

Uddeholm
Vanax[®]
SuperClean

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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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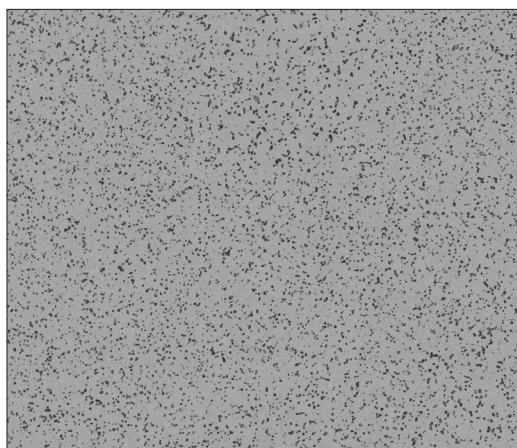
GENERAL

Uddeholm Vanax SuperClean is a Cr-Mo-V-N alloyed steel characterized by:

- Excellent corrosion resistance
- High mechanical strength
- Good ductility
- Good mixed wear resistance
- Good through hardening properties
- Good dimension stability at hardening

Via a process route based on powder metallurgy a high nitrogen steel is produced with unique property combinations of hardness, wear resistance, ductility and corrosion resistance. In Uddeholm Vanax SuperClean most of the carbon is substituted by nitrogen, modifying the traditional chromium carbides into carbonitrides. These carbonitrides are less harmful when it comes to corrosion resistance compared to chromium carbides.

Typical analysis %	C	N	Si	Mn	Cr	Mo	V
	0.36	1.55	0.30	0.30	18.2	1.10	3.50
Delivery condition	Soft annealed to approx. 260 HB						
Colour code	Grey/Dark blue						



*Uddeholm Vanax SuperClean – Approx. 13% hard phase particles 60 HRC.
1080°C (1975°F)/DC + 200°C (390°F)/2 x 2h*

APPLICATIONS

Uddeholm Vanax SuperClean has an excellent corrosion resistance both in low and high temperature tempered condition in combination with good wear resistance to counteract mixed wear/galling/fretting. Applications are e.g. found in plastic moulding, food processing and engineering designs.

Typical applications are:

- Plastic mould components requiring high corrosion resistance, fretting resistance, and/or mould release properties
- Hand knives
- Components and knives in food processing
- Wear parts in corrosive environments
- Wear parts in sliding and rolling engineering applications
- Highly stressed machine parts in corrosive environments

PROPERTIES

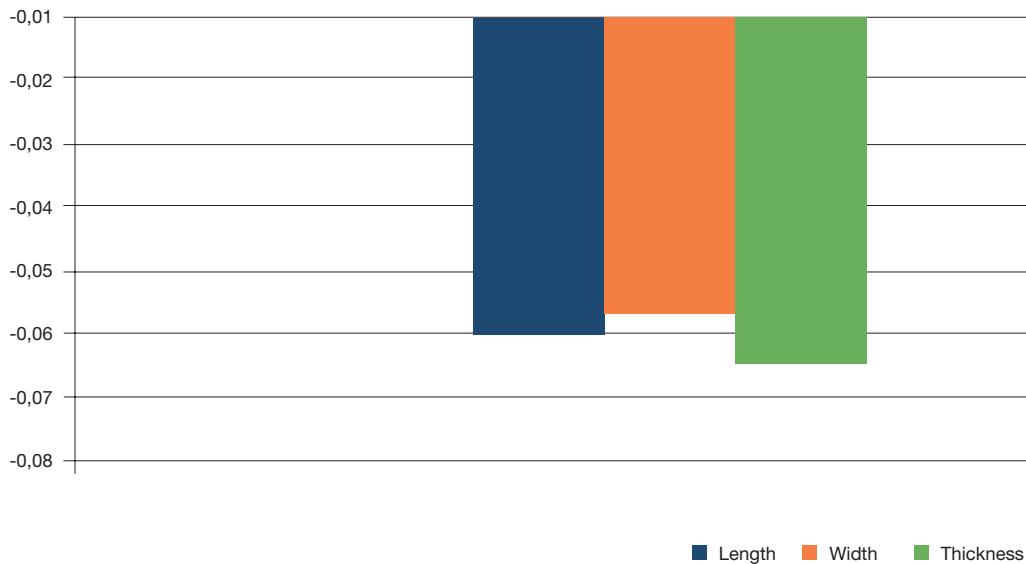
PHYSICAL DATA

Hardened, sub-zero treated and tempered to 60 HRC.

