

## S7 SHOCK RESISTING TOOL STEEL

S7 toolsteel has exceptional impact properties plus the highest hardenability of shock resisting grades of tool steel. It also possesses good softening resistance at high temperatures which gives it hot work capabilities. Because of its unusual combination of properties, S7 is suitable for a wide range of tool and die applications. It is used for hot and cold shock applications, medium hot-work dies and medium-run cold work tools and dies.

### Typical Applications

Shear Blades	Extrusion Dies	Leaf Springs
Bending Dies	Gripper Dies	Pipe Cutters
Chisels	Hot Header Dies	Plastic Molds
Die Casting Dies	Mandrals	Punches
Zinc Die Casting Dies	Collets	Cold Forming Dies

Colour Code	Stocked Sizes	
Yellow & Black (Bar end) 	Rounds	25 mm - 102 mm Dia
	Squares	250 mm

### Related Specifications

Germany	W-nr 1.2357
USA	AISI S7

### Chemical Composition

	%
Carbon	0.50
Silicon	0.30
Manganese	0.60
Chromium	3.30
Molybdenum	1.40
Vanadium	0.20

### Physical Properties

<b>Elastic Modulus</b>	207GPa	
<b>Density</b>	7.83 g/cm <sup>3</sup>	
<b>Thermal Conductivity</b>	W/m- °K	Cal/cm-s-°C
<b>at 95°C</b>	28.5	0.068

### Thermal Properties

<b>Critical Temperature:</b>	800c
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<b>CTE, linear 20°C</b>	12.59µm/m- °C
<b>CTE, linear 250°C</b>	13.33µm/m- °C
<b>CTE,linear 500°C</b>	14.27µm/m- °C
<b>Transformation Temperature</b>	785 °C

\*Material stocked in annealed condition

**Heat Treatment**

**Annealing:**

Heat to 845C,hold for 2hours, slow cool 30C per hour to 540C then air cool.  
Or heat to 845C, hold 2hrs., cool to 760C hold 4hrs,then air cool

**Annealed Hardness About BHN 187/220**

**Stress Relief**

Annealed Parts:	Heat to 650-675°C, hold for 2hours, then cool in still air.
Hardened Parts:	Heat to 15-30°C below the original tempering temperature, hold for 2 hours, then cool in still air

**Hardening**

<b>Preheat:</b>	Heat to 730-760C, equalize
<b>Austenitize:</b>	940-955C, Hold time at temperature 30-45 minutes
<b>Quench:</b>	Air, positive pressure quench 2bar minimum or interrupted oil to below 65C Sections above >75mm may require interrupted oil quench or higher bar pressure. Oil quench to 540-595C, then air cool to handwarm
<b>Temper:</b>	205-540°C Temper 2hours minimum or at least 1hour per 25mm of thickness. Double Tempering is recommended. Cool to room temperature in between tempers.
<b>Size Change:</b>	0.10% when air cooled from 940/955°C and tempered at 205°C

**Heat Treat Response  
Hardness and Impact Toughness Data**

**Austenitized 940°C Air Cool**

Tempering Temperature			HRC	Charpy C-Notch Joules
As Air Quenched	59-61	62		
205°C	55-58	171		
260°	54-56	169		
315°	53-55	156		
370°	52-54	142		
420°	52-54	138		
480°	51-53	163		
540°	50-52	203		
595°	46-48	257		
650°	40-42	___		
705°	33-35	___		

\* Note all values are approximate and depend on type of heat treatment and quenching rates.

**Flame, Induction Hardening or Nitriding Steel**

Very good Flame, Induction Hardening and Nitriding Steel

**Welding**

Welding should be carried out by an experienced Die repair welder.  
Choice of weld consumable, consult your supplier. Preheating and retempering of work piece is a must.

**Polishing**

S7 has good polishability in the hardened and tempered condition. Normal polishing techniques should be followed, taking care not to over polish as this will lead to a poor surface finish.

#### **Hard Chrome Plating**

After hard chrome plating, tool should be tempered for approximately 4 hours at 180°C so as to avoid hydrogen embrittlement.

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