HIGH SPEED STEELS

Application Segments

Cutting Tools | Automotive

Available Product Variants

Long Products* | Plates

* Presented data refer exclusivly to long products. Please observe the detailed explanations at the end of the data sheet (pdf).

Product Description

Sustainable Performance – "our resource efficient material solutions deliver the highest efficiency and help create a more sustainable tomorrow, today!"

BÖHLER S390SP – “The decathlete with the small footprint”
Engineered for excellence, our high-performance PM steel masters every challenge with ease. From twist drills and taps to milling cutters, broaching tools, and cold work applications – BÖHLER S390SP delivers peak performance with precision and sustainability. A true all-rounder that combines strength, versatility, and a reduced environmental footprint.

Process Melting

Powder metallurgy

Properties

- Toughness & Ductility : high
- Wear Resistance : high
- Compressive strength : very high
- Edge Stability : very high
- Grindability : high
- Hot Hardness (red hardness) : very high

Applications

- Broaches and Reamers
- Fine Blanking, Stamping, Blanking
- Rolling
- Twist Drills and Taps
- Packaging
- Cold Forming / Coining
- Gear Cutting, Shaving and Shaping Tools
- Industrial Knives
- Wear parts
- Roll Forming
- End Mills
- Powder Pressing
- Special Cutting Tools
- Pill punching dies

Chemical composition (wt. %)

C	Cr	Mo	V	W	Co
1.64	4.80	2.00	4.80	10.40	8.00

Material characteristics

	Compressive strength	Grindability	Red hardness	Toughness	Wear resistance	Edge Stability
BÖHLER S390SP	★★★★	★★★	★★★★	★★★★	★★★★	★★★★
BÖHLER S390 MICROCLEAN	★★★★	★★★	★★★★	★★★★	★★★★	★★★★
BÖHLER S290 MICROCLEAN	★★★★★	★	★★★★	★★	★★★★★	★★★★
BÖHLER S393 MICROCLEAN	★★★★	★★★	★★★★	★★★★	★★★★	★★★★
BÖHLER S590 MICROCLEAN	★★★★	★★★	★★★★	★★★	★★★	★★★
BÖHLER S690 MICROCLEAN	★★★	★★★	★★	★★★★★	★★★	★★
BÖHLER S790 MICROCLEAN	★★★	★★★	★★	★★★★	★★	★★★
BÖHLER S793 MICROCLEAN	★★★	★★★	★★★★	★★★	★★★	★★★

Delivery condition

Annealed

Hardness (HB)	max. 320 | drawn execution max. 320 HB
Tensile Strength (MPa)	max. 1,080

Hardened and Tempered

Hardness (HRC)	64 to 68

Heat treatment

Annealing

Temperature	770 to 840 °C	4 h || controlled slow cooling in furnace (10 to 20°C/h / (50 to 68°F/h) to 740°C/2h (1364°F/2 h) || cooling in furnace,

Stress relieving

Temperature	600 to 650 °C	Slow cooling in furnace. || To relieve stresses set up by extensive machining or in tools of intricate shape. || After through heating, hold in neutral atmosphere for 1 to 2 hours.

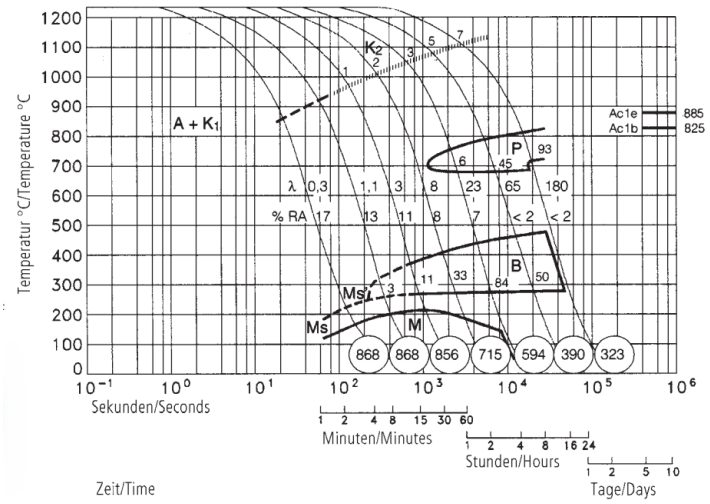
Hardening and Tempering

Temperature	1,100 to 1,230 °C	Salt bath, vacuum || Preheating: 1st stage ~ 500 °C (930 °F), 2nd stage ~ 850 °C (1560 °F), 3rd stage ~1050 °C (1920 °F) || Austenitising: 1100 - 1230 °C (2012 °F - 2246 °F), holding time after complete heating 80 seconds, maximum 150 seconds, to avoid material damage due to overheating. || Quenching: oil, warm bath (500 - 550 °C (930 °F - 1020 °F)), gas
Temperature	550 to 570 °C	Slow heating to tempering temperature immediately after austenitising. || Holding time in the furnace at least 2 hours || Slow cooling to room temperature between each tempering step || 3 tempering cycles recommended || Hardness see tempering chart

