

# HOTVAR®

## Premium High Hardness Hot Work Die Steel Heat Treatment Recommendations

	Vacuum / Atmosphere Furnace Muffle Furnace/Packed	Salt Bath/Fluidized Bed												
<b>Preheating Temperature</b>	1. Bring up to 1200°F, equalize 2. Heat up to 1550°F, equalize	1. 800-900°F, equalize 2. 1100-1200°F, equalize 3. 1500-1650°F, equalize Step 1 only for big blocks (cross section above 6")												
<b>Hardening Temperature Austenitizing</b>	1920-1960°F (Normally 1920°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*</b>	<b>Alt. 1</b> Inert gas, positive pressure <b>Alt. 2</b> Back-filled pressurized gas to 610-840°F, then equalize center and surface (Maximum holding time 30 minutes) Continue forced cooling to 150°F	<b>Alt. 1</b> Oil 175°F until the die is black, then air cool <b>Alt. 2</b> Circulated high speed inert gas												
		<b>Alt. 1</b> Quench in oil 175°F until the die is black <b>Alt. 2</b> Martempering, salt bath or fluidized bed at 840-1020°F or 360-390°F												
<b>Tempering (minimum two times)</b>  <b>Temper immediately after quenching when the complete tool reaches 150°F</b>	<table style="margin: auto;"> <thead> <tr> <th>Temperature</th> <th>Hardness</th> </tr> </thead> <tbody> <tr> <td>1020°F</td> <td>56-58 HRC</td> </tr> <tr> <td>1070°F</td> <td>54-56 HRC</td> </tr> <tr> <td>1090°F</td> <td>52-54 HRC</td> </tr> <tr> <td>1125°F</td> <td>50-52 HRC</td> </tr> <tr> <td>*480°F</td> <td>56-58 HRC</td> </tr> </tbody> </table>	Temperature	Hardness	1020°F	56-58 HRC	1070°F	54-56 HRC	1090°F	52-54 HRC	1125°F	50-52 HRC	*480°F	56-58 HRC	
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	* The 480°F temper can be used in applications experiencing less than 450°F working temperatures, where maximum ductility is required. It is <b>NOT</b> recommended where high temperature coatings (>450°F), welding or extensive EDM is expected to be performed.													
<b>Stress temper performed on hardened tools after EDM; welding with QRO 90 or DIEVAR TIG Rods; or during preventative maintenance.</b>	Check hardness to confirm tool status. Temperature: Shall be 50°F(25°C) below the highest tempering temperature, or 970°F minimum whichever is higher. For the 480°F temper, the stress temper should be performed at 430°F. Time: Soak 30 minutes per inch of maximum section with a minimum of 2 hours once tool comes to temperature. Cool in still air for simple shapes. For complex shapes, furnace cool to 800°F, then air cool for high temperature tempered tools. Furnace cool to room temperature on tools tempered at 480°F.													
Average size change as a result of hardening and tempering may not exceed .005 inch/inch/maximum dimension (.0025" /inch side) if the tool has been stress relieved before finish machining.  If stress relieving is not performed as recommended, movement in excess of .007 inch/inch/maximum dimension may be experienced, and cannot be guaranteed.														

\* 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. A minimum quench rate of 50°F/minute as measured at a depth of ~ 5/8" is recommended to optimize tool properties.

### HOTVAR® - Re-defining Die Steels

- Excellent hot wear resistance and thermal properties—improved tooling life
- Increased working hardness—improved tooling performance
- Very good toughness and ductility—more consistent tooling life

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.