.014[2]
Carbide designation ISO US	K10, P40 C3, C5	P15–P40 C6–C5	–

[1] For coated high speed steel end mill v_c = 20–25 m/min (66–82 f.p.m)
[2] Depending on radial depth of cut and cutter diameter

DRILLING

HIGH SPEED STEEL TWIST DRILL

Drill diameter Ø		Cutting speed (v_c)		Feed (f)	
mm	inch	m/min	f.p.m.	mm/r	i.p.r.
–5	–3/16	10–12*	33–39*	0.05–0.10	0.002–0.004
5–10	3/16–3/8	10–12*	33–39*	0.10–0.20	0.004–0.008
10–15	3/8–5/8	10–12*	33–39*	0.20–0.25	0.008–0.010
15–20	5/8–3/4	10–12*	33–39*	0.25–0.30	0.010–0.012

* For coated high speed steel drill v_c =16–18 m/min (53–59 f.p.m.)

CARBIDE DRILL

Cutting data parameter	Type of drill		
	Indexable insert	Solid carbide	Carbide tip[1]
Cutting speed (v_c) m/min f.p.m.	150–170 492–558	100–130 328–426	50–70 164–230
Feed (f) mm/r i.p.r.	0.03–0.12[2] 0.001–0.005[2]	0.05–0.15[3] 0.002–0.006[3]	0.10–0.20[4] 0.004–0.008[4]

[1] Drill with replaceable or brazed carbide tip
[2] Feed rate for drill diameter 20–40 mm (0.8”–1.6”)
[3] Feed rate for drill diameter 5–20 mm (0.2”–0.8”)
[4] Feed rate for drill diameter 10–20 mm (0.4”–0.8”)

GRINDING

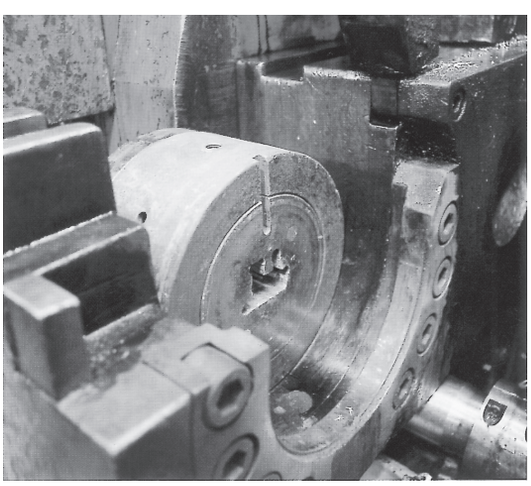
A general grinding wheel recommendation is given below. More detailed information can be found in the Uddeholm publication “Grinding of Tool Steel”.

Type of grinding	Wheel recommendation	
	Soft annealed condition	Prehardened condition
Face grinding straight wheel	A 46 HV	A 46 HV
Face grinding segments	A 24 GV	A 36 GV
Cylindrical grinding	A 60 KV	A 60 KV
Internal grinding	A 46 JV	A 60 JV
Profile grinding	A 100 KV	A 120 JV

ELECTRICAL DISCHARGE MACHINING – EDM

If spark-erosion is performed in the hardened and tempered condition, the white re-cast layer should be removed mechanically e.g. by grinding or ston-ing. The tool should then be given an additional temper at approx. 25°C (50°F) below the previous tempering temperature.

More information is given in the Uddeholm brochure “EDM of Tool Steel”.



WELDING

Welding of tool steel can be performed with good results if proper precautions are taken regarding elevated temperature, joint preparation, choice of consumables and welding procedure.

Welding method	TIG	MMA
Working temperature	225–275°C 435–525°F	225–275°C 435–525°F
Filler metals	UTP A 73G4 ESAB OK Tigrod 13.22	UTP 73G4 ESAB OK 83.28
Hardness after welding	350–400 HB	340–390 HB

More detailed information can be found in the Uddeholm brochure “Welding of Tool Steel”.

FURTHER INFORMATION

Please contact your local Uddeholm office for further information on the selection, heat treatment, application and availability of Uddeholm tool steel.

Manufacturing solutions for generations to come

SHAPING THE WORLD®

We are shaping the world together with the global manufacturing industry. Uddeholm manufactures steel that shapes products used in our every day life. We do it sustainably, fair to people and the environment. Enabling us to continue shaping the world – today and for generations to come.

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