

### CHEMICAL COMPOSITION

C	Cr	Mo	W	Co	V
1.50	4.0	2.5	2.5	-	4.0

### STANDARDS

- Europe: HS 3-3-4
- Germany: 1.3377

### DELIVERY HARDNESS

- Typical soft annealed hardness is 250 HB
- Cold drawn and cold rolled material is typically 10-40 HB harder

### DESCRIPTION

ASP<sup>®</sup>2005 is the best choice for high toughness, hardness and wear resistance.

### APPLICATIONS

- Cold work tools: Powder compacting tools, cold extrusion tools, cold-heading dies, fine blanking tools
- Plastic injection moulders
- Rolls
- Warm applications: extrusion dies, forging dies and punches

### FORM SUPPLIED

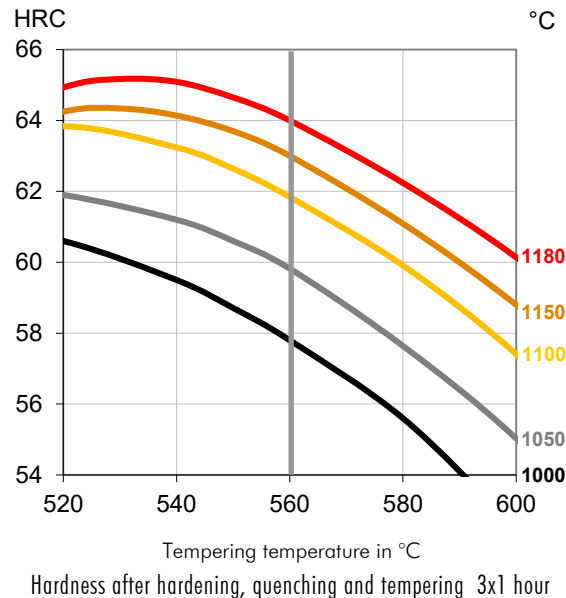
- Round bars
- Flat & square bars

Available surface conditions: drawn, ground, peeled, rough machined, hot rolled.

### HEAT TREATMENT

- Soft annealing in a protective atmosphere at 850-900°C for 3 hours, followed by slow cooling at 10°C/h down to 700°C, then air cooling.
- Stress-relieving at 600-700°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. Cooling down to 40-50°C.
- Tempering at 560°C three times for at least 1 hour each time. Cooling to room temperature (25°C) between temperings.

### GUIDELINES FOR HARDENING



### PROCESSING

ASP<sup>®</sup>2005 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 may 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.

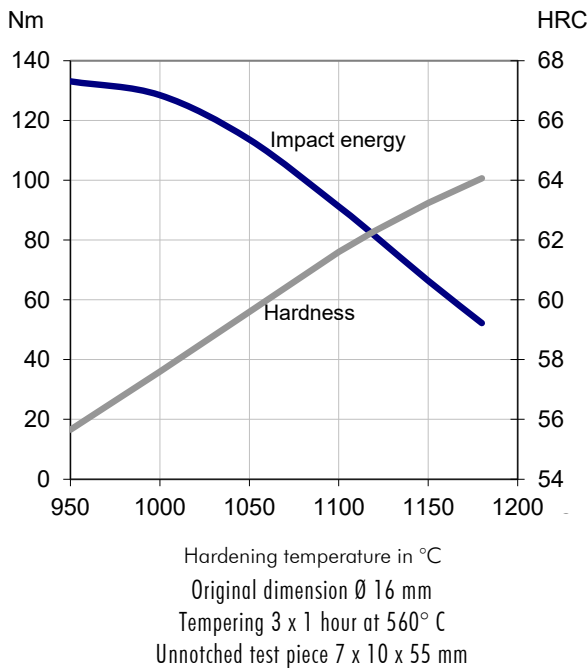
PHYSICAL PROPERTIES

Temperature	20°C	400°C	600°C
Density g /cm <sup>3</sup> (1)	7.8	7.7	7.6
Modulus of elasticity kN/mm <sup>2</sup> (2)	220	195	175
Thermal expansion ratio per °C (2)	-	12.1x10 <sup>-6</sup>	12.7x10 <sup>-6</sup>
Thermal conductivity W/m°C (2)	24	28	27
Specific heat J/kg °C (2)	420	510	600

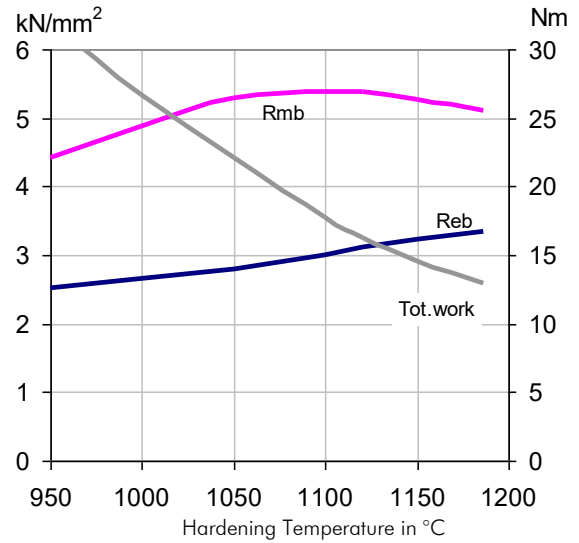
(1)=Soft annealed

(2)=Hardened 1180°C and tempered 560°C, 3x1 hour

IMPACT TOUGHNESS

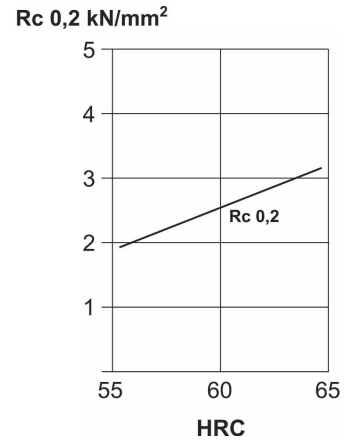


4-POINT BEND STRENGTH



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

COMPRESSION YIELD STRESS



SAFETY DATA SHEET SDS: A

COMPARATIVE PROPERTIES

