BÖHLER

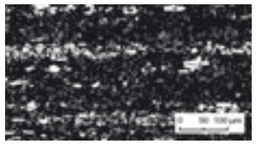
YOUR PARTNER FOR HIGH SPEED STEELS, TOOL STEELS AND SPECIAL MATERIALS

COLD WORK TOOL STEELS
3 QUALITY LEVELS – 3 TECHNOLOGIES

COLD WORK
TOOL STEEL

Conventional Manufacture

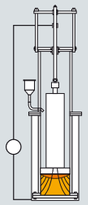
Ingot casted cold work tool steel
The conventional steel quality for standard tooling applications.

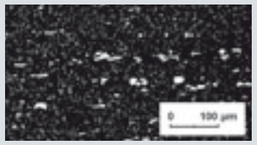


Microstructure of conventional 12% Cr steel

PESR Manufacture

Improved service life due to:
- the least possible inclusion content
- lower micro and macro segregation
- good homogeneity and a higher degree of purity
- a homogenic structure throughout the entire cross-section and bar length
- producing larger bar dimensions at a constant carbide distribution
- uniform size change
- a broad range of application owing to a high degree of toughness

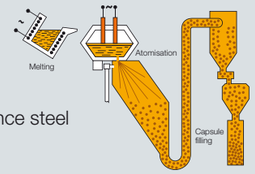


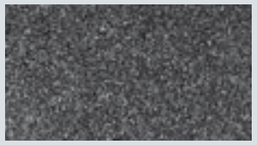


Microstructure of an 8% Cr steel in ESR quality

Powder metallurgical manufacturing

For the highest demands:
- the finest carbide distribution
- the highest metallurgical purity
- segregation free high performance steel
- isotropic properties
- maximum wear resistance with a simultaneously higher toughness
- a high degree of hardness
- very good dimensional stability
- high compressive strength
- good polishability

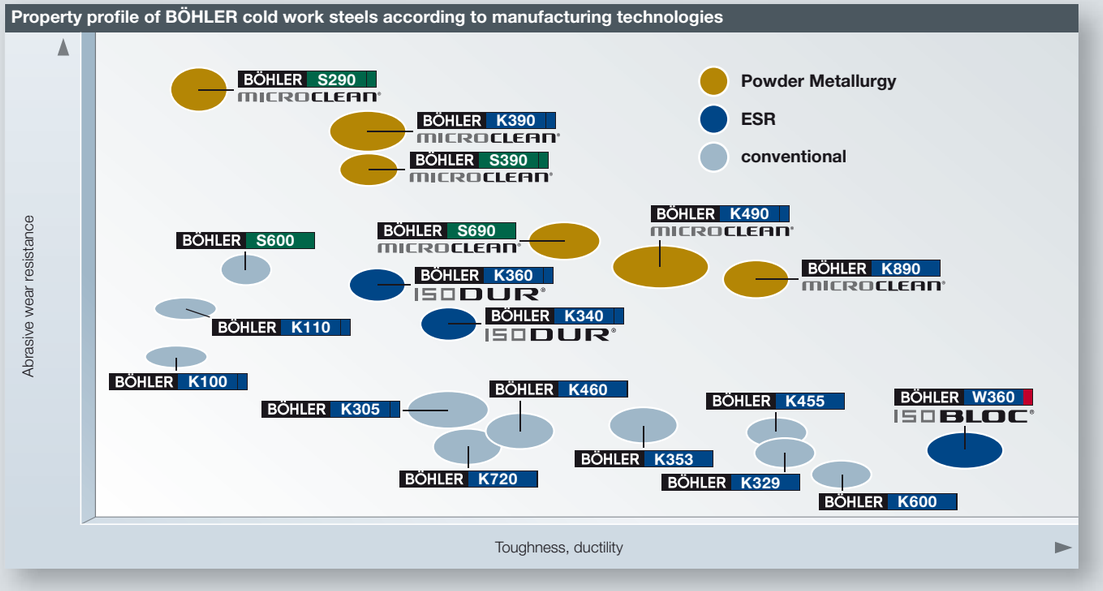




MICROCLEAN®
Microstructure PM materials

The reason for using quality tool materials is obvious, as the material amount of a high performance tool is often only 5% of the total value of a tool, yet it **extends the lifetime of tools many times.** In a word, it's a direct commercial advantage in production.

Property profile of BÖHLER cold work steels according to manufacturing technologies



BÖHLER K340 ISODUR®

BÖHLER K340 ISODUR is a universal cold work tool steel with which you'll be making money – and just when blanking coins, but also when **blanking, cutting, cold rolling, extruding, deep drawing, bending**

In applications where materials with good wear resistance and compressive strength coupled with excellent toughness are required, BÖHLER K340 ISODUR has proved itself to be the all-rounder among tool steels.

Advantages compared to ledeburitic 12% Cr-steels and conventional 8% Cr-steels

- homogeneous structure throughout the entire cross-section and length
- production of bars with greater diameters and a good distribution of carbides
- uniform, solely minor dimensional changes
- high toughness providing a wider scope of application
- increased compressive strength, a particular advantage for critical tools
- improved machinability due to the homogeneous structure

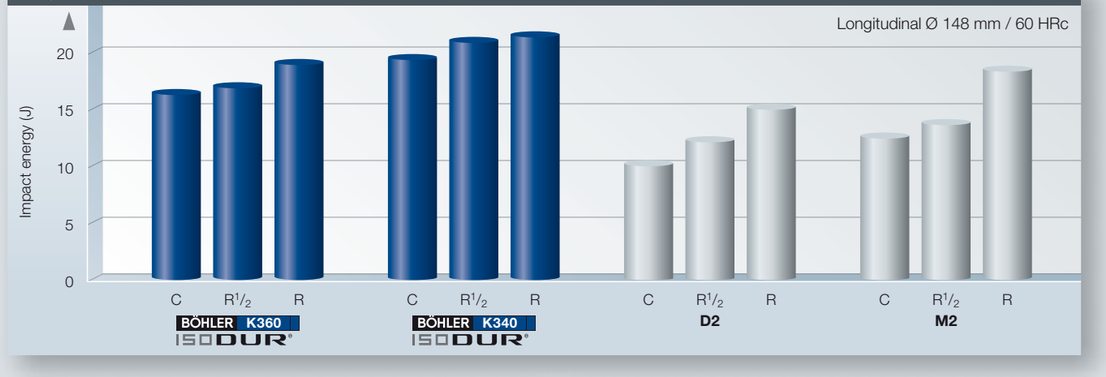
Reasons why BÖHLER K340 ISODUR is so cost-efficient

- 8% Cr-steel with a modified chemical composition
- high toughness and outstanding compressive strength
- excellent adhesive wear resistance thanks to special alloy additions
- high abrasive wear resistance
- very good resistance to tempering
- Secondary-hardening cold work tool steel with good dimensional stability
- outstanding EDM machinability
- very well suited to salt-bath, gas and plasma nitriding
- can be PVD coated well
- well suited to vacuum hardening
- thanks to the chemical composition and the manufacturing process, this steel has finer and more evenly distributed carbides than ledeburitic 12% Cr-steels (AISI D2) and conventional 8% Cr-steels. This gives the steel its improved toughness properties.

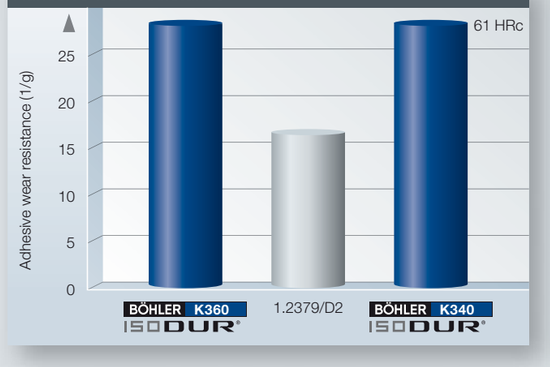
Application fields

Forming and punching tools e.g. dies and punches, cold working tools e.g. tools for deep drawing or extrusion, coining tools, bending tools, thread rolling tools, industrial knives, machine components (e.g. guide rails)

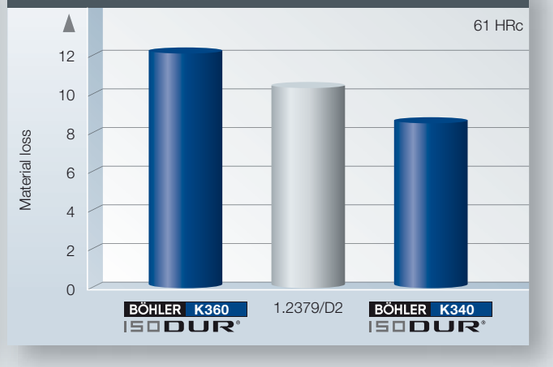
Toughness (unnotched)



Adhesive wear resistance



Abrasive wear resistance



BÖHLER K490 MICROCLEAN®

Innovation

BÖHLER's new cold work tool steel K490 MICROCLEAN closes the gap in the material demands between wear resistance and the desired toughness on a very high level.

