since 1945
75 years

VANAX SUPERCLEAN

UDDEHOLM VANAX SUPERCLEAN

ASSAB

Edition 20200416

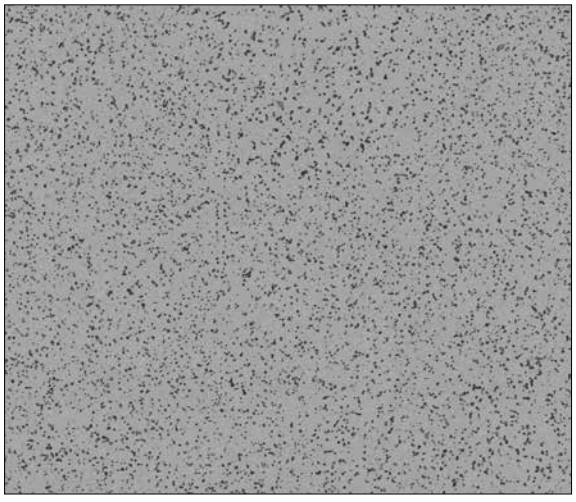
GENERAL

Vanax SuperClean is a Cr-Mo-V-N alloyed steel characterised 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 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 0.36	N 1.55	Si 0.30	Mn 0.30	Cr 18.2	Mo 1.10	V 3.50
Delivery condition	Soft annealed to approx. 260 HB						



Vanax SuperClean – Approx. 13% hard phase particles. 1080°C / DC + 200°C /2 x 2h, 60 HRC.

APPLICATIONS

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 environment
- Wear parts in sliding and rolling engineering applications
- Highly stressed machine parts in corrosive environment

PROPERTIES

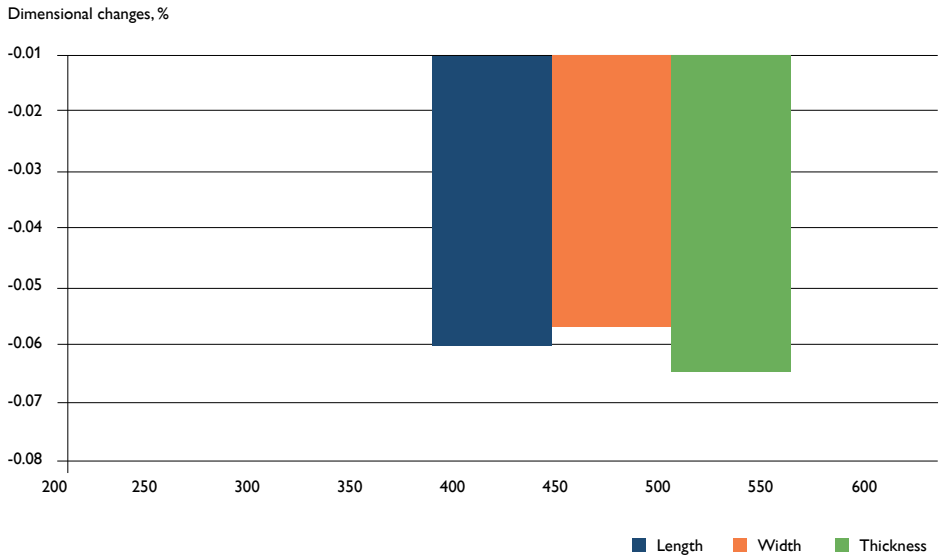
PHYSICAL DATA

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

Temperature	20°C	200°C
Density kg/m^3	7 560	-
Modulus of elasticity MPa	220 000	-
Coefficient of thermal expansion /°C from 20°C	-	11.7 x 10^{-6}
Thermal conductivity W/m°C	-	18
Specific heat J/kg°C	490	-

