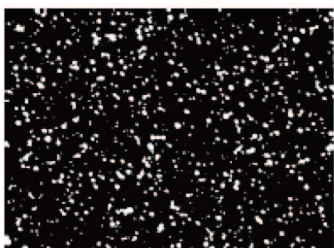


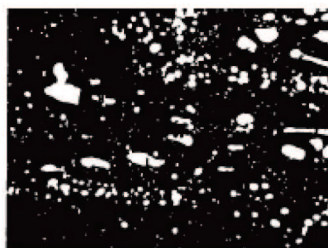
# CRUCIBLE CPM<sup>®</sup> Rex<sup>®</sup> 86<sup>®</sup>

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.

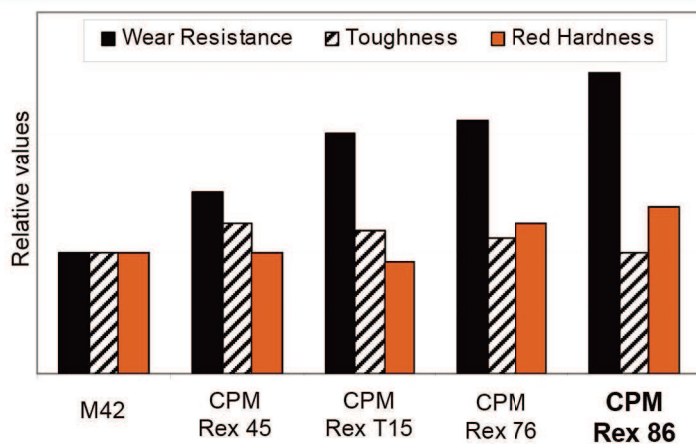


CPM Steel



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	0.12 %

*\*Sulfur is 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.*

**Crucible Industries LLC**

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## 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.

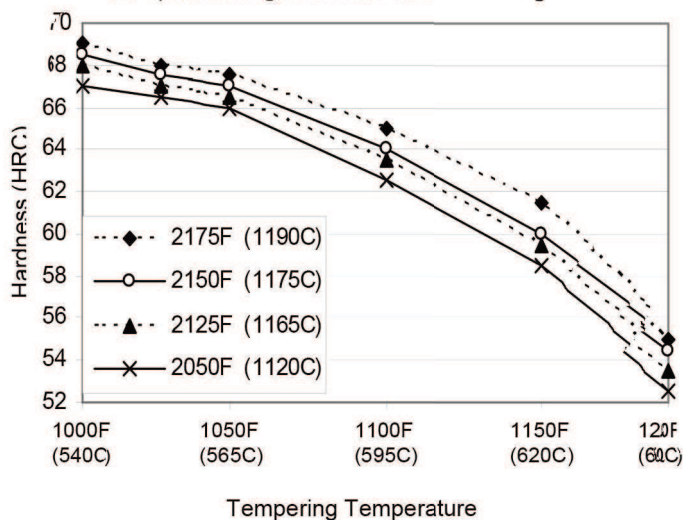
**Quench:** Interrupted salt quench, oil quench, rapid gas quench, or air cool to below 1100°F (595°C), equalize, then air cool to hand warm (< 125°F or 50°C).

**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 gasnitrided, ion nitrided, PVD coated, or CVD coated.



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