Flexibility

A further advantage of this powder metallurgical cold work tool steel, being produced in a plant of the newest generation, lies in the good machinability and the high flexibility of its heat treatment, which allows variable heat treatment cycles without affecting the mechanical properties.

Cost-Efficiency

These excellent properties guarantee a risk-free, more flexible and faster – that is economically efficient – tool manufacture.

Versatility

BÖHLER's K490 MICROCLEAN is a greatly improved and more efficient cold work tool steel compared with other commonly used PM steels such as M4 or PM23. **Toughness is more than doubled** with a similar wear resistance.

BÖHLER K490 MICROCLEAN's balanced properties can be made use of in a wide range of applications, making it a real PM all-rounder for cold work tool steel applications.

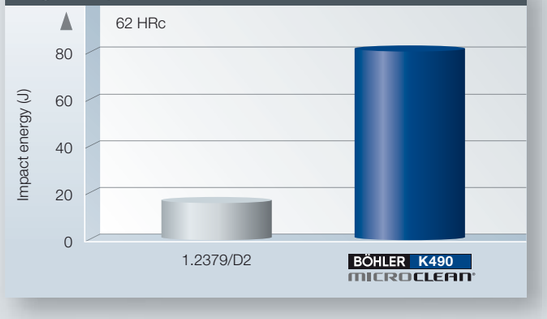
Blanking and punching industry

- Cutting tools (dies, punches) for normal and precision blanking
- Cutting rolls

Cold forming applications

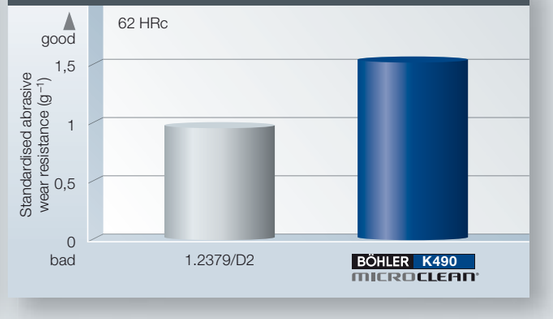
- Extrusion tooling (cold and warm forming)
- Drawing and deep-drawing tools
- Stamping tools
- Thread rolling tools
- Cold rolls for multiple roller stands
- Cold pilger rolling mandrels
- Compression moulding dies for the ceramics and pharmaceutical industries
- Compression moulding dies for the processing of sintered parts
- **Industrial knives**
- **Plastic processing industry**

Toughness (unnotched)



Samples taken from a rolled steel bar in longitudinal direction, heat treated at a cooling rate of: λ ≤ 0,5
Primary material size: rund / round 35 mm
Sample size: 10 x 7 x 55 mm
Heat treatment parameters for:
BÖHLER K490 MICROCLEAN: 1080 °C, 3 x 2 h, 560 °C
1.2379/D2: 1070 °C, 3 x 2 h, 520 °C

Abrasive wear resistance



Determined by the Rubber-Wheel-Dry-Sand test according to ASTM G65
Samples taken from a of rolled steel bar in lateral direction, center
Primary material size: rund / round 70 mm
Sample size: 60 x 25 x 8 mm, Ra < 0,8 µm
Heat treatment parameters for:
BÖHLER K490 MICROCLEAN: 1080 °C, 3 x 2 h, 560 °C
1.2379/D2: 1070 °C, 3 x 2 h, 510 °C

Saves time and money

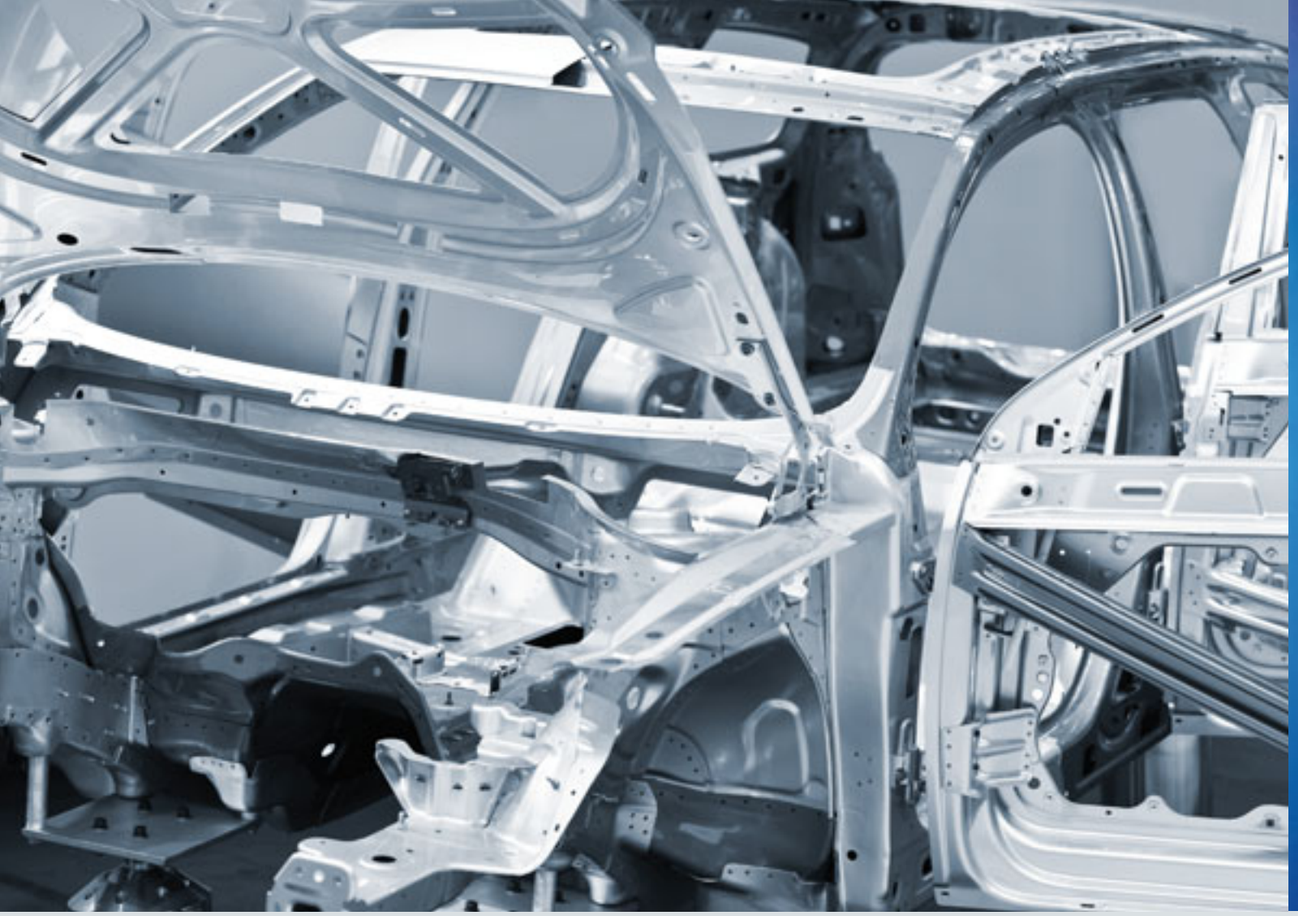
Speed is vital in component manufacture. Process time from prototype to finished tooling is drastically reduced. Tools of complicated design and high quality can be produced quickly and efficiently.

