

CarTech® A9 Tool Steel

(ASTM A9)

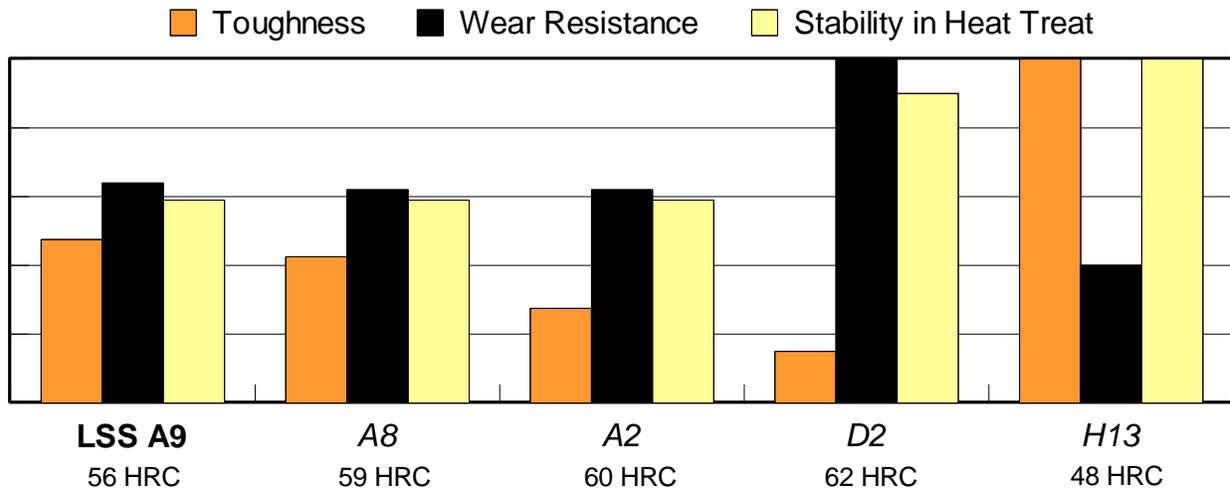
Typical Composition

C	Mn	Si	Cr	Mo	V	Ni
0.50	0.35	1.05	5.15	1.55	1.00	1.50

CarTech A9 tool steel is a 5% chromium tool steel with a unique combination of properties that make it suitable for both cold work and hot work tooling applications. The combination of nickel, vanadium, and a relatively low carbon content provide excellent toughness and hardenability with good wear resistance.

Typical applications for CarTech A9 tool steel include shear blades, punches and dies, forming tools, hot upsetting dies, and hot gripper dies.

Relative Properties



Physical Properties

Density: 0.281 lb/in³ (7780 kg/m³)

Specific Gravity: 7.78

Modulus of Elasticity: 30x10⁶ psi (207 GPa)

Machinability: 65 - 70% of a 1% carbon steel

Coefficient of Thermal Expansion: (at 55-56 HRC)

Temperature, °F	in/in °F ⁻¹ x10 ⁻⁶	Temperature, °C	mm/mm °C ⁻¹ x10 ⁻⁶
100 - 800	6.65	38 - 427	11.97
100 - 1000	6.68	38 - 538	12.00
100 - 1200	7.06	38 - 649	12.71

CARTECH A9

HEAT TREATING INSTRUCTIONS

(See Tech-Topics Bulletin 102 for a more thorough explanation of heat treating.)

HARDENING:

Preheating: Heat at a rate not exceeding 400°F per hour (222°C per hour) to 1400-1450°F (760-788°C) and equalize.

Austenitizing (High Heat): Heat slowly from the preheat to 1800-1850°F (982-1010°C)

Soak for 30 minutes for the first inch (25.4 mm) of thickness, plus 15 minutes for each additional inch (25.4 mm).

Quenching: Air, pressurized gas, or interrupted oil to 150-125°F(66-51°C).

For oil, quench until black, about 900°F (482°C), then cool in still air to 150-125°F(66-51°C).

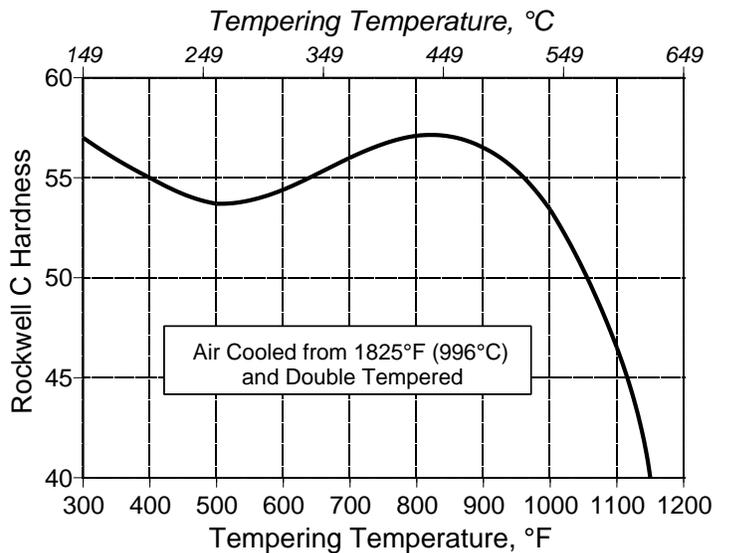
Tempering: *Temper immediately after quenching.* Hold at temperature for 1 hour per inch (25.4 mm) of thickness, 2 hours minimum, then air cool to ambient temperature. The typical tempering range is 900 to 1100°F (482 to 593°C)

To minimize internal stresses in cross sections greater than 6 inches (152.4 mm) and to improve stability in tools that will be EDM'd after heat treatment, a soaking time of 4 to 6 hours at the tempering temperature is strongly recommended.

Cryogenic Treatment: Refrigeration treatments should typically be performed after the first temper, and must be followed by a second temper.

ANNEALING: Annealing must be performed after hot working and before rehardening.

Heat at a rate not exceeding 400°F per hour (222°C per hour) to 1550°F (843°C), and hold at temperature for 1 hour per inch (25.4mm) of maximum thickness; 2 hours minimum. Then cool slowly with the furnace at a rate not exceeding 25°F per hour (14°C per hour) to 1000°F (538°C). Continue cooling to ambient temperature in the furnace or in air. The resultant hardness should be a maximum of 248 HBW.



The data presented herein are typical values, and are not a guarantee of maximum or minimum values. Applications specifically suggested for material described herein are made solely for the purpose of illustration to enable the reader to make his/her own evaluation and are not intended as warranties, either express or implied, of fitness for these or other purposes. There is no representation that the recipient of this literature will receive updated editions as they become available.

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