



PLASTIC  
MOULD STEEL

## PLASTIC MOULD STEEL

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**BÖHLER M261**  
**EXTRA**

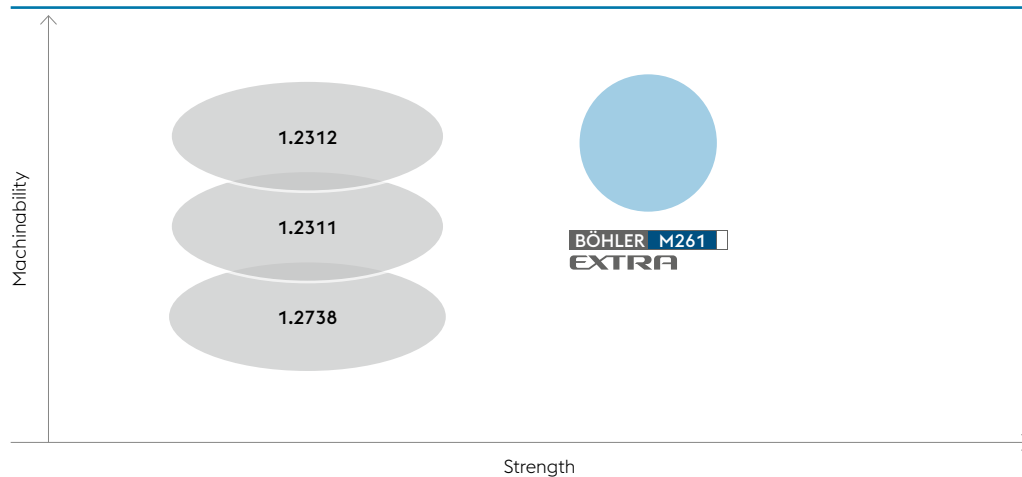
# THE STEEL FOR INNOVATIVE TOOL MAKERS



**BÖHLER M261 EXTRA** is a **precipitation-hardening steel grade for plastic moulds**, featuring excellent machinability in the as-supplied, i.e. **solution annealed** and **aged**, condition. There is no need for an additional heat treatment, **significantly shortening the throughput time**.

When producing tools from the solution-annealed steel, simple ageing allows strength levels of max. 44 HRC to be achieved without significant changes in dimension or the surface, resulting in a substantial increase in compressive strength and wear resistance.

## Product placement



On request, BÖHLER M261 EXTRA can also be supplied in the solution-annealed condition



**BÖHLER M261 EXTRA** – follows current trends in tool and die-making:

- » Excellent machinability coupled with higher hardness
- » Good dimensional stability
- » Excellent nitriding properties

And in the **processing of plastics** by offering:

- » High compressive strength
- » High wear resistance



#### Chemical composition (%)

C	Si	Mn	Cr	Ni	Cu	Al	
0.13	0.30	2.00	0.35	3.50	1.20	1.20	+ S

#### Supplied condition:

Stock standard: precipitation hardened to 38 – 42 HRC  
 alternatively: solution annealed ~30 HRC