Benefits

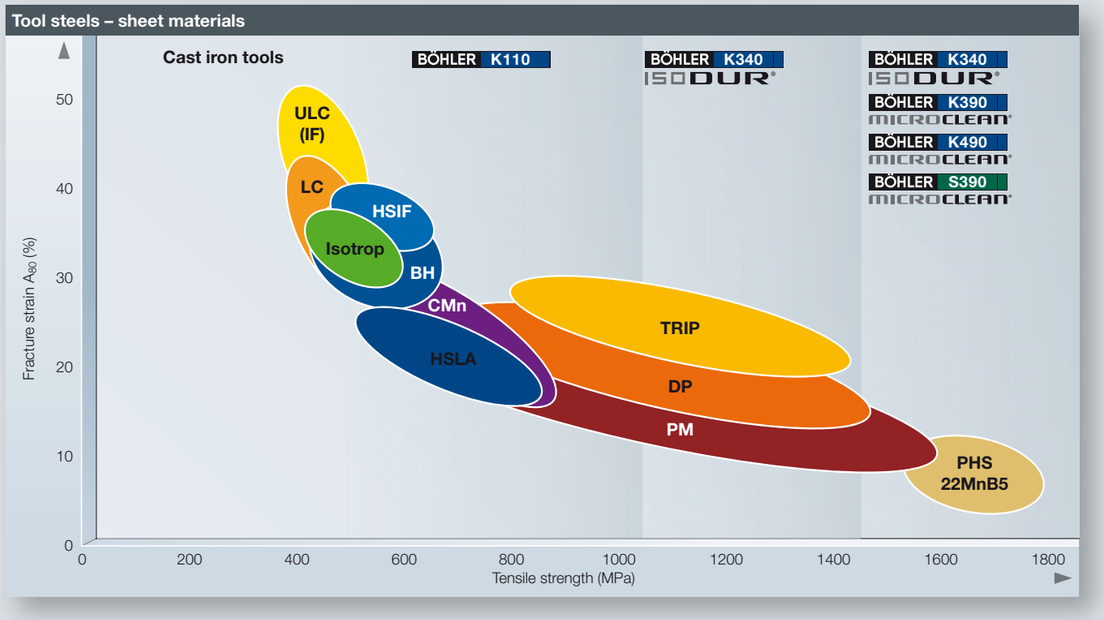
- Shorter and cheaper production processes due to a flexible heat treatment and an excellent hard machinability
- Higher tool life due to the excellent and stable mechanical properties

Properties

- High hardness (64 HRc)
- Very good toughness
- High abrasive and adhesive wear resistance
- Excellent hard machinability
- High compressive strength
- Heat treatment together with common cold work steels (1.2379, D2) at hardening temperatures from 1030 to 1080 °C possible
- Stable mechanical properties



Materials used for cutting, punching and blanking of high-strength and ultrahigh-strength sheets



- ULC Ultra low carbon steels
- LC Low carbon steels
- HSIF High strength IF steels
- Isotrop Isotropic steels
- BH Bake-hardening steels
- HSLA High-strength low alloyed steels
- TRIP Transformation induced plasticity steels
- CMn Carbon manganese steels
- DP Dual phase steels
- PM Partial martensitic steels
- PHS Presshardened steels

Evaluation of material properties in blanking and cutting applications (please note: The comparison is strongly dependent on the heat treatment conditions and applicable for the brands within this table only):

BÖHLER grade	Wear resistance abrasive	Wear resistance adhesive	Toughness	Compressive strength	Dimensional stability in heat treatment
BÖHLER K100	★★★	★★	★	★★	★★
BÖHLER K110	★★★	★ ★	★	★★	★★
BÖHLER K305	★	★	★★★★	★	★
BÖHLER K340 ISODUR	★★★	★★★★	★★★	★★★★	★★★
BÖHLER K353	★★ ★	★★★	★★★★★	★★	★★
BÖHLER K360 ISODUR	★★★★	★★★★	★★	★★★★	★★★
BÖHLER K390 MICROCLEAN	★★★★★	★★★★★	★★★★	★★★★★	★★★★
BÖHLER K455	★	★	★★★★★	★	★
BÖHLER K490 MICROCLEAN	★★★★	★★★★	★★★★★	★★★	★★★★
BÖHLER K600	★	★	★★★★★	★	★
BÖHLER K890 MICROCLEAN	★★★	★★★	★★★★★	★★★★	★★★★
BÖHLER S600	★★★	★★	★★★	★★★	★★★
BÖHLER S290 MICROCLEAN	★★★★★	★★★★★	★	★	★★★★★
BÖHLER S390 MICROCLEAN	★★★★	★★★★	★★★★	★★★	★★★★
BÖHLER S690 MICROCLEAN	★★	★★★	★★★★★	★★★	★★★
BÖHLER W360 ISOBLOC	★	★	★★★★★★	★	★★

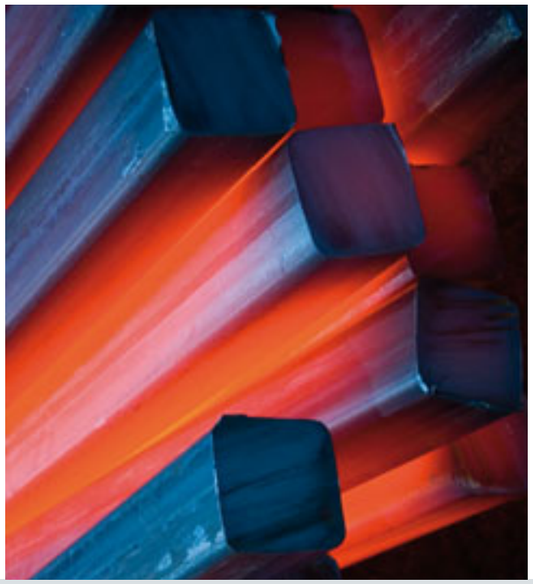
For specific applications and selection of proper material and working hardness please refer to our technical sales staff.

HOT WORK TOOL STEELS

HOT WORK
TOOL STEEL

Tool load

Hot work tool steels applied in hot forming processes such as die casting, forging or extrusion may be damaged on multiple and complex occasions. Damages may arise by collective stress factors combining high mechanical strengths, high temperatures and temperature gradients, whereas the individual stress factors dependent on process type and processing exert variably strong effects on the material. Material hardness, material strength, toughness, ductility and thermal conductivity are vital hot work tool steel properties when it comes to damage mechanisms to be avoided or delayed.



As the leading producer of tool steels worldwide BÖHLER is focused on offering solutions for the demanding requirements on hot working tool steels.

Hot wear resistance, hot toughness, hot strength, retention of hardness, thermal shock resistance as well as thermal conductivity are characterized not only by the compostion of the hot work tool steel but are metallurgical features regulated during the melting and re-melting process.

Our experience and on-going research lead to the continuous improvement of the metallurgical properties by further developments in the melting and remelting process of hot work tool steels and their heat treatment.

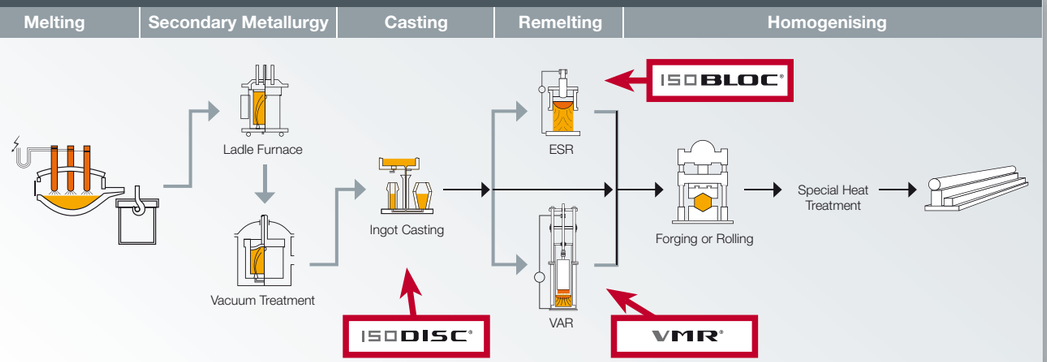
3 qualities for special applications:

