

# 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

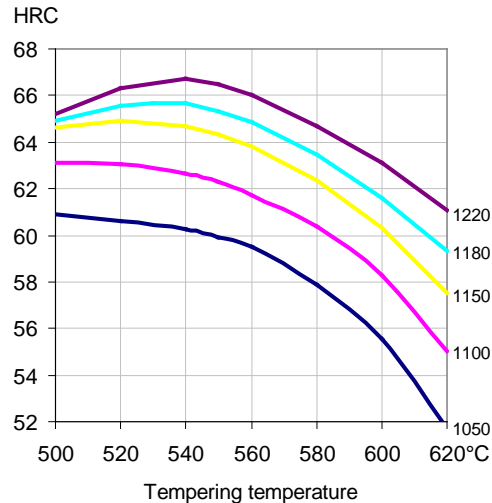
Available surface conditions: drawn, ground, rolled, hot rolled, cold rolled, peeled, turned.

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## 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

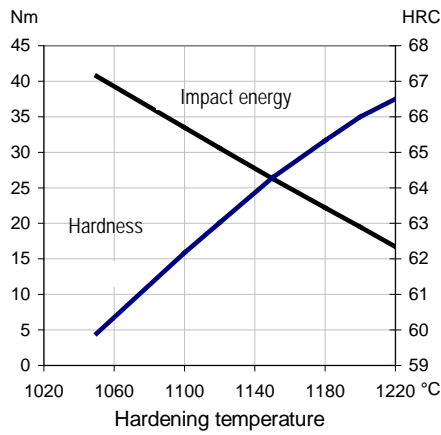
The steel grade is a good substrate material for PVD and CVD coating. If nitriding is requested a small zone of 2-15 µm is recommended. The steel grade can also be steam-tempered if so desired.

# PROPERTIES

## PHYSICAL PROPERTIES

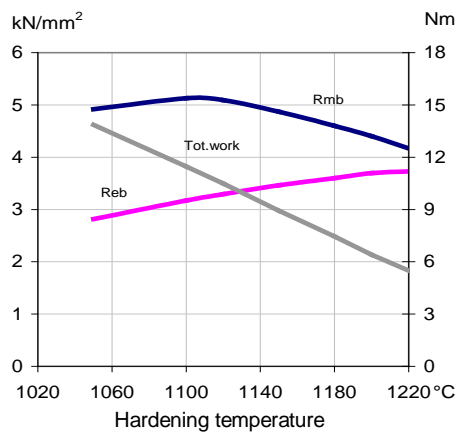
	Temperature		
	20°C	400°C	600°C
Density g/cm <sup>3</sup>	8.1	8.0	8.0
Modulus of elasticity kN/mm <sup>2</sup>	230	205	184
Thermal expansion ratio per °C	-	11.6x10 <sup>-6</sup>	11.9x10 <sup>-6</sup>
Thermal conductivity W/m°C	24	28	27
Specific heat J/kg °C	420	510	600

## IMPACT STRENGTH



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

## 4-POINT BEND STRENGTH



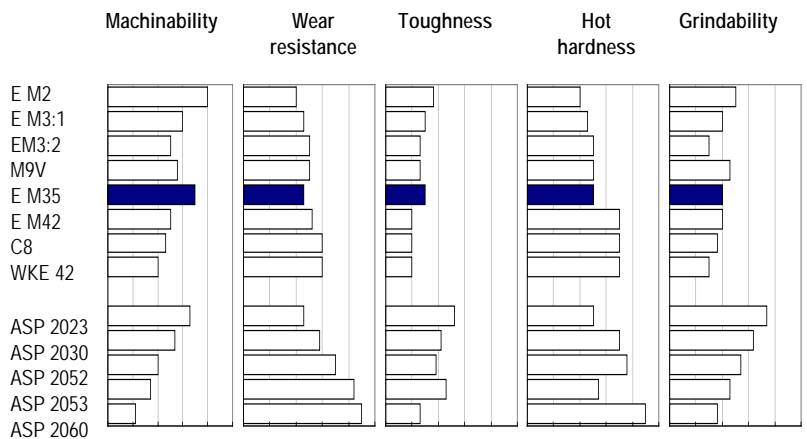
Tempering 2 x 1 hour at 560°C  
Dimension of test piece Ø 4.7 mm

Rmb = Ultimate bend strength  
in kN/mm<sup>2</sup>

Reb = Bend yield strength  
in kN/mm<sup>2</sup>

Tot. work = Total work in Nm

## COMPARATIVE PROPERTIES



## MATERIAL SAFETY DATA SHEET

MSDS: B

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