# MANIFOLD APPLICABLE

## ADVANTAGES

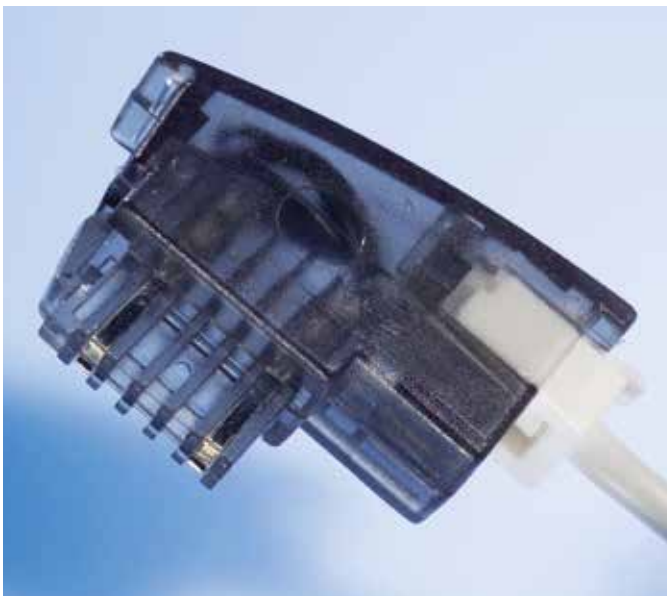
- » no heat treatment required if supplied in the precipitation-hardened condition
- » simple heat treatment if supplied in the solution-annealed condition
- » high hardness of up to 44 HRC after ageing
- » minimum dimensional changes during ageing
- » isotropic mechanical properties
- » excellent machinability in the solution-annealed condition and very satisfactory machinability in the precipitation-hardened condition
- » conditionally weldable
- » suited for gas and bath nitriding treatments to improve the surface wear resistance; no hardness decrease during bath nitriding thanks to high retention of hardness at temperatures up to 570 °C (1058 °F) (low over-ageing tendency); in the solution annealed condition, nitriding and ageing can be carried out in one step
- » suited for chromium plating and for any other type of surface coating
- » high tool life of the tool, therefore reduced downtimes and maintenance costs

## APPLICATIONS

- » High-precision plastic injection moulds e.g. for the production of camera parts, electronic parts and household items
- » compression moulds for all types, e.g. for plastic containers
- » moulds for elastomers
- » moulds for the production of sealing rings (O-ring seals)
- » hot runner systems
- » tool holder

