DATA SHEET

LATROBE SPECIALTY STEEL COMPANY
Latrobe, PA 15650-0031 USA

Issue 1

LSS™ D2 Tool Steel

(ASTM D2)

Typical Composition

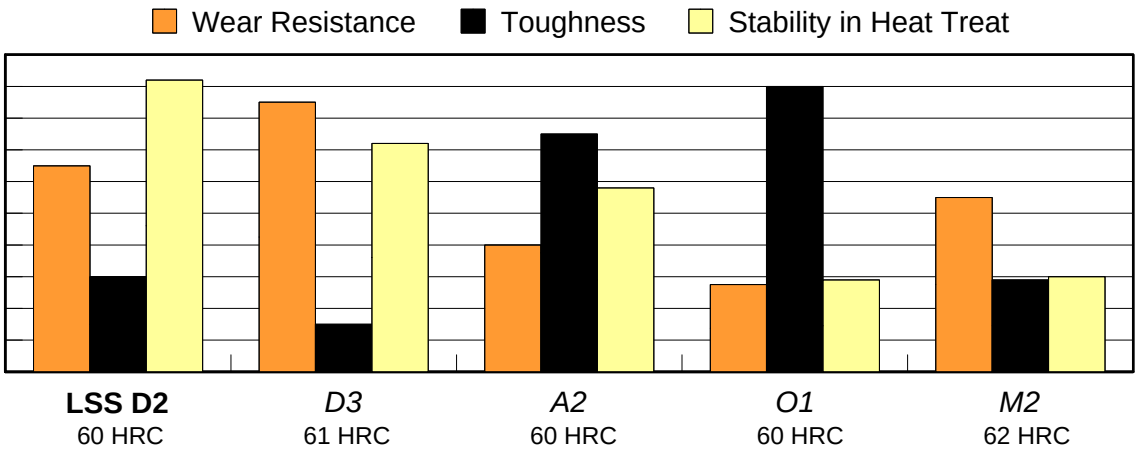
C	Mn	Si	Cr	Mo	V
1.50	0.30	0.30	12.00	0.75	0.90

LSS D2 tool steel is a versatile high-carbon, high-chromium, air-hardening tool steel that is characterized by a relatively high attainable hardness and numerous, large, chromium-rich alloy carbides in the microstructure. These carbides provide good resistance to wear from sliding contact with other metals and abrasive materials. Although other steels with improved toughness or improved wear resistance are available, LSS D2 provides an effective combination of wear resistance and toughness, tool performance, price, and a wide variety of product forms.

LSS D2 is also available as an Electro-Slag-Remelted (ESR) product. The remelting process provides improved chemical homogeneity, refinement of carbide size, and the associated improvements in mechanical and fatigue properties.

Typical applications for LSS D2 tool steel include rolls, punches, dies for blanking, forming, trimming, and thread rolling, shear knives, food-processing knives, and gages.

Relative Properties



Physical Properties

Density: 0.278 lb/in^3 (7695 kg/m^3)
Specific Gravity: 7.70
Modulus of Elasticity: 30x10^6 psi (207 GPa)

Machinability: 50-60% of a 1% carbon steel

Coefficient of Thermal Expansion: (at 61-62HRC)

Temperature, °F	in/in °Fx10^{-6}	Temperature, °C	mm/mm °Cx10^{-6}
100 - 500	5.71	38 - 260	10.3
100 - 800	6.63	38 - 427	11.9
100 - 1000	6.82	38 - 538	12.3
100 - 1200	6.83	38 - 649	12.3
100 - 1500	6.90	38 - 816	12.4

LSS™ D2
HEAT TREATING INSTRUCTIONS

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

HARDENING:

Critical Temperatures:

Ac1: 1449°F (788°C) Ac3: 1553°F (845°C)
Ar1: 1418°F (769°C) Ar3: 1373°F (744°C)

Preheating: To minimize distortion and stresses in large or complex tools use a double preheat. Heat at a rate not exceeding 400°F per hour (222°C per hour) to 1150-1250°F (621-677°C) equalize, then heat to 1400-1450°F (760-788°C). For normal tools, use only the second temperature range as a single preheating treatment.

