REX® M4 (AISI M4)

CRUCIBLE DATA

REX M4 is a special purpose high speed steel designed to give high wear resistance in tools. Its high vanadium and carbon content provide for superior resistance to cratering and wear in cold work punches, die inserts, and cutting applications involving high speed and light cuts. It is designed to give maximum performance working with abrasive materials, exhibiting better wear resistance than M2 or M3.

Typical Chemistry

Carbon	1.30%
Manganese	0.30%
Silicon	0.30%
Chromium	4.00%
Vanadium	4.00%
Tungsten	5.50%
Molybdenum	4.50%
Sulfur	0.03% max.

Typical Applications

Broach Inserts	Spade Drills
End Mills	Punches
Form Tools	Dies
Taps	Rolls

Annealed Hardness: BHN 225/255

Machinability in the annealed condition is approximately 20% of W1 Tool Steel (1%C).

Thermal Treatments

Critical Temperature: 1545F (840C)

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

Annealing: 1600F(870C), hold 2 hours, slow cool 30F (15C)/hour maximum to 1000F(540C), then air or furnace cool. Hardness BHN 225/255.

Stress-relieving (After machining): 1100-1300F(595-740C), hold 2 hours 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 high temperature hardening in vacuum.

High heat: 1875-2225F(1025-1218C). 2150-2200F(1175-1205C) recommended for cutting tools. 1875-2125(1025-1160C) recommended for cold work applications.

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 the 1850-1300F(1010-705C) range is critical to achieve optimum heat treat response.

Chemistries & Properties Table

Heat Treatments Table

Temper: 1000F(540C) minimum recommended. Double tempering required and triple tempering recommended when hardening from 2100F(1150C) or higher. Air cool to room temperature between tempers.

Stress-relieving (Hardened parts): Temper 30F(15C) below original tempering temperature.

Hardening Data

Tempering Temperature		HEAT TREAT RESPONSE ±1 HRC (NOTE A)					
°C	°F	1875F (1025C)	1975F (1080C)	2050F (1120)C	2100F (1150C)	2150F (1175C)	2200F (1205C)
As Quenched		59.5	62.5	64.5	65	65	63.5
540	1000	58.5	61	62.5	63.5	65	66
OPTIMUM FOR MAXIMUM TOUGHNESS AND EFFECTIVE STRESS-RELIEVING.							
550	**1025**	**58**	**60.5**	**62**	**63**	**64.5**	**65.5**
565	**1050**	**57.5**	**59.5**	**61**	**62**	**63.5**	**64.5**
595	1100	54	56	58.5	60	61.5	62.5
620	1150	50	53	55	56	58	59
650	1200	44	48	51	52	54	55
NOTE A:		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.					
MINIMUM TIME AT AUST TEMP (MINS)		45	30	20	15	10	5
MINIMUM NUMBER OF TEMPERS (2 HRS)		2	2	2	3	3	3

Size Change During Hardening

Hardening Temp.		Tempering Temp.		HRC	Longitudinal Size Change
°F	°C	°F	°C		%
2200	1205	1025	550	65	+.2

Surface Treatments

CPM REX M4 can be nitrided, steam tempered or titanium-nitride coated if desired. If the CVD TiN treatment is used, care is required in vacuum hardening.

Toughness

Lowering the hardening temperature (underhardening) reduces the grain size and increases toughness.

Hardening Temperature		Tempering Temperature		Hardness HRC	Charpy C-Notch Impact Value	
°F	°C	°F	°C		ft-lb	(J)
2200	1205	1025	550	65	8.5	11
2125	1165	1050	565	64	11	15

Physical Properties

Modulus of Elasticity .....31 psi x 10^6 (214 GPa)

Specific gravity 7.97

Density .....0.288 lb/in^3 (7970 kg/m^3)

Coefficient of Thermal Expansion

Temperature Range		Coefficient of Thermal Expansion	
°F	°C	in/in/°Fx10^{-6}	mm/mm/°Cx10^{-6}
100-500	38-260	6.40	11.5
100-800	38-427	6.58	11.8
100-1000	38-593	6.72	12.1

Return to top of page