

# Uddeholm Sleipner

## Cold Work 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 rework after heat treatment.																						
<b>Preheating Temperature</b>	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																				
<b>Hardening Temperature (Austenitizing)</b>	1740 – 1980°F (Normally 1890-1920°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 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 bath at 390-660°F <b>Alt. 2</b> Circulated high speed inert gas	<b>Alt. 1</b> Circulated inert gas <b>Alt. 2</b> Circulated air																				
	*Quench as rapidly as possible without cracking or creating excessive distortion.																						
<b>Tempering</b>  (minimum twice*)  Temper immediately after quenching when the complete tool reaches 150°F	<table border="0"> <thead> <tr> <th><u>Tempering Temperatures (°F)</u></th> <th colspan="3"><u>Hardening Temperatures and Hardness</u></th> </tr> <tr> <td></td> <td>1885°F</td> <td>1920°F</td> <td>1980°F**</td> </tr> </thead> <tbody> <tr> <td>1020°F</td> <td>59-61 HRC</td> <td>60-62 HRC</td> <td>62-64 HRC</td> </tr> <tr> <td>1040°F</td> <td>57-59 HRC</td> <td>58-60 HRC</td> <td>61-63 HRC</td> </tr> <tr> <td>1050°F</td> <td>56-58 HRC</td> <td></td> <td></td> </tr> </tbody> </table> <p>Tempering Time: 1 hour per inch of wall thickness, or hold at temperature for a minimum of 2 hours once the tool comes to temperature. *For high dimensional stability temper 3 times for one hour each. An increase of 1-2 HRC points may be achieved. **Temper three times when austenitizing at 1980°F</p>			<u>Tempering Temperatures (°F)</u>	<u>Hardening Temperatures and Hardness</u>				1885°F	1920°F	1980°F**	1020°F	59-61 HRC	60-62 HRC	62-64 HRC	1040°F	57-59 HRC	58-60 HRC	61-63 HRC	1050°F	56-58 HRC		
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<b>Stress Temper performed on hardened tools after EDM or after welding</b>	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.																						
<b>Dimensional Stability</b>	Average size change as a result of hardening and tempering may 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

- Good combination of toughness and wear resistance
- Capable of high hardness (>60 HRC) with high temper
- Wear resistance similar to D2 with better chipping 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. Revision Date: June 5, 2018