ISODISC®
- Conventional hot work tool steels
- Special heat treated

ISOBLOC®
- Hot work tool steels, ESR quality
- Special heat treated

VMR®
- Hot work tool steels, VAR quality
- Special heat treated

Production routes for BÖHLER hot work tool steels



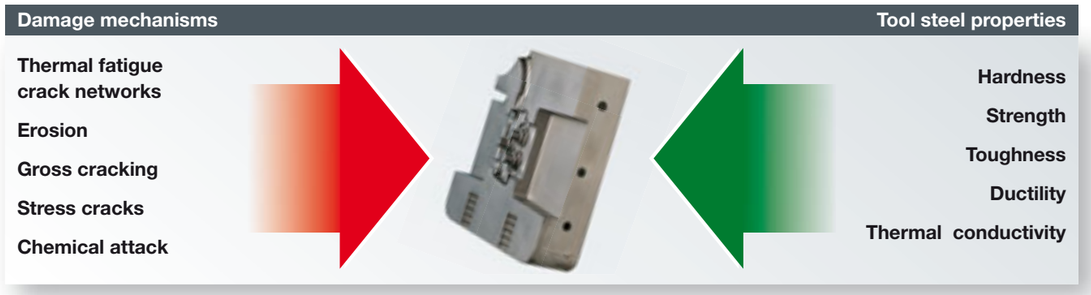
DIE CASTING

Heat treatment

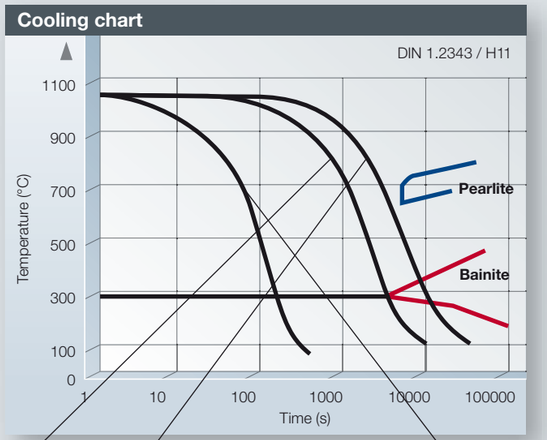
In order to achieve high toughness in tools, the cooling rate from the hardening temperature is of major importance. Cooling rate is primarily dependent on the tool size.

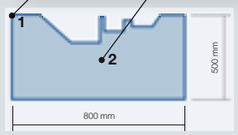
With increasing tool thickness, resulting in a reduced quenching rate, a change of microstructure occurs, leading to a significant decrease of toughness.

The quality of a tool made of hot work tool steel is defined by its mechanic-technological properties. It largely depends on the metal alloy's chemical composition, on the tool material's production process (electro slag remelting, vacuum remelting, forging and annealing technologies) and finally on the tool's heat treatment.



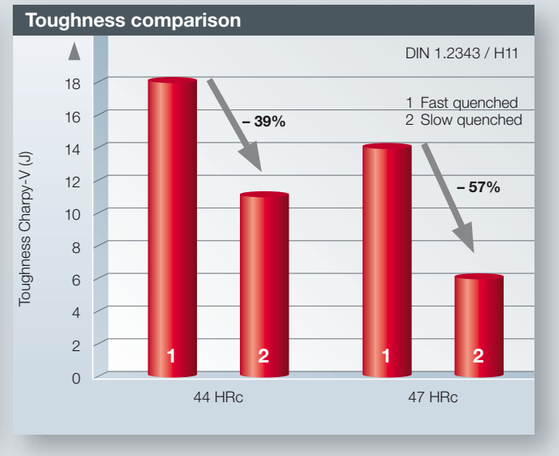
Cooling chart



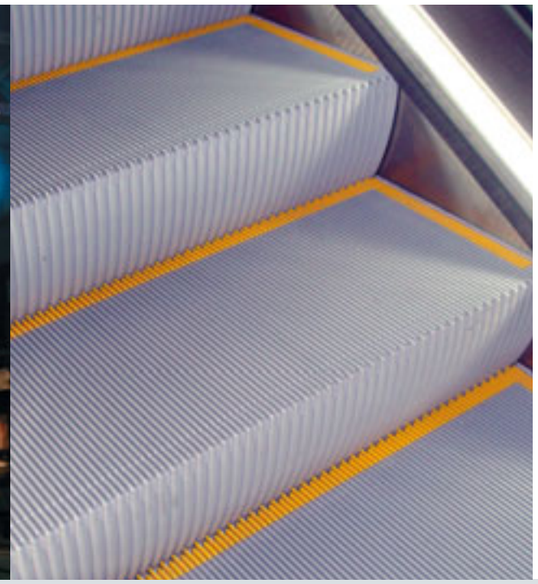


1 Die casting die edge
2 Die casting die core
3 Toughness sample Charpy-V

Toughness comparison



BÖHLER W350
ISOBLOC®



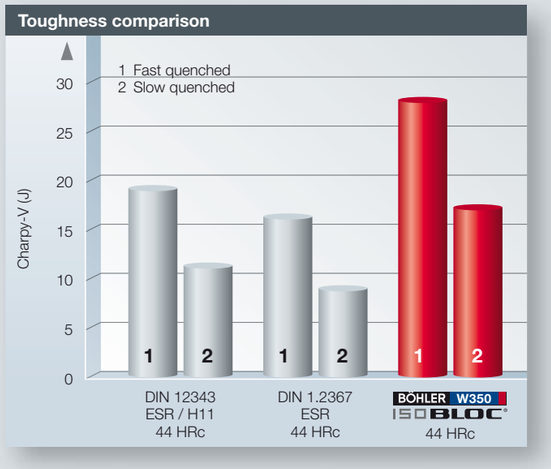
With the development of **W350 ISOBLOC**, BÖHLER Edelstahl allows large tool sizes for the complex loads in hot forming and for effects of heat treating.

A balanced alloy composition ensuring high toughness even in large tools and an improved thermal stability opts for an optimal hardness/strength-toughness/ductility ratio (elongation after fracture and percentage reduction of area after fracture) tailor-fit to every application.

A pressurized remelting process (pressure ESR) coupled with optimized forging technology in three dimensions guarantees a high degree of homogeneity of the mircrostructure and the material properties. A high degree of purity can also be realized.

Hot work steel BÖHLER W350 ISOBLOC is characterized by a significantly higher level of toughness for a fast and a slow cooling from the hardening temperature compared with standard materials DIN 1.2343 and 1.2367.

Toughness comparison



The reduced cooling velocity leads to a significant decrease of toughness. If the hardness is increased, the decrease in toughness is even higher.

FORGING

The demands on forging die steels are primarily determined by the respective forging process but also by the shape and properties of the material the components are to be made of. As a result, the demands on the die steel are derived, such as

- high thermal shock resistance
- high hot strength
- high retention of hardness
- exceptional high hot toughness
- high hot wear resistance
- improved thermal conductivity
- good heat checking resistance

Drop forging

Drop forging is carried out by impacting material with a hammer or by applying a great amount of pressure with a forging press or forging machine.

When forging with a **hammer** the forging piece is only in contact with the die for a short period of time. Due to this, the die has to withstand lower temperatures. However, the **mechanical stress is high.** Thus, it is quite important for the hot work tool steel used to have very good toughness properties.

Compared with that, the contact during **forging pressing** occurs over a longer period of time, which then causes a **higher temperature strain on the tool.** Thus, in such a case hot work tool steels with a chromium-molybdenum base are used, which are singled out as having good tempering resistance, high temperature strength, hot wear resistance, and hot toughness.

Rapid forging

A fully automatic multi-stage press is forging equipment that produces even the **most difficult shapes from materials hard to deform in several stages of deformation.** This equipment mostly produces **rotation symmetric parts.** Heating the slugs, feeding, shearing and deforming take place completely automatically.

Semi hot forging

The term semi hot forging refers to a deformation process in which **the workpiece is preheated to such a point that permanent strain hardening** occurs under the given deformation conditions. This definition means that the material is deformed below the recrystallization temperature, yet the term is also used for temperatures occurring above this. In practice this is understood to be the deformation of steel in the temperature range of 650 to approx. 950 °C. These temperatures lie significantly below the conventional forging temperatures of 1100 – 1250 °C.

Requirements	Drop forging with hammer	Drop forging with press	Semi hot forging
Wear resistance	★★★★★	★★★★★	★★★★★
Retention of hardness	★★	★★★★	★★★
High temperature strength	★★★	★★★	★★★★
Heat checking resistance	★	★★	★
High temperature toughness	★★★★	★★★	★★

BÖHLER W360 ISOBLOC

BÖHLER W360 ISOBLOC was developed as a tool steel for dies and punches in warm and hot forging. It owes its excellent properties to a patented alloing concept and the electroslag remelting (ESR) process. This grade can be used for a variety of applications where **hardness** and **toughness** are required.

