



# **BOHLER M314 EXTRA**

## **Corrosion Resistant Prehardened Stainless Holder Steel**

# BOHLER M314 EXTRA

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## Chemical Composition (Average %)

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<b>C</b>	<b>Si</b>	<b>Mn</b>	<b>S</b>	<b>Cr</b>	<b>Mo</b>
0.34	0.35	1.40	.12	16.0	.15

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## Properties

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BOHLER M314 EXTRA is a free machining stainless steel that has been developed specifically for the plastics molding industry. It is supplied in the prehardened condition at a hardness level of approximately 300 Brinell. The balanced chemical composition and specialized heat treatment results in the following characteristics:

- Lower mold production costs due to improved machinability
- Uniform hardness levels throughout the cross section
- Good dimensional stability during machining
- High level of corrosion resistance

The benefit to the mold builder is a reduction in mold production costs, due to less tool wear experienced during machining operations and the option to use increased cutting speeds.

The chemical composition of M314 EXTRA has been adjusted to provide for improved corrosion resistance. The ability to resist corrosive attack results in:

- Cooling channels that are less likely to be affected by corrosion resulting in consistent cycle times over the life of the mold.
- Resistance to attack from corrosive by-products and vapors, providing for easier operation and mold storage.

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## Application

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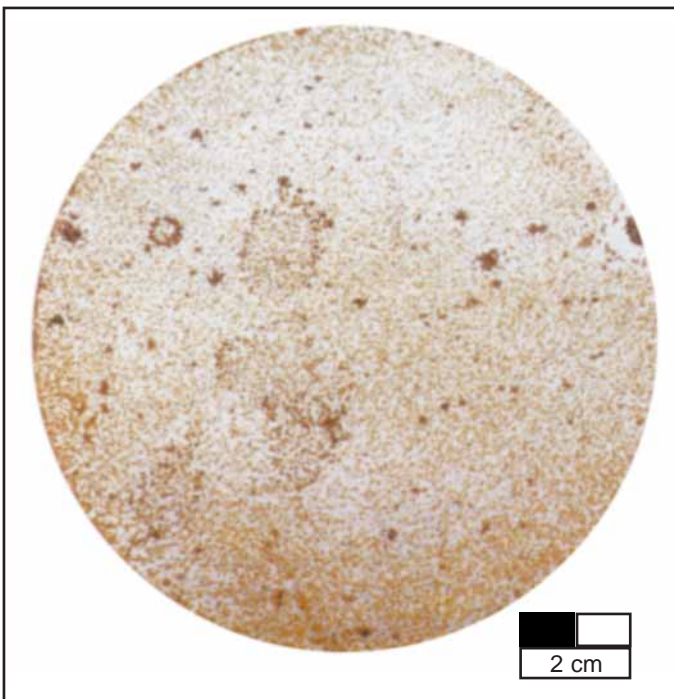
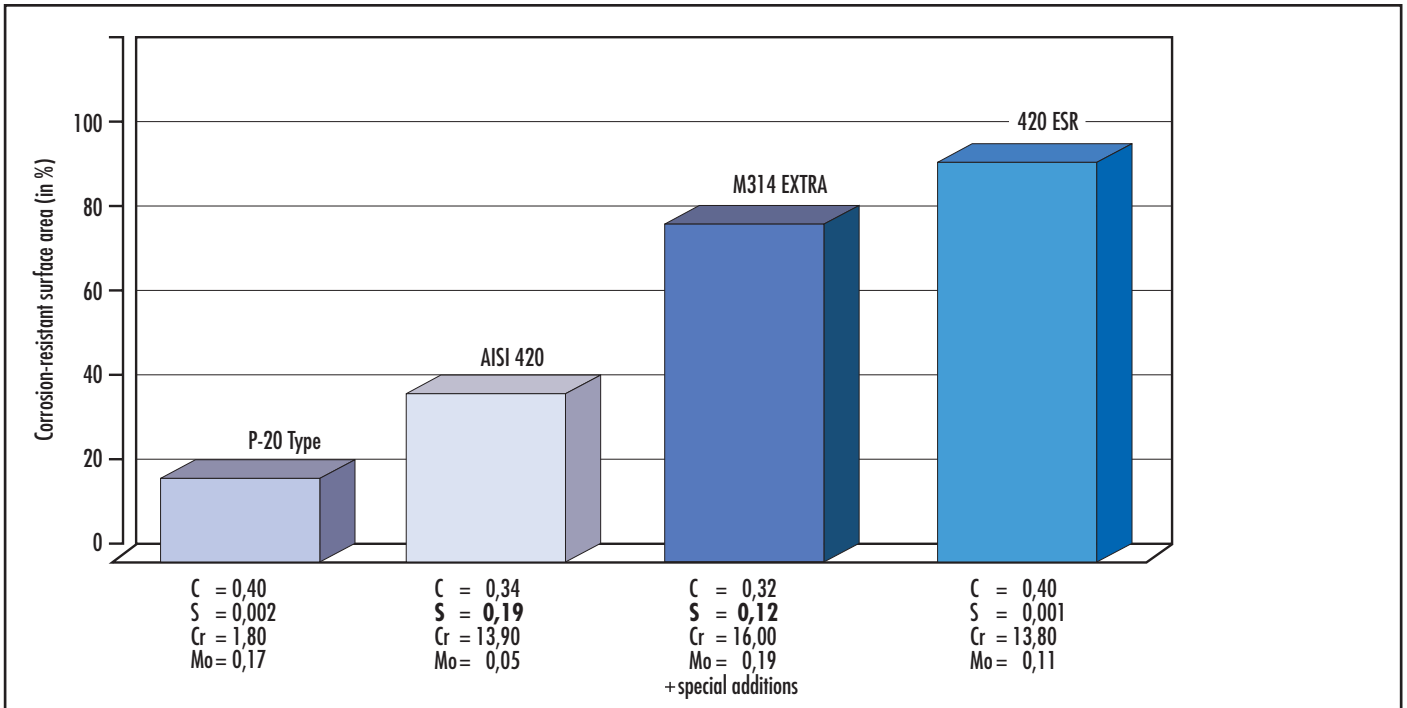
- Holder/Mold frames, backing plates and bolsters for plastic mold tooling
- Structural components and fixtures that require corrosion resistance
- Tooling for plastics extrusion
- Rubber molding and other plastics molding applications where polishability is not a priority

