BÖHLER
BLECHE

BÖHLER V330SH

HEAT TREATABLE STEEL

Properties

Chromium – molybdenum steel for applications requiring high tensile and toughness values, in particular in medium and large cross sections in the quenched and tempered condition.
The molybdenum addition prevents the steel from being susceptible to temper brittleness.

Application

Components in automotive and gear and engine construction, e.g. crankshafts, steel ring knuckles, connecting rods, spindles, intermediate gears, pump and gear shafts.

Chemical composition

(Average values in %)

C	Si	Mn	Cr	Mo
0,32	0,3	0,5	1,1	0,2

Standards

EN / DIN

~1.7220

Hot forming

Forging: **1100 – 850℃** / slow cooling in furnace

Heat treatment

Normalizing: **850 - 890 ℃** / Air cooling

Annealing: **680 – 720℃** / Controlled slow cooling in furnace.

Stress reliving: **600 - 650 ℃**
In the quenched and tempered condition, approx. 30 – 50℃ below the tempering temperature. In the annealed condition 600 to 650℃ . Holding time: 1 hour min.

Hardening: **830 - 870 ℃** / Water, **840 – 870℃** / Oil
Oil hardening for thin cross sections and complex shapes, water hardening for large sizes and parts of simple shapes.

Tempering: **540 - 680 ℃** / Air cooling.
Tempering should immediately follow hardening. Holding time: 1 Hour min. (refer to quenched and tempered chart).

Nitriding: The steel admits both gas and bath nitriding.

Welding:

Welding is possible under certain conditions but the welded joint will not reach the mechanical requirements of the base metal in all cases.
Welding should be done in the hardened and tempered condition.
Preheat parts at 300 – 400 ℃. Post-weld heat treat ment approx. 30 – 50℃ below the tempering temperature.

Filler metals:

BÖHLER FOX DCMS Kb, BÖHLER DCMS -IG

Mechanical properties:

at room temperature

Condition: hardened and tempered

Product	Thickness mm	Yield strength MPa min.	Tensile strength MPa	Elongation %	Impact strength (DVM) J
Sheet Plate	≤ 8 > 8 ≤ 20 >20 ≤ 60	800 650 550	1000 – 1200 900 – 1100 800 - 950	11 12 14	40 45 45

High-temperature properties:

Condition: hardened and tempered (average values for thickness ≤60 mm)

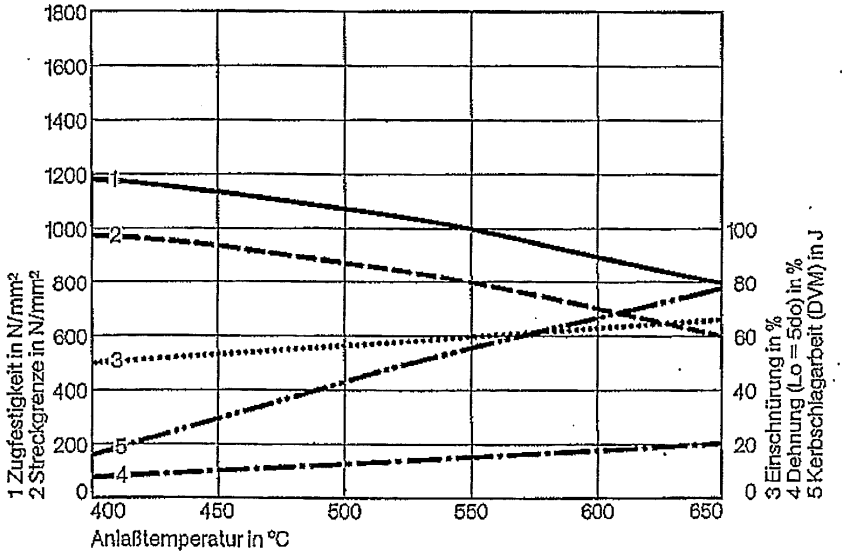
Temperature	100℃	200℃	250℃	300℃	350℃	400℃	
Yield strength MPa	441	422	392	363	333	304	

Quench and temper chart:

Hardening temperature: 850℃

Quenched and tempered cross section: Ø 60 mm

1. Tensile strength, N/mm^2
2. Yield strength, N/mm^2
3. Reduction of area, %
4. Elongation A_5, %
5. Impact strength (DVM), J



Tempering temperature, ℃

Physical Properties:

Density at	20℃	7,85	Kg/dm³
Thermal conductivity at	20℃	42	W/(m.K)
Specific heat at	20℃	460	J/(kg.K)
Electrical resistivity at	20℃	0,19	Ohm.mm²/m
Modulus of elasticity at	20℃	210x10³	N/mm²
Thermal expansion between	20℃ und 400℃	13,5x10 $^{-6}$	m/(m.K)

