



## CPM® 10V (AISI A11)

**CRUCIBLE DATA**

CPM 10V is a unique tool steel made by the Crucible Particle Metallurgy process. It is designed with a tough, air hardening base analysis with added high carbon and vanadium for exceptionally good wear resistance, toughness and strength for cold and warm work tooling applications.

The exceptional wear resistance and good toughness of CPM 10V make it an excellent candidate to replace carbide and other highly wear resistant materials in cold work tooling applications, particularly where tool toughness is a problem or where cost effectiveness can be demonstrated.

### Typical Chemistry

Carbon	2.45%
Manganese	0.50%
Silicon	0.90%
Chromium	5.25%
Vanadium	9.75%
Molybdenum	1.30%
Sulfur	0.07%

### Typical Applications

Punches & Dies for Blanking, Piercing, Forming and Cold Extrusion  
Knives for Slitting, Shearing, Trimming, etc.  
Granulator/Pelletizer Blades  
Nozzles, Screw Tips, Barrel Liners, etc. for  
Plastic Injection Molding Equipment  
Powder Compaction Tooling  
Woodworking Tools      Wear Parts

**Annealed Hardness:** BHN 255/277.

Machinability in the annealed condition is similar to D2 or M2. SG type alumina wheels or CBN wheels are recommended for the best grinding performance with the CPM steels.

## **Thermal Treatments**

**Critical Temperature:** 1540F(838C).

**Forging:** 2000-2100F(1095-1150C) Do not forge below 1700F(930C). Slow cool after forging.

**Annealing:** 1600F(870C), hold 2 hours, slow cool 30F(15C)/ hr max. to 1000F(540C), then air or furnace cool. Hardness BHN 255/277. Stress Relieving (After machining): 1100-1300F(595-740C), hold 2 hrs. and air or furnace cool.

**Straightening:** Best done warm 400-800F(200-430C).

**Hardening:** (Salt, vacuum or atmosphere)

**Preheat:** 1500-1550F(820-845C), equalize. Second preheat stage at 1850-1900F(1010-1040C) suggested for vacuum or atmosphere hardening.

**High Heat:** 1850-2150F(1010-1175C). Standard recommendation to achieve Rc 60-62 after tempering is to use 2050F(1120C).

**Quench:** Salt, oil or atmosphere quench to 1000-1100F(540-595C), equalize, then air cool to below 125F(50C) or hand warm. Vacuum or atmosphere quench rate through 1850-1300F(1010-705C) range is critical to achieve optimum heat treat results.

**Temper:** 1000F(540C) minimum recommended. Double tempering is required.

## Hardening Data

Tempering HEAT TREAT RESPONSE ±1 HRC (NOTE A)							
Temperature		1850F	1900F	1950F	2050F	2100F	2150F
°C	°F	(1025C)	(1040C)	(1065C)	(1120C)	(1150C)	(1175C)
As Quenced		61	63	65	65	64.5	63.5
540	1000	56	57	60.5	62	63	64
OPTIMUM FOR MAXIMUM TOUGHNESS AND EFFECTIVE STRESS-RELIEVING.							
<b>550</b>	<b>1025</b>	<b>54</b>	<b>56</b>	<b>58.5</b>	<b>60</b>	<b>62</b>	<b>63</b>
<b>565</b>	<b>1050</b>	<b>52</b>	<b>54</b>	<b>56.5</b>	<b>58</b>	<b>60</b>	<b>61</b>
595	1100	49	51	52	54	55	56
620	1150	44	45	46	48	50	51
650	1200	40	41	43	46	47	48

NOTE RESULTS MAY VARY WITH HARDENING METHOD AND A: SECTION SIZE. SALT OR OIL QUENCHING WILL GIVE MAXIMUM RESPONSE. VACUUM OR ATMOSPHERE COOLING MAY RESULT IN UP TO 1-2 HRC POINTS LOWER.

### MINIMUM TIME

AT AUST TEMP (MINS)	60	45	30	20	15	10
MINIMUM NUMBER OF TEMPER (2 HRS)	2	2	2	2	3	3

## Size Change During Hardening

Hardening Temp.		Tempering Temp.		HRC	Longitudinal Size Change %
°F	°C	°F	°C		
1950	1065	1000	540	60	+0.04
2150	1175	1000	540	64	+0.04

**Chemistries  
& Properties  
Table**  
**Heat  
Treatments  
Table**

## Surface Treatments

CPM 10V can be nitrided, steam tempered or titanium-nitride coated if desired. If the CVD TiN treatment is used, care is required in vacuum hardening.

## Physical Properties

<b>Modulus of Elasticity</b> .....	32 psi
x 10 <sup>6</sup> (221 GPa)	
<b>Specific gravity</b> .....	7.41
<b>Density</b> .....	0.268
lb/in <sup>3</sup> (7418 kg/m <sup>3</sup> )	
<b>Coefficient of Thermal Expansion</b>	

Temperature Range		Coefficient of Thermal Expansion	
°F	°C	in/in/°F x 10 <sup>-6</sup>	mm/mm/°C x 10 <sup>-6</sup>
70- 200	21-93	5.96	10.7
70-500	21-260	6.18	11.1
70- 800	21-427	6.54	11.8
70-1100	21-593	6.82	12.3

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