

### CHEMICAL COMPOSITION

C	Si	Mn	Cr	Mo	W	V
0.60	1.0	0.3	4.0	2.0	2.1	1.5

### STANDARDS

- Europe: HS 2-2-2
- Germany: 1.3397

### DELIVERY HARDNESS

- Typical soft annealed hardness is 230 HB

### DESCRIPTION

ASP®2012 is the best in class for high toughness up to 58 HRC in cold-, warm- and hot applications.

### APPLICATIONS

- Cold work tools: Powder compacting tools, cold extrusion tools, cold-heading dies, fine blanking tools.
- Plastic injection moulders, broaches and injector pins.
- Machine components and rolls.
- Warm- and hot-work applications: extrusion dies, forging dies and punches, hot forming dies.

### FORM SUPPLIED

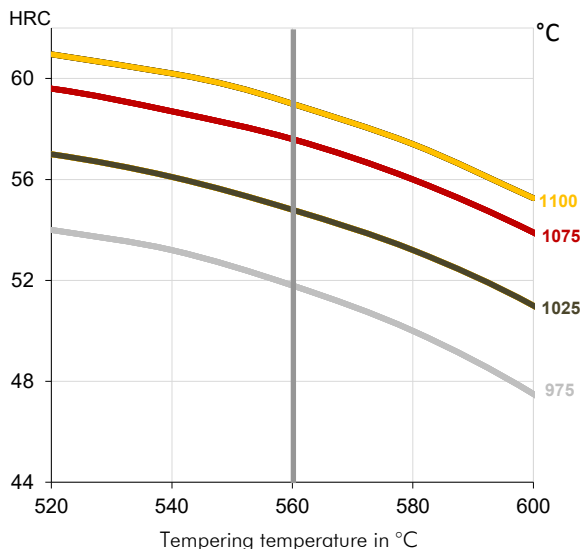
- Round bars
- Flat bars

Available surface conditions: drawn, peeled, 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



Hardness after hardening, quenching and tempering 3x1 hour

ASP®2012 has a good flexibility in heat treatment with hardening temperatures commonly used for cold work tool steel applications.

To achieve the optimal hardness and toughness combination we recommend tempering at 560°C.

For a hardness above 58 HRC, do not hesitate to contact our technical support to define the best heat treatment process for the application.

### PROCESSING

ASP®2012 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

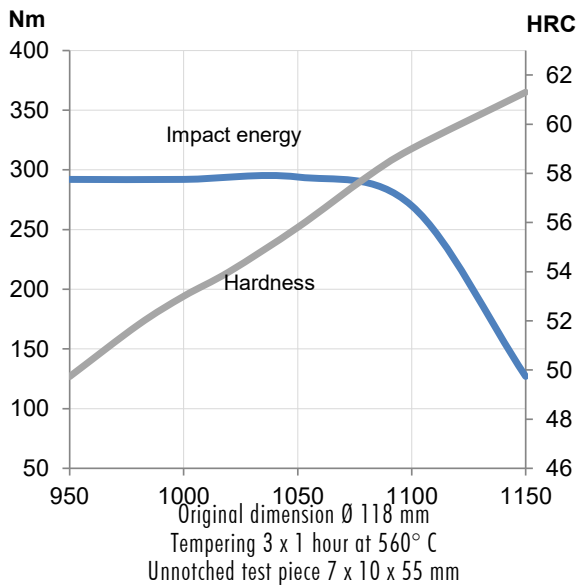
## PHYSICAL PROPERTIES

Temperature	20°C	400°C	600°C
Density g /cm <sup>3</sup> (1)	7.8	7.7	7.6
Modulus of elasticity kN/mm <sup>2</sup> (2)	220	195	175
Coefficient of thermal expansion from 20°C, per °C (2)	-	12.1x10 <sup>-6</sup>	12.7x10 <sup>-6</sup>
Thermal conductivity W/m°C (2)	26	30	30
Specific heat J/kg °C (2)	420	510	600

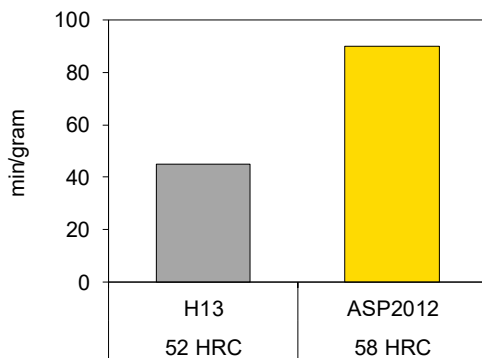
(1)=Soft annealed

(2)=Hardened 1100°C and tempered 560°C, 3x1 hour

## IMPACT TOUGHNESS



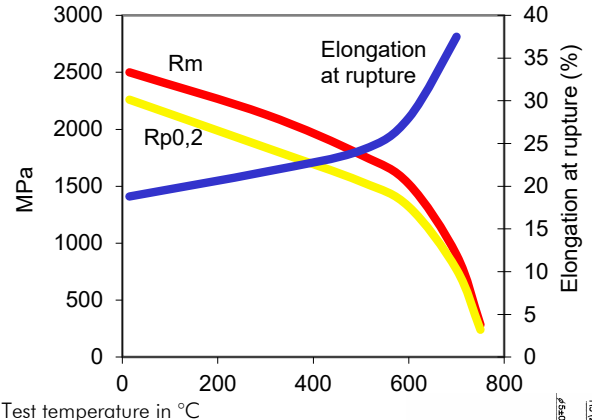
## WEAR RESISTANCE



Wear resistance is measured as the time needed for removal of one-gram material from a test piece.

Technique: Pin-on-cylinder, dry SiO<sub>2</sub>-paper of grade 00, sliding rate 0,3m/s, load 9N and size of specimen 2 x 5 x 30mm.

## TENSILE STRENGTH

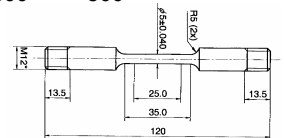


Test temperature in °C

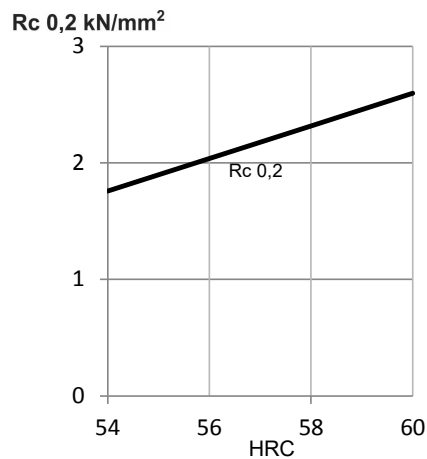
Size of blank Ø15mm

Test piece dimensions are given below.

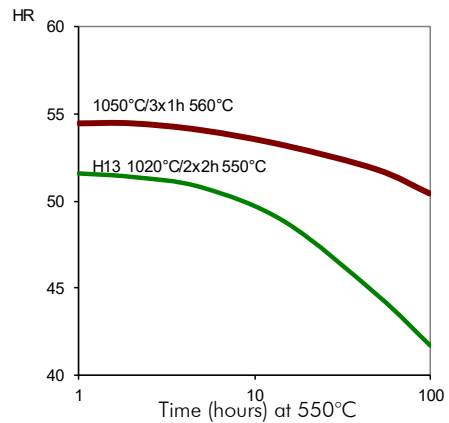
Hardness 58 HRC



## COMPRESSION YIELD STRESS



## TEMPERING RESISTANCE



SAFETY DATA SHEET SDS: A

## COMPARATIVE PROPERTIES