Continuous cooling CCT curves

Chemical composition %

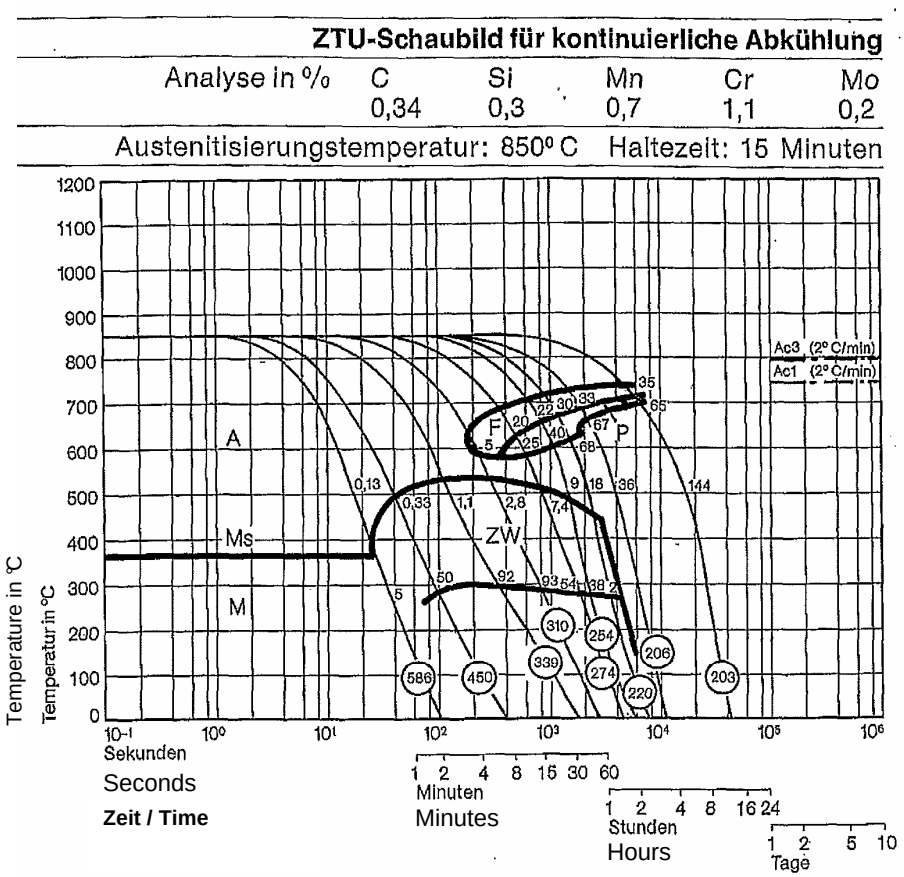
Austenitizing temperature: 850℃
Holding time: 15 minutes

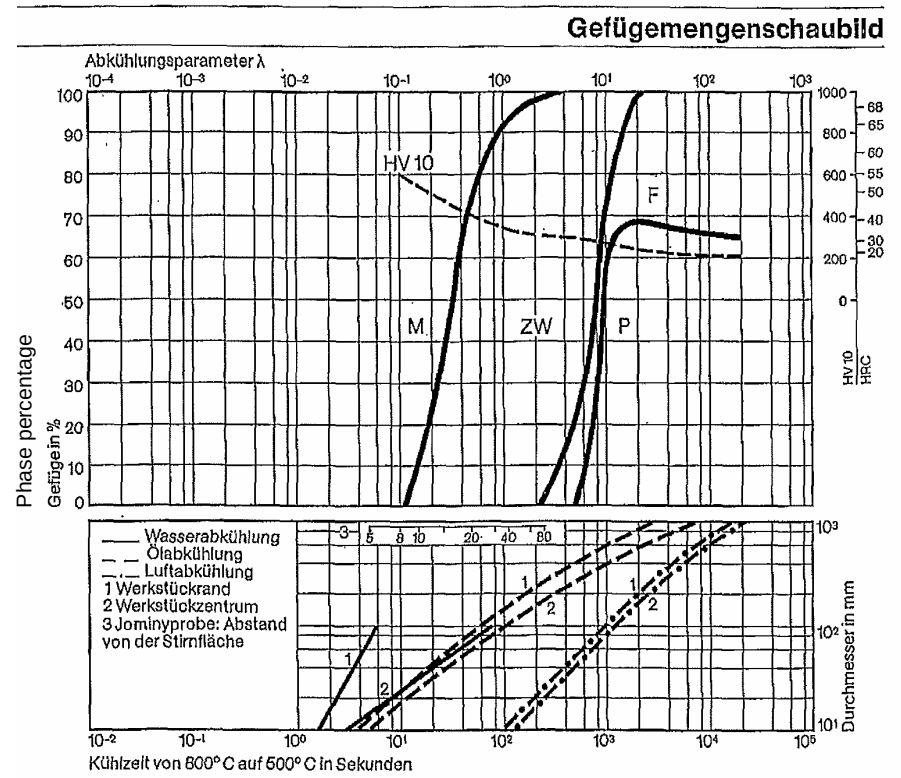
○… Hardness in HV
1 … 85 phase percentages
0.03 …. 90 cooling parameter, i.e. duration of cooling from 800℃ to 500℃ in s x 10 $^{-2}$

A …. Austenite
B …. Bainite
F …. Ferrite
M …. Martensite
P …. Perlite

___ Water cooling
----- Oil cooling
-.-.-. Air cooling

1 …. Edge or face
2 …. Core
3 …. Jominy test: distance from end





Time of cooling from 800℃ to 500℃ in seconds

Isothermal TTT curves

Chemical composition %

Austenitizing temperature: 850℃
Holding time: 15 minutes