Temperature	20°C (68°F)	200°C (390°F)	400°C (750°F)
Density kg/m ³ lbs/in ³	7 560 0.273	–	–
Modulus of elasticity N/mm ² ksi	220 000 32 x 10 ⁶	–	–
Coefficient of thermal expansion per °C from 20°C per °F from 68°F	–	11.7 x 10 ⁻⁶ 6.5 x 10 ⁻⁶	–
Thermal conductivity W/m °C Btu in/(ft ² h °F)	–	18 125	–
Specific heat J/kg °C Btu/lb, °F	490 0.12	–	–

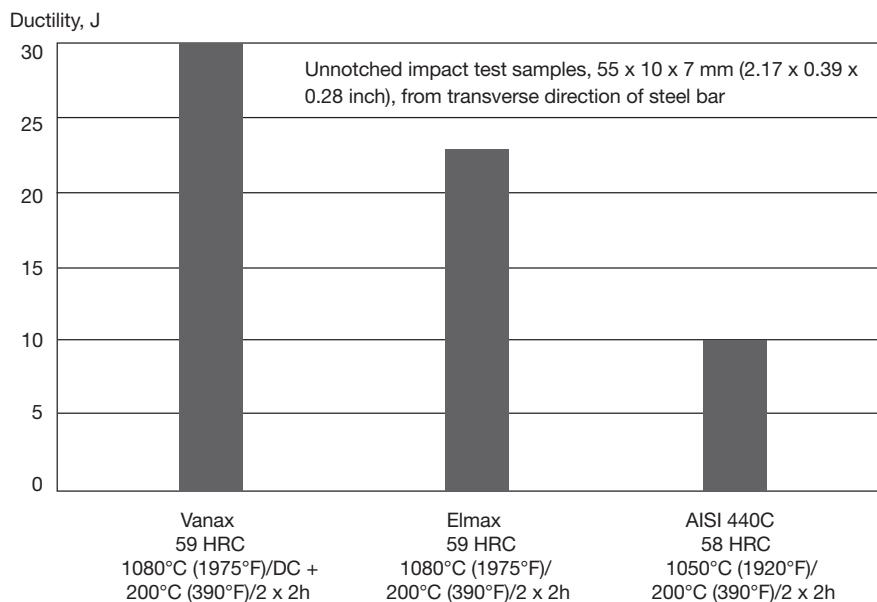
DIMENSIONAL CHANGES

As the steel will contain approx. 10% retained austenite after the recommended heat treatment procedure, 1080°C (1975°F)/30 min + DC + 200°C (390°F)/2 x 2h, the dimensions will decrease approx. 0.1% after heat treatment. Enough machining allowance must therefore be included for this shrinkage in dimension.



DUCTILITY

Conventionally produced grades of similar hardness and wear response have an uneven distribution of large carbides and therefore a lower ductility than PM grades. Uddeholm Vanax SuperClean has a ductility in parity with or better than Uddeholm Elmax SuperClean.



