

# VANADIS 4 EXTRA®

## SuperClean<sup>3</sup> Powder Metallurgical Tool Steel Heat Treatment Recommendation

	Vacuum	Salt Bath / Fluidized Bed	Atmosphere Furnace Muffle Furnace / Packed
<b>Preheating Temperature</b>	1. Bring up to 1200°F, equalize 2. Heat up to 1450°F, equalize	1. 1100 – 1200°F, equalize 2. 1400 – 1450°F, equalize	1. Bring up to 1200°F, equalize 2. Heat up to 1450°F, equalize
<b>Hardening<sup>1,2</sup> Temperature (Austenitizing)</b>	1800 – 2100°F (Normally 1870°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.		
<b>Quenching<sup>3</sup></b>	<b>Alt. 1</b> Inert gas, positive pressure <b>Alt. 2</b> Back-filled pressurized gas to 1050°F, then equalize center and surface. Continue to 600°F and equalize. Then cool in circulating air.	<b>Alt. 1</b> Quench in Salt 390-930°F <b>Alt. 2</b> Circulated high speed inert gas	<b>Alt. 1</b> Circulated inert gas <b>Alt. 2</b> Circulated air
<b>Tempering (minimum two times)</b>  <b>Temper immediately after quenching when the complete tool reaches 150°F</b>	Tempering Temperatures (°F)  980 1020 1050  Tempering Times: 1 hour per inch of wall thickness, or hold at temperature a minimum of 2 hours.	Hardening Temperatures  1870°F 60-62 HRC 58-60 HRC 56-58 HRC	Hardening Temperatures  1940°F 61-63 HRC 59-61 HRC 57-59 HRC  2010°F 62-64 HRC 61-63 HRC 59-61 HRC
<b>Stress Temper performed on hardened tools after EDM.</b>	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.		
<b>Dimensional Stability</b>	Average size change as a result of hardening and tempering may not exceed 0.0015 inch per inch per dimension if the tool has been stress relieved before finish machining.  If Stress relieving is not performed as recommended, dimensional stability maybe inconsistent and cannot be guaranteed.		

<sup>1</sup> For Hardening temperatures at and over 2010°F soaking time should decrease.

<sup>2</sup> For best ductility use the lower hardening temperature for the desired hardness range in connection with the above tempering temperatures.

<sup>3</sup> 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.

### Vanadis 4 Extra®

#### Designed to Meet Customers Demanding Needs

- Excellent toughness and ductility - improved tooling performance
- Excellent hardenability – improved heat treatment response
- Higher working hardness – improved tool life
- Excellent Machinability – decreases machining time

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.

**BÖHLER**  **UDDEHOLM**

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