SIRAPID 3346 Steel

Designation by Standards

Brand Name	Ravne	Mat. No.	DIN	EN	AISI/SAE
SIRAPID 3346	BRM1	1.3346	S2-9-1 †	HS2-9-1	M1

Chemical Composition (in weight %)

C	Si	Mn	Cr	Mo	Ni	V	W	Others
0.82	max. 0.45	max. 0.40	3.85	8.60	-	1.15	1.75	-

Description
M1 is a molybdenum, chromium, vanadium alloy tool steel generally known as a Molybdenum High Speed Tool Steel. It is on of the most widely available tool steels in use today. It is similar in properties to the tungsten tool steels (T series) at a lower. Very tough high-speed Mo steel good grindability.

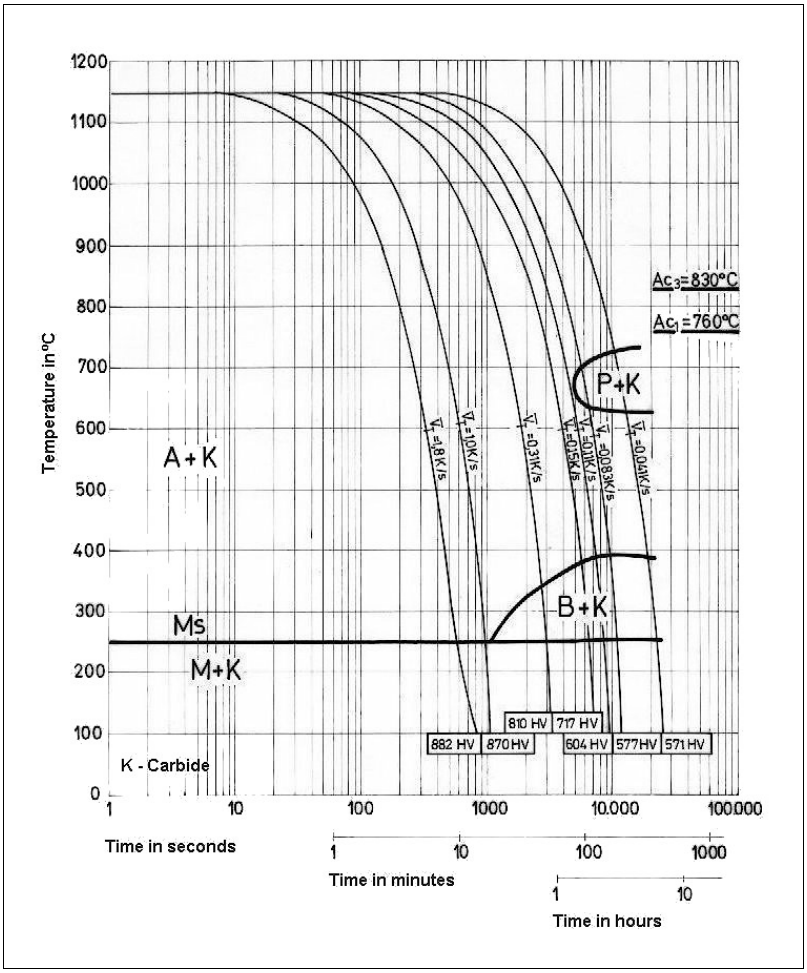
Applications
Twist drills, thread cutting tools, hobs and dies for broaching and cold flow pressing, cross recess dies for screw manufacture, cold rolling for e.g. Sendzimir equipment.

Physical properties (average values) at ambient temperature
Modulus of elasticity [10^3 x N/mm^2]: 217
Density [g/cm^3]: 8.0
Thermal conductivity [W/m.K]: 19.0
Electric resistivity [Ohm mm^2/m]: 0.60
Specific heat capacity[J/g.K]: 0.46

Coefficient of Linear Thermal Expansion 10^{-6} $^oC^{-1}$

20-100^{o}C	20-200^{o}C	20-300^{o}C	20-400^{o}C	20-500^{o}C	20-600^{o}C	20-700^{o}C
11.0	11.5	11.9	12.3	12.4	12.5	12.5

Continuous Cooling Transformation (CCT) Diagram



Soft Annealing

Heat to 820-850^{O}C, cool slowly in furnace to 550^{O}C then air. This will produce a maximum Brinell hardness of 262.

Stress Relieving

Stress relieving to remove machining stresses should be carried out by heating to 600-650^{O}C, holding for one hour at heat, followed by air cooling. This operation is performed to reduce distortion during heat treatment.

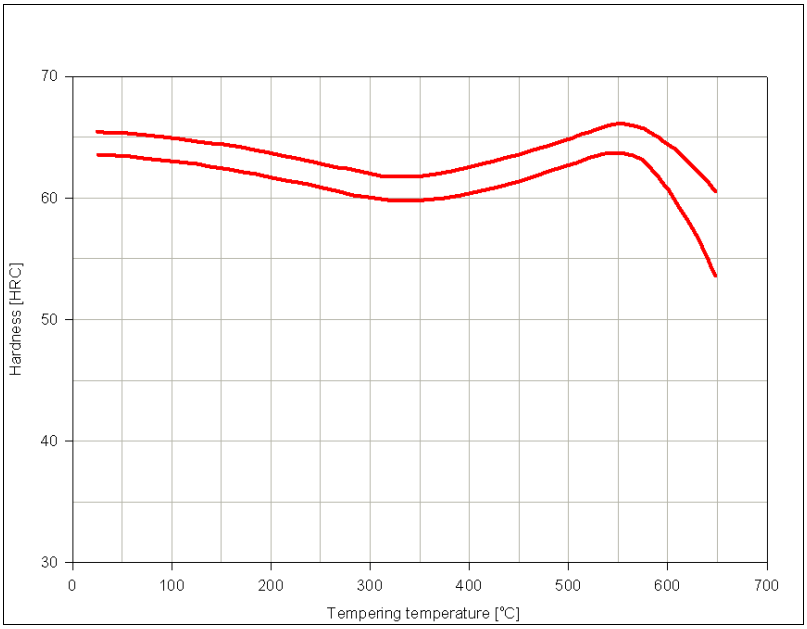
Hardening

0 Harden from a temperature of 1180-1219^{O}C followed by air or oil quenching or warm bath at 550^{O}C. Hardness after quenching is 64-66 HRC.

Tempering

Tempering temperature: 530 - 560^{O}C, at least 2x for at least 63 HRC.

Tempering Diagram



Forging
Hot forming temperature: 1100-900^{o}C.

Cold Working
This alloy may be cold worked in the annealed condition.

Machinability
M1 is classified as a "medium" machinable alloy. Machining should be accomplished prior to hardening heat treatment followed by finish grinding. It has a rating of 50% that of the water hardening (W group) low alloy tool steels in regard to machinability.

Corrosion Resistance
This is not a corrosion resistant alloy. In use as tooling it is often coated with oil to prevent rusting. A light film of oil. or protective wrapping, is essential to keep it free from corrosion.

Welding
Consult the alloy supplier for information on weld procedures.

Forms manufactured: Please see the Dimensional Sales Program.

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