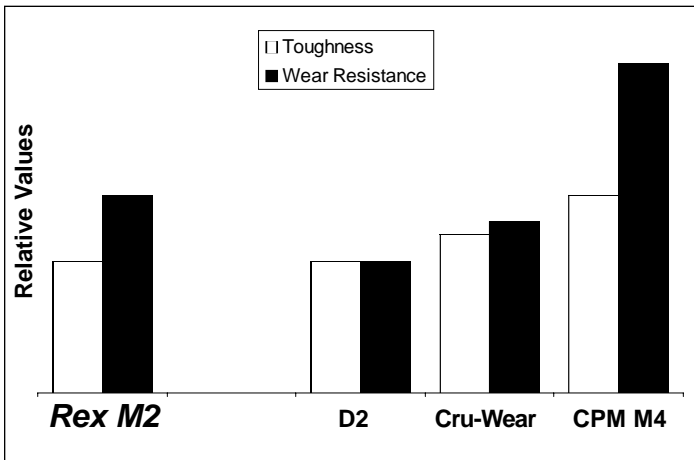


CRUCIBLE

Rex M2 is a tungsten-molybdenum general purpose high speed steel. It is suitable for a wide variety of cutting tools and is often used for metalforming tools such as punches and dies. Rex M2 is a good choice for cutting tools which require moderate feeds and speeds. It provides sufficient red hardness along with outstanding toughness for a high speed steel. For cold work applications, Rex M2 offers higher hardness and wear resistance than D2. Its high attainable hardness provides superior compressive strength for deformation resistance, reducing susceptibility to such problems as peening, denting and edge rollover. Its high tempering temperature and red hardness make it an excellent substrate for most surface treatments.

Tool Steel Comparagraph



Typical Applications

Punches
Dies
Broaches
Milling Cutters

Thread Roll Dies
Form Tools
Lathe Tools

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

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DATA SHEET

CRUCIBLE REX M2

Issue #2

Carbon	0.85%
Chromium	4.15%
Vanadium	1.95%
Tungsten	6.40%
Molybdenum	5.00%

Physical Properties

Elastic Modulus	30 X 10 ⁶ psi	(207 GPa)
Density	0.294 lbs./in ³	(8.14 g/cm ³)
Coefficient of Thermal Expansion		
	in/in/°F	mm/mm/°C
100-500°F (40-260°C)	6.28X10 ⁻⁶	(11.3X10 ⁻⁶)
100-800°F (40-425°C)	6.67X10 ⁻⁶	(12.0X10 ⁻⁶)
100-1000°F (40-540°C)	6.97X10 ⁻⁶	(12.5X10 ⁻⁶)

Mechanical Properties

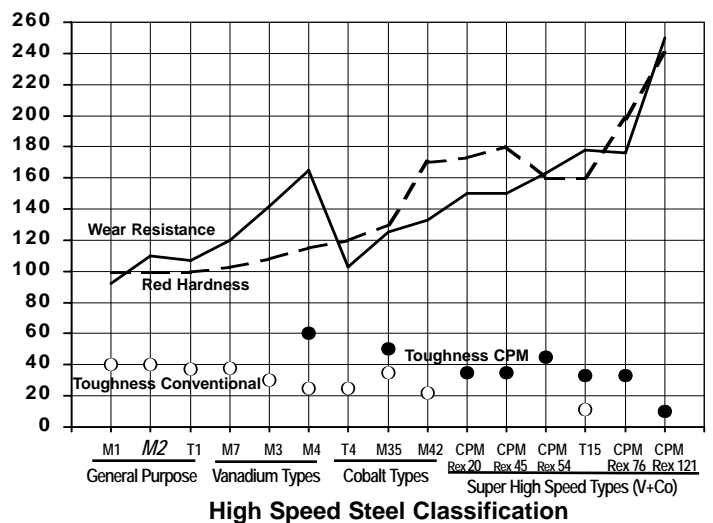
Impact Toughness

Heat Treatment ⁽¹⁾		HRC	Impact Toughness ⁽²⁾	
Austenitizing Temperature	Tempering Temperature		ft.-lb. (J)	
2175°F (1190°C)	1025°F (550°C)	64	17	(23)
2150°F (1175°C)	1050°F (565°C)	63	19	(26)
2100°F (1150°C)	1075°F (580°C)	61	21	(28)

(1) Heat Treatment: Austenitized as indicated and tempered to hardness.

