

DATA SHEET



**LATROBE SPECIALTY
STEEL COMPANY**

Latrobe, PA 15650-0031 USA

Issue 1

TATMO™ High Speed Steel ASTM M1

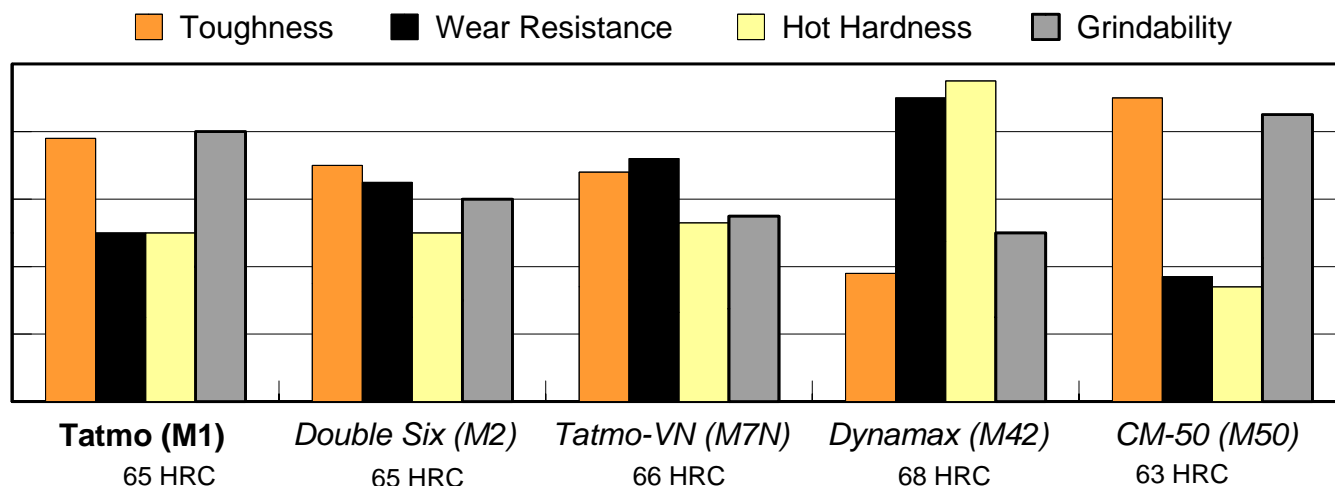
Typical Composition

C	Mn	Si	Cr	W	Mo	V
0.83	0.25	0.30	3.75	1.75	8.50	1.15

TATMO is an M1-type, general-purpose high speed steel. In comparison with other popular high speed steels, it exhibits excellent toughness and grindability. These factors and its relatively low cost make it an economic and efficient tool material.

Typical applications for Tatmo high speed steel include twist drills, taps, milling cutters, reamers, broaches, saws, and knives.

Relative Properties



Physical Properties

Density: 0.285 lb/in³ (7889 kg/m³)

Specific Gravity: 7.89

Modulus of Elasticity: 31x10⁶ psi (214 GPa)

Machinability: 55-65% of a 1% carbon steel

Coefficient of Thermal Expansion: (at 65-66 HRC)

Temperature, °F	in/in °Fx10 ⁻⁶	Temperature, °C	mm/mm °Cx10 ⁻⁶
100 - 500	5.60	38 - 260	10.07
100 - 800	6.32	38 - 427	11.36
100 - 1000	6.66	38 - 538	11.97
100 - 1200	6.86	38 - 649	12.33
100 - 1500	7.07	38 - 816	12.71

TATMO™

HEAT TREATING INSTRUCTIONS

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

HARDENING:

Critical Temperatures:

Ac1: 1520°F (827°C) Ac3: 1580°F (860°C)
 Ar1: 1400°F (760°C) Ar3: 1335°F (724°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 1100°F (593°C) equalize, then heat to 1450-1550°F (788-843°C). For normal tools, use only the second temperature range as a single preheating treatment.

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

Furnace: 2175-2225°F (1191-1218°C)

Salt: 2150-2200°F (1177-1204°C)

Soak 2 - 5 minutes at temperature.