Continuous cooling CCT curves

Austenitisierungstemperatur: 1230°C
Haltedauer: 180 Sekunden

Austenitising temperature: 1230°C (2246°F)
Holding time: 180 seconds



Austenitising temperature: 1230 °C (2246 °F)

Holding time: 180 seconds

◯ Vickers hardness

3...93 phase percentages

0.30...180 cooling parameter λ, i.e. duration of cooling from 800 to 500 °C (1472 to 932 °F) in s x 10^{-2}

A… Austenite

K… Carbide

P… Perlite

B... Bainite

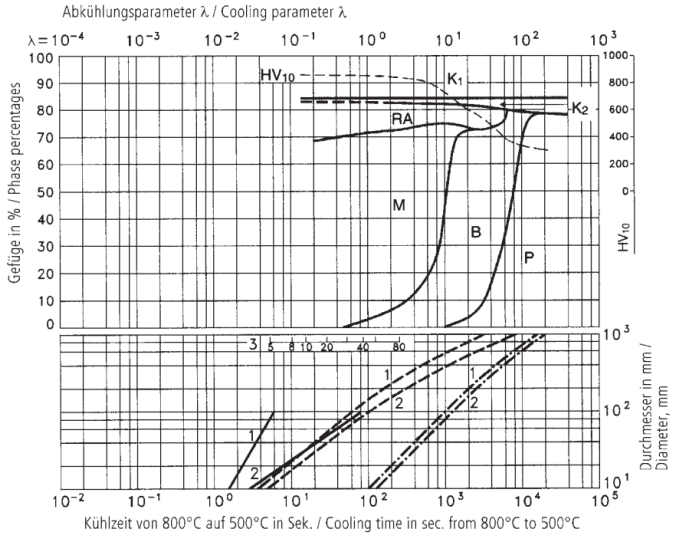
M… Martensite

Ms… Martensite starting temperature

Quantitative phase diagram

Austenitisierungstemperatur: 1230°C
Haltedauer: 180 Sekunden

Austenitising temperature: 1230°C (2246°F)
Holding time: 180 seconds



A....Austenite

B....Bainite

K....Carbide

P....Perlite

M....Martensite

RA...Retained Austenite

1....Edge or Face

2....Core

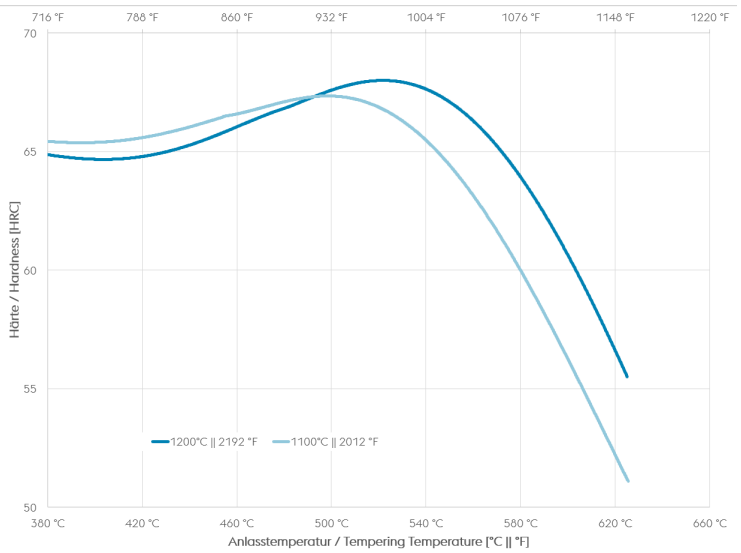
3....Jominy test: distance from quenched end

— watercooling

– – oilcooling

– · – aircooling

Tempering Chart



Holdingtime 3x2 hours

Specimensize: square 25mm

Austenitising in vacuum

Physical Properties

Temperature (°C)	**20**
Density (kg/dm³)	8.1
Thermal conductivity (W/(m.K))	17
Specific heat (kJ/kg K)	0.42
Spec. electrical resistance (Ohm.mm²/m)	0.61
Modulus of elasticity (10³N/mm²)	231

Thermal Expansions between 20°C | 68°F and ...

Temperature (°C)	**100**	**200**	**300**	**400**	**500**	**600**	**700**
Thermal expansion (10⁻⁶ m/(m.K))	10	10.5	10.8	11.2	11.3	11.4	11.6

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ONE STEP AHEAD.