Uddeholm Vanadis® 4 Extra

SuperClean Powder Metallurgical Tool Steel

	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 reworked after heat treatment.		
Preheating Temperature	1. Bring up to 1200°F, equalize 2. Heat up to 1550°F, equalize	1. 1100 – 1200°F, equalize 2. 1500 – 1550°F, equalize	1. Bring up to 1200°F, equalize 2. Heat up to 1550°F, equalize
Hardening Temperature* **(Austenitizing)**	1725 – 2150°F (Normally 1870°F) Holding time after the tool or part has fully heated through at the hardening temperature: 30 to 40 minutes. Alternatively hold 20 minutes for first 1" and then 15 minutes for each additional inch of wall thickness. *For hardening temperatures at 2010 °F and higher, holding time should be 15 minutes once fully heated through. *For best ductility use the lower hardening temperature for the desired hardness range.		
Quenching*	**Alt. 1** Inert gas, positive pressure **Alt. 2** Back-filled pressurized gas to 1050°F, then equalize center and surface. Continue to 600°F and equalize. Then cool in circulating air. *Cooling rate must be adequate to avoid any transformation products, with decreased properties as a result. However, also consider the risk of excessive distortion from very fast cooling. *For maximum dimensional stability, a cryogenic treatment can be applied immediately after quench. An increase in hardness may occur. However, avoid intricate shapes due to risk of cracking.	**Alt. 1** Quench in Salt 930-1020°F **Alt. 2** Circulated high speed inert gas	**Alt. 1** Circulated inert gas **Alt. 2** Circulated air

Tempering

(minimum three times)

Temper immediately after quenching when the complete tool reaches 150°F

Hardening Temperature and Hardness

Tempering Temperature	1870°F / 1885°F	1940°F	2010°F	2100°F	2150°F
1000°F	58-60 HRC				
1040°F	57-59 HRC	60-62 HRC	61-63 HRC	61-63 HRC	62-64 HRC

Tempering Times: Temper 1 hour once the tool is at temperature.
To ensure the highest dimensional stability in service, a minimum of three tempers is required. Check hardness between tempers.

Stress temper performed on hardened tools after EDM, welding or during preventative maintenance	Check hardness to confirm tool status. Temperature: Shall be 50°F below the lowest tempering temperature. Time: Soak 30 minutes per inch of maximum section with a minimum of 2 hours once tool comes to temperature. Cool in still air.
Dimensional Stability	Average size change as a result of hardening and tempering should not exceed 0.003 inch/inch/maximum dimension if the tool has been stress relieved before finish machining. If stress relieving is not performed as recommended, dimensional stability may be inconsistent and cannot be guaranteed.

Characteristics

- Excellent chipping resistance for superior edge retention
- Excellent machinability
- Excellent choice for cutting and forming high strength work materials
- Readily coatable

UDDEHOLM
a voestalpine company

USA/Canada: 1-800-METAL20
Mexico: +52 442-349-7946
Website: www.uddeholm.com