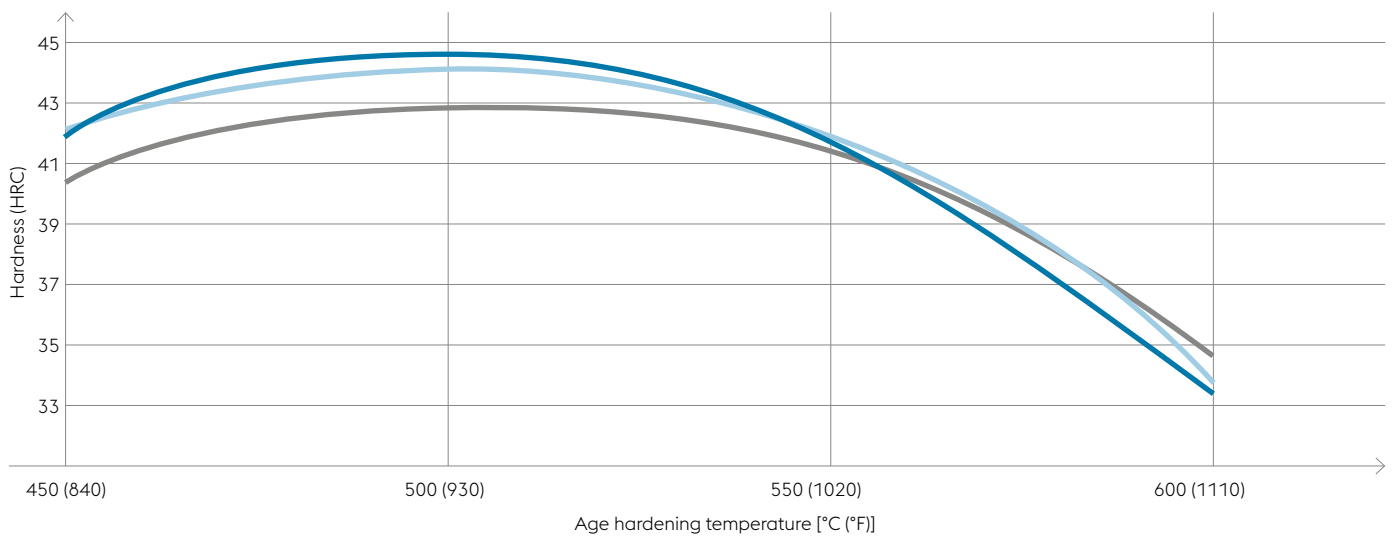






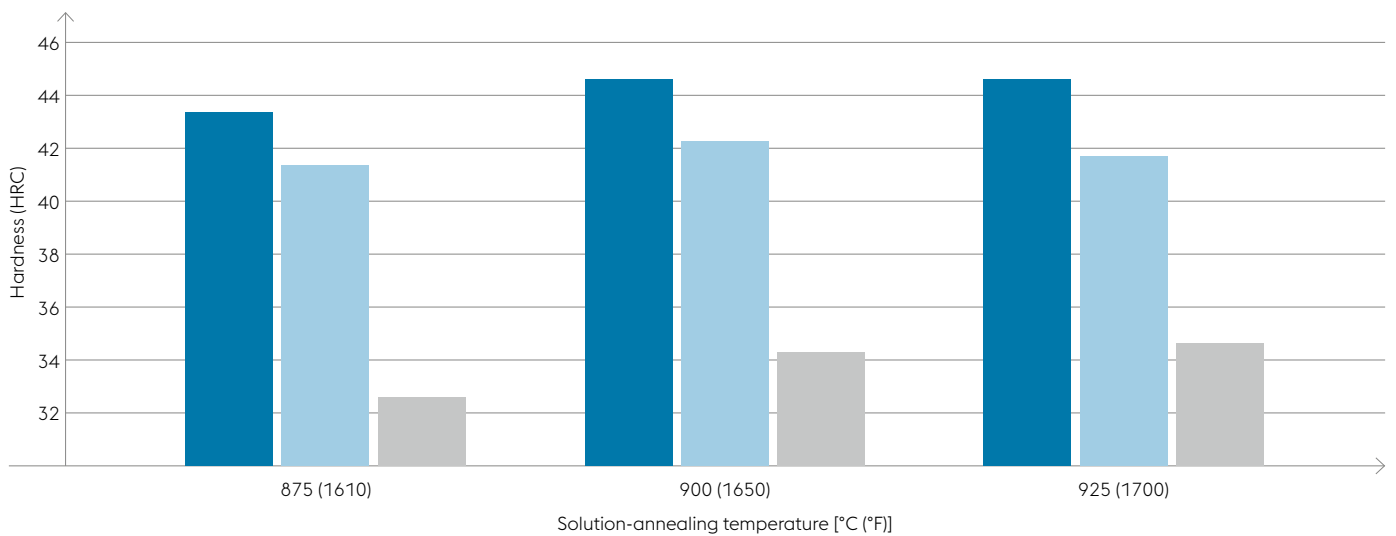
# NUMBERS, DATA, FACTS

Age hardening chart (no sub zero treatment)



Precipitation time: — 4 h — 6 h — 8 h  
 Condition: solution annealed 900 °C (1650 °F)

