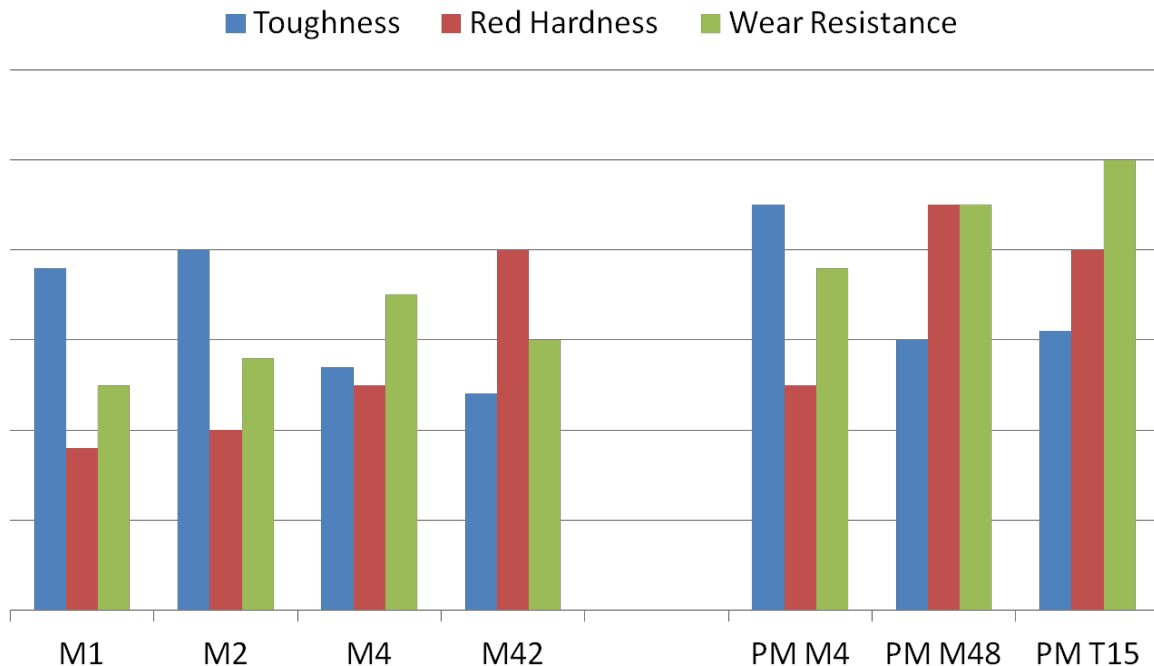


## Technical Information: PM T15

PM T15 is a tungsten-cobalt-vanadium super high speed steel  
 PM T15 is produced using the PM (powder metallurgy) process  
 The grade has an excellent combination of high red hardness and high wear resistance  
 PM steels have better grindability and toughness vs conventional produced steels

Typical Chemical Composition			
Carbon	1.55%	Chromium	4.50%
Molybdenum	1.00% Max	Tungsten	12.25%
Vanadium	4.75%	Cobalt	5.00%

### High Speed Steel Properties Comparison



### Physical Properties

Modulus of Elasticity.....31 psi x 10<sup>6</sup> .....(207 GPa)  
 Density..... 0.296 lb/in<sup>3</sup>  
 Annealed Hardness.....245-275 Brinell Hardness (BHN)  
 Machinability.....Similar to M42 High Speed Steel

## Technical Information: PM T15

### 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 5 to 10 minutes at heat.  
 Higher Austenitizing temperatures require less time 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 (HRC)

Tempering Temp °F	Hardening Temp 2150°F	Hardening Temp 2200°F	Hardening Temp 2250°F
As Quenched	66	65	64
1000	66	66	68
1025	65	66	67
1050	64	65	67
1075	63	64	65
1100	62	63	64

#### Longitudinal Size Change

Approximately: plus 0.20%