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

Furnace or Salt: 1850-1875°F (1010-1024°C)

Quenching: Air or pressurized gas.

Cool 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.

For maximum wear resistance, temper between 300-350°F (149-177°C) for a hardness of 62-64 HRC.

For the optimal balance between wear resistance and toughness, temper between 500-550°F (260-288°C). This will produce 58-60 HRC.

For maximum toughness, double temper, 2 hours plus 2 hours, at temperatures above 950°F (510°C). This will produces hardnesses of less than 58 HRC.

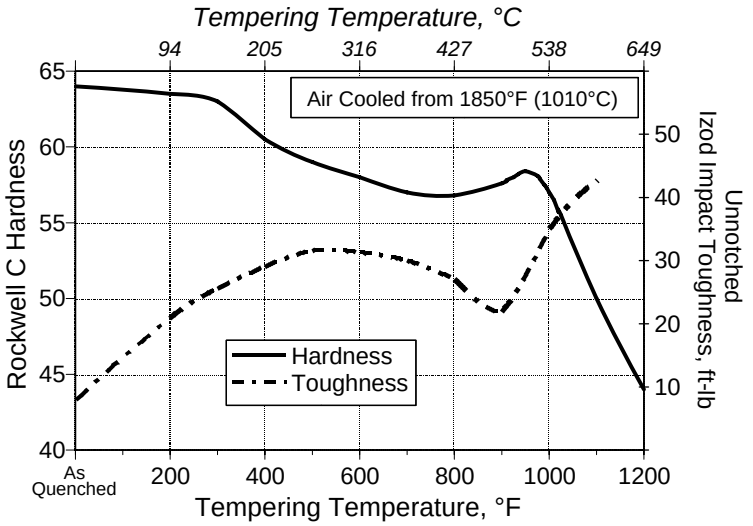
To minimize internal stresses in cross sections greater than 6 inches (152.4 mm) and to improve stability in tools that will be EDM'd after heat treatment, soaking times of 4 to 6 hours at the tempering temperature below 950°F (510°C) are strongly recommended.

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

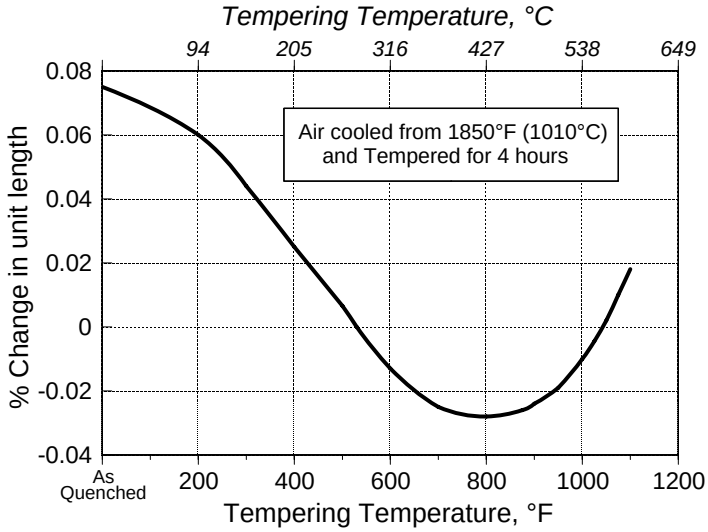
Heat at a rate not exceeding 400°F per hour (222°C per hour) to 1600-1650°F (871-899°C), and hold at temperature for 1 hour per inch (25.4mm) of maximum thickness; 2 hours minimum. Then cool slowly with the furnace at a rate not exceeding 50°F per hour (28°C per hour) to 1000°F (538°C). Continue cooling to ambient temperature in the furnace or in air. The resultant hardness should be a maximum of 255 HBW.

HEAT TREATMENT RESPONSE

As Air Cooled from	HRC
1800°F (982°C), 30 minutes	62.5
1825°F (996°C), 30 minutes	63.5
1850°F (1010°C), 30 minutes	64
1875°F (1024°C), 30 minutes	64.5
1900°F (1038°C), 30 minutes	63



Size Change During Hardening



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

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