

1.1545, C105U, W5 / W1, C105W1, SS 1880, JIS SK3, (Approximate)

Chemical Composition (in weight %)

C	Si	Mn	Cr	Mo	Ni	V	W	Others
1.05	0.20	0.25	-	-	-	-	-	-

Description

This alloy is one of the common water hardening tool steel grades available. W1 is basically a simple high carbon steel and is easily hardened by heating and quenching in water, just as with plain carbon steel alloys. The W series of tool steels are a very simple alloy group, low cost, and responsive to simple heating and water quenching for hardening. The alloy does undergo considerable distortion during quenching.

Applications

W1 is commonly used for hand operated metal cutting tools, cold heading, embossing taps and reamers as well as cutlery.

Physical properties (average values) at ambient temperature

Modulus of elasticity [$10^3 \times \text{N/mm}^2$]: 210

Density [g/cm^3]: 7.85

Thermal conductivity [W/m.K]: 45.0

Electric resistivity [$\text{Ohm mm}^2/\text{m}$]: 0.20

Specific heat capacity [J/g.K]: 0.46

Coefficient of Linear Thermal Expansion $10^{-6} \text{ }^\circ\text{C}^{-1}$

20-100 $^\circ\text{C}$	20-200 $^\circ\text{C}$	20-300 $^\circ\text{C}$	20-400 $^\circ\text{C}$	20-500 $^\circ\text{C}$
11.1	12.1	12.9	13.5	13.9

Forging

Hot forming temperature: 1050-800 $^\circ\text{C}$.

Machinability

W1 is a plain carbon steel and machines with ease. It is the base line of 100% machinability on which machinability of the other tool steels is compared.

Corrosion Resistance

This is a plain carbon steel and it will corrode unless protected.

Welding

W1 may be welded by all of the standard techniques.

Soft Annealing

Heat to 680-720°C, cool slowly in furnace. This will produce a maximum Brinell hardness of 213.

Stress Relieving

Stress relieving to remove machining stresses should be carried out by heating to approx. 600-650°C, holding for 1-2 hours at heat, followed by air cooling. This operation is performed to reduce distortion during heat treatment.

Hardening

Harden from a temperature of 760-800°C followed by water. Hardness after quenching is 65 HRC.

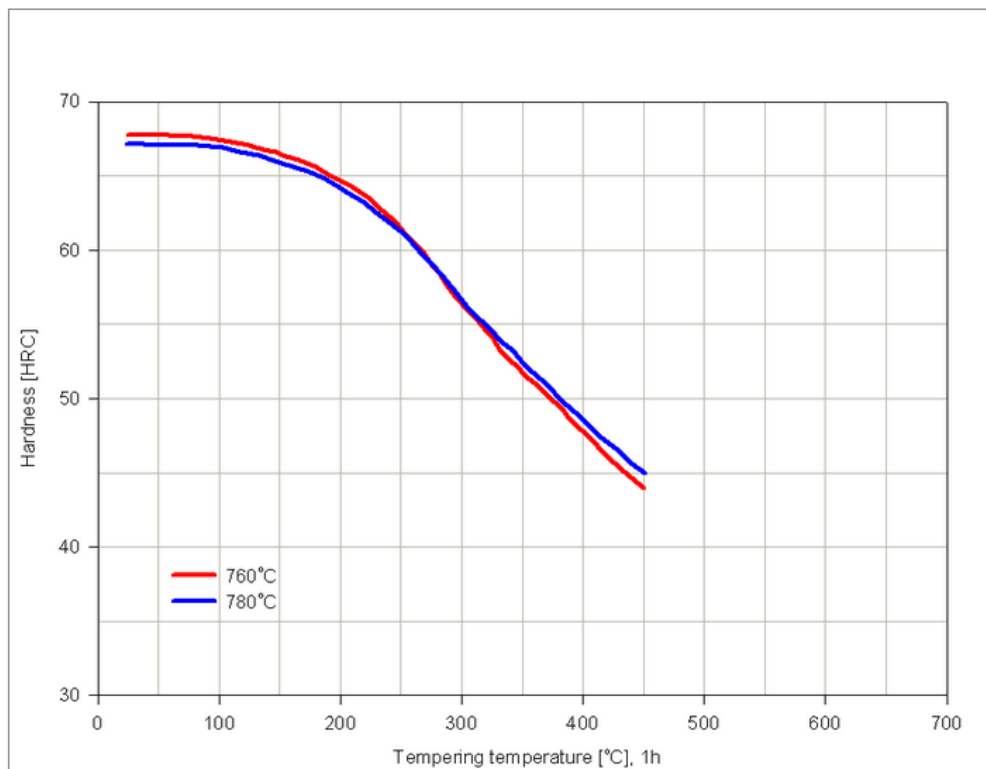
Tempering

Tempering temperature: See the data below.