To maximize toughness, use the lowest temperature. To maximize hot hardness, use the highest temperature.

Quenching: Pressurized gas, warm oil, or salt.

For pressurized gas, a rapid quench rate to below 1000°F (538°C) is critical to obtain the desired properties.

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

For salt maintained at 1000-1100°F (538-593°C), equalize, then cool in still air to 150 -125°F (66-51°C).

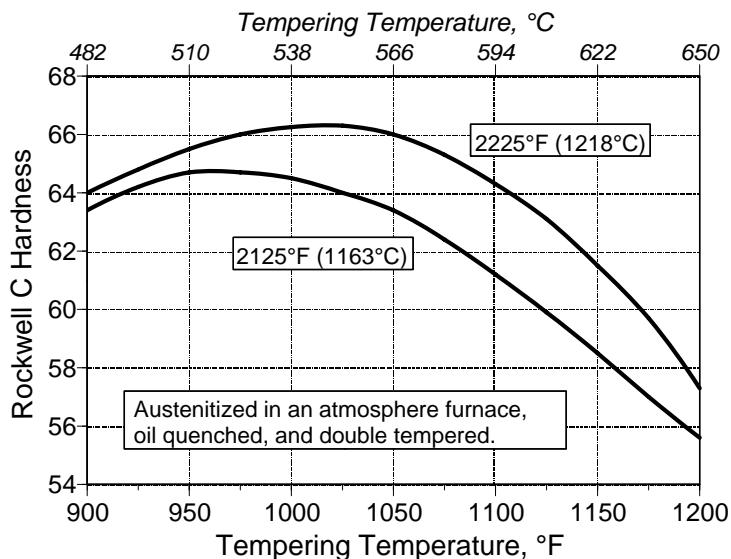
Tempering: Temper immediately after quenching. Typical tempering range is 1020-1080°F (549-582°C). Hold at temperature for 2 hours, then air cool to ambient temperature. Double tempering is required. For large cross sections, and especially for blanks from which tools will be cut by wire EDM, triple tempering is strongly recommended.

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

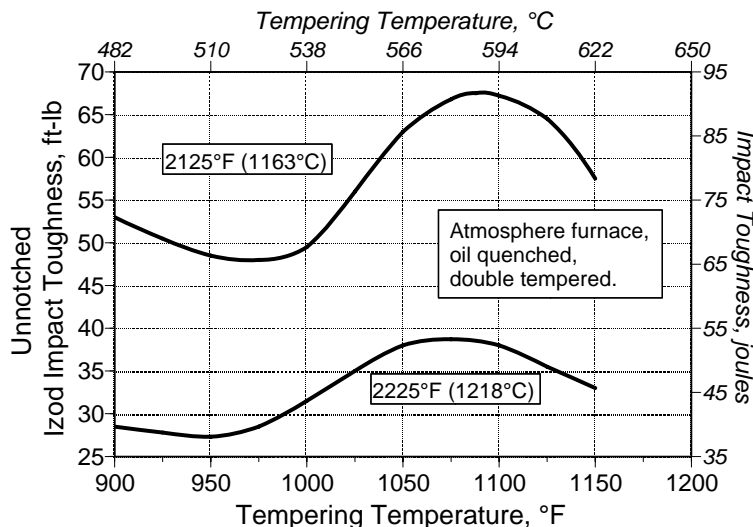
Heat at a rate not exceeding 400°F per hour (222°C per hour) to 1550-1575°F (843-857°C), and hold at temperature for 1 hour per inch (25.4 mm) of thickness, 2 hours minimum. Then cool slowly with the furnace at a rate not exceeding 50°F per hour (28°C per hour) to 1000°F (538°C). Continue cooling to ambient temperature in the furnace or in air. The resultant hardness should be 248 HBW or lower.

HEAT TREATMENT RESPONSE

As Oil Quenched from	HRC
2050°F (1121°C)	65.5
2100°F (1149°C)	66.0
2150°F (1177°C)	66.5
2200°F (1204°C)	65.5
2250°F (1232°C)	64.5



IMPACT TOUGHNESS



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.



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