UNITED STATES CUTTING TOOL INSTITUTE

LEADING THE FUTURE OF THE NORTH AMERICAN CUTTING TOOL INDUSTRY

M3 High Speed Steel

M3 high-speed tool steel contains carbon and vanadium levels that are intermediate between those of M2 and M4. This gives the steel a fine balance of wear-resistance and grindability, and provides superior resistance to abrasion and edge breakdown. This makes M3 high-speed steel a superb tool material for form tools and roll turning for severe cutting operations. An increase in tool life will also be experienced in the machining of heat- treated sections, castings and similar hard materials.

Other Known Names: REX M3-1®, PM M3, Corsair

Common Usage: Broaches, Blades, Form Tools, and Reamers

Physical Properties

Density

0.295 lb/in^3 (8166 kg/m^3) Specific Gravity

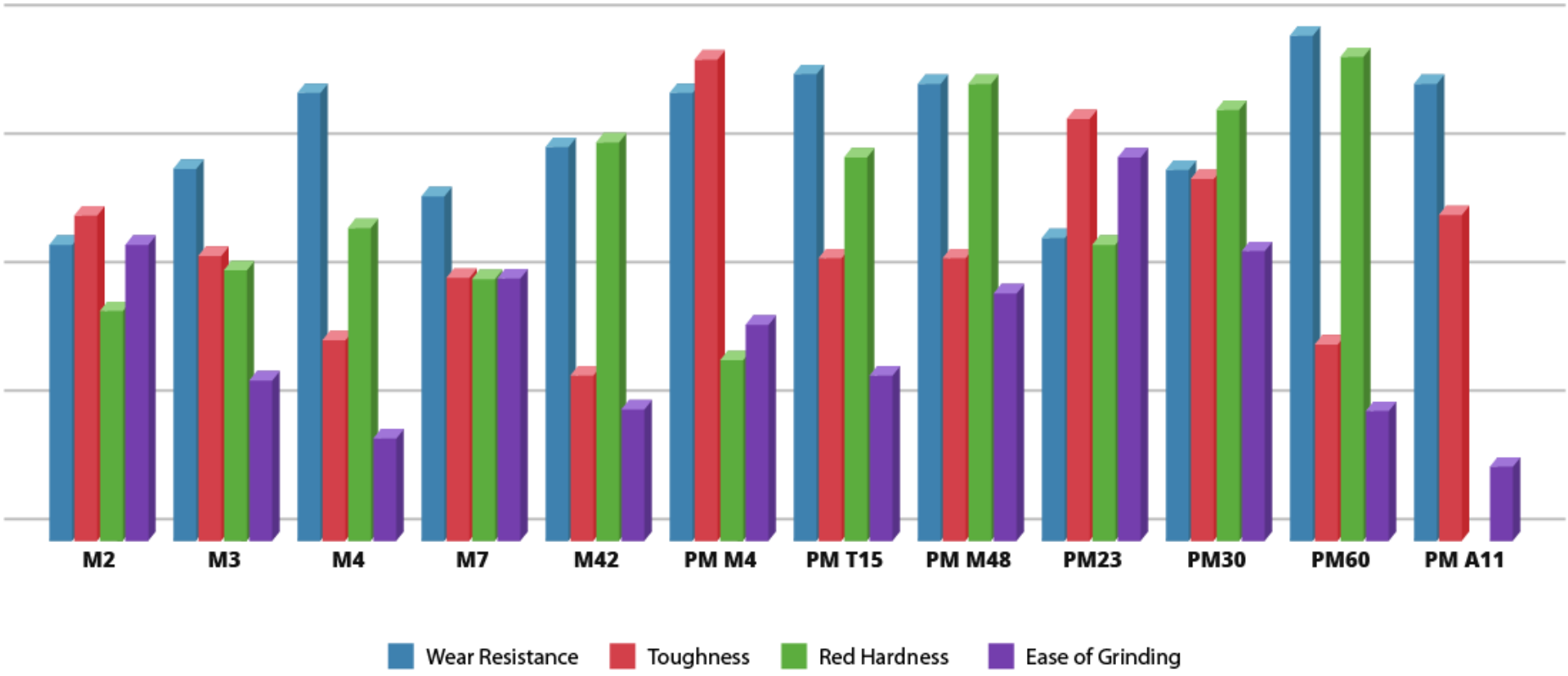
8.17

Modulus Of Elasticity 30 x 10^6 psi (207 GPa)

Machinability

37-42% of a 1% carbon steel

High Speed Steel Properties Comparison



M3 High Speed Steel Chemical Composition

						MAXIMUM	TYPICAL
Carbon	Chromium	Tungsten	Molybdenum	Vanadium	Cobalt	Annealed	Tempered
C	Cr	W	Mo	V	Co	Hb	HrC
1.05	4.15	6.15	5.75	2.5	-	255	66

M3 High Speed Steel Heat Treating

ANNEALING	PREHEAT	AUSTENITIZING	QUENCH	TEMPERING
Temp	Temp	Temp	Medium	Temp
°F	°F	°F		°F
1550/1600	1500/1550	2185/2210	Salt/Oil/Atm	1025/1050

PM M3, M3 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.

- Furnace: 2200-2250°F (1204-1232°C)
- Salt: 2175-2225°F (1191-1218°C)

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 1025-1050°F (552-566°C). Hold at temperature for 2 hours, then air cool to ambient temperature. Double tempering is required. 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 1550-1600°F (843-871°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