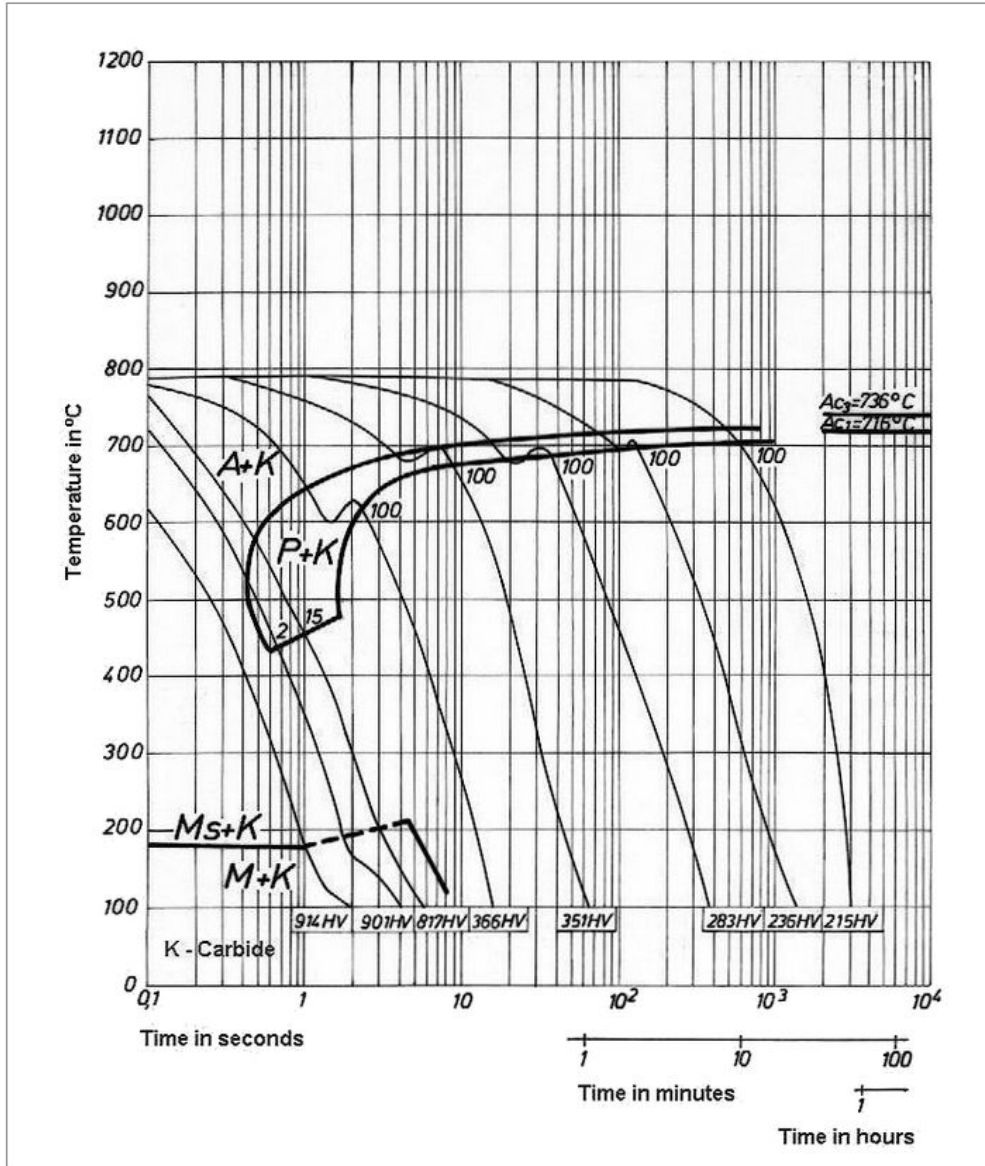
Tempering Temperature (°C) vs. Hardness (HRC)

100°C	200°C	300°C	400°C	450°C
67	64	56	48	45

Tempering Diagram



Continuous Cooling Transformation (CCT) Diagram



Time-Temperature Transformation (TTT) Diagram