Properties

- High hardness (recommended in use: 52 – 57 HRc)
- Exceptional toughness
- High temper resistance
- Good thermal conductivity
- Can be cooled with water
- Homogeneous microstructure

Applications and uses

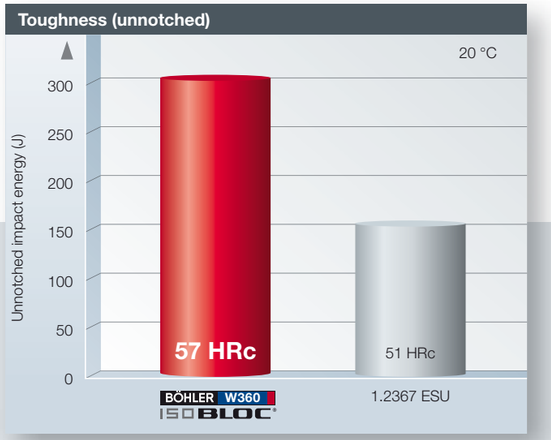
- Dies and punches in warm and hot forging
- Tooling for high speed presses
- Toughness-critical cold work applications
- Extrusion tooling, e.g. dies
- Core pins and inserts in die-casting dies
- Specific applications in the plastic processing sector

Toughness

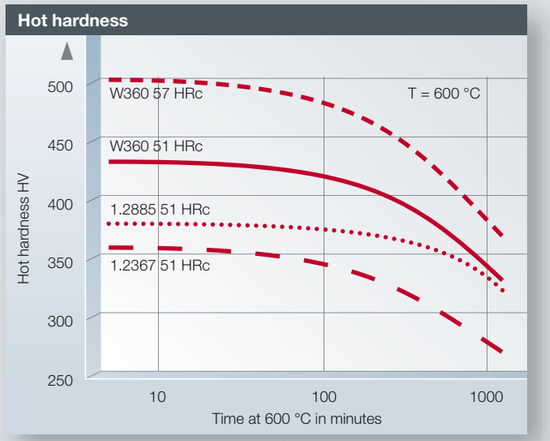
The toughness of hot work tool steels is one of the most important properties for safety against fracture and increased resistance to heat-checking and thermal shock. High hardness is usually associated with low toughness. This is not the case for W360 ISOBLOC.

Hot hardness

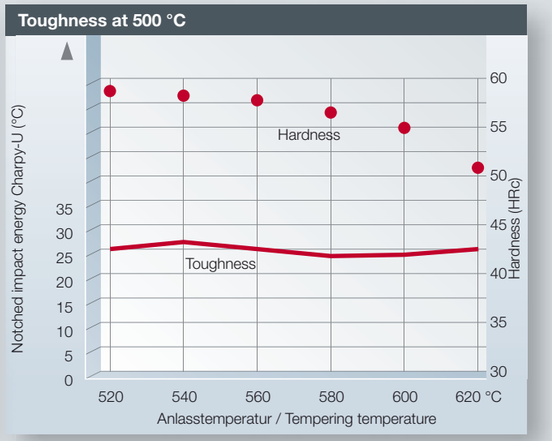
Alongside the outstanding toughness, W360 ISOBLOC is distinguished by its high thermal stability. This is reflected in the high hot hardness and the stability of the material under thermal loading. These properties, combined in W360 ISOBLOC, ensure a high resistance to thermal fatigue and catastrophic failure.



BÖHLER W360 ISOBLOC has a significantly higher toughness than 1.2367 ESU – at a higher hardness.



At 51 HRc, BÖHLER W360 ISOBLOC has a higher hot hardness than 1.2885 and 1.2367. If the hardness of BÖHLER W360 ISOBLOC is increased to 57 HRc, then the result is a further increase in the hot hardness.



Looking at the toughness over tempering temperature (hardness) it can be seen that the toughness of BÖHLER W360 ISOBLOC is almost constant from 51 to 57 HRc.

ROD EXTRUSION

Rod extrusion

Highly stressed extrusion tools require a high degree of metallurgical cleanless, excellent homogeneity and best toughness at high working hardness. These requirements are met by selected BÖHLER hot work tool steels for the extrusion industry.

- **increased heat checking resistance**
- **reduced hot wear**
- **increased hot strength**
- **higher working hardness**
  and therefore
- **longer tool life.**

That increases the productivity, lowers the unit costs and makes the final product more competitive.

Requirement profile	Mantle	Liner holder	Liner	Stem
Wear resistance	★	★	★★★★	★★
Hot hardness	★★★	★★★	★★★★	★★★★
High temperature strength	★★★	★★★★	★★★★	★★★
Creep resistance	★★★★★	★★★★★	★★★	★
Heat checking resistance	★	★	★★★★	★
Compressive strength	★	★★★	★★	★★★★★
High temperature toughness	★★★	★	★★★	★★

Evaluation of material properties

BÖHLER grade	High temperature strength	High temperature toughness	High temperature wear resistance	Machinability
BÖHLER W300 ISODISC®	★★	★★★	★★	★★★★★
BÖHLER W300 ISOBLOC®	★★	★★★★	★★	★★★★★
BÖHLER W302 ISODISC®	★★★	★★★	★★★	★★★★★
BÖHLER W302 ISOBLOC®	★★★	★★★★	★★★	★★★★★
BÖHLER W303 ISODISC®	★★★★	★★★	★★★★	★★★★★
BÖHLER W320 ISODISC®	★★★	★★	★★★	★★★★★
BÖHLER W321 ISODISC®	★★★★	★★	★★★★	★★★★★
BÖHLER W350 ISOBLOC®	★★★	★★★★★	★★★★	★★★★★
BÖHLER W360 ISOBLOC®	★★★★★	★★★★	★★★★★	★★★★★
BÖHLER W400 VMR®	★★	★★★★★	★★	★★★★
BÖHLER W403 VMR®	★★★★	★★★★	★★★★	★★★★
BÖHLER W500	★	★★★	★	★★★
BÖHLER W720 VMR®	Maraging steels (ageing temperature about 480 °C), in this form not comparable with the heat treatable steels.			
BÖHLER W722 VMR®				

For specific applications and selection of proper material and working hardness please refer to our technical sales staff.

PLASTIC MOULD STEELS

PLASTIC MOULD STEEL

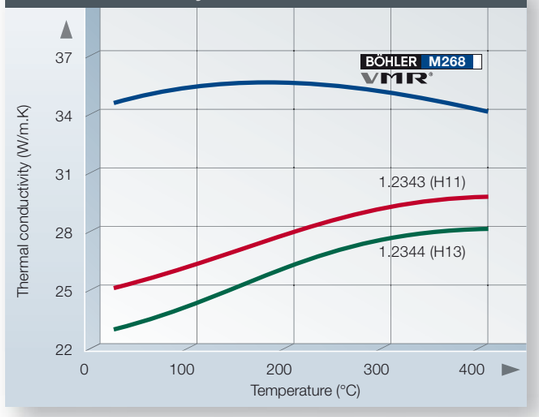
To meet the highest demands BÖHLER plastic mould steels are the ultimate solution to any application in the manufacture of mould and machine parts, meeting the highest expectations of users as regards shape, function, aesthetics, product quality and durability. BÖHLER steels are of a guaranteed consistent quality and developed for the most stringent future demands.

As a **mould maker** you certainly know of all the demands a product should meet. BÖHLER, therefore, offers you competent material consulting on the steel its properties and the heat treatment to meet your requirements best.

BÖHLER M268 VMR

BÖHLER M268 VMR is a hardened and tempered plastic mould steel with excellent cleanliness for best polishability. The hardness is constant over the entire cross-section of the steel block, even at large sizes, due to the addition of nickel.

Thermal conductivity



Applications
Moulds for plastics processing, components for general mechanical engineering and tool manufacture where highest polishability and fatigue strength are required.

Condition of supply
Hardened and tempered to 350 – 400 BHN, High-hard. Generally, no heat treatment is required. If heat treatment is carried out, e.g. to obtain an increase in strength, the instructions given in this brochure should be observed.

Mirror Polishability
The excellent cleanliness of **BÖHLER M268 VMR,** achieved by the vacuum remelting technology, has a positive impact on the polishability of large moulds and complex geometries.

Optimizing of cycle times
The high thermal conductivity guarantees a reduction of cycle time and increases the efficiency of the production process.

