High speed steel

E M35

CHEMICAL COMPOSITION

C	Cr	Mo	W	Co	V
0.93	4.2	5.0	6.4	4.8	1.8

STANDARDS

- USA: AISI M35
- Europe: HS 6-5-2-5
- Germany: W.Nr. 1.3243
- (France: (AFNOR Z90WDKCV6.5.5.4.2))
- Sweden: SS 2723
- (UK: BM35)
- Japan: (JIS SKH55)

DELIVERY HARDNESS

Soft annealed max. 270 HB
Cold drawn max. 320 HB
Cold rolled max. 320 HB

DESCRIPTION

E M35 contains cobalt for increased hot hardness. The composition of E M35 offers a good combination of toughness and hardness. E M35 has a good machinability.

APPLICATIONS

- Reamers
- Milling cutters
- End mills
- Cutters
- Hobs
- Broaches
- Saws
- Cold work

FORM SUPPLIED

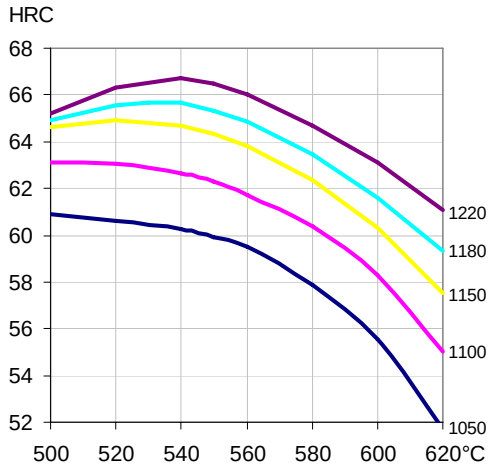
- Wire rod
- Drawn wire
- Round bars
- Flat bars
- Square bars
- Strips
- Sheets
- Discs

Available surface conditions: drawn, ground, rolled, hot rolled, cold rolled, peeled, 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 2 x 1 hour

Tool	Hardening	Tempering
Single-edge cutting tools	1220°C	560°C
Multi-edge cutting tools	1180-1220°C	550-570°C
Cold work tools	1050-1150°C	550-570°C

ERASTEEL

PROCESSING

E M35 can be worked as follows:

- machining (grinding, turning, milling)
- polishing
- plastic 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 furnish advice on the choice of grinding wheels.

SURFACE TREATMENT

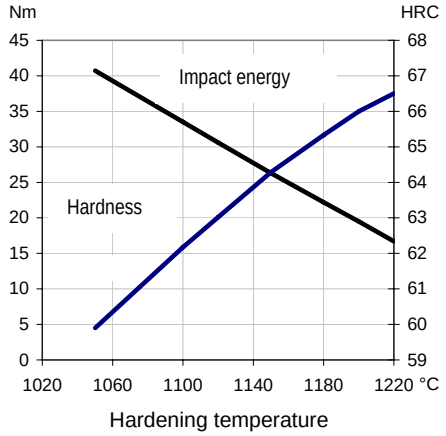
The steel grade is a good substrate material for PVD and CVD coating. If nitriding is requested a small zone of 2-15 µm is recommended. The steel grade can also be steam-tempered if so desired.

PROPERTIES

PHYSICAL PROPERTIES

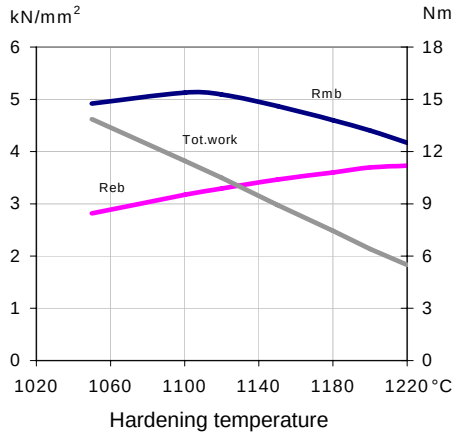
	Temperature		
	20°C	400°C	600°C
Density g/cm³	8.1	8.0	8.0
Modulus of elasticity kN/mm²	230	205	184
Thermal expansion ratio per °C	-	11.6×10^{-6}	11.9×10^{-6}
Thermal conductivity W/m°C	24	28	27
Specific heat J/kg °C	420	510	600

IMPACT STRENGTH



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

4-POINT BEND STRENGTH



Tempering 2 x 1 hour at 560°C
Dimension of test piece ∅ 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