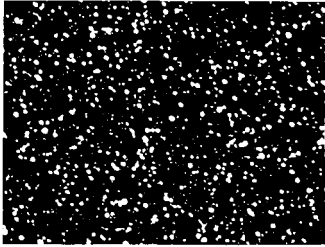


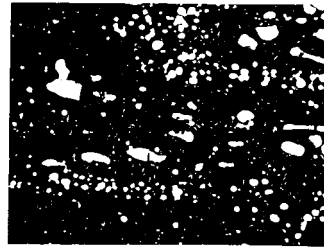
CRUCIBLE

CPM 1V is a medium carbon, high alloy tool steel which exhibits high toughness combined with high heat resistance. It is suited for both hot or cold applications which demand high impact toughness and also require moderate wear resistance.

The CPM (Crucible Particle Metallurgy) process produces very homogeneous, high quality steel characterized by superior dimensional stability, grindability, and toughness compared to steels produced by conventional processes.

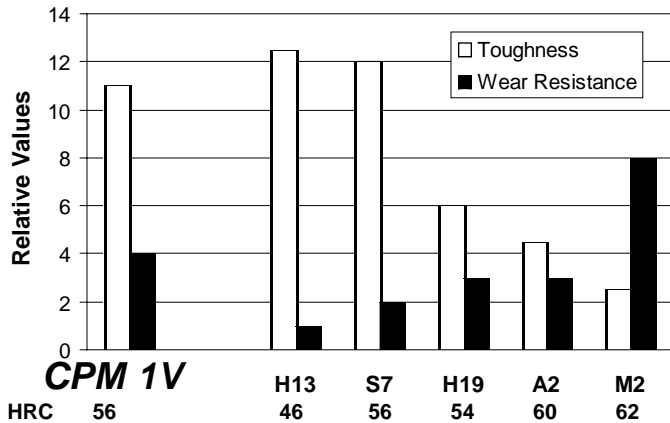


CPM Steel



Conventional Steel

Tool Steel Comparagraph



Typical Applications

Hot (Warm) Work

- Hot and Warm Forming Dies
- Hot Shear Dies
- Hot Heading Dies
- Extrusion Dies
- Forging Dies and Punches

Cold Work

- Cold Heading Dies
- High Impact Blanking Dies
- Punches
- Thread Rolling Dies

Note: These are some *typical* applications. Your specific application should not be undertaken without independent study and evaluation for suitability.

Crucible...
The Tool Steel Pros®

DATA SHEET

CRUCIBLE CPM® 1V®

Issue #5

Carbon	0.55%
Chromium	4.5%
Vanadium	1.00%
Tungsten	2.15%
Molybdenum	2.75%

Physical Properties

Elastic Modulus	30 X 10 ⁶ psi	(207 GPa)	
Density	0.284 lbs./in ³	(7.85 g/cm ³)	
Thermal Conductivity	BTU/hr-ft-°F	W/m-°K	cal/cm-s-°C
72°F (22°C)	12.64	21.88	5.23X10 ⁻²
212°F (100°C)	13.80	23.88	5.70X10 ⁻²
572°F (300°C)	14.90	25.80	6.16X10 ⁻²
752°F (400°C)	15.46	26.76	6.39X10 ⁻²
1004°F (540°C)	16.23	28.09	6.71X10 ⁻²

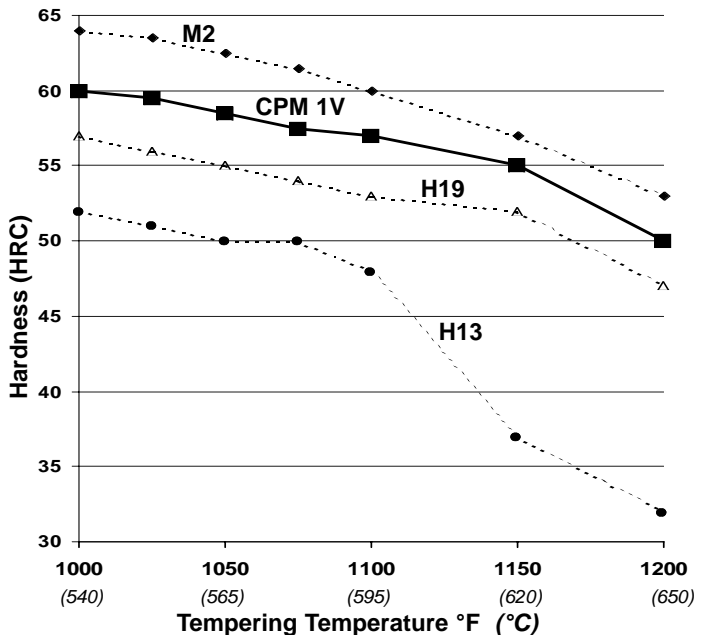
Relative Mechanical Properties

Impact Toughness and Wear Resistance

With its 1% vanadium content, CPM 1V has wear resistance slightly better than A2. Because of its CPM microstructure, 1V has high impact toughness approaching that of the shock-resistant tool steels such as S7.

Temper Resistance

Because of its high alloy composition, CPM 1V has temper resistance similar to high speed steel (M2) and much better than most typical hot work tool steels as shown in the comparative temper curves below.



Specimens double tempered a minimum of 2 hrs. at temperature each temper. M2 austenitized 1975°F (1080°C), CPM 1V austenitized 2000°F (1095°C), H19 austenitized 2100°F (1150°C), H13 austenitized 1850°F (1010°C), and S7 austenitized 1725°F (940°C).