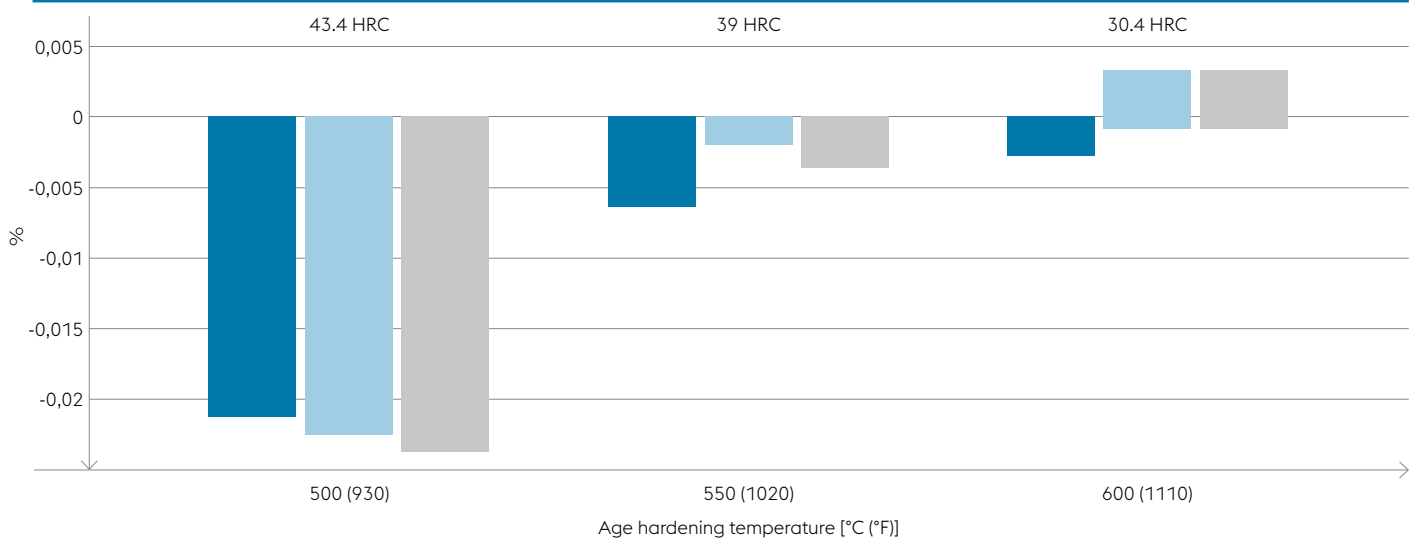
Precipitation hardening behaviour



Age hardening temperature: ■ 500 °C (930 °F) ■ 550 °C (1020 °F) ■ 600 °C (1110 °F)  
 Precipitation time: 6 h

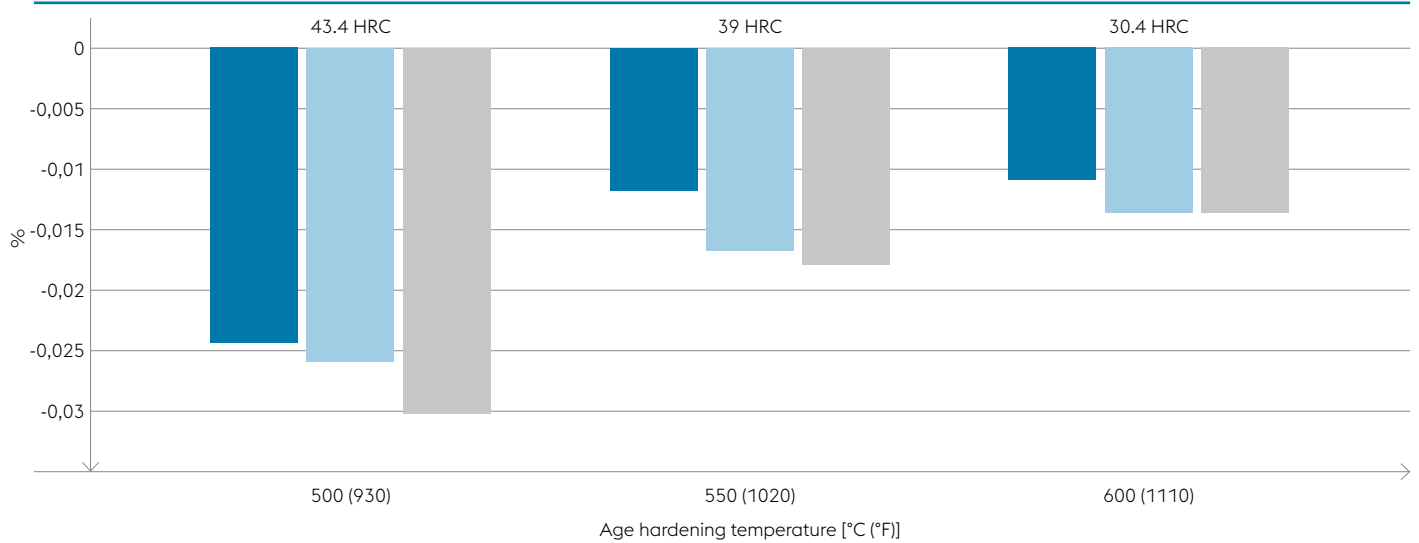


### Dimensional change in longitudinal direction



Sample taken from motherbloc: ■ Surface ■ Half radius ■ Centre  
 Cube 60 mm; measured in rolling direction Condition: solution annealed 900 °C (1650 °F), compressed air Age hardening time: 5 h