HEAT TREATMENT

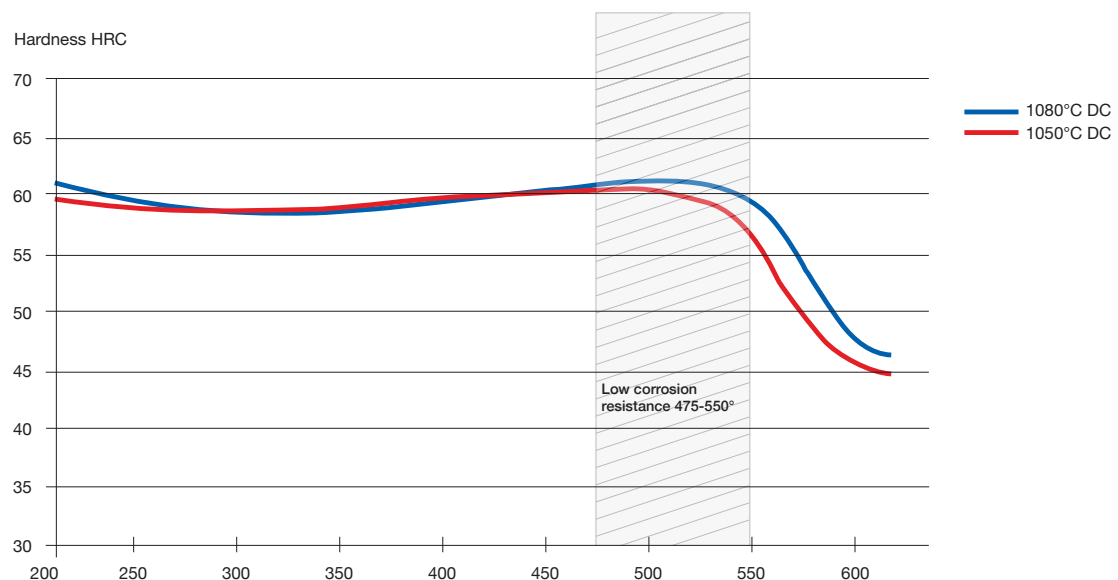
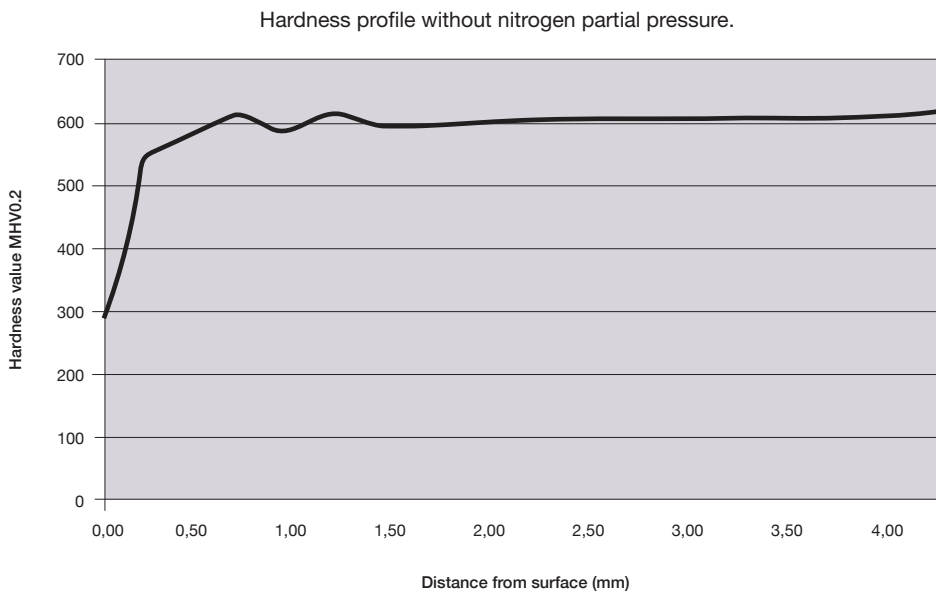
The recommended austenitizing temperature for Uddeholm Vanax SuperClean is 1080°C (1975°F) with 30 minutes holding time followed by deep cooling between -100° (148°F) and -196°C (-320°F) to minimize the amount of retained austenite.

For best corrosion properties low temperature tempering at 200°C (390°F)/2 x 2h is recommended. If the product application conditions require a higher tempering temperature Uddeholm Vanax SuperClean can be tempered

up to 450°C (840°F) without significant loss of corrosion properties.

When hardening in vacuum furnaces it is recommended to apply a nitrogen partial pressure of 150–200 mbar to counteract loss of N on the surface. The effect on surface hardness without applying a partial pressure is seen in the diagram below.

