TOOLMAN SPECIAL STEELS

M2

High-Speed Steel

CHEMICAL COMPOSITION

C	Cr	Mo	W	Co	V
0.90*	4.1	5.0	6.0	-	1.8

STANDARDS

- Europe: HS 6-5-2
- Germany: 1.3343
- France: AFNOR Z85WDCV6.5.4.2
- Japan: JIS SKH51
- USA: AISI M2
- Sweden: SS 2722
- UK: BM2

DELIVERY HARDNESS

- Typical soft annealed hardness is 250 HB

DESCRIPTION

M2 is a medium-alloyed high speed steel which has a good machinability and a good performance and is used in a wide variety of applications.

APPLICATIONS

- Twist drills
- Reamers
- Milling cutters
- Taps & dies
- Broaches
- Knives
- Saws
- Cold work tools

FORM SUPPLIED

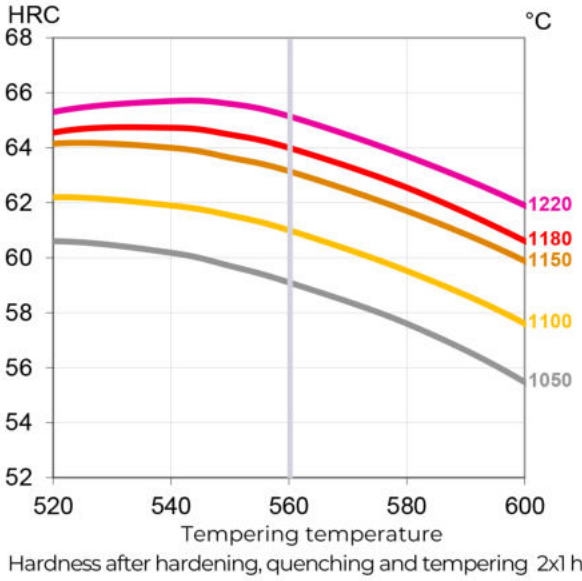
- Round bars
- Flat bars
- Square bars

Available surface conditions: ground, peeled, hot rolled, turned.

HEAT TREATMENT

- Soft annealing in a protective atmosphere at 850-900°C for 3 hours, followed by slow cooling 10°C per hour down to 700°C, then air cooling.
- Stress-relieving at 600°C to 700°C for approximately 2 hours, slow cooling down to 500°C.
- Hardening in a protective atmosphere with pre-heating in 2 steps at 450-500°C and 850-900°C and austenitising at a temperature suitable for chosen working hardness.
- 2 tempers at 560°C are recommended with at least 1 hour holding time each time.

GUIDELINES FOR HARDENING



Hardness after hardening, quenching and tempering 2x1 hour

Tool	Hardening	Tempering
Single-edge cutting tools	1220°C	560°C
Multi-edge cutting tools	1180-1220°C	560°C
Cold work tools	1050-1150°C	560°C

PROCESSING

M2 can be worked as follows:

- machining (grinding, turning, milling)
- polishing
- hot forming
- electrical discharge machining
- welding (special procedure including preheating and filler materials of base material composition).

GRINDING

During grinding, local heating of the surface, which can alter the temper, must be avoided. Grinding wheel manufacturers can provide advice on the choice of grinding wheels.

SURFACE TREATMENT

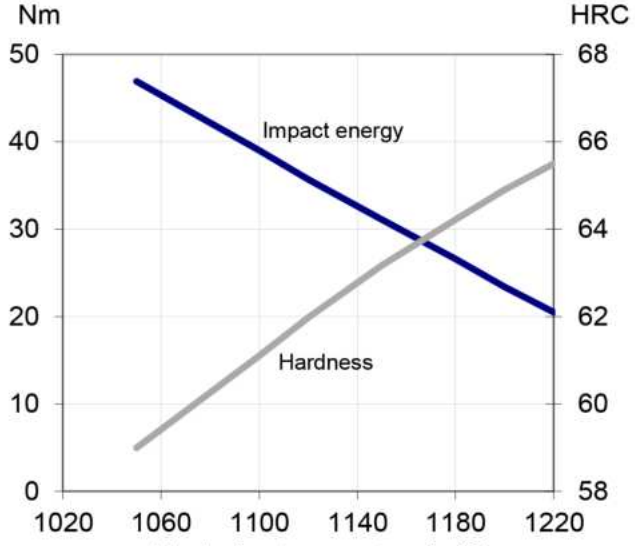
The steel grade is a perfect substrate material for PVD coating. If nitriding is requested, a small diffusion zone is recommended but avoid compound and oxidized layers.

PROPERTIES

PHYSICAL PROPERTIES

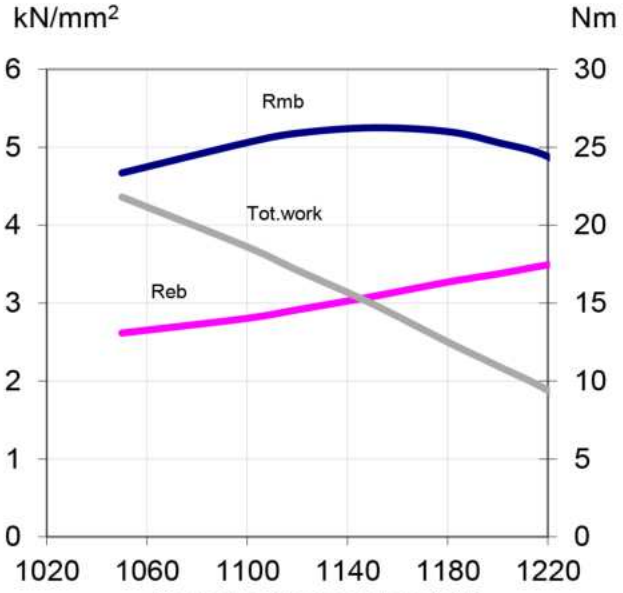
Temperature	20°C	400°C	600°C
Density g /cm³	8.1	8.1	8.0
Modulus of elasticity kN/mm²	225	200	180
Thermal expansion ratio per °C	-	$12.1x10^{-6}$	$12.6x10^{-6}$
Thermal conductivity W/m°C	24	28	27
Specific heat J/kg °C	420	510	600

IMPACT TOUGHNESS



Hardening temperature in °C
Tempering 2 x 1 hour at 560° C
Unnotched test piece 7 x 10 x 55 mm

4-POINT BEND STRENGTH



Hardening Temperature in °C
Tempering 2 x 1 hour at 560°C
Dimension of test piece Ø 4.7 mm

Rmb = Ultimate bend strength in kN/mm²
Reb = Bend yield strength in kN/mm²
Tot. work = Total work in Nm

COMPARATIVE PROPERTIES