

## AISI Type H-13 Hot Work Tool Steel

**Material Notes:** High hardenability, excellent wear resistance and hot toughness. H13 has good thermal shock resistance and will tolerate some water cooling in service. Nitriding will improve hardness, but can diminish shock resistance if hardened layer is too thick. Electroslag Remelted (ESR) H13 has greater homogeneity and an exceptionally fine structure, resulting in improved machinability, polishability and high temperature tensile strength.

**Applications:** Hot Work Applications: **Pressure Die Casting Tools, Extrusion Dies, Forging Dies, Hot Shear Blades, Stamping Dies, Plastic Moulds.** ESR H13 is Great For Aluminum-die casting Tools And Plastic Mold Tools Requiring A Very High Polish.



**Weldability:** Pre and Post-heating recommended, can be welded with oxy acetylene, inert shielded gas and shielded metal arc; Filler should be similar to the base metal.

**Key Words:** UNS T20813, ASTM A681, FED QQ -T-570, BS 4659 BH13, BS 4659 H13, BS EN ISO 4957 :2000 X40CrMoV5-1, Werkstoff 1.2344

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Physical Properties	Metric	English	Comments
Density	7.80 g/cc	0.282 lb/in <sup>3</sup>	

Mechanical Properties	Metric	English	Comments
Hardness, Rockwell C	28 - 30	28 - 30	air or oil quenched and tempered at 705°C (1300°F).
	31 - 33	31 - 33	air or oil quenched and tempered at 675°C (1250°F).
	39 - 41	39 - 41	air or oil quenched and tempered at 650°C (1200°F).
	45 - 47	45 - 47	air or oil quenched and tempered at 620°C (1150°F).
	49 - 51	49 - 51	air or oil quenched and tempered at 595°C (1100°F).
	51 - 53	51 - 53	air or oil quenched and tempered at 565°C (1050°F).
	51 - 53	51 - 53	air quenched from 1025°C (1875°F) or oil quenched from 1010°C (1850°F) with no temper, or tempered for 1 hour at 315°C (600°F), 425°C (800°F), and 480°C (900°F).
	52 - 54	52 - 54	air or oil quenched and tempered at 510°C (950°F) and 540°C (1000°F).
Tensile Strength, Ultimate	1990 MPa	289000 psi	at HRC = 55 (air or oil quenched from 995-1025°C)
Tensile Strength, Yield	1650 MPa	239000 psi	at HRC = 55 (air or oil quenched from 995-1025°C)
Elongation at Break	9.0 %	9.0 %	at HRC = 55 (air or oil quenched from 995-1025°C)
Modulus of Elasticity	210 GPa	30500 ksi	
Bulk Modulus	140 GPa	20300 ksi	Typical for steel.
Poissons Ratio	0.30	0.30	Calculated
Machinability	50 %	50 %	Based on 1% carbon steel, as 100% machinability
Shear Modulus	81.0 GPa	11700 ksi	Estimated from elastic modulus

Thermal Properties	Metric	English	Comments
CTE, linear 	11.0 µm/m-°C	6.11 µin/in-°F	
	@Temperature 25.0 - 95.0 °C	@Temperature 77.0 - 203 °F	
	11.5 µm/m-°C	6.39 µin/in-°F	
	@Temperature 25.0 - 205 °C	@Temperature 77.0 - 401 °F	
	12.4 µm/m-°C	6.89 µin/in-°F	
	@Temperature 25.0 - 540 °C	@Temperature 77.0 - 1000 °F	
Specific Heat Capacity	0.460 J/g-°C	0.110 BTU/lb-°F	
	@Temperature 0.000 - 100 °C	@Temperature 32.0 - 212 °F	
Thermal Conductivity 	24.3 W/m-K	169 BTU-in/hr-ft <sup>2</sup> -°F	
	@Temperature 215 °C	@Temperature 419 °F	
	24.3 W/m-K	169 BTU-in/hr-ft <sup>2</sup> -°F	
	@Temperature 475 °C	@Temperature 887 °F	
	24.4 W/m-K	169 BTU-in/hr-ft <sup>2</sup> -°F	
	@Temperature 350 °C	@Temperature 662 °F	
	24.7 W/m-K	171 BTU-in/hr-ft <sup>2</sup> -°F	
	@Temperature 605 °C	@Temperature 1120 °F	

Processing Properties	Metric	English	Comments
Processing Temperature	540 - 650 °C	1000 - 1200 °F	Tempering Temperature
	995 - 1040 °C	1820 - 1900 °F	Hardening Temperature
Annealing Temperature	845 - 900 °C	1550 - 1650 °F	

Component Elements Properties	Metric	English	Comments
Carbon, C	0.32 - 0.40 %	0.32 - 0.40 %	
Chromium, Cr	5.13 - 5.25 %	5.13 - 5.25 %	
Iron, Fe	>= 90.95 %	>= 90.95 %	as remainder
Molybdenum, Mo	1.33 - 1.4 %	1.33 - 1.4 %	
Silicon, Si	1.0 %	1.0 %	
Vanadium, V	1.0 %	1.0 %	

Descriptive Properties		
Annealing Temperature	850 - 870°C for 4 hours	furnace cool 20°C per hour max.
Stress Relieving Temperature	600 - 650°C for 2 hours (approx.)	cool in still air; always stress relief before hardening.

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