The CM logo, Crucible, CPM, 1V, 9V, Tool Steel Pros, and Crucible Particle Metallurgy are all registered trademarks of Crucible Materials Corporation, Syracuse, NY.

Thermal Treatments

Annealing

Heat to 1600-1650°F (870-900°C), hold 2 hours, slow cool no faster than 25°F (15°C) per hour to 1100°F (595°C), then furnace cool or cool in still air to room temperature.

Annealed Hardness: About BHN 187

Stress Relieving

Annealed Parts: Heat to 1100-1300°F (595-705°C), hold 2 hours, then furnace cool or cool in still air.

Hardened Parts: Heat to 25-50°F (15-30°C) below original tempering temperature, hold 2 hours, then furnace cool or cool in still air.

Hardening

Preheat: Heat to 1550-1600°F (840-870°C) Equalize.

Austenitize: 1950-2025°F (1065-1110°C), hold time at temperature 10-15 minutes. Lower austenitizing temperatures of 1950°F-1975°F (1065°C-1080°C) provide the best impact toughness.

Quench: Positive pressure quench (2 bar minimum) to below 125°F (50°C), or salt or interrupted oil quench to about 1000°F (540°C), then air cool to below 125°F (50°C). Salt bath treatment if practical will ensure maximum attainable toughness for a given hardening treatment.

Temper: Three times at 1000-1025°F (540-550°C), 2 hours minimum each time.

Aim hardness 57-59 HRC.

Surface Treatments

CPM 1V can be nitrided or PVD coated. Due to its high tempering temperature, it will retain its hardness after such processes, making it a more suitable substrate than A2 or S7. As for most tool steels, higher temperature surface treatments, such as CVD, may result in dimensional distortion.

Note: Properties shown throughout this data sheet are typical values. Normal variations in chemistry, size and heat treat conditions may cause deviations from these values. For additional data or metallurgical engineering assistance, consult your local Crucible Service Center.

Service Center Locations

Location	Phone	Toll Free	FAX
Auburn, MA	508-832-5353	800-365-1101	508-832-2217
Charlotte, NC	704-372-3073	800-365-1160	704-342-0985
Chicago, IL	630-378-0093	800-365-1151	630-378-1965
Cincinnati, OH	513-771-1310	800-365-1163	513-771-0119
Cleveland, OH	330-562-3131	800-365-1132	330-562-7818
Columbus, OH	614-262-4959	800-365-1131	614-262-7850
Dallas, TX	817-6492800	800-365-1168	817-633-8142
Detroit, MI	248-528-0332	800-365-1133	248-528-1977
Grand Rapids, MI	616-554-9699	800-365-1137	616-554-9328
Huntsville, AL	256-772-0201	800-365-1161	256-772-3361
Indianapolis, IN	317-638-4501	800-365-1146	317-634-7375
Los Angeles, CA	323-775-7344	800-365-1179	310-830-9784



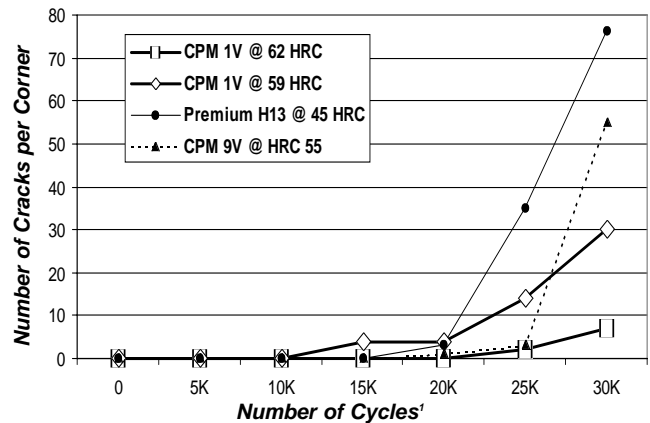
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Machinability and Grindability

The machinability and grindability of CPM 1V in the annealed condition is similar to that of A2.

Thermal Fatigue

The results of thermal fatigue tests show that CPM 1V offers an improvement over premium quality H13 and CPM 9V. Thermal fatigue tests are used to predict performance in die casting or other applications involving cyclic high temperature exposures.



¹Specimens were dipped in molten aluminum at 1250°F and water quenched. Every 5000 cycles specimens were microscopically examined for corner cracks.

Heat Treatments of Specimens for Thermal Fatigue Tests

	HRC	Austenitize	Quench	Temper
CPM 1V	60	2000°F/10 min.	Air	1000°F/2+2hrs.
CPM 1V	59	1950°F/30 min.	Air	1000°F/2+2hrs.
Premium H13	45	1875°F/30 min.	Oil	1130°F/2+2hrs.
CPM 9V	55	2050°F/30 min.	Air	1000°F/2+2hrs.

Location	Phone	Toll Free	FAX
Meadville, PA	814-337-8804	800-365-0530	814-337-8808
Milwaukee, WI	262-781-6710	800-242-0948	262-781-6743
Minneapolis, MN	612-331-6320	800-365-1153	612-331-4137
St. Louis, MO	636-272-7220	877-201-4049	636-978-9559
Canada			
Wallaceburg, ONT	519-627-2245	800-265-5293	519-627-2247
Mexico (SISA)			
Monterrey, N.L.	52-818-351-7220		52-818-351-2981
Naucalpan, E. de M.	52-555-576-4011		52-555-360-1865

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