



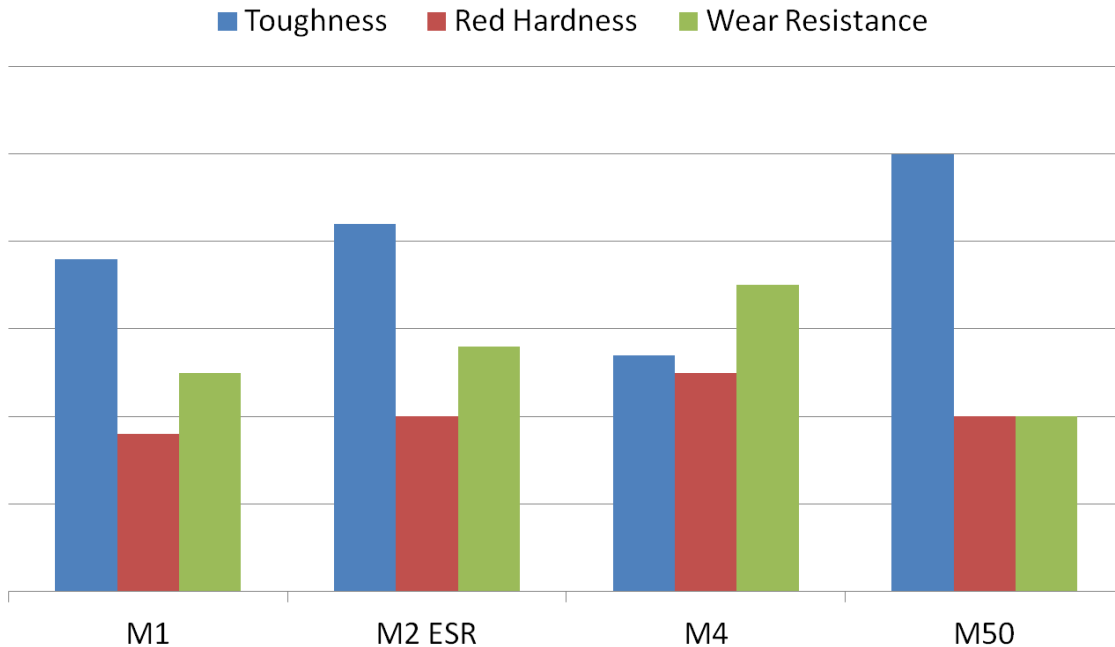
## Technical Information: M2 ESR

**M2 ESR is a premium version of M2 general purpose high speed steel .  
M2 ESR has a good balance of toughness, wear resistance, and red hardness.  
M2 ESR has a good balance of wear resistance and toughness which also makes it a  
good cold work material for a variety of applications.**

### Typical Chemical Composition

Carbon	0.85%	Chromium	4.15%
Molybdenum	5.00%	Silicon	0.30%
Vanadium	1.95%	Manganese	0.30%
Tungsten	6.15%	Sulfur	0.010% Max

### SBSM Tool Steel Properties Comparison



### Physical Properties

Modulus of Elasticity.....30 psi x 10<sup>6</sup> .....(207 GPa)  
 Density..... 0.294 lb/in<sup>3</sup>  
 Annealed Hardness.....215-255 Brinell Hardness (BHN)



## Technical Information: M2 ESR

### 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)

2050/2250°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 2050°F	Hardening Temp 2150°F	Hardening Temp 2250°F
As Quenched	64	65	65
1000	64	65	66
1025	63	65	67
1050	62	65	66
1075	61	64	64
1100	60	63	64

Longitudinal  
 Size Change

Approximately: plus 0.22%