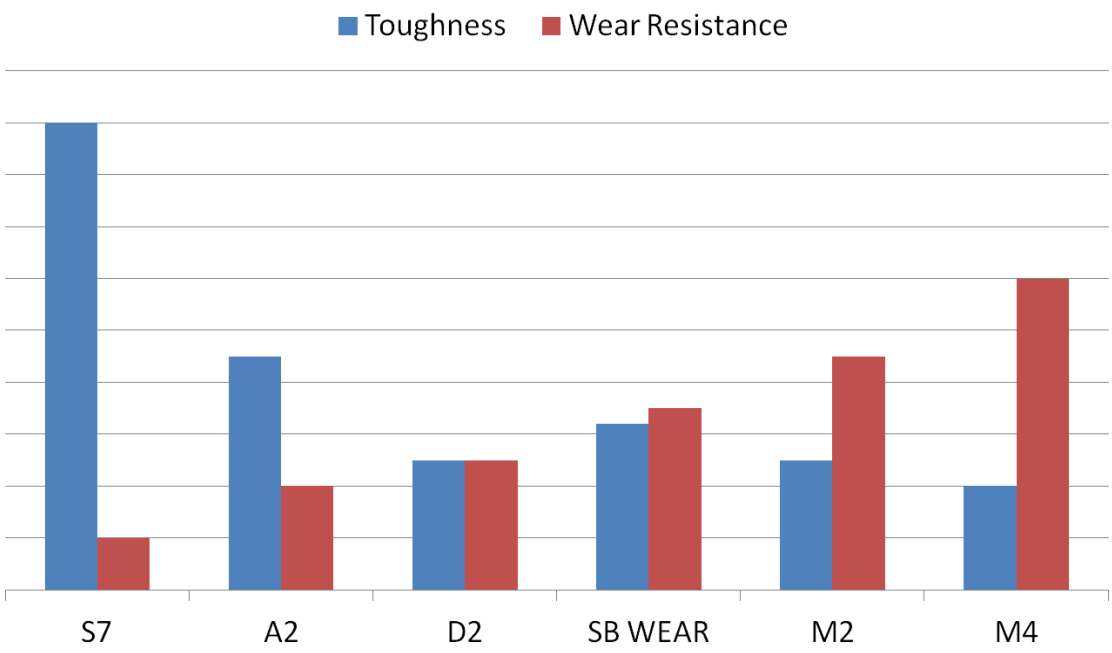
Métaux Solutions

# Technical Information: M4

M4 is a general purpose high speed steel
M4 has a good balance of toughness, wear resistance, and red hardness
M4 is used as an upgrade to M2 for wear resistance.

| Typical Chemical Composition | | | |
|---|---|---|---|
| Carbon | 1.35% | Chromium | 4.15% |
| Molybdenum | 5.00% | Silicon | 0.30% |
| Vanadium | 4.15% | Manganese | 0.30% |
| Tungsten | 6.00% | Sulfur | 0.03% Max |

## Tool Steel Properties Comparison




## Physical Properties

Modulus of Elasticity. . . . . 30 psi x $10^6$ . . . . . (207 GPa)
Density. . . . . 0.294 lb/$in^3$
Annealed Hardness. . . . . 215-255 Brinell Hardness (BHN)
Machinability. . . . . Similar to D2 Tool Steel

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## Heat Treatment

### Annealing

Heat to 1600°F, hold two hours
Slow cool 20°F/hour to 600°F
Then air or furnace cool to room temperature

### Stress Relieving

Performed prior or after machining to minimize distortion in heat treating
1100/1200°F, hold two hours
then air cool to room temperature

### Hardening

Salt bath, protective atmosphere, or vacuum furnace equipment preferred.

### High Heat (Austenitizing)

2150/2250°F for 10-15 minutes at heat.

### Quench

Salt bath quench to 1000-1100°F, equalize, then air cool to 150°F.
Vacuum or atmosphere quench rate of a minimum 50 degrees F per minute down to 1200F is critical to achieve best heat treat response.
Temper immediately following quench

### Tempering

Minimum 1000°F tempering temperature required.
Double tempering is required, triple tempering recommended.
Air cool to room temperature between tempers.

## Typical Heat Treat Response

| Tempering Temp °F | Hardening Temp 2150°F | Hardening Temp 2250°F |
|---|---|---|
| As Quenched | 65 | 65 |
| 1000 | 65 | 65 |
| 1025 | 64 | 65 |
| 1050 | 63 | 64 |
| 1075 | 62 | 63 |
| 1100 | 60 | 62 |

### Longitudinal Size Change

Approximately: plus 0.22%