

HIGH SPEED STEELS

Available Product Variants

- Long Products*
- Plates

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

Product Description

BÖHLER S790 MICROCLEAR – "The 1st MICROCLEAR"

High-speed steel manufactured in a powder metallurgy process, with good hot hardness, compressive strength, and wear resistance. PM technology gives it good toughness and excellent workability, including the best machinability.

Process Melting

- Powder metallurgy

Properties

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

Applications

- > Automotive Racing
- > Broaches and Reamers
- > Cold Forming / Coining
- > Powder Pressing
- > Rolling
- > Shearing / Machine Knives
- > Special Cutting Tools
- > Wear parts

Technical data

Material designation		Standards	
1.3345	SEL	4957	EN ISO
HS6-5-3C	EN		

Chemical composition (wt. %)

C	Cr	Mo	V	W
1.3	4.2	5	3	6.3

Material characteristics

	Compressive strength	Grindability	Red hardness	Toughness	Wear resistance	Edge Stability
BÖHLER S790 MICROCLEAN®	★★★	★★★	★★	★★★★	★★	★★★
BÖHLER S290 MICROCLEAN®	★★★★★	★	★★★★	★★	★★★★★	★★★★
BÖHLER S390 MICROCLEAN®	★★★★	★★★	★★★★	★★★★	★★★★	★★★★
BÖHLER S393 MICROCLEAN®	★★★★	★★★	★★★★	★★★★	★★★★	★★★★
BÖHLER S590 MICROCLEAN®	★★★★	★★★	★★★★	★★★	★★★	★★★
BÖHLER S592 MICROCLEAN®	★★★★	★★★	★★★★	★★★	★★★	★★★
BÖHLER S690 MICROCLEAN®	★★★	★★★	★★	★★★★★	★★★	★★
BÖHLER S692 MICROCLEAN®	★★★	★★★	★★	★★★★★	★★★	★★
BÖHLER S792 MICROCLEAN®	★★★	★★★	★★	★★★★	★★	★★★
BÖHLER S793 MICROCLEAN®	★★★	★★★	★★★★	★★★	★★★	★★★

Delivery condition

Annealed

Hardness (HB)	max. 280 drawn max. 300 HB
Tensile Strength (MPa ksi)	max. 1,020 148
Yield Strength (N/mm ² ksi)	max. 1,020 148

Heat treatment

Annealing

Temperature	870 to 900 °C 1,598 to 1,652 °F	870 to 900°C (1598 to 1652°F) The steel needs to be protected against decarburization. Through heating of the material is followed by controlled, slow furnace cooling at a maximum cooling rate of 10°C (50°F) per hour, down to approx. 700°C (1292°F). Final cooling in air.
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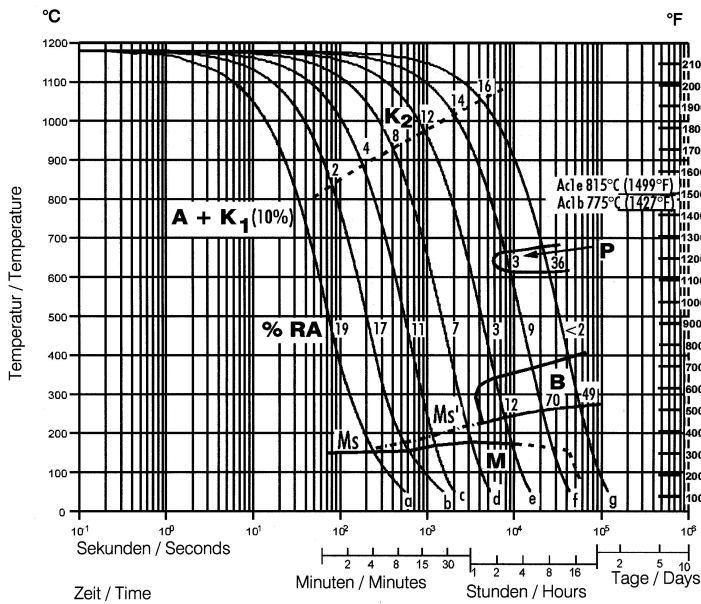
Stress relieving

Temperature	600 to 650 °C 1,112 to 1,202 °F	Slow cooling 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.
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Hardening and Tempering

Temperature	1,050 to 1,200 °C 1,922 to 2,192 °F	Salt bath, vacuum Preheating: 1st stage ~ 500 °C, 2nd stage ~ 850 °C, 3rd stage ~1050 °C (for higher austenitising temperature) Austenitising: for cutting applications at higher austenitising temperatures (> 1130 °C), holding time after complete heating 80 seconds, maximum 150 seconds, to avoid material damage due to overtime. Austenitising: for cold work applications at lower austenitising temperatures (< 1100°C). Holding time after complete heating 15 to 30 min Quenching: oil, warm bath (500 - 550 °C), gas.
Temperature	560 to 580 °C 1,040 to 1,076 °F	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