The hardenability of Uddeholm Vanax SuperClean is adequate to ensure good through hardening properties when gas quenching in vacuum furnaces.



CORROSION RESISTANCE

In carbon based high chromium alloys the solid solution of chromium is low due to the chromium being tied up as chromium carbides, thereby affecting corrosion resistance negatively.

MACHINING RECOMMENDATIONS

The cutting data recommendations below are to be considered as guidelines and may require adjustments based on equipment, selection of cutting tools, etc. More information can be found in the Uddeholm publication "Cutting data recommendations".

The recommendations in the following tables are valid for Uddeholm Vanax SuperClean in soft annealed condition.

TURNING

Cutting data parameter	Turning with carbide		Turning with high speed steel Fine turning
	Rough turning	Fine turning	
Cutting speed (v_c) m/min f.p.m.	100–150 330–490	150–200 490–655	12–15 39–49
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 0.02–0.1
Carbide designation ISO	K20, P20* Coated carbide	K15* Coated carbide or cermet	–

* Use a wear resistant Al_2O_3 coated grade

DRILLING

HIGH SPEED STEEL TWIST DRILLS

Drill diameter		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	0.010–0.014

* For coated HSS drill $v_c = 16–18$ m/min. (52–59 f.p.m.)

CARBIDE DRILL

Cutting data parameter	Type of drill		
	Indexable insert	Solid carbide	Carbide tipped ¹⁾
Cutting speed, (v_c) m/min f.p.m.	90–120 295–395	60–80 200–260	40–60 130–200
Feed, (f) mm/r i.p.r.	0.05–0.15 ²⁾ 0.002–0.006 ²⁾	0.10–0.25 ³⁾ 0.004–0.01 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")

MILLING

FACE AND SQUARE SHOULDER FACE MILLING

Cutting data parameter	Milling with carbide	
	Rough milling	Fine milling
Cutting speed (v_c) m/min f.p.m.	80–100 260–330	100–120 330–390
Feed (f_z) mm/tooth in/tooth	0.2–0.4 0.008–0.016	0.1–0.2 0.004–0.008
Depth of cut (a_p) mm inch	2–4 0.08–0.16	–2 –0.08
Carbide designation ISO	K20, P20* Coated carbide	K15, P15* Coated carbide or cermet

* Use a wear resistant Al_2O_3 coated grade

END MILLING

Cutting data parameter	Type of end mill		
	Solid carbide	Carbide indexable insert	High speed steel ¹⁾
Cutting speed (v_c) m/min f.p.m.	40–50 130–160	70–90 320–295	12–15 39–49
Feed (f_z) mm/tooth in/tooth	0.03–0.20 ²⁾ 0.001–0.008 ²⁾	0.08–0.20 ²⁾ 0.003–0.008 ²⁾	0.05–0.35 ²⁾ 0.002–0.014 ²⁾
Carbide designation ISO	–	P15, K20 ³⁾	–

¹⁾ For coated HSS end mill $v_c = 20–30$ m/min. (66–100 f.p.m.)