### Dimensional change in transverse direction



Sample taken from motherbloc: ■ Surface ■ Half radius ■ Centre  
 Cube 60 mm; measured transverse to the rolling direction Condition: solution annealed 900 °C (1650 °F), compressed air Age hardening time: 5 h

# MACHINING RECOMMENDATIONS

## Turning with carbide tools

Depth of cut mm (inch)	0.5 - 2 (.02 - .08)	1 - 4 (.04 - .16)	4 - 8 (.16 - .31)	over 8 (.31)
Feed mm/rev. (inch/rev.)	0.1 - 0.3 (.004 - .012)	0.2 - 0.4 (.008 - .016)	0.3 - 0.8 (.012 - .031)	0.5 - 1.5 (.02 - .06)
Cutting speed $v_c$ m/min (f.p.m)	130 - 260 (425 - 850)	90 - 180 (165 - 590)	70 - 130 (230 - 425)	30 - 80 (100 - 260)
Recommended BOEHLERIT-geometry	FP, FMP	MP, MRP	MRP	RP, BR, BRP
BOEHLERIT grade	LCP15T	LCP15T, LCP25T	LCP25T, LC240F	LC240F
ISO grade	P15	P15, P20	P20, P30	P30, P40

(Condition: age hardened to 38 - 42 HRC; average values)

## Drilling with sintered carbide: ISO HC-K10

Drill diameter mm (inch)	3 - 8 (.12 - .31)	8 - 20 (.31 - .80)	20 - 40 (.80 - 1.6)
Feed mm/rev. (inch/rev.)	0.02 - 0.05 (.001 - .002)	0.05 - 0.1 (.002 - .004)	0.1 - 0.15 (.004 - .005)
Cutting speed $v_c$ m/min (f.p.m)	30 - 50 (100 - 165)	30 - 50 (100 - 165)	30 - 50 (100 - 165)
Point angle	115 - 120°	115 - 120°	115 - 120°
Clearance angle	5°	5°	5°