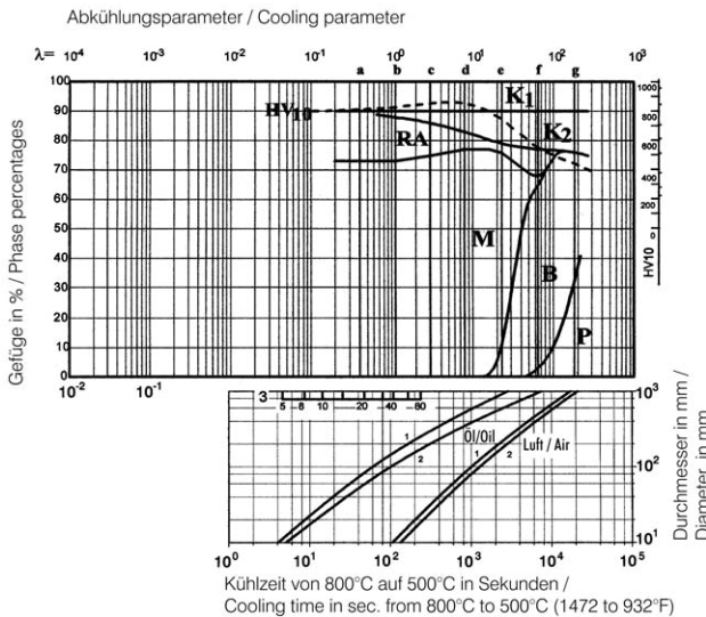


Austenitising temperature: 1180°C (2156°F)
Holding time: 180 seconds

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

Sample	λ	HV10	Sample	λ	HV10
a	0,4	811	e	23,0	751
b	1,1	827	f	65,0	560
c	3,0	854	g	180,0	448
d	8,0	855			

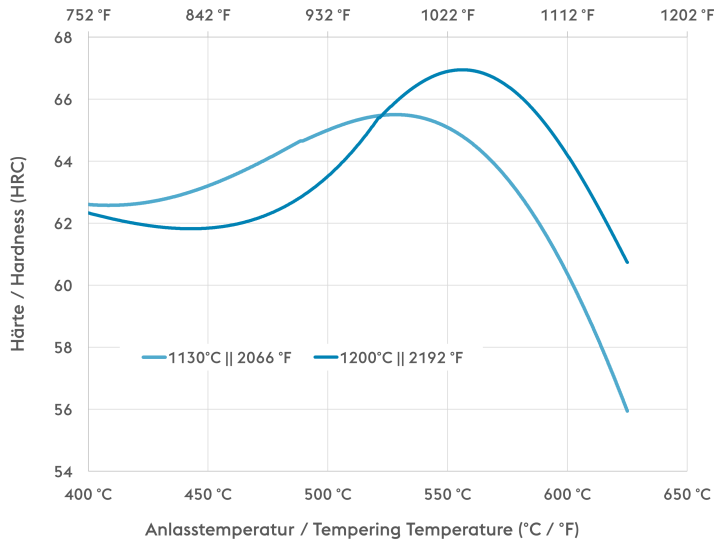
Quantitative phase diagram



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

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

Tempering Chart



Holding time 3 x 2 hours
Specimen size: square 25 mm

Physical Properties

Temperature (°C °F)	20 68
Density (kg/dm ³ lb/in ³)	8 0.29
Thermal conductivity (W/(m.K) BTU/ft h °F)	24 13.87
Specific heat (kJ/kg K BTU/lb °F)	0.42 0.1003
Spec. electrical resistance (Ohm.mm ² /m 10 ⁻⁴ Ohm.inch ² /ft)	0.54 2.55
Modulus of elasticity (10 ³ N/mm ² 10 ³ ksi)	230 33.36

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

Temperature (°C °F)	100 212	200 392	300 572	400 752	500 932	600 1,112	700 1,292
Thermal expansion (10 ⁻⁶ m/(m.K) 10 ⁻⁶ inch/inch.°F)	11.5 6.4	11.7 6.5	12.2 6.8	12.4 6.9	12.7 7.1	13 7.2	12.9 7.2

Long Products: For additional specifications and technical requirements, please contact our regional voestalpine BÖHLER sales companies.

Sheet & Plates: Product Variant may differ in terms of melting process, technical data, delivery, and surface condition as well as available product dimensions. Please contact voestalpine BÖHLER Bleche GmbH & Co KG.

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voestalpine
ONE STEP AHEAD.