

# DATA SHEET



LATROBE SPECIALTY  
STEEL COMPANY

Latrobe, PA 15650-0031 USA

## Graph-Air<sup>®</sup> Cold Work Tool Steel (ASTM A10)

Issue 1

Typical Composition

C	Mn	Si	Ni	Mo
1.35	1.80	1.20	1.85	1.50

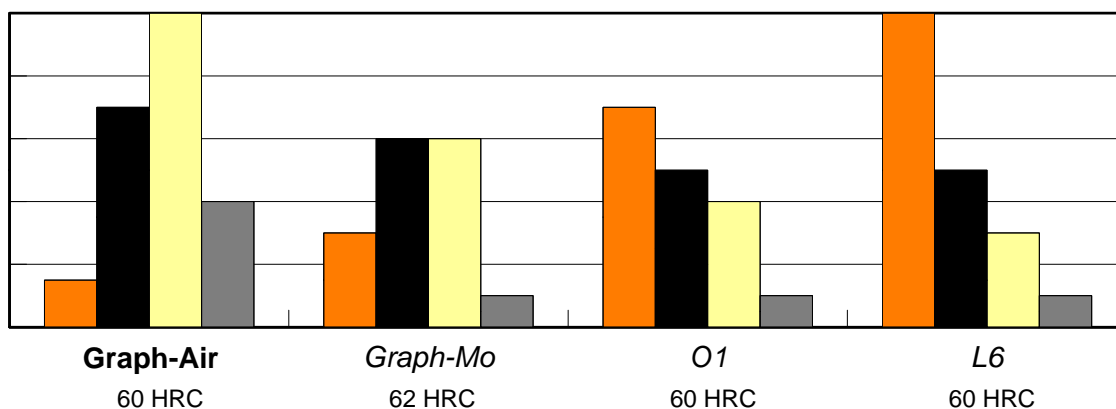
**Graph-Air tool steel** is an air-hardening, graphitic tool steel with outstanding resistance to metal-to-metal sliding wear and galling. The steel contains a uniform dispersion of graphite particles, which impart excellent machinability and non-seizing characteristics. The graphite particles make the steel self-lubricating in dry environments, and help to retain oil in lubricated environments.

Graph-Air tool steel can be hardened to over 60 Rockwell C from a relatively low hardening temperature, which minimizes size change and distortion during heat treatment.

Typical applications include thread gauges, master gages, cams, bushings, sleeves, meat granulator plates, arbors, forming rolls, shear blades, punches, dies, bar feed guides and other machine tool parts.

### Relative Properties

■ Toughness   ■ Wear Resistance   ■ Stability in Heat Treat   ■ Temper Resistance



### Physical Properties

Density: 0.277 lb/in<sup>3</sup> (7680 kg/m<sup>3</sup>)

Specific Gravity: 7.680

Modulus of Elasticity: 30x10<sup>6</sup> psi (207 GPa)

Coefficient of Thermal Expansion: (at 62-63 HRC)

Temperature, °F	in/in °F <sup>-1</sup> x10 <sup>-6</sup>	Temperature, °C	mm/mm °C <sup>-1</sup> x10 <sup>-6</sup>
75 - 200	7.10	24 - 93	12.78
75 - 400	7.36	24 - 204	13.25

Machinability: 85 -90% of a 1% carbon steel

# Graph-Air®

## HEAT TREATING INSTRUCTIONS

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

### HARDENING:

**Preheating:** Preheating is not required, but for tools with complex geometries, may be beneficial for dimensional stability. Heat at a rate not exceeding 400°F per hour (222°C per hour) to 1200-1250°F (649-677°C) and equalize.

**Austenitizing (High Heat):** Heat slowly from the preheat to 1450-1550°F (788-843°C).

- Up to 2 in. (51mm) thickness: use 1450°F (788°C)
- 2 in. (51mm) to 4 in. (101.6mm) thickness: use 1475°F (802°C)
- Over 4 in. (101.6mm) thickness: use 1500°F (816°C)

**Quenching:** Air cool to 90 to 80°F (32 to 27°C).

**Tempering:** Temper immediately after quenching. The typical tempering range is 300 - 500°F (149 - 260°C). Hold at temperature for 1 hour per inch (25.4 mm) of thickness, 2 hours minimum, then air cool to ambient temperature. The actual hardness obtained is dependent upon the section size of the part being quenched and tempered.

