

UDDEHOLM ELMAX

SuperClean³ Powder Metallurgical Tool Steel

General Heat Treatment Recommendations

	Vacuum	Salt Bath** / Fluidized Bed	Atmosphere Furnace Muffle Furnace / Packed
	** Salt Bath heat treatment can be performed but is not recommended for details with blind holes or threaded holes that will not be rework after heat treatment.		
Preheating Temperature	1. Bring up to 1200°F, equalize 2. Heat up to 1550°F, equalize (optional)	1. 1100 – 1200°F, equalize 2. 1500 – 1600°F, equalize	1. Bring up to 1200°F, equalize 2. Heat up to 1550°F, equalize
Hardening Temperature (Austenitizing)	1920 – 2010°F (Normally 1980°F) Holding time after the tool or part has fully heated through at the hardening temperature: minimum 30 minutes, maximum 1 hour. Alternatively hold 20 minutes for first 1" and then 15 minutes for each additional inch of wall thickness.		
Quenching *	Alt. 1 Inert gas, positive pressure Alt. 2 Back-filled pressurized gas to 1000°F, then equalize center and surface. Continue to 700°F and equalize. Then cool in circulating air.	Alt. 1 Quench in Salt 390-1020°F, equal then air cool. Alt. 2 Quench in oil 150°F until the part is black, then air cool. Alt. 3 Circulated air.	Alt. 1 Oil 150°F until the part is black, then air cool. Alt. 2 Circulated inert gas. Alt. 3 Circulated air.
	▪ For maximum dimensional stability sub-zero sub-zero treatment can be applied immediately after quench. An increase of 1-2 HRC can then be expected. However, avoid intricate shapes due to the risk of cracking.		
	*Cooling rate must be adequate to ensure good mechanical properties. However, also consider the risk of excessive distortion from very fast cooling.		
Tempering (minimum two times) Temper immediately after quenching when the tool or part reaches 150°F	Tempering Temperatures (°F)		Hardening Temperature
	480°F* 980°F		<u>1980°F</u> 56-58 HRC 57-59 HRC
	Tempering Times: 1 hour per inch of wall thickness, or hold at temperature a minimum of 2 hours. *Not recommended when surface treating tools or when maximum dimensional stability is required.		
Stress Temper performed on hardened tools after EDM	Temperature: Shall be 50°F (25°C) below the highest tempering temperature. Time: Soak 2 hours once tool comes to temperature. Cool in still air.		
Dimensional Stability	Average size change as a result of hardening and tempering may not exceed 0.3% of max dimension if the tool has been stress relieved before finish machining.		

UDDEHOLM ELMAX SuperClean³

Wear Resistant P/M Stainless Tool Steel

- Very good polishability
- Can be readily surface treated
- High hardness stainless steel
- Good corrosion resistance

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. It is your responsibility to confirm you have the latest revision of this document (verify on our website) and that you forward to your Heat Treatment service provider. Failure to do so may result in inferior material properties.

Uddeholm Powder Metallurgy Tool Steel Special Heat Treatment Guidelines

For Optimum Wear Resistance

P/M Steel Grades	VANADIS 4 EXTRA	VANADIS 6	VANADIS 10	ELMAX
Hardening Temp. °F (°C)	2100 (1150)	2100 (1150)	2010 (1100)	2010 (1100)
Tempering Temp. °F (°C)	3x1000 (3x540)	3x1040 (3x560)	3x1000 (3x540)	3x980 (3x525)
Hardness, HRC	63-65	63-65	63-65	58-60

For Optimum Ductility

P/M Steel Grades	VANADIS 4 EXTRA	VANADIS 6	VANADIS 10	ELMAX
Hardening Temp. °F (°C)	1725 (940)	1830 (1000)	1870 (1020)	1920 (1050)
Tempering Temp. °F (°C)	2x1000 (2x540)	2x480 (2x250)	2x480 (2x250)	2x480 (2x250)
Hardness, HRC	54-56	60-62	59-61	54-56

Note:

The choice of heat treatment has to be based on the specific requirements of the individual application.

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