

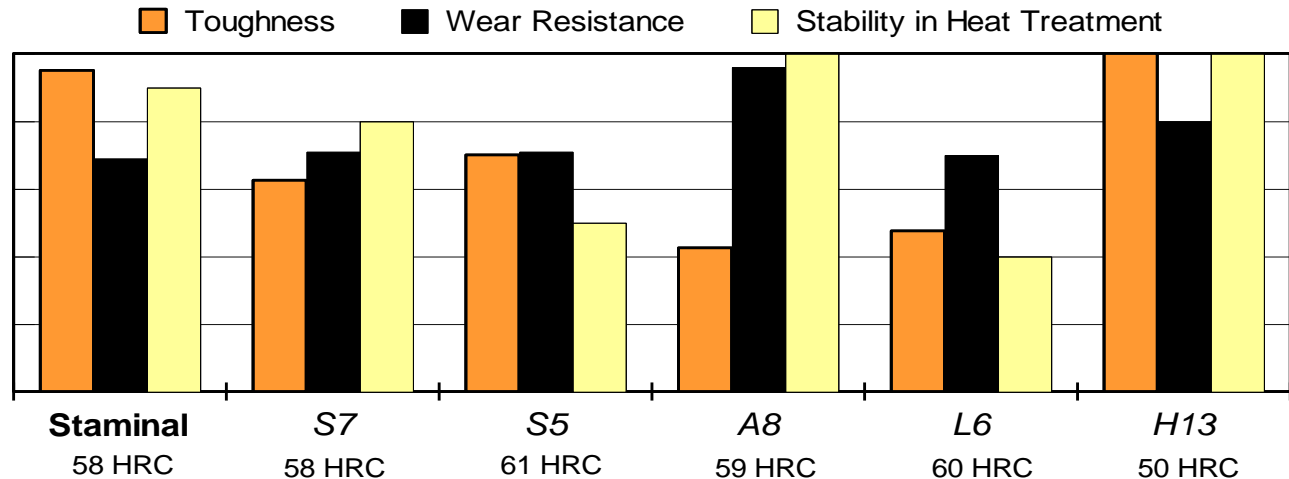
## CarTech Staminial® Shock Resisting Steel

### Typical Composition

C	Mn	Si	Cr	Ni	Mo	V
0.55	0.90	1.0	0.40	2.70	0.45	0.13

CarTech Staminial is an air or oil hardening die steel containing a large percentage of nickel combined with a proper balance of other alloying elements for deep hardening and extreme toughness. For tools, dies, or other parts that operate in the range of Rockwell C 56-58 and where maximum toughness is required, CarTech Staminial is suggested. It is well suited for applications where extreme pressures are involved, such as cams, gears, other machinery parts, and master hobs. Non-deforming characteristics make it a good selection for intricate shear blades, forming dies, hobs for cold hobbing, swaging dies, punches and stamps. It has also been found to give long life for mandrels for both hot and cold work. Staminial possesses good non-deforming characteristics and is relatively easy to heat treat because of its wide hardening range.

### Relative Properties



### Room Temperature Tensile Properties

Tempering Temperature		Hardness HRC	Tensile Str.		Yield Str.		EL in 2" %	RA %
°F	°C		ksi	MPa	ksi	MPa		
400	204	56	285	1965	242	1670	5	20
600	316	54	270	1860	235	1620	11	25
800	427	49	245	1690	220	1515	12	27
1000	538	45	220	1515	195	1345	13	28
1200	649	36	190	1310	165	1140	15	35

All samples oil quenched from 1600°F (871°C) prior to tempering.

# CARTECH STAMINAL®

## 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 1200-1300°F (649-704°C) and equalize.

**Austenitizing (High Heat):** Heat slowly from the preheat.

Furnace or Salt: 1600°F (871°C)

Soak for 40 minutes for the first inch (25.4 mm) of thickness, plus 20 minutes for each additional inch (25.4 mm).

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

For the oil quench, 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 350 - 400°F (177 - 204°C) for cold work applications and 800 - 900°F (427 - 482°C) for hot work applications. Double tempering is required for 600°F and above.

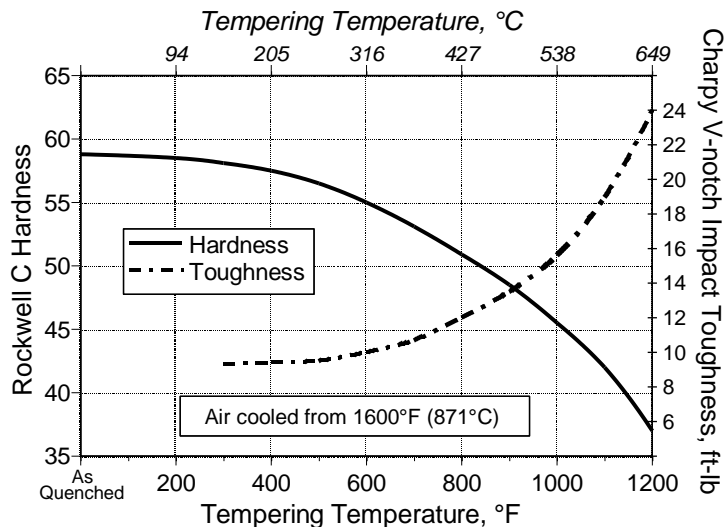
To minimize internal stresses in cross sections greater than 6 inches (152.4 mm) and to improve stability in tools that will be EDM'd after heat treatment, a soaking time of 4 to 6 hours at the tempering temperature is strongly recommended.

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

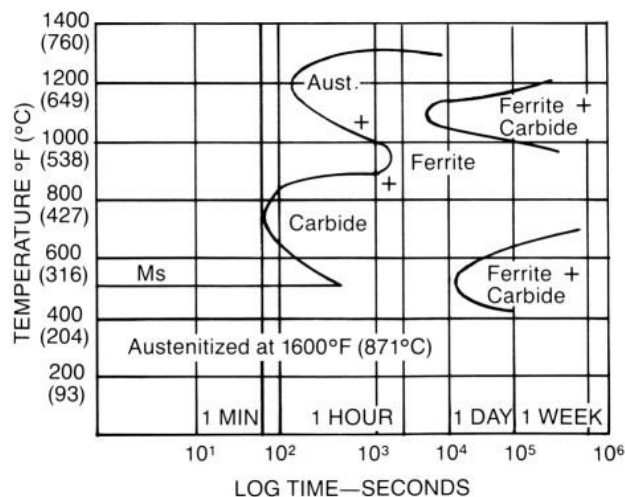
Heat at a rate not exceeding 400°F per hour (222°C per hour) to 1550-1600°F (843-871°C), and hold at temperature for 1 hour per inch (25.4 mm) of thickness, 2 hours minimum. Cool slowly with the furnace at a rate not exceeding 50°F per hour (28°C per hour) to 1000°F (538°C). Continue cooling to ambient temperature in the furnace or in air. Then reheat to 1100-1125°F (593-607°C) and hold for 2 hours per inch of thickness. Slow cool with the furnace. The resultant hardness should be 255-285 HBW.

## HEAT TREATMENT RESPONSE

As Air Cooled from	HRC
1300°F (704°C)	30.0
1400°F (760°C)	56.0
1500°F (816°C)	58.0
1600°F (871°C)	59.0



## TIME-TEMPERATURE TRANSFORMATION



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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