Further advantages of our hardened and tempered plastic mould steel BÖHLER M268 VMR:
- Suitable for all nitriding processes to improve wear resistance
- Can be hard chromium plated. Suitable for every type of galvanic surface treatment used to optimize hardness and corrosion resistance
- Suitable for PVD coating, providing excellent adhesion conditions for the TiN-layer
- The material can be induction-hardened if necessary
- Suitable for photo-etching

Advantages and benefits
The economic and technological advantages of **BÖHLER M268 VMR** at a glance:

Higher quality
- Uniformly high strength and toughness, even at larger sizes
- High through hardenability
- Excellent thermal conductivity

Efficient tool making
- No heat treatment required
- Excellent, high polishability
- Good texturing properties
- Good electrical discharge machining properties

Reliability
- The material does not require heat treatment, reducing the risk of errors
- The good toughness decreases the risk of cracking during service

= Improved productivity and cost reduction

BÖHLER M303 EXTRA

The new classic

BÖHLER M303 EXTRA is a corrosion resistant martensitic chromium steel, offering **excellent toughness, corrosion** and **wear resistance.** It is characterized by **improved machinability and polishability.**

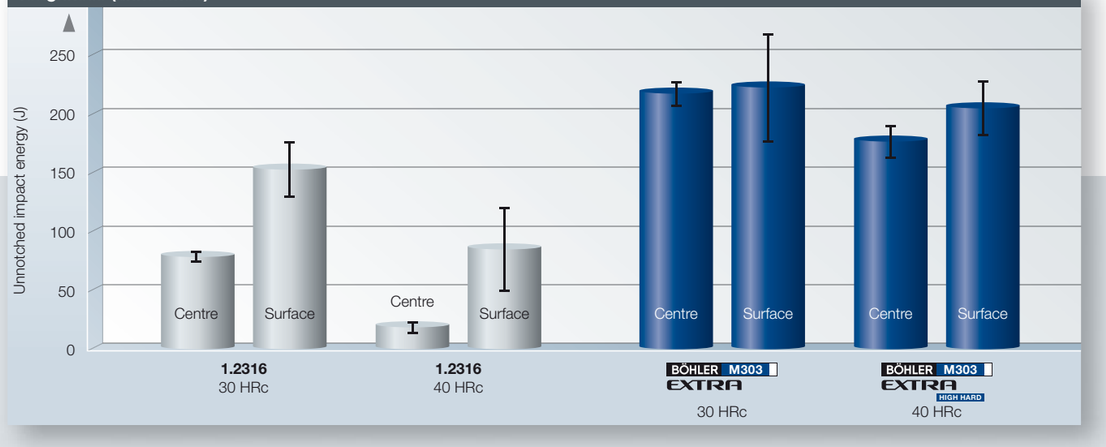
And what is special about it – BÖHLER M303 EXTRA was developed for improved homogeneity ensuring excellent usage properties. And the outcome is – compared to 1.2316 – the prevention of delta ferrite in the matrix.

This material is also offered by BÖHLER in the **"High-Hard"-version,** with a significant better wear resistance.

BÖHLER M303 EXTRA — Hardened and tempered: 290 – 330 HB

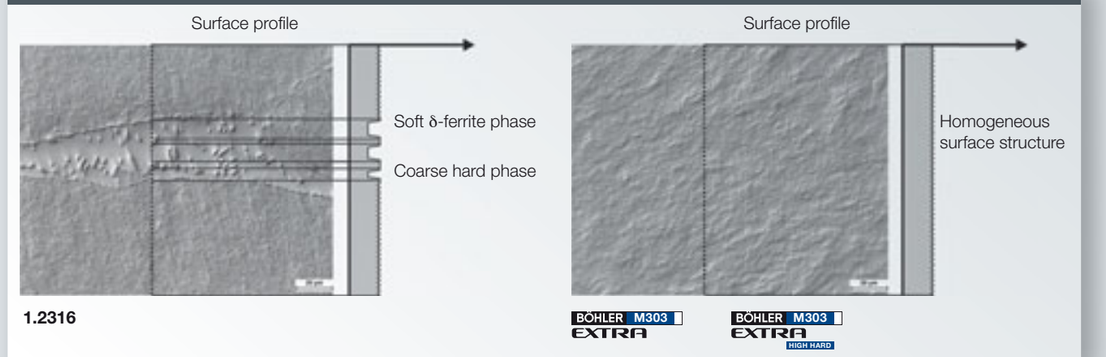
BÖHLER M303 EXTRA HIGH HARD — Hardened and tempered: 350 – 390 HB

Toughness (unnotched)



Comparisons made with 1.2316 show that **BÖHLER M303 EXTRA** has a more regular and improved toughness over the block zones thus ensuring a better fracture resistance and avoiding unexpected downtimes.

Surface comparison



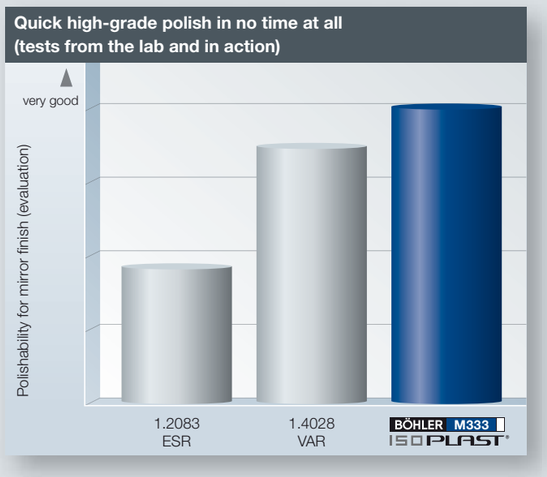
In the case of 1.2316, the hard carbide phases being imbedded in the soft delta ferrite zone, are causing an irregular polish. In contrast **BÖHLER M303 EXTRA** shows regular polish.

BÖHLER M333 ISOPLAST®

A product is only as good as the surface finish of the tool in which the product is formed. Particularly in the field of mirrored finishes no mistakes are condoned. Irregularities on the surface are immediately visible. Until now it has been particularly time-consuming and costly for toolmakers to produce inserts with a mirrored finish. That effort was coupled with the fact that the finished results were less than satisfactory.

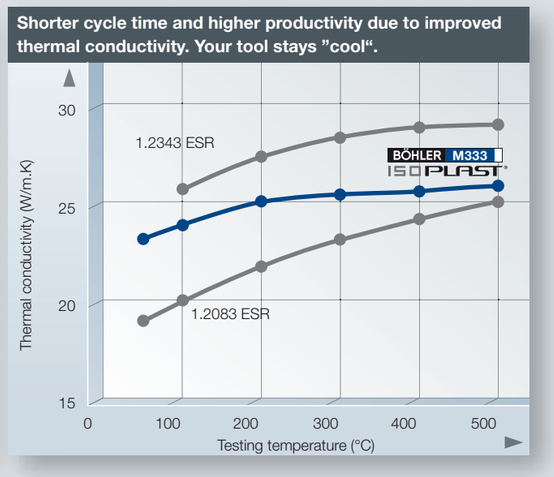
Advantage of BÖHLER M333 ISOPLAST at a glance:
- Optimum polishability for mirror finish
- Improved thermal conductivity
- Exceptional toughness and hardness
- Very good corrosion resistance

Quick high-grade polish in no time at all (tests from the lab and in action)



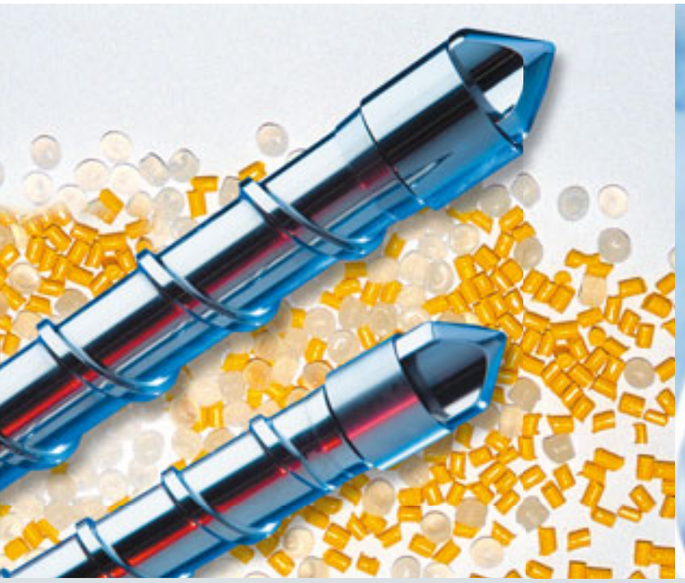
Mean values of the findings of several Austrian and German companies regarding time and quality after mechanical and handpolishing of 6 samples of each material.