(2) Charpy C-Notch Impact Test

High Speed Steel Comparagraph



Thermal Treatments

Critical Temperature: 1530°F (830°C)

Annealing: Heat to 1600°F (870°C), hold 2 hours, slow cool no faster than 25°F (15°C) per hour to 1000°F (535°C), then furnace cool or cool in still air to room temperature.

Annealed Hardness: About BHN 217/255

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 1450-1500°F (790-815°C) Equalize.

Second Preheat: Suggested for vacuum hardening. Heat to 1850-1900°F (1010-1040°C)

Austenitize: 1975-2225°F (1150-1220°C), hold time at temperature 5-30 minutes (see chart).

Quench: Air or 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 the maximum attainable toughness for a given hardening treatment. Temper immediately.

Temper: Two to three times at 1000°F (540°C) or higher. 2 hours minimum each time. Triple tempering is recommended when hardening from 2100°F (1150°C) or higher. Air cool to room temperature in between tempers.

Size Change: +0.0015 to +0.0022 in/in.

Recommended Heat Treatment:

Cutting tools: Austenitize at 2125-2225°F (1165-1220°C)

Cold work tools: Austenitize at 1975-2125°F (1080-1165°C) (See chart.)

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	817-649-2800	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



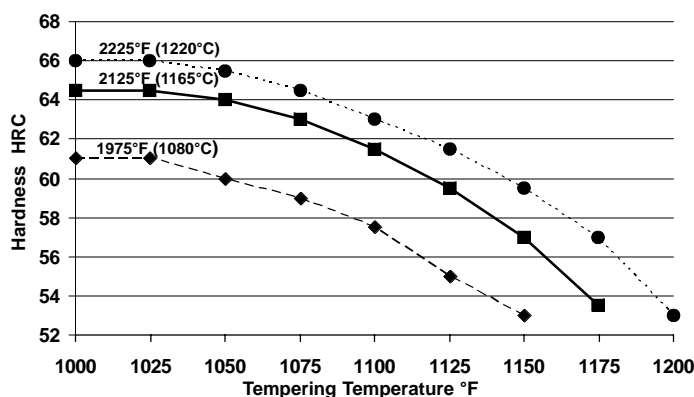
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Heat Treat Response

Hardness HRC

Tempering Temperature	Austenitizing Temperature		
	1975°F (1080°C)	2125°F (1165°C)	2225°F (1220°C)
Minimum time at Austenitizing Temp.	30 min.	15 min.	5 min.
Oil Quenched			
1000°F (540°C)	61	64.5	66
Optimum for Maximum Toughness and Effective Stress Relieving			
1025°F (550°C)	61	64.5	66
1050°F (565°C)	60	64	65.5
1075°F (580°C)	59	63	64.5
1100°F (595°C)	57.5	61.5	63
1125°F (605°C)	55	59.5	61.5
1150°F (620°C)	53	57	59.5
1175°F (635°C)	—	53.5	57
1200°F (650°C)	—	—	53
Minimum number of Tempers	2	3	3

Results may vary with hardening method and section size. Salt or oil quenching will give maximum response. Vacuum or atmosphere cooling may result in up to 1-2 HRC points lower.



Surface Treatments

Because of its high tempering temperatures (>1000°F) Rex M2 is suitable for nitriding, PVD coating or similar surface treatments. CVD coating processes may result in non-predictable dimensional changes.

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

CRUCIBLE SERVICE CENTERS DIVISIONAL HEADQUARTERS:

Syracuse, NY 315-487-0800 800-365-1185 315-487-4028

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