



## 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)



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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)

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<br>°F | Hardening Temp<br>2050°F | Hardening Temp<br>2150°F | Hardening Temp<br>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%