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the solution to corrosion problems.

Corrosion-resistant surface area after performance of the salt spray test (DIN 50021) on hardened and tempered steels (approx. 32 HRC).



P-20

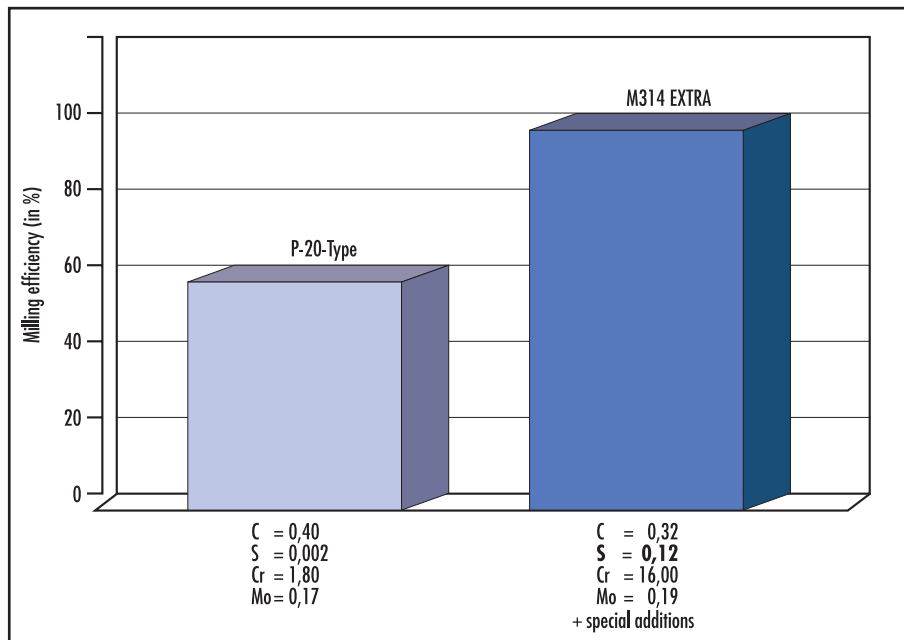


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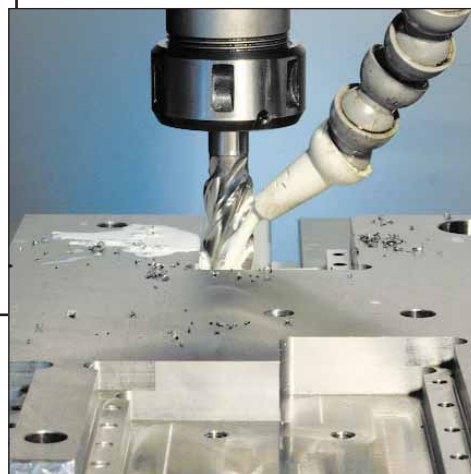
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## Milling with HSS-tools

Width of wear land on HSS milling cutters after a cutting distance ~60 inches (1500 mm).

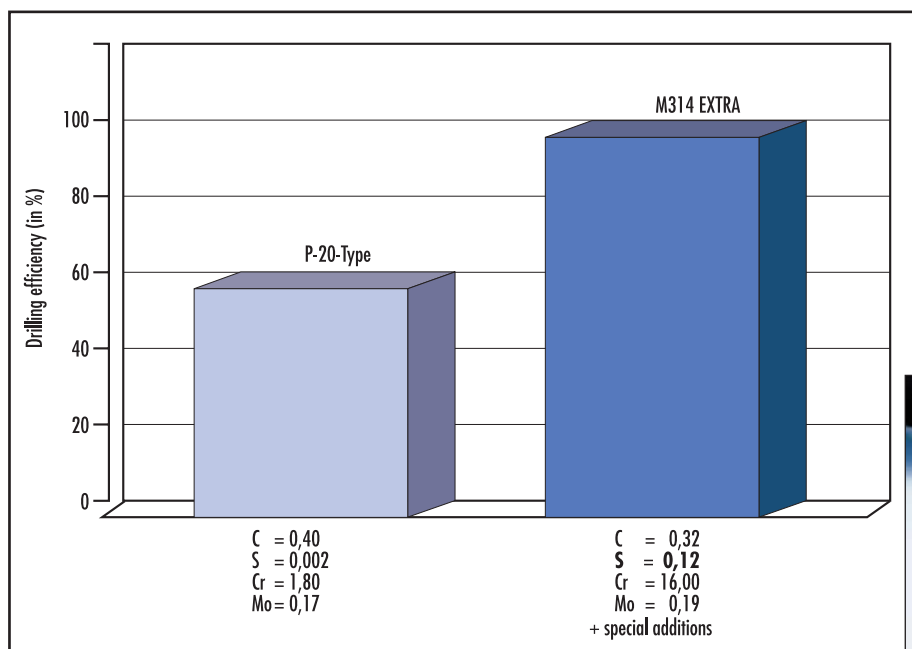


~Sample hardness 300HB (~32HRC)



## Deep hole drilling with carbide inserted tools.

Length of hole drilled with carbide-tipped gun drill.



