

DIEVAR®

Premium Hot Work Die Steel Heat Treatment Recommendations

	Vacuum / Atmosphere Furnace Muffle Furnace/Packed	Salt Bath/Fluidized Bed	
Preheating Temperature	Blocks < 12 inches thick 1. Bring up to 1200°F, equalize 2. Heat up to 1550°F, equalize	Blocks ≥12 inches thick 1. Bring up to 1100-1200°F, equalize 2. Heat up to 1510°F, equalize 3. Heat up to 1650°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")
Hardening Temperature Austenitizing	1830-1875°F (Normally 1850°F) For dies greater than 6" in cross section 1850-1870°F is recommended. 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 610-840°F, then equalize center and surface (Maximum holding time 30 minutes) Continue forced cooling to 150°F	Alt. 1 Oil 175°F until the die is black, then air cool Alt. 2 Circulated high speed inert gas	Alt. 1 Quench in oil 175°F until the die is black Alt. 2 Martempering, salt bath or fluidized bed at 840-1020°F or 360-390°F
Tempering (minimum two times) Temper immediately after quenching when the complete tool reaches 150°F	Temperature 1050°F 1070°F 1090°F 1125°F 1150°F	Hardness 48-52 HRC 46-50 HRC 44-48 HRC 42-46 HRC 40-44 HRC	Time: 1 hour per inch of wall thickness, or hold at temperature a minimum of 2 hours.
Stress temper performed on hardened tools after EDM; welding with QRO 90 or DIEVAR TIG Rods, or during preventative maintenance.	Check hardness to confirm tool status. Temperature: Shall be 50°F(25°C) below the highest tempering temperature, or 1020°F minimum whichever is higher. 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.		
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.			

The generally recommended hardness ranges for the following hot work tool steels in die casting applications are as follows if there are no gross cracking issues:

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Die parts < 5 inches thick	46-48 HRC	47-52 HRC
Die parts 5 to 9 inches thick	44-46 HRC	45-47 HRC
Die parts > 9 to 12 inches	42-44 HRC	43-45 HRC
Die parts > 12 to 16 inches	40-42 HRC	41-43 HRC
Die parts > 16 inches	Per Application	

*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.

DIEVAR® - Re-defining Die Steels

- Excellent toughness and ductility – improved tooling performance
- Excellent hardenability – improved heat treatment response
- Higher working hardness – improved tool 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. Current revision of this document located on our website.