UNITED STATES CUTTING TOOL INSTITUTE

LEADING THE FUTURE OF THE NORTH AMERICAN CUTTING TOOL INDUSTRY

PM M48 High Speed Steel

PM M48 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 M48 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: ~1.3207, CPM REX 76®, ASP 2048, HS 10-5-3-9, SKH 57

Common Usage: Broaches, End Mills, Form Tools, Hobs, Tabs, and Cut Off Blades.

Physical Properties

Density

0.298 lb/in^3 (8256 kg/m^3) Specific Gravity

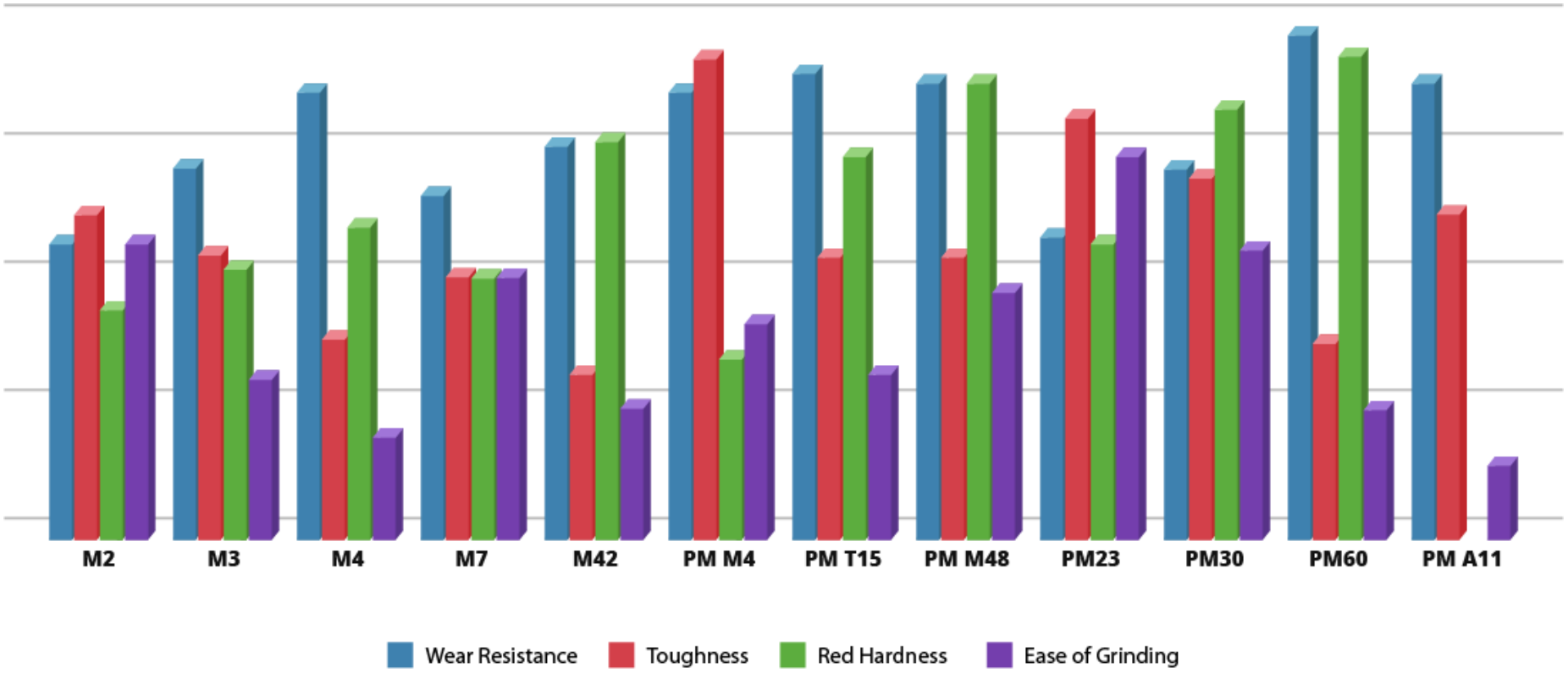
8.26

Modulus Of Elasticity 31 x 10^6 psi (214 GPa)

Machinability

10-15% of a 1% carbon steel

High Speed Steel Properties Comparison



PM M48 High Speed Steel Chemical Composition

						MAXIMUM	TYPICAL
Carbon	Chromium	Tungsten	Molybdenum	Vanadium	Cobalt	Annealed	Tempered
C	Cr	W	Mo	V	Co	Hb	HrC
1.5	3.75	9.75	5.25	3.1	8.5	310	68

PM M48 High Speed Steel Heat Treating

ANNEALING	PREHEAT	AUSTENITIZING	QUENCH	TEMPERING
Temp	Temp	Temp	Medium	Temp
°F	°F	°F		°F
1550/1600	1500/1550	2150/2175	Salt/Oil/Atm	1080

PM M48 High Speed Steel Thermal Treatments

Preheating

1500-1550°F (816-845°C), equalize. A second preheat at 1850-1900°F (1010-1040°C) is recommended for vacuum hardening.

Austenitizing (High Heat)

Heat rapidly from the preheat.

- Furnace: 2125-2220°F (1163-1204°C) Salt: 2100-2190°F (1149-1199°C)
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Soak 3 – 10 minutes depending on the 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, 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

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. Triple tempering is required. Quadruple tempering is required when austenitized at 2175°F (1190°C) or higher.

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 (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