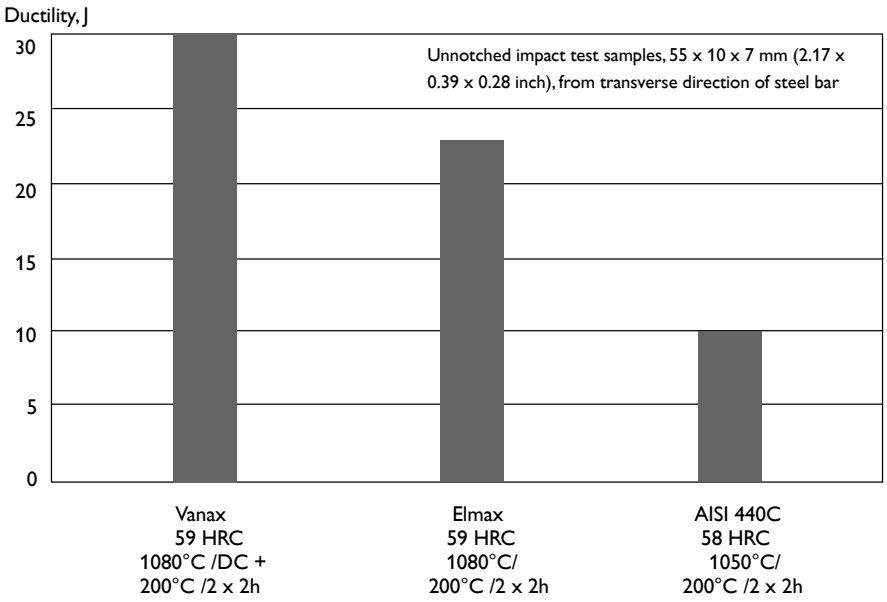
DIMENSIONAL CHANGES

As the steel will contain approx. 10% retained austenite after the recommended heat treatment procedure, 1080°C/30 min + DC + 200°C / 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. Vanax SuperClean has a ductility in parity with or better than Elmax SuperClean.



HEAT TREATMENT

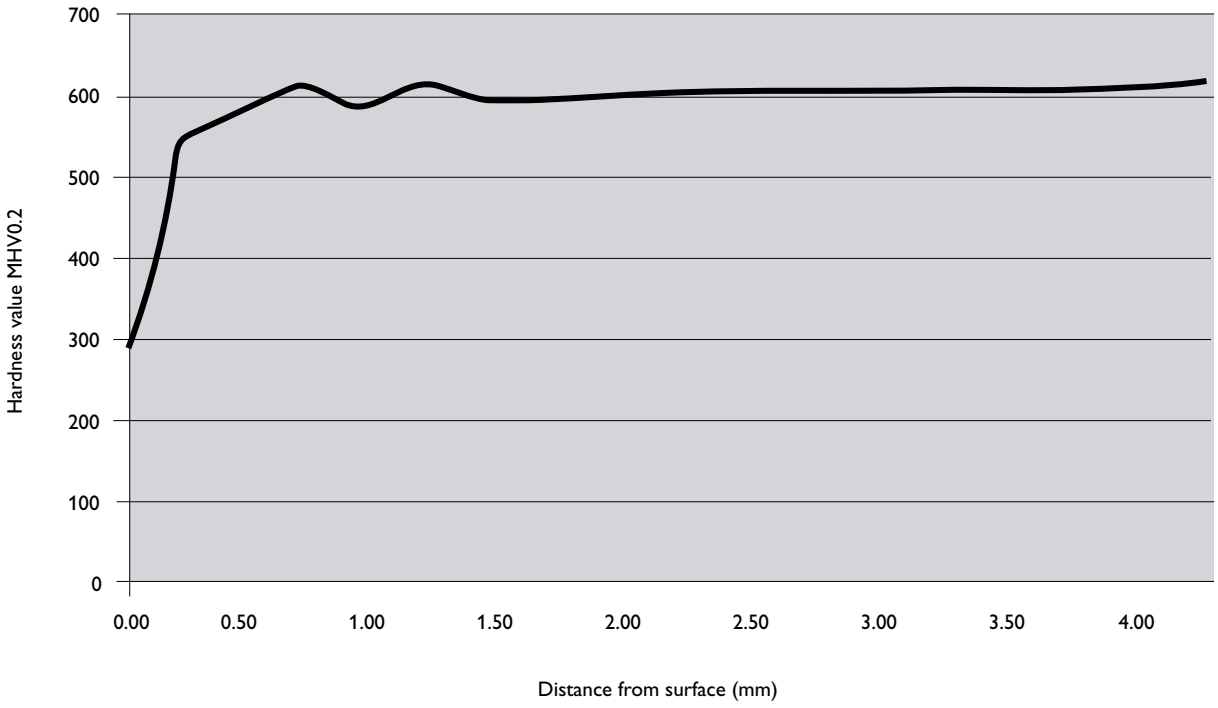
The recommended austenitising temperature for Vanax SuperClean is 1080°C with 30 minutes holding time followed by deep cooling between -100° and -196°C to minimize the amount of retained austenite.