Shorter cycle time and higher productivity due to improved thermal conductivity. Your tool stays "cool".



Source: Materials Center Leoben Forschung GmbH, ÖGI

BÖHLER M390 MICROCLEAN®



BÖHLER M390 MICROCLEAN is a martensitic chromium steel produced with powder metallurgy. Due to its alloying concept this steel offers **extremely high wear resistance** and **high corrosion resistance** – the perfect combination for **best application properties**.

- extremely high wear resistance
- high corrosion resistance
- excellent grindability
- high mirrorfinish polishability
- high toughness
- minimum dimensional changes
- better resistance to vibrations and mechanical shocks

enable

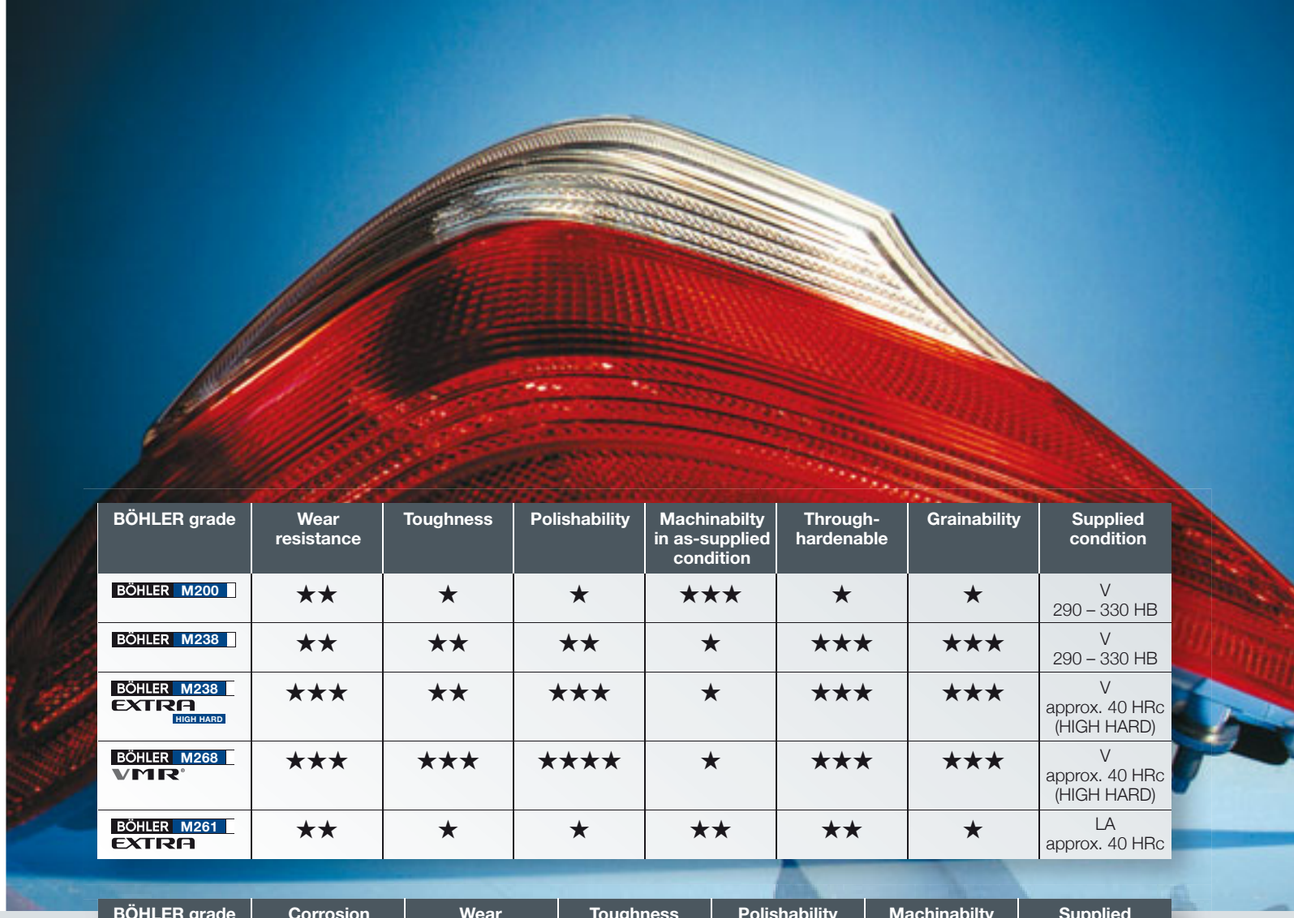
- long and consistant tool life
- reproducibility of production processes
- high precision components

Benefit

- **increased productivity**
- **reduced unit costs**

Field of applications

- Mould inserts for the production of CDs and DVDs
- Moulds for the processing of chemically aggressive plastics containing highly abrasive fillers
- Moulds for the processing of duroplasts
- Moulds for the production of chips for the electronics industry
- Screws for injection moulding machines
- Non return valves
- Linings for injection moulding cylinders

