



PM M4 High Speed Steel

PM M4 high speed tool steel is a flexible steel that provides a unique combination of high wear-resistance with high impact toughness and bend strength, which are results of the fine grain size, small carbides and superior cleanliness of the steel. PM M4 offers improved cutting tool life compared to conventionally-wrought M1, M2, M7 and other lower-alloyed high-speed steels. It excels in cold work tooling applications, outlasting high- carbon, high-chromium die steels such as D2 and D3.

Other Known Names: CPM REX M4 steel[®], ASP 2004, S690

Common Usage: Broaches, End Mills, Punches, Hobs, Fine Blanking, and Forming Dies.

Physical Properties

Density

0.286 lb/in³ (7806 kg/m³) Specific

Gravity

7.92

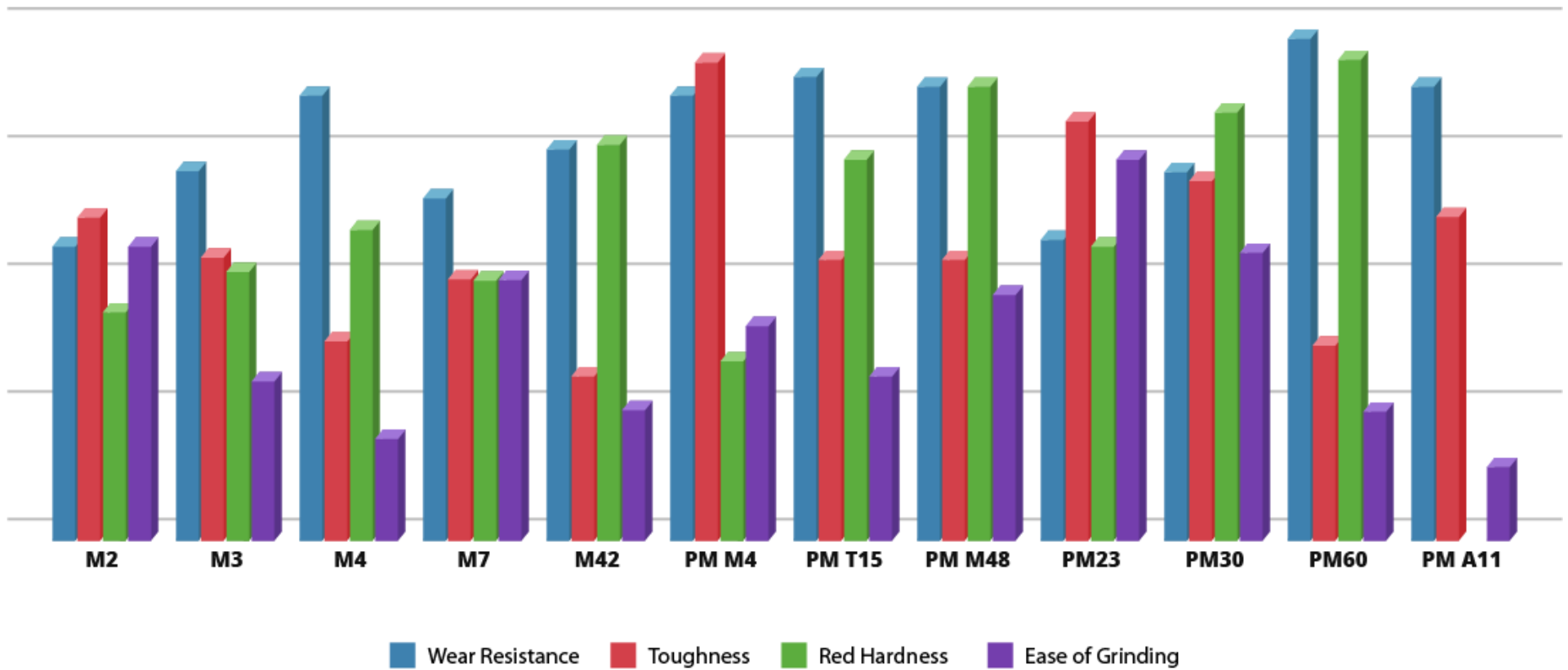
Modulus Of Elasticity 31×10^6

psi (214 GPa)

Machinability

40-45% of a 1% carbon steel

High Speed Steel Properties Comparison



PM M4 High Speed Steel Chemical Composition

						MAXIMUM	TYPICAL
Carbon	Chromium	Tungsten	Molybdenum	Vanadium	Cobalt	Annealed	Tempered
C	Cr	W	Mo	V	Co	Hb	HrC
1.4	4	5.65	5.2	4	-	255	65

PM M4 High Speed Steel Heat Treating

ANNEALING	PREHEAT	AUSTENITIZING	QUENCH	TEMPERING
Temp	Temp	Temp	Medium	Temp
°F	°F	°F		°F
1550/1600	1500/1550	2175/2220	Salt/Oil/Atm	1025/1050

PM M4 High Speed Steel Thermal Treatments

Preheating

Heat at a rate not exceeding 400°F per hour (222°C per hour) to 1500-1600°F (816-871°C), and equalize.

Austenitizing (High Heat)

Heat rapidly from the preheat. For Cutting Tools:

- ◆ Soak for 5 to 15 minutes.
- ◆ Furnace: 2150-2175°F (1177-1191°C) Salt Bath:
2125-2175°F (1163-1191°C)

For Cold Work Tooling:

- ◆ Soak for 20 to 45 minutes. Furnace: 1875-2125°F
(1023-1163°C)
- ◆ Salt Bath: 1850-2100°F (1010-1149°C)

				Quenching
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Pressurized gas, warm oil, or salt.

For pressurized gas, the furnace should have a minimum quench pressure of 4 bars. A quench rate of approximately 400°F (222°C) per minute 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 maintain at 1000-1100°F (538-593°C), equalize in the salt, then cool in still air to 150-125°F (66-51°C).

				Tempering
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Temper immediately after quenching.

Typical temperature range is 1000-1100°F (538-593°C). Do not temper below 1000°F (538°C). Hold at temperature for 2 hours then air cool to ambient temperature. Double tempering is required. Triple tempering is required when austenitized at 2100°F (1149°C) or higher.

				Annealing
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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 (15°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