## Milling with carbide tools

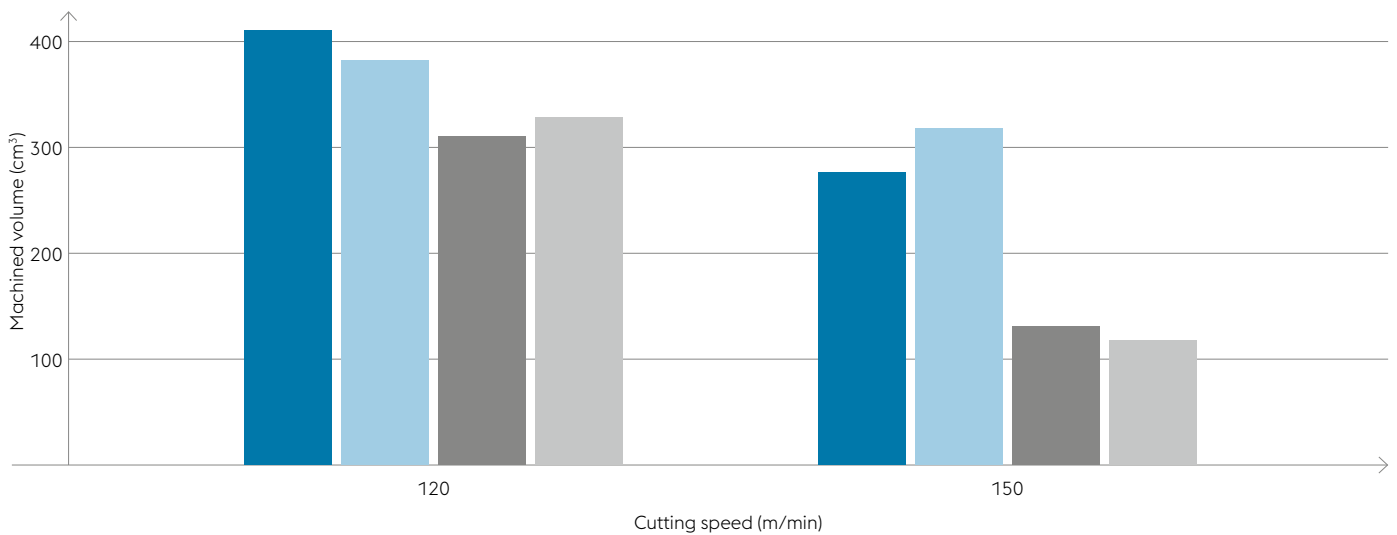
Cutting speed $v_c$ m/min (f.p.m)	140 - 220 (330 - 720)	120 - 180 (395 - 590)	100 - 160 (330 - 525)
BOEHLERIT grade	BCH10M, BCP25M	BCH30M, BCP35M	BCH30M, BCK20M
ISO grade	H10, P25	H30, P35	H30, K20
$F_z$ Milling 90° mm (inch)	0.1 - 0.25 (.004 - .010)	0.1 - 0.25 (.004 - .010)	0.1 - 0.3 (.004 - .012)
$F_z$ Milling 45° mm (inch)	0.15 - 0.7 (.006 - .028)	0.15 - 0.7 (.006 - .028)	0.15 - 0.8 (.006 - .031)
$F_z$ High feed cutting mm (inch)	1.0 - 2.5 (.04 - .10)	1.0 - 2.5 (.04 - .10)	0.6 - 3.0 (.024 - .12)





# NUMBERS, DATA, FACTS

## Machinability



### Milling

Depth of cut: 2.0 mm  
 Feed: 0.24 mm/tooth  
 Tool material: LC 225T

- **1.2312** hardened + tempered 1025 N/mm<sup>2</sup>
- **BÖHLER M261 EXTRA** solution annealed ~30 HRC
- **Competitor** solution annealed ~30 HRC
- **BÖHLER M261 EXTRA** age hardened 38.5 HRC



### Physical properties

<b>Modulus of elasticity at</b>	20 °C	$204 \times 10^3 \text{ N/mm}^2$
	68 °F	$29.6 \times 10^3 \text{ KSI}$
<b>Density at</b>	20 °C	7,73 kg/dm <sup>3</sup>
	68 °F	0.279 lbs/in <sup>3</sup>
<b>Specific heat capacity at</b>	20 °C	465 J/(kg.K)
	68 °F	0.11 Btu/lb°F

### Thermal expansion between 20 °C (68 °F) and ... °C (°F)

<b>100 °C</b>	<b>200 °C</b>	<b>300 °C</b>	<b>400 °C</b>	<b>500 °C</b>	
12.63	13.06	13.50	13.89	14.27	$10^{-6} \text{ m/(m.K)}$
<b>210 °F</b>	<b>390 °F</b>	<b>570 °F</b>	<b>750 °F</b>	<b>930 °F</b>	
7.02	7.26	7.50	7.72	7.93	$10^{-6} \text{ in/in}^\circ\text{F}$

### Thermal conductivity

<b>20 °C</b>	<b>100 °C</b>	<b>200 °C</b>	<b>300 °C</b>	<b>400 °C</b>	<b>500 °C</b>	
29.0	30.7	31.9	31.8	31.4	31.5	W/(m.k)
<b>68 °F</b>	<b>210 °F</b>	<b>390 °F</b>	<b>570 °F</b>	<b>750 °F</b>	<b>930 °F</b>	
16.76	17.74	18.43	18.37	18.14	18.20	Btu/ft h°F

Source: Measured values at Materials Center Leoben / ÖGI 2001



Regarding applications and processing steps that are not expressly mentioned in this product description/data sheet, the customer shall in each individual case be required to **consult us**.



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ONE STEP AHEAD.