~Sample hardness 300HB (~32HRC)



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## Heat Treatment

### As-delivered condition:

M314 Extra is intended to be used in the as-delivered condition; that is, hardened and tempered to ~300 Brinell. If this needs to be adjusted, the steel must first be soft annealed and then heat treated according to the recommendations listed below. Note: the tool must be protected from decarburization and/or oxidation during the heat treating process.

### Soft Annealing:

The steel must be held in a protective atmosphere up to a temperature of 1580°F (860°C). After reaching this annealing temperature the steel must be cooled slowly at a rate of 35°F (20°C) per hour down to 1200°F (650°C), then cooling can be completed freely in air.

### Hardening:

The tool must be held in a protective atmosphere throughout the hardening process.

- Preheat temperature at 930-1110°F (500-600°C)
- Austenitizing/Hardening Temperature at 1830-1920°F (1000-1050°C)

The steel should be heated through to the appropriate hardening temperature and then held at this temperature for 30 minutes. This soak time is measured from the point at which the core of the block has reached the designated temperature.

### Quenching:

Quenching should be as rapid as possible to avoid unwanted transformation products. Complex geometries and thick cross sections may require an interrupted quench procedure to prevent excessive distortion and/or cracking. (i.e. step or marquenching/martempering).

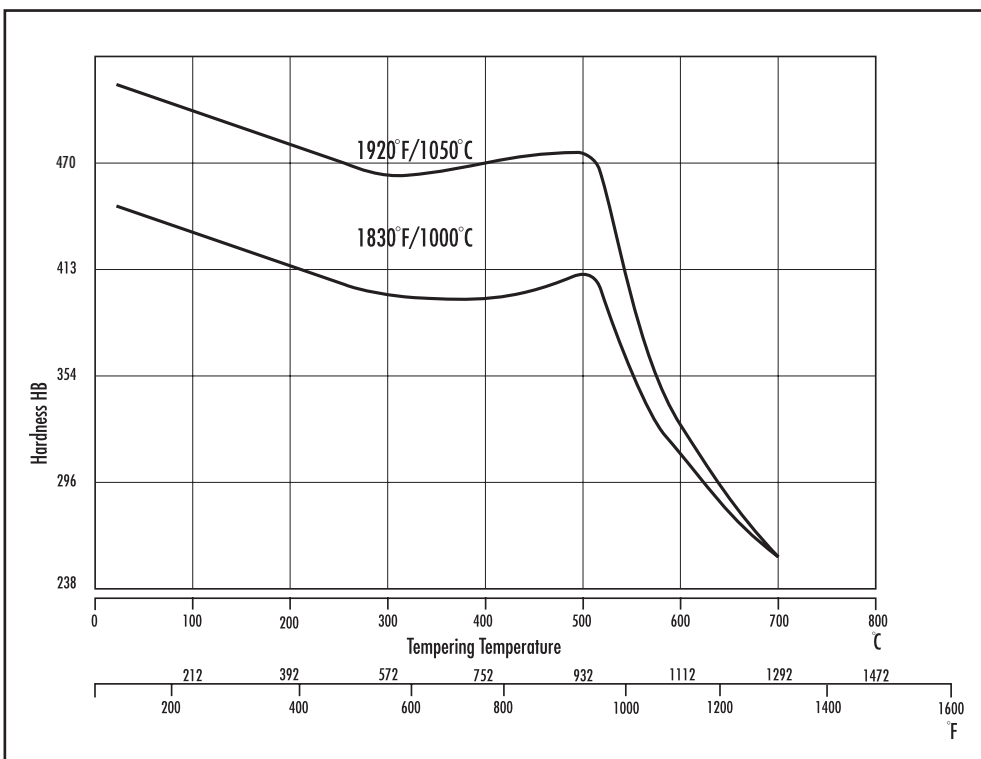
Regardless of the quenching process the tooling must be tempered after reaching 150°F (65°C).

### Tempering:

Select the tempering temperature from the tempering curve based on the hardness requirements. A minimum of two tempers with intermittent cooling to room temperature is required. Holding time at temperature for a minimum of two hours is recommended for each tempering cycle.