²⁾ Depending on radial depth of cut and cutter diameter

³⁾ Use a wear resistant Al_2O_3 coated grade

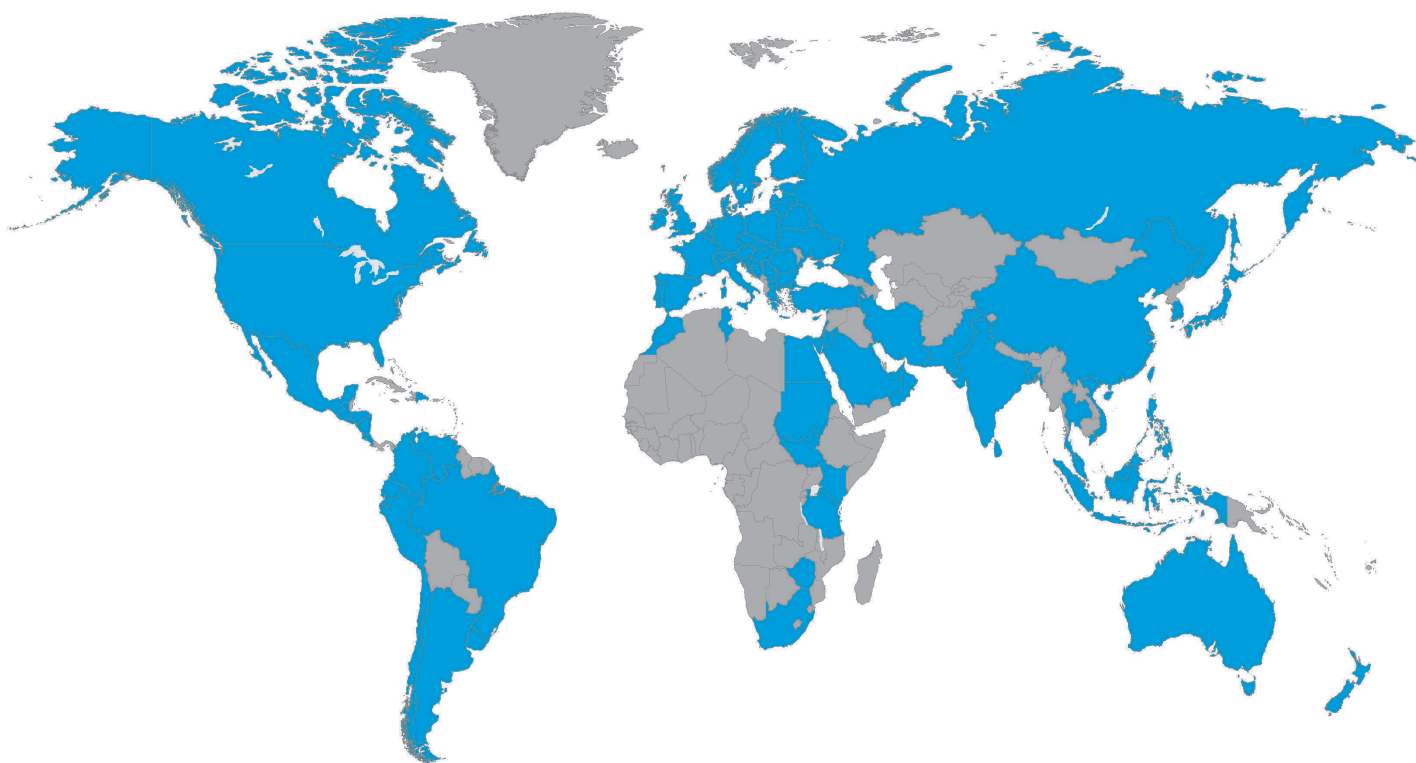
GRINDING

A general grinding wheel recommendation is given below. More information can be found in the Uddeholm publication "Grinding of tool steel".

Type of grinding	Wheel recommendation	
	Annealed condition	Hardened condition
Face grinding straight wheel	A 46 HV	B151 R50 B3 ¹⁾ A 46 HV ²⁾
Face grinding segments	A 36 GV	A 46 GV
Cylindrical grinding	A 60 KV	B151 R50 B3 ¹⁾ A 60 KV ²⁾
Internal grinding	A 60 JV	B151 R75 B3 ¹⁾ A 60 IV
Profile grinding	A 100 JV	B126 R100 B6 ¹⁾ A 120 JV ²⁾

¹⁾ If possible, use CBN-wheels for this application

²⁾ Preferable a wheel type containing ceramic Al_2O_3



NETWORK OF EXCELLENCE

Uddeholm is present on every continent. This ensures you high-quality Swedish tool steel and local support wherever you are. Our goal is clear – to be your number one partner and tool steel provider.

Uddeholm is the world's leading supplier of tooling materials. This is a position we have reached by improving our customers' everyday business. Long tradition combined with research and product development equips Uddeholm to solve any tooling problem that may arise. It is a challenging process, but the goal is clear – to be your number one partner and tool steel provider.

Our presence on every continent guarantees you the same high quality wherever you are. We act worldwide. For us it is all a matter of trust – in long-term partnerships as well as in developing new products.

For more information, please visit www.uddeholm.com