HIGH SPEED STEELS

Application Segments

Cutting Tools

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

BÖHLER S290 MICROCLEAN – "The hard stuff"
The unusual alloy point of this bridge material between carbide and high-speed steel gives it a hardness of up to 70 HRC. In addition to its hot hardness and good wear resistance, its compressive strength is one of the most important properties of this powder-metallurgical high-speed steel class.

Process Melting

Powder metallurgy

Properties

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

Applications

- Cold Forming / Coining
- Powder Pressing
- Fine Blanking, Stamping, Blanking
- Special Cutting Tools
- Gear Cutting, Shaving and Shaping Tools
- Wear parts

Chemical composition (wt. %)

C	Cr	Mo	V	W	Co
2.0	3.8	2.5	5.1	14.3	11.0

Material characteristics

	Compressive strength	Grindability	Red hardness	Toughness	Wear resistance	Edge Stability
BÖHLER S290 MICROCLEAN	★★★★★	★	★★★★	★★	★★★★★	★★★★
BÖHLER S390 MICROCLEAN	★★★★	★★★	★★★★	★★★★	★★★★	★★★★
BÖHLER S393 MICROCLEAN	★★★★	★★★	★★★★	★★★★	★★★★	★★★★
BÖHLER S590 MICROCLEAN	★★★★	★★★	★★★★	★★★	★★★	★★★
BÖHLER S690 MICROCLEAN	★★★	★★★	★★	★★★★★	★★★	★★
BÖHLER S790 MICROCLEAN	★★★	★★★	★★	★★★★	★★	★★★
BÖHLER S792 MICROCLEAN	★★★	★★★	★★	★★★★	★★	★★★
BÖHLER S793 MICROCLEAN	★★★	★★★	★★★★	★★★	★★★	★★★

Delivery condition

Annealed

Hardness (HB)	max. 350

Heat treatment

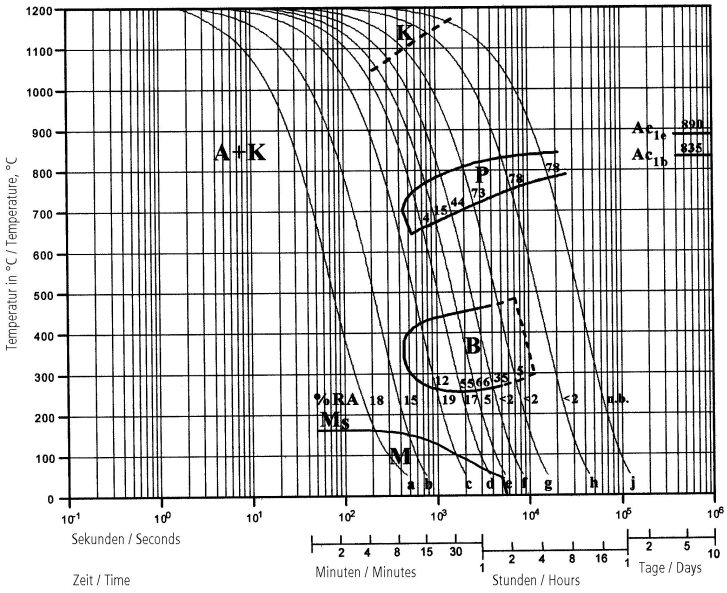
Stress relieving

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	1,150 to 1,210 °C	Salt bath, vacuum || Preheating: 1st stage ~ 500 °C (930 °F), 2nd stage ~ 850 °C (1560 °F), 3rd stage ~1050 °C (1920 °F)|| Austenitising: 1150 - 1210 °C (2100 °F - 2210 °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 580 °C	Slow heating to tempering temperature immediately after austenitising. || Dwell time in the furnace 1 hour per 20 mm material thickness (at least 1 hour) || Slow cooling to room temperature between each tempering step || 3 tempering cycles recommended || Hardness see tempering chart