## Tempering chart

Hardening:  
Holding time 30 minutes/oil  
Tempering: 2 x 2 hours  
Specimen size: square 20 x 20 mm



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## Recommendation for machining

(Annealed condition, ~300 Brinell average values)

### Turning with carbide tipped tools

depth of cut, inches (mm)	.02-.04 (0.5-1)	.04-.16 (1-4)	.16-.31 (4-8)
feed, inches/rev, (mm/rev)	.004-.016 (.1-.2)	.008-.016 (.2-.4)	.012-.024 (.3-.6)
US Grade (ISO Grade)	C6, C7 (P10, P20, M10)	C6 (P20, M10, M20)	C5, C3 (P30, M20, K10)
cutting speed—fpm (m/min)			
indexable inserts			
edge life 15 min	655-850 (200-260)	490-655 (150-200)	360-490 (110-150)
brazed tools			
edge life 30 min	560-690 (170-210)	425-560 (130-170)	295-460 (90-140)
angles for brazed tools—			
rake angle	12 to 15°	12 to 15°	12 to 15°
clearance angle	6 to 8°	6 to 8°	6 to 8°
angle of inclination	0°	0°	-4°

### Turning with HSS tools

depth of cut, inches (mm)	.02 (.5)	.12 (3)	.24 (6)
feed, inches/rev, (mm/rev)	.004 (.1)	.002 (.5)	.04 (1.0)
HSS-grade AISI T42	AISI T42/DIN S10-4-3-10		
cutting speed—fpm (m/min)			
edge life 60 min	150-180 (45-55)	115-150 (35-45)	80-115 (25-35)
rake angle	14 to 18°	14 to 18°	14 to 18°
clearance angle	8 to 10°	8 to 10°	8 to 10°
angle of inclination	0°	0°	0°

### Milling

feed, inches/tooth, (mm/tooth)	to .008 (to .2)	.008-.012 (.2-3)
cutting speed, fpm (m/min)		
US grade C6 (ISO Grade P25)	330-525 (100-160)	200-360 (60-110)
US grade C5 (ISO Grade P40)	260-360 (80-110)	130-230 (40-70)
US grade (ISO Grade P35)	360-460 (110-140)	

### Drilling with sintered carbide

drill diameter, inches (mm)	.12-.31 (3-8)	.31-.80 (8-20)	.80-1.6 (20-40)
feed, inches/rev, (mm/rev)	.001-.002 (.02-.05)	.002-.005 (.05-.12)	.005-.007 (.12-.18)
ISO Grade	K10	K10	K10
cutting speed, fpm (m/min)	115-165 (35-50)	115-165 (35-50)	115-165 (35-50)
point angle	115 to 120°	115 to 120°	115 to 120°
clearance angle	5°	5°	5°

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## Physical Properties

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Density at 68°F(20°C)	.276 lbs./in <sup>3</sup>	(7.65 g/cm <sup>3</sup> )
Thermal conductivity 68°F(20°C)	10.4 Btu/ft • h • °F	(18.00 W/m • °C)
Specify heat 68°F(20°C)	.110 Btu/lb. • °F	(460 J/kg • °C)
Electrical resistivity 68°F(20°C)	.026 ohm • in <sup>2</sup> /in	(.65 ohm • mm <sup>2</sup> /m)
Modulus of Elasticity 68°F (20°C)	30.7 x 10 <sup>6</sup> psi	212 x 10 <sup>3</sup> N/mm <sup>2</sup>

Thermal expansion between 68°F (20°C) and...°F (°C) x 10<sup>-6</sup> in/in • °F (x 10<sup>-6</sup> m/m • °C)

212°F (100°C)	392°F (200°C)	572°F (300°C)	752°F (400°C)	932°F (500°C)
6.1 (11.0)	6.1 (11.1)	6.2 (11.2)	6.4 (11.6)	6.6 (12.0)

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