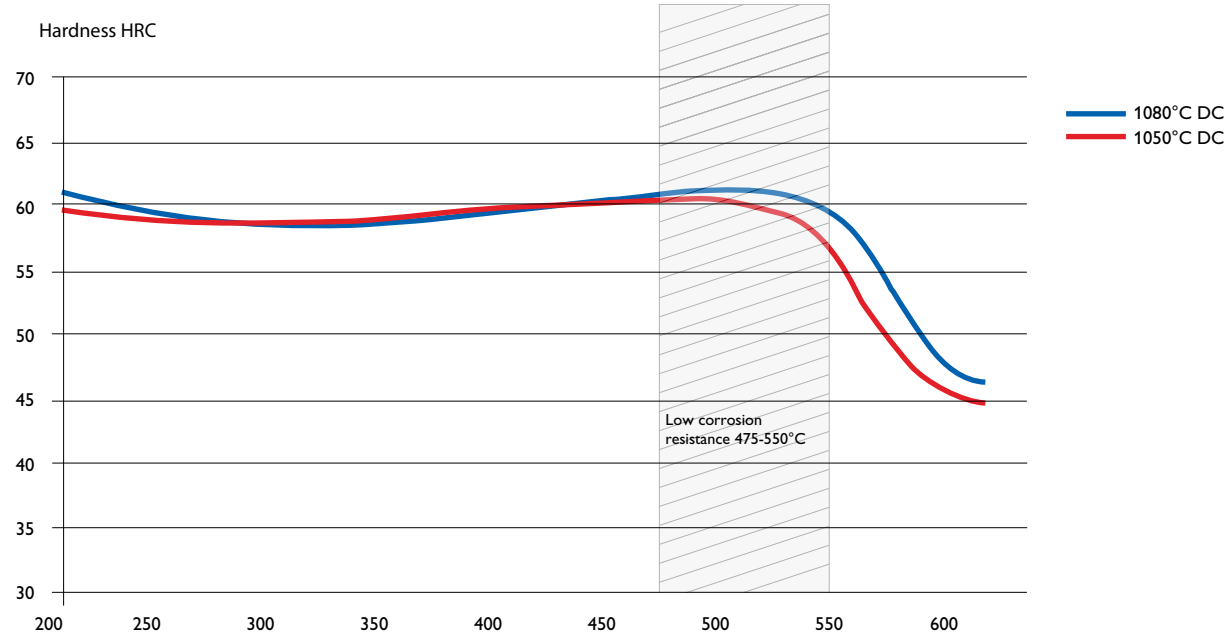
For best corrosion properties low temperature tempering at 200°C / 2 x 2h is recommended. If the product application conditions require a higher tempering temperature Vanax SuperClean can be tempered up to 450°C without significant loss of corrosion properties.

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

Hardness profile without nitrogen partial pressure.





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

TURNING

Cutting data parameter	Turning with carbide		Turning with High speed steel Fine tuning
	Rough tuning	Fine tuning	
Cutting speed (V_c) m/min	100 – 150	150 – 200	12 – 15
Feed. (f) mm/tooth	0.2 – 0.4	0.05 – 0.2	0.05 – 0..3
Depth of cut (a_p) mm	2 – 4	0.5 – 2	0.5 – 3
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 mm	Cutting speed (Vc) m/min	Feed (f) mm/rev
≤ 5	10 – 12*	0.05 – 0.10
5 – 10	10 – 12*	0.10 – 0.20
10 – 15	10 – 12*	0.20 – 0.25
15 – 20	10 – 12*	0.25 – 0.30

* For coated HSS drill vc =16 – 18 m/min.

