

CHEMICAL COMPOSITION

C	Cr	Mo	W	Co	V
1.28	4.0	5.0	6.4	-	3.1

ASP 2023 is a non cobalt grade for high performance cutting tools, cold work tools and rolls for cold rolling.

STANDARDS

- _ USA: AISI (M3:2)
- _ Europe: HS 6-5-3
- _ Germany: W.Nr. 1.3344
- _ Sweden: SS 2725
- _ Japan: JIS SKH53

DELIVERY HARDNESS

Soft annealed max. 260 HB
Cold drawn max. 300 HB
Cold rolled max. 300 HB

FORM SUPPLIED

- _ Coils
- _ Round bars
- _ Discs
- _ Flat & square bars
- _ Strips
- _ Sheets

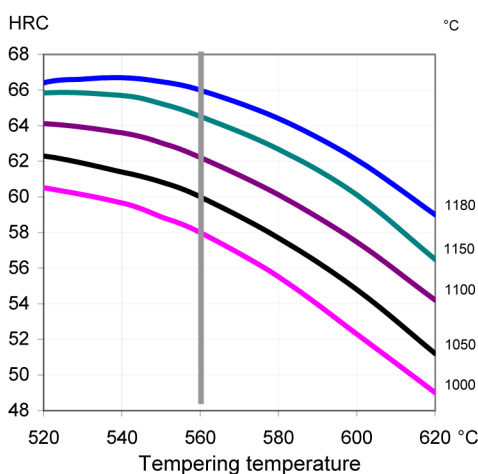
Available surface conditions: drawn, ground, peeled, rough machined, cold rolled, hot rolled.

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.

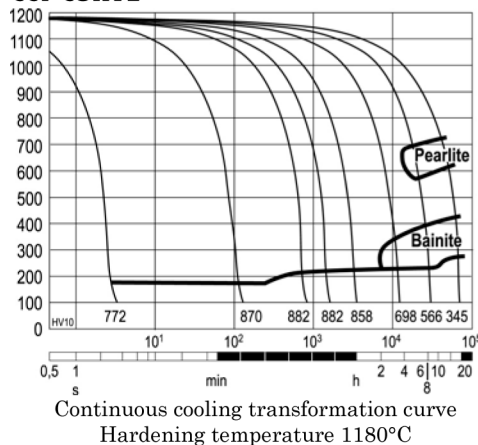
GUIDELINES FOR HARDENING

Hardness HRC	Hardening temperature °C
56	975
58	1000
59	1030
60	1050
61	1075
62	1100
63	1120
64	1140
65	1160
66	1180



Hardness after hardening, quenching and tempering 3x1 hour

CCT CURVE



Continuous cooling transformation curve
Hardening temperature 1180°C



PROCESSING

ASP 2023 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 may 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

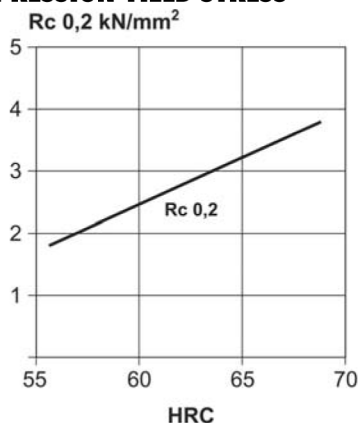
PHYSICAL PROPERTIES

	Temperature		
	20°C	400°C	600°C
Density g/cm ³ (1)	8.0	7.9	7.9
Modulus of elasticity kN/mm ² (2)	230	205	184
Thermal expansion ratio, per °C (2)	-	12,1x10 ⁻⁶	12,7x10 ⁻⁶
Thermal conductivity W/m°C (2)	24	28	27
Specific heat J/kg °C (2)	420	510	600

(1)=Soft annealed

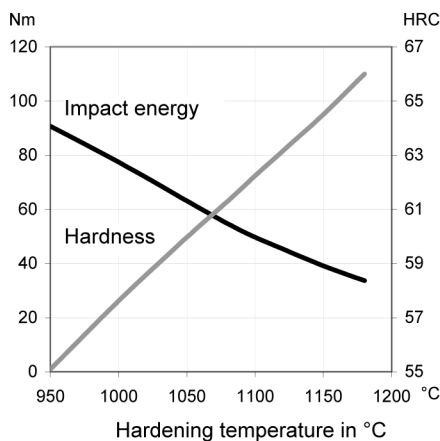
(2)=Hardened 1180°C and tempered 560°C, 3x1 hour

COMPRESSION YIELD STRESS



Test piece : hour glass with 10 mm Ø waist

IMPACT STRENGTH

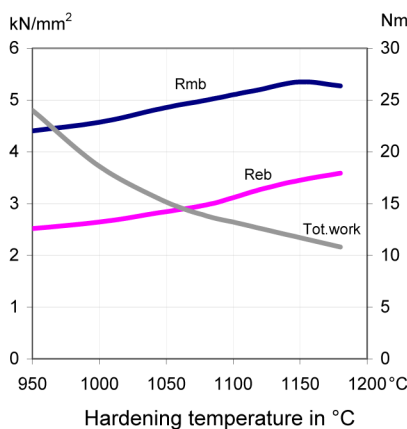


Original dimensions 9 x 12 mm

Tempering 3 x 1 hour at 560° C

Unnotched test piece 7 x 10 x 55 mm

4-POINT BEND STRENGTH



Original dimensions Ø 6 mm

Tempering 3 x 1 hour at 560° C

Dimensions 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

