

## CHEMICAL COMPOSITION

C	Cr	Mo	W	Co	V
1.50	5.00	-	12.5	5.00	5.00

## STANDARDS

- USA: AISI T15
- Europe: HS 12-0-5-5
- Germany: 1.3202

## DELIVERY HARDNESS

- Typical soft annealed hardness is 280 HB

## DESCRIPTION

ASP 2015 is a high tungsten alloy grade for high performance cutting tools.

## APPLICATIONS

- End mills
- Hobs
- Shaper cutters
- Broaches

## FORM SUPPLIED

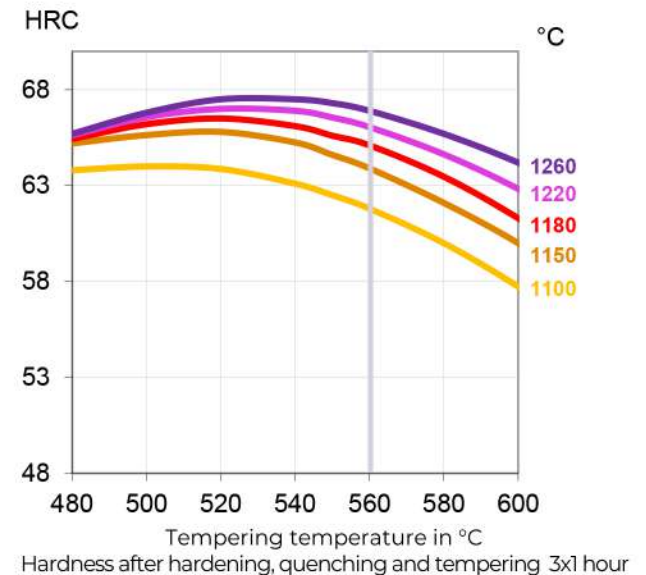
- Forged blanks
- Round bars
- Flat & square bars

Available surface conditions: peeled, hot-worked, hot rolled, centerless-ground, rough-machined.

## 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>2015 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.

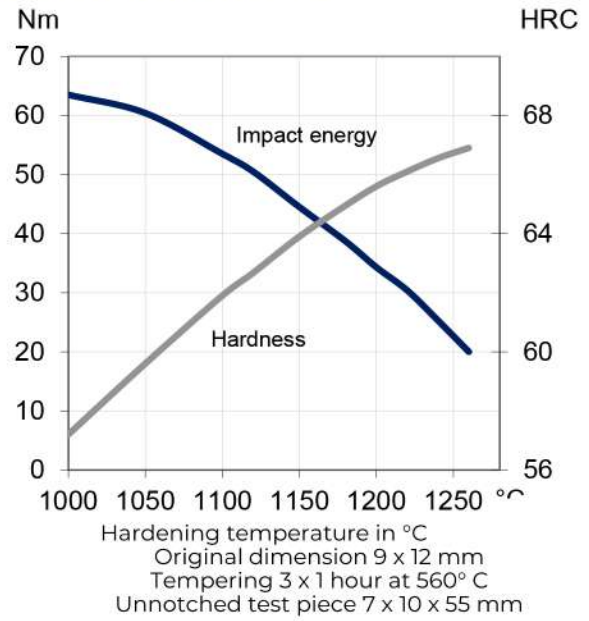
**PROPERTIES**

**PHYSICAL PROPERTIES**

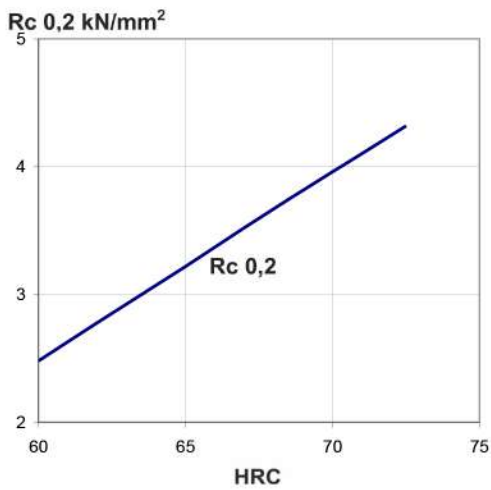
Temperature	20°C	400°C	600°C
Density g /cm <sup>3</sup> (1)	8.2	8.1	8.0
Modulus of elasticity kN/mm <sup>2</sup> (2)	245	220	195
Thermal expansion ratio per °C (2)	-	11.0x10 <sup>-6</sup>	11.7x10 <sup>-6</sup>
Thermal conductivity W/m°C (2)	24	28	27
Specific heat J/kg °C (2)	420	510	600

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

**IMPACT TOUGHNESS**



**COMPRESSION YIELD STRESS**



**COMPARATIVE PROPERTIES**

