UNITED STATES CUTTING TOOL INSTITUTE
LEADING THE FUTURE OF THE CUTTING TOOL INDUSTRY

M2 High Speed Steel

M2 steel is a general purpose molybdenum-type high-speed steel exhibiting well-balanced toughness, wear-resistance and red hardness properties. This grade is commonly used in cold work punches and dies and cutting applications involving high-speed and light cuts. M2 high-speed steel is by far the most popular high- speed steel replacing T1 in most applications because of its superior properties such as its bending strength, toughness and thermo-plasticity—all of which are higher than T1 by 50%.

Other Known Names: HS 6-5-2, 1.3343, S600 Steel, E M2, REX M2®, SKH 51, P6M5, 6-6, M2 Tool Steel

Common Usage: Broaches, Knives, Drills, Pins, Reamers, Taps, Thread roll Dies, Rolls, Mandrels, End, Mills, Rolling Racks, Milling Cutters

Physical Properties

Density

0.294 lb/in^3 (8138 kg/m^3)

Specific Gravity

8.14

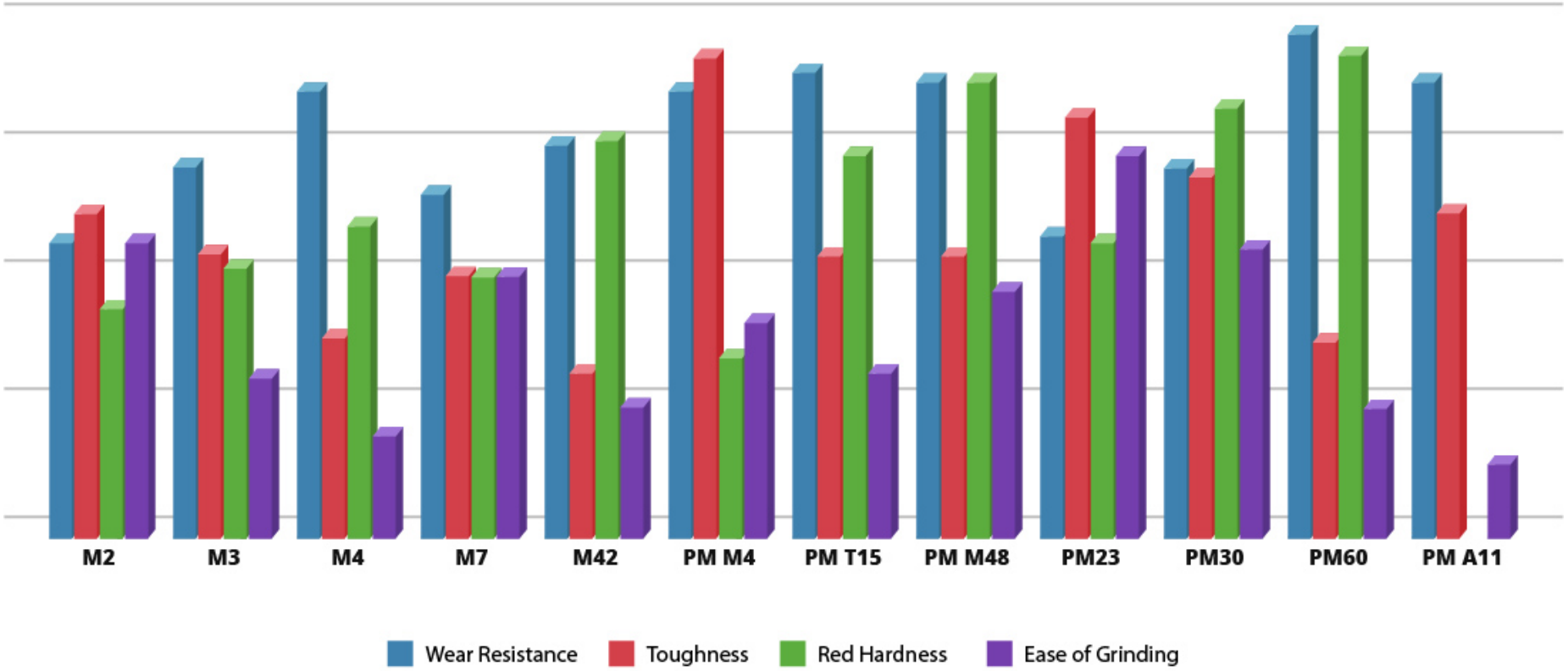
Modulus Of Elasticity 30 x

10^6 psi (207 GPa)

Machinability

50-60% of a 1% carbon steel

High Speed Steel Properties Comparison



M2 High Speed Steel Chemical Composition

						MAXIMUM	TYPICAL
Carbon	Chromium	Tungsten	Molybdenum	Vanadium	Cobalt	Annealed	Tempered
C	Cr	W	Mo	V	Co	Hb	HrC
0.85	4.15	6.15	5.1	1.95	-	255	64

M2 High Speed Steel Heat Treating

ANNEALING	PREHEAT	AUSTENITIZING	QUENCH	TEMPERING
Temp	Temp	Temp	Medium	Temp
°F	°F	°F		°F
1550/1600	1500/1550	2175/2225	Salt/Oil/Atm	1025/1050

M2 High Speed Steel Thermal Treatments

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. For

Cutting Tools:

- Furnace: 2200-2250°F (1204-1232°C)
- Salt: 2175-2225°F (1191-1218°C)
- To maximize toughness, use the lowest temperature. To maximize hot hardness, use the highest temperature.

For punches, dies, and tools that require maximum toughness without hot hardness:

- Furnace: 2075-2175°F (1175-1191°C)
- Salt: 2050-2150°F (1121-1177°C)

Quenching

Pressurized gas, warm oil, or salt. For pressurized gas, a rapid quench rate to below 1000°F (538°C) is critical to achieve 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 1025-1050°F (552-566°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 re-hardening

Heat at a rate not exceeding 400°F per hour (222°C per hour) to 1525-1550°F (829-843°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.

Information provided by Griggs Steel Company