

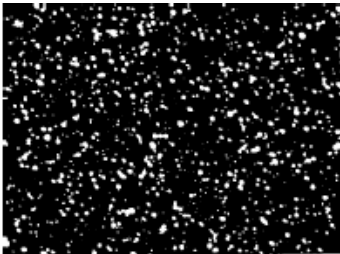
CRUCIBLE CPM[®] Rex[®] 86[®]

Data Sheet

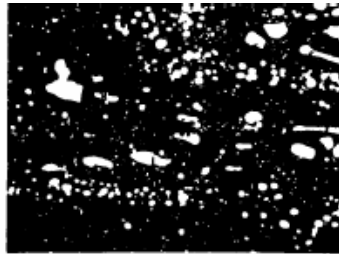
Issue #1

CPM Rex 86 is a super high speed steel (HSS) produced by the Crucible Particle Metallurgy (CPM) process that exhibits an excellent combination of high attainable hardness capability (68-70 HRC), red hardness, and abrasive wear resistance for difficult machining applications. The composition is designed to provide an optimum balance of vanadium-rich MC and tungsten-molybdenum-rich M6C primary carbides in the heat treated microstructure for enhanced wear resistance, while still maintaining good fabricating and toughness characteristics compared to other super HSS with similar attainable hardness capability.

CPM Rex 86 may also be considered for cold work tooling or precision wear parts requiring a combination of excellent wear resistance and high attainable hardness.

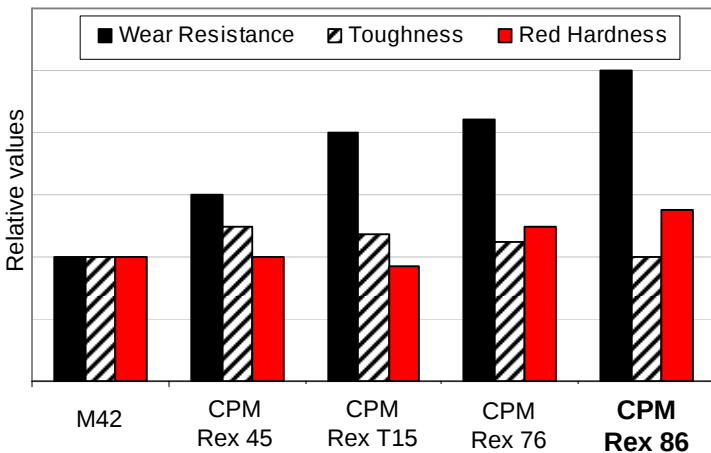


CPM Steel



Conventional Steel

High Speed Steel Comparagraph



Typical Applications

End Mills	Form Tools	Broaches
Gear Hobs	Shaper Cutters	Spade Drills
Tool Bits	Milling Cutters	Special Taps
Rolls	Punches	Dies

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

Carbon	2.0 %
Chromium	4.0 %
Vanadium	5.0 %
Tungsten	10.0%
Molybdenum	5.0 %
Cobalt	9.0 %
Sulfur	0.07 max (0.12*)

**Sulfur is purposely added to larger diameter rounds (e.g. $\geq 2-9/16$ " diameter) to improve the machinability in the annealed condition.*

Physical Properties

Similar to CPM Rex 76.

Density ~ 0.292 lb /cu in (~ 8.1 g/cc)

Annealed hardness – 285 / 311 BHN

Machinability and Grindability

Machinability (annealed) – comparable to CPM T15.

Grindability (heat treated) – comparable to CPM T15 and CPM Rex 76, and significantly better than conventional T15 or other PM HSS with greater vanadium-rich MC carbide content.

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.

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Crucible...

THE TOOL STEEL PROS[®]

Thermal Treatments

Forging: 2000-2100°F (1095-1150°C). Do not forge below 1700°F (925°C). Slow cool after forging.

Annealing: Heat to 1600°F (870°C), hold 2 hours, slow cool no faster than 25°F (15°C) per hour to 1000°F (540°C), then furnace cool or cool in still air to room temperature.

Stress Relieving:

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

Hardened parts: Heat to 25°F (15°C) below original tempering temperature or 1000°F (540°C) minimum, hold 2 hours, furnace or still air cool to room temperature.

Hardening:

Pre-heat: Heat to 1500-1550°F (815-845°C), equalize. An additional pre-heat at 1850-1900°F (1010-1040°C) may be desirable to minimize time at final austenitizing temperature.

Austenitize: heat to 2050-2175°F (1120-1190°C) depending upon desired hardness (see table). Lower hardening temperatures (underhardening) provide finer grain size and increased toughness. Higher hardening temperatures provide maximum hardness, red hardness, and wear resistance.

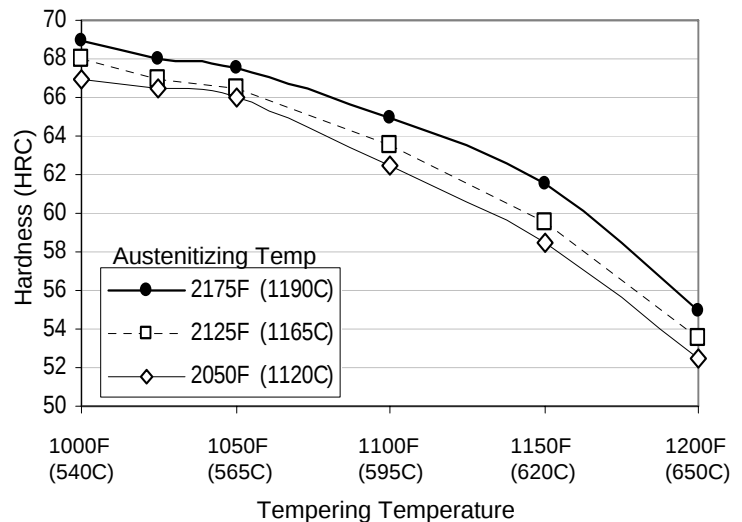
Quench: Interrupted salt quench, oil quench, rapid gas quench, or air cool to below 1100°F (595°C), equalize, then air cool to hand warm (< 125°F or 50°C).

Temper: Triple tempering at 1025-1050°F (550-560°C) recommended for optimum tempering and/or stress-relieving (2 hrs each). Cool to room temperature between tempers. Cryogenic cooling between the first and second tempers optional.

Straightening: Best done warm at 400°F (205°C) minimum.

Tempering Temperature*	Austenitizing Temperature			
	2050F (1120C)	2125F (1165C)	2150F (1175C)	2175F (1190C)
1000F (540C)	67	68	68.5	69
1025F (550C)	66.5	67	67.5	68
1050F (565C)	66	66.5	67	67.5
1100F (595C)	62.5	63.5	64	65
1150F (620C)	58.5	59.5	60	61.5
1200F (650C)	52.5	53.5	54.5	55
Soak time (min)	15-20	10	5	5
No. tempers	3	3	3	4

* Tempering at **1025-1050F (550-565C)** recommended for optimum toughness and stress relieving.



Surface Treatments

CPM Rex 86 can be gas nitrided, ion nitrided, PVD coated, or CVD coated.

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
Dallas, TX	817-649-2800	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	714-632-1131	800-365-1179	714-632-1181
Meadville, PA	814-337-8804	800-365-0530	814-337-8808

Location	Phone	Toll Free	FAX
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

Chatham, ONT	519-354-4420	800-265-5293	519-354-4401
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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

CRUCIBLE SERVICE CENTERS DIVISIONAL HEADQUARTERS:

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