



# SB Specialty Metals LLC

Your *First Choice* for Specialty Metals

## PM9 – Technical Data

### General Descriptions:

PM9 is a high vanadium tool steel produced using the Particle Metallurgy (PM) steel making process. The grade has excellent wear resistance and toughness combined with moderate hardness. It is usually limited in hardness to about 52-54 HRC and is therefore not intended for applications requiring high compressive strength.

### Examples of applications:

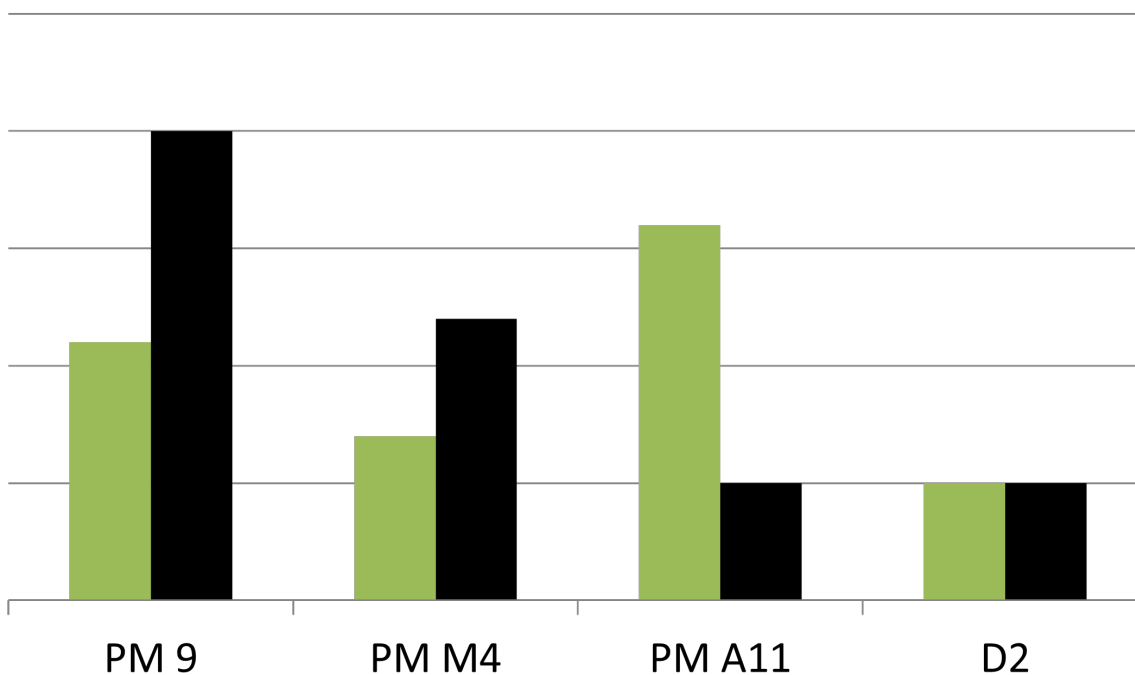
Plastics processing equipment, form rolls, punches, trim and shear blades and header tooling.

### Chemical Composition

Carbon	Molybdenum	Vanadium	Chromium	Silicon	Manganese
1.80%	1.30%	9.00%	5.30%	0.90%	0.50%

### Comparison Chart

■ Wear Resistance ■ Toughness



### Typical Heat Treat Response

Tempering Temp °F	Hardening Temp °F / HRC			Charpy C-Notch Ft.-lbs (2050 °F)
	1900	1950	2050	
As Quenched	54	56	58	
1000	53	54	56	47
1025	52	53	55	49
1050	51	52	53	52
1100	47	50	51	55
1150	40	48	49	60

### Size Changes During Hardening

Hardening Temp °F	Tempering Temp	HRC	Longitudinal Size Change %
2050	1050	53	+0.10

### Surface Treatment

Because of its high tempering temperatures (>1000°F), PM9 may be treated by most surface treating processes, including conventional and ion nitriding, titanium nitride coating and other surface treatments.



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### Heat Treatment

#### Annealing

Heat to 1650 °F, hold two hours at temperature. Slow cool (30 °F/ hour maximum) to 1000 °F. Then air cool to room temperature.

#### Stress Relieving

Performed prior or after machining to minimize distortion in heat treating. 1200-1250 °F, hold two hours at temperature, then air cool to room temperature.

#### Hardening

Preheat to 1500-1575 °F, let parts equalize, then preheat again at 1850-1900 °F let parts equalize.

#### High Heat (Austenitizing)

1950-2050 °F for 20 to 30 minutes at heat. Higher austenitizing temperatures require less time at heat.

#### Quench

Vacuum or atmosphere quench rate of 50 °F per minute down to 1200 °F is critical to achieve best heat treat response. Then cool to room temperature.

#### Tempering

1025 - 1150 °F tempering temperature required, holding time at temperature is two hours. Double tempering is required, triple tempering recommended. Air cool to room temperature between tempers.

### Physical Properties

<b>Modulus of Elasticity</b>	32 x 10 <sup>6</sup> psi (207 GPa)	<b>Density</b>	0.285 lb/in <sup>3</sup>
<b>Annealed Hardness</b>	225-255 BHN	<b>Machinability</b>	65% of O1