CARBIDE DRILL

Cutting data parameter	Type of drill		
	Indexable insert	Solid carbide	Carbide tip[1)]
Cutting speed (V_c) m/min	90 – 120	60 – 80	40 – 60
Feed. (f) mm/rev	0.05 – 0.15[2)]	0.10 – 0.25[3)]	0.15 – 0.25[4)]

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

MILLING

FACE AND SQUARE SHOULDER MILLING

Cutting data parameter	Turning with carbide	
	Rough milling	Fine milling
Cutting speed (V_c) m/min	80 – 100	100 – 120
Feed (f) mm/tooth	0.2 – 0.4	0.1 – 0.2
Depth of cut (a_p) mm	2 – 4	≤ 2
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	40 – 50	70 – 90	12 – 15
Feed. (f) mm/tooth	0.03 – 0.20 [2)]	0.08 – 0.20 [2)]	0.05 – 0.35 [2)]
Carbide designation ISO	–	P15, K20 [3)]	–

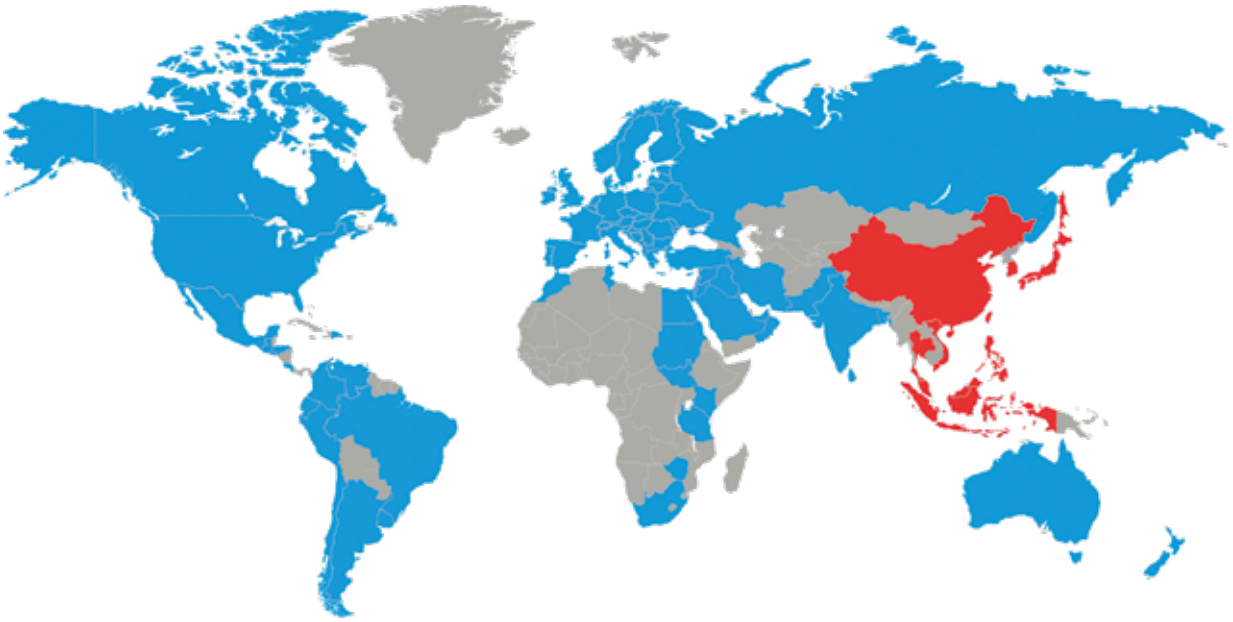
[1)] For coated high speed steel end mill Vc = 20–30 m/min
[2)] Depending on radial depth of cut and cutter diameter
[3)] Use a wear resistant Al_2O_3 coated grade

GRINDING

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

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	B 151 R75 B3 [1)] A 60 IV
Profile grinding	A100 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



Choosing the right steel is of vital importance. ASSAB engineers and metallurgists are always ready to assist you in your choice of the optimum steel grade and the best treatment for each application. ASSAB not only supplies steel products with superior quality, we offer state-of-the-art machining, heat treatment and surface treatment services to enhance steel properties to meet your requirement in the shortest lead time. Using a holistic approach as a one-stop solution provider, we are more than just another tool steel supplier.

ASSAB and Uddeholm are present on every continent. This ensures you that high quality tool steel and local support are available wherever you are. Together we secure our position as the world's leading supplier of tooling materials.

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