To minimize internal stresses in cross sections greater than 3 inches (76.2 mm) and to improve stability in parts that will be EDM'd after heat treatment, a soaking time of 4 to 6 hours at the tempering temperature is strongly recommended.

## HEAT TREATMENT RESPONSE

Thickness	As Air Cooled from	HRC
2 in. (51mm)	1450°F (788°C), 45 minutes	63
3 in. (76mm)	1475°F (802°C), 60 minutes	62
5 in. (127mm)	1500°F (816°C), 120 minutes	61

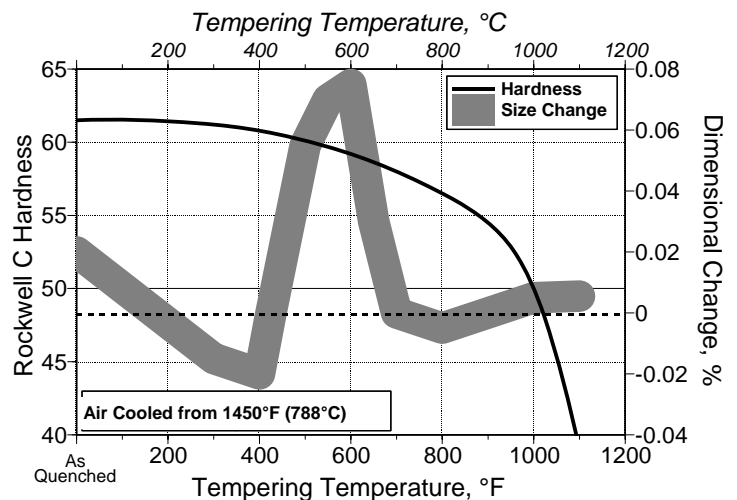
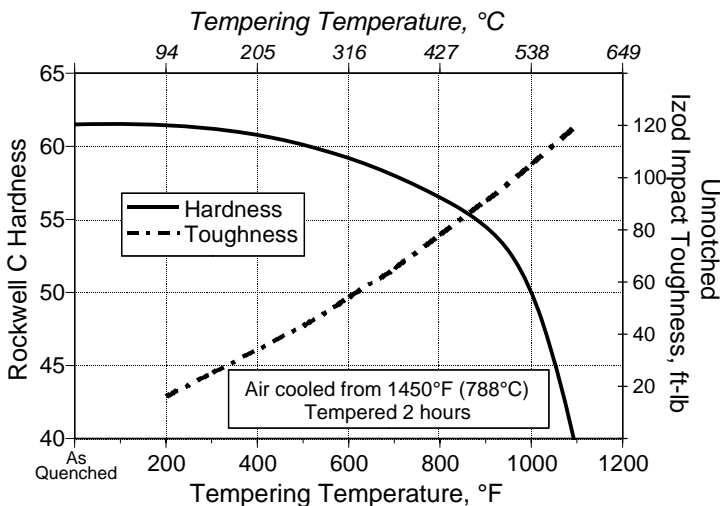
**Tempering Response:** See graph below.

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

**ANNEALING:** Annealing must be performed after hot working.

Heat at a rate not exceeding 400°F per hour (222°C per hour) to 1450°F (788°C), and hold at temperature for 2 hours. Cool at 20°F (11°C) per hour to 900°F (482°C) then air cool to ambient temperature. Reheat to 1150°F (621°C), hold for 6 hours, then air cool to ambient temperature. The resultant hardness should be a maximum of 269 HBW.

**Softening for reworking:** To anneal for reworking after a tool has been hardened, an abbreviated treatment may be used. Heat to 1450°F (788°C), hold for 2 hours. Cool to 1260°F (682°C) at any convenient rate, then cool at 20°F (11°C) per hour from 1260 (682°C) to 1000°F (538°C). Hold at 1000°F (538°C) for 3 hours, then air cool to ambient temperature.



The data presented herein are typical values, and do not warrant suitability for any specific application or use of this material. Normal variations in the chemical composition, the size of the product, and heat treatment parameters may result in different values for the various physical and mechanical properties.



**LATROBE SPECIALTY  
STEEL COMPANY**

Latrobe, PA Phone: 724-537-7711  
FAX: 724-532-6316

WEB: www.latrobebesteel.com

Vienna, OH Phone: 800-321-6446  
FAX: 330-609-2054

Marlborough, MA Phone: 800-444-4447  
FAX: 508-481-6581