Continuous cooling CCT curves

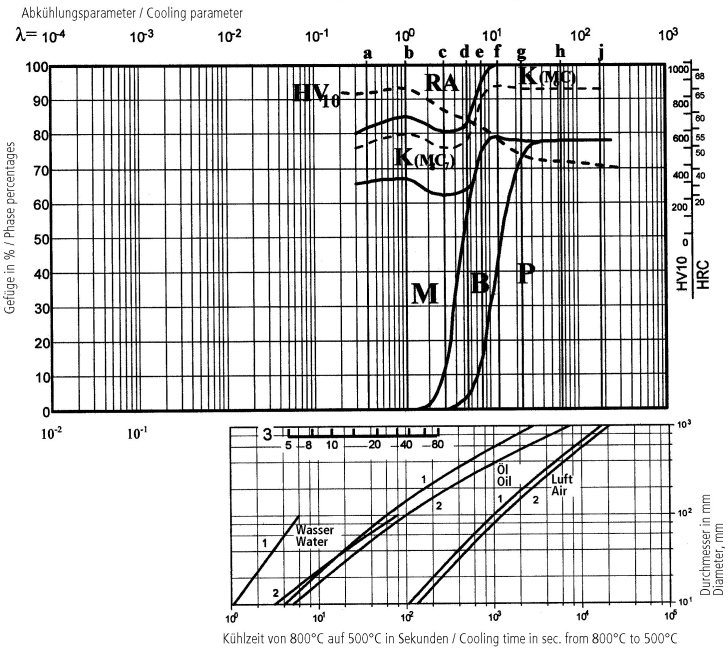


Austenitising temperature: 1210°C (2210°F)
Holding time: 180 seconds

A....Austenite
B....Bainite
K....Carbide
P....Perlite
M....Martensite
RA...Retained Austenite

Sample	λ	HV10	Sample	λ	HV10
a	0,4	842	f	12,5	562
b	1,1	864	g	23,0	476
c	3,0	737	h	65,0	444
d	5,5	678	j	180,0	418
e	8,0	626			

Quantitative phase diagram



A....Austenite
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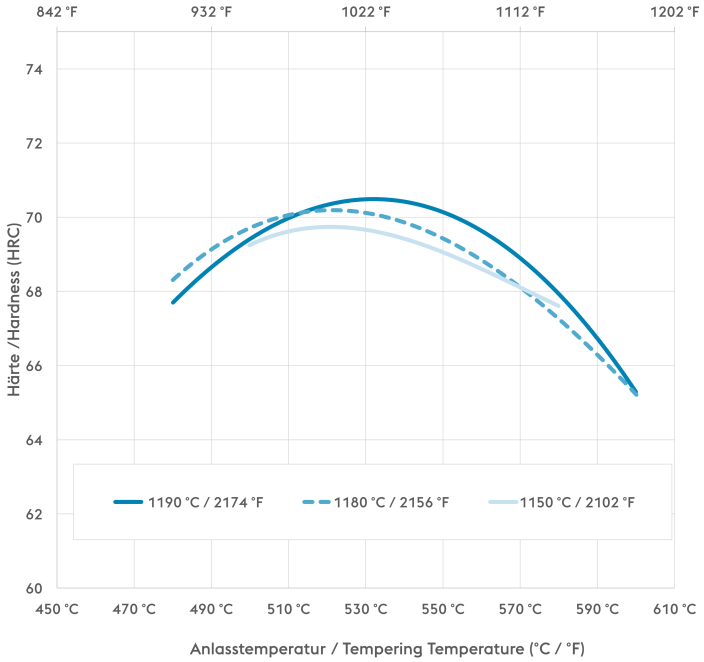
1....Edge or Face
2....Core
3....Jominy test: distance from quenched end

Tempering Chart



Holdingtime 3x2 hours

Specimensize: square 25mm

Physical Properties

Temperature (°C)	**20**
Density (kg/dm^3)	8.3
Thermal conductivity (W/(m.K))	19
Specific heat (kJ/kg K)	0.41
Spec. electrical resistance (Ohm.mm^2/m)	0.56
Modulus of elasticity (10^{3}N/mm^2)	242

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

Temperature (°C)	100	200	300	400	500	600	700
Thermal expansion (10^{-6} m/(m.K))	9.6	10	10.3	10.6	10.9	11.2	11.6

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ONE STEP AHEAD.