BÖHLER

BÖHLER S790 MICROCLEAN®

HIGH SPEED STEELS

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 S790 MICROCLEAN – "The 1st MICROCLEAN"

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

Technical data

Material designation	
1.3345	SEL
HS6-5-3C	EN

Standards	
4957	EN ISO

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.

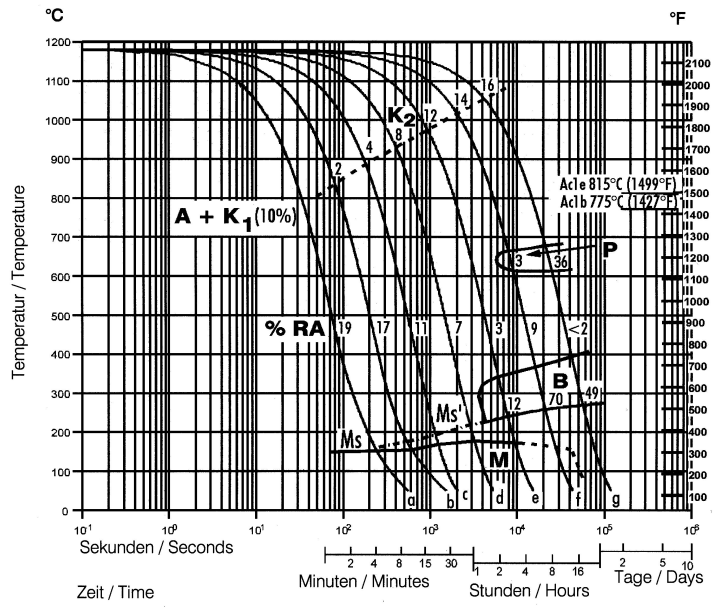
Stress relieving

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.

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

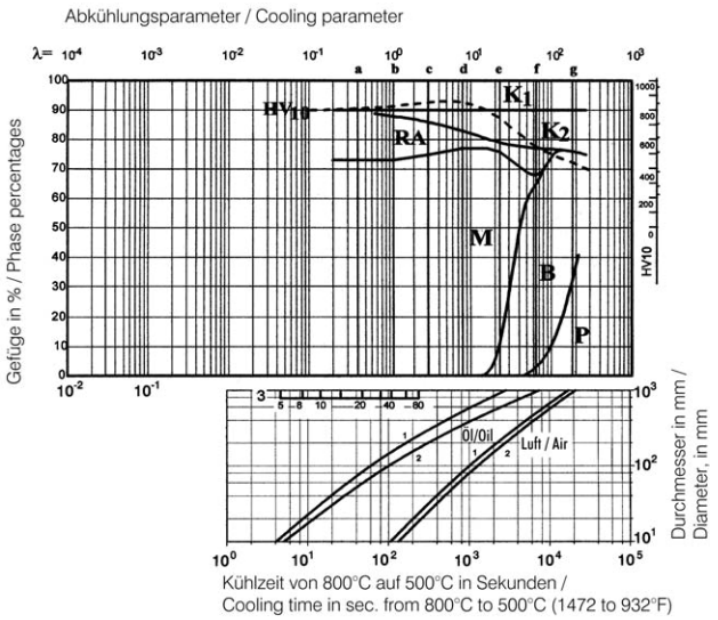


Austenitising temperature: 1180°C (2156°F)
Holding time: 180 seconds

A....Austenite
B....Bainite
K....Carbide
P....Perlite
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



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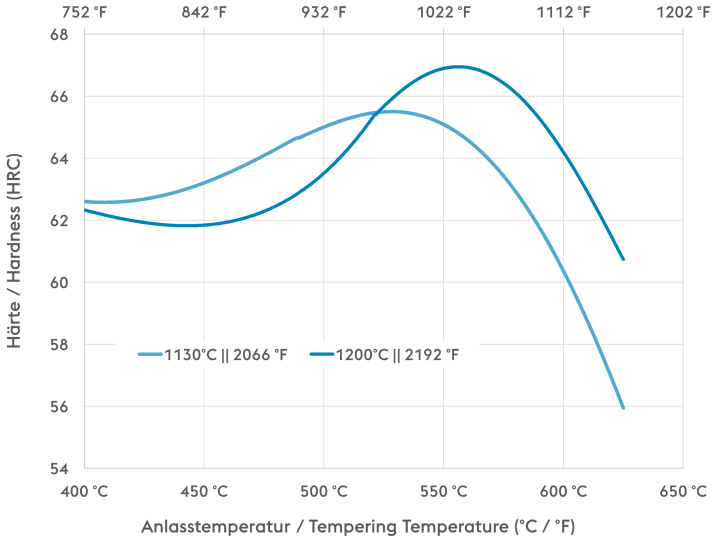
1....Edge or Face
2....Core
3....Jominy test: distance from quenched end

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 (10^3N/mm^2 | 10^3ksi)	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.

The data contained in this brochure is merely for general information and therefore shall not be binding on the company. We may be bound only through a contract explicitly stipulating such data as binding. Measurement data are laboratory values and can deviate from practical analyses. The manufacture of our products does not involve the use of substances detrimental to health or to the ozone layer.

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ONE STEP AHEAD.