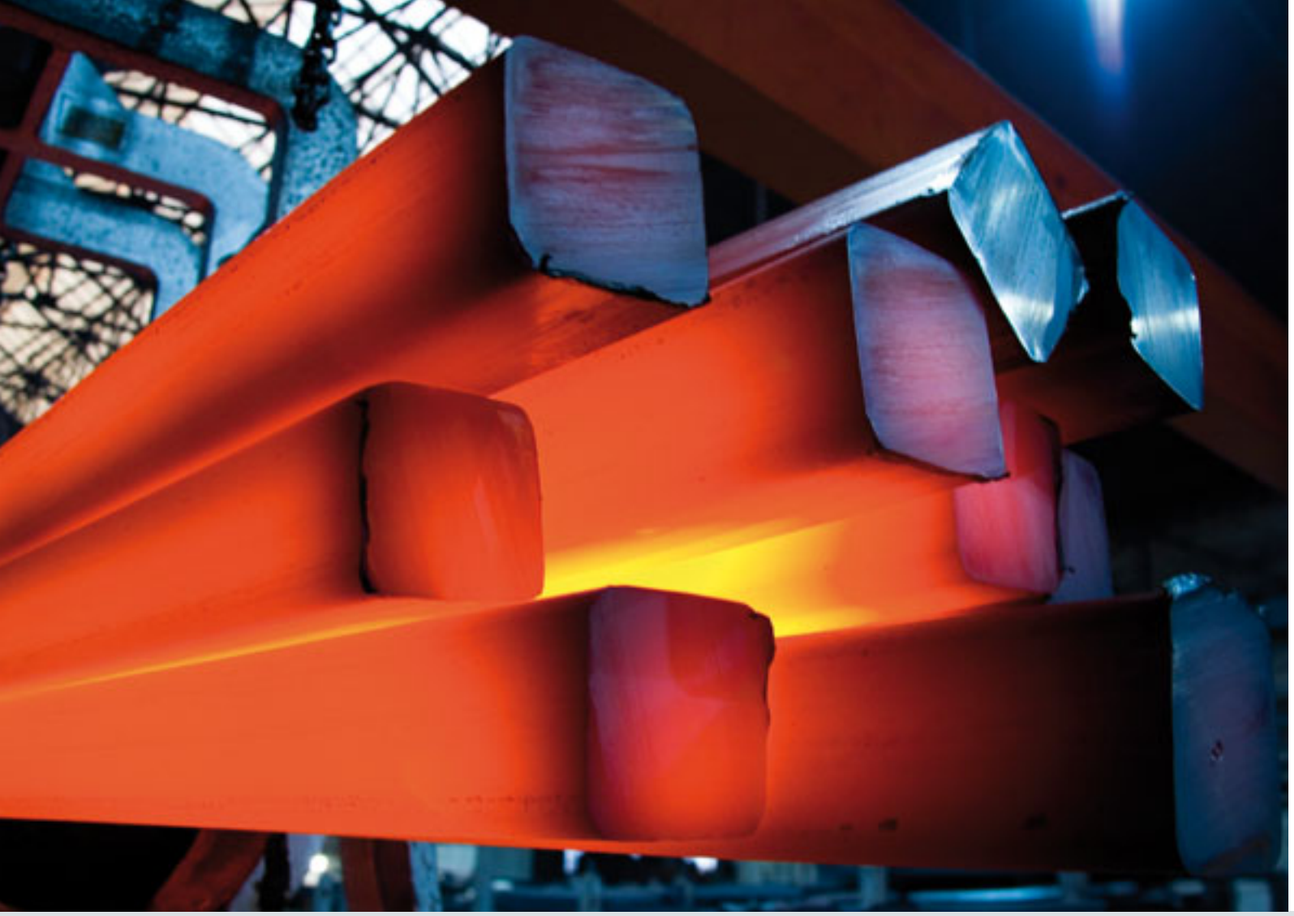


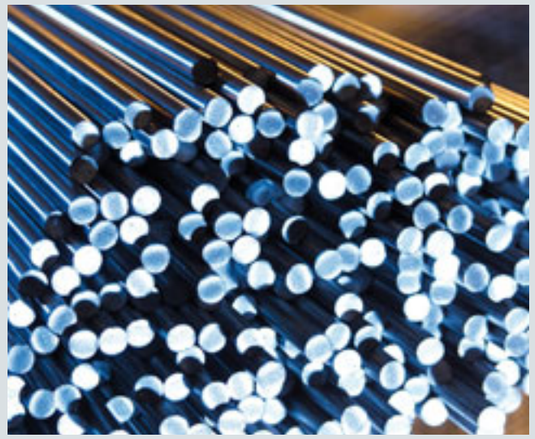
BÖHLER grade	Wear resistance	Toughness	Polishability	Machinabilty in as-supplied condition	Through-hardenable	Grainability	Supplied condition
BÖHLER M200	★★	★	★	★★★	★	★	V 290 – 330 HB
BÖHLER M238	★★	★★	★★	★	★★★	★★★	V 290 – 330 HB
BÖHLER M238 EXTRA HIGH HARD	★★★	★★	★★★	★	★★★	★★★	V approx. 40 HRc (HIGH HARD)
BÖHLER M268 VMR®	★★★	★★★	★★★★	★	★★★	★★★	V approx. 40 HRc (HIGH HARD)
BÖHLER M261 EXTRA	★★	★	★	★★	★★	★	LA approx. 40 HRc

BÖHLER grade	Corrosion resistance	Wear resistance	Toughness	Polishability	Machinabilty in as-supplied condition	Supplied condition
Heat treated, corrosion resistant steels *						
BÖHLER M303 EXTRA	★★★	★★	★★	★★★	★	V approx. 1000 N/mm²
BÖHLER M303 EXTRA HIGH HARD	★★★	★★★	★★	★★★	★	V approx. 40 HRc
BÖHLER M314 EXTRA	★★	★	★	★★	★★	V approx. 1000 N/mm²
BÖHLER M315 EXTRA	★★	★	★	★	★★★	V approx. 1000 N/mm²
BÖHLER N700	★★★	★★	★★★	★★★	★	V approx. 1500 N/mm²
Hardenable, corrosion resistant steels *						
BÖHLER M310 ISOPLAST®	★★	★★	★	★★	★★★	W max. 225 HB
BÖHLER M333 ISOPLAST®	★★	★★	★★★	★★★	★★★	W max. 220 HB
BÖHLER M340 ISOPLAST®	★★★	★★★	★	★	★★	W max. 260 HB
BÖHLER M390 MICROCLEAN®	★★★	★★★	★★	★★★	★	W max. 280 HB
BÖHLER N685	★	★★★	★	★	★	W max. 265 HB

Evaluation of material properties in plastic moulding applications (Please note: The comparison is applicable for the brands of each group only): For particular requirements in terms of corrosion resistance, wear resistance or dimensional stability please consult our technical sales staff.

W Soft annealed
V Hardened and tempered to obtain good mechanical properties
LA Solution annealed and precipitation hardened
* The profiles given are characteristic of each group of steels.





MICROCLEAN®
Powder metallurgical steels

VMR®
Special materials subjected to vacuum refining or melting during at least one stage of manufacture.

ISOPLAST®
Plastic mould steels in ESR quality

ISODUR®
Cold work tool steels in ESR quality

ISORAPID®
High speed steels in ESR quality

ISOBLOC®
Hot work tool steels in ESR quality with special heat treatment

ISODISC®
Hot work tool steels in conventional quality with special heat treatment

ISOEXTRA®
Special materials in ESR quality (excluding vacuum remelted)

EXTRA
Special property and/or achievement characteristics

BÖHLER BHT
Bars hardened and tempered

THE PRODUCTION PROCESS MICROCLEAN®

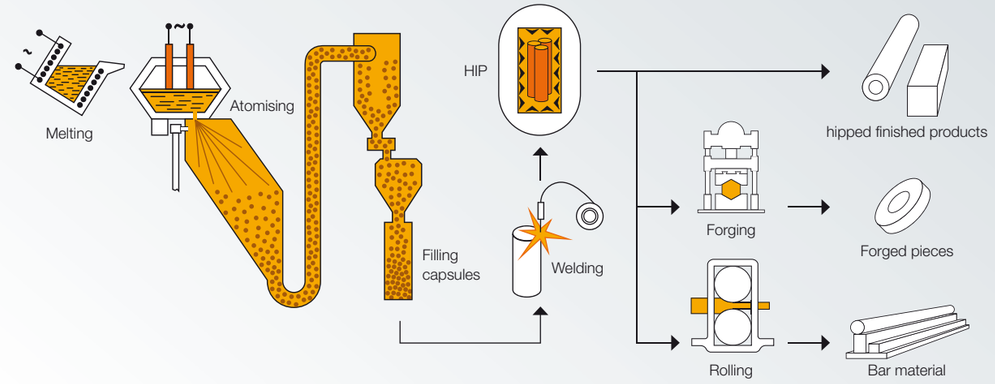
POWDER METALLURGY

3rd generation high speed steels and tool steels made from uniquely fine, pure powder produced in the world's most modern PM plant at BÖHLER Edelstahl in Kapfenberg, Austria.

- **high homogeneity**
- **improved toughness**
- **high fatigue resistance**
- **optimal reliability**
- **uniquely consistent properties**

High purity, homogeneous alloyed powders, with appropriate particle size and distribution are subjected to a high pressure, high temperature process to obtain a homogeneous, segregation-free tool steel with virtually isotropic properties.

Production routes for BÖHLER MICROCLEAN



BOHLER grade	Chemical composition in %										Standards	
	C	Si	Mn	Cr	Mo	Ni	V	W	Co	Others	EN / DIN	AISI
BÖHLER S290 MICROCLEAN	2.00	0.50	0.30	3.80	2.50	–	5.10	14.30	11.00	–	Patent	–
BÖHLER S390 MICROCLEAN	1.64	0.45	0.30	4.80	2.00	–	4.80	10.40	8.00	–	–	–
BÖHLER S590 MICROCLEAN	1.29	0.60	0.30	4.20	5.00	–	3.00	6.30	8.40	–	1.3244 HS6-5-3-8	–
BÖHLER S690 MICROCLEAN	1.35	0.60	0.30	4.10	5.00	–	4.10	5.90	–	–	~ 1.3351 ~ HS6-5-4	~ M4
BÖHLER S790 MICROCLEAN	1.29	0.60	0.30	4.20	5.00	–	3.00	6.30	–	–	1.3345 HS6-5-3C	~ M3 Cl.2
BÖHLER K190 MICROCLEAN	2.30	12.50	1.10	–	4.00	–	–	0.60	0.30	–	–	–
BÖHLER K390 MICROCLEAN	2.47	0.55	0.40	4.20	3.80	–	9.00	1.00	2.00	–	Patent HS6-5-3C	–
BÖHLER K490 MICROCLEAN	1.40	–	–	6.40	1.50	–	3.70	3.50	–	Nb	–	–
BÖHLER K890 MICROCLEAN	0.85	0.55	0.40	4.35	2.80	–	2.10	2.55	4.50	–	Patent	–
BÖHLER M390 MICROCLEAN	1.91	0.60	0.30	20.00	1.00	–	4.00	6.00	–	–	Patent	–

BOHLER has improved the production process for powder metallurgy high speed steels and tool steels. MICROCLEAN materials of the 3rd generation with improved performance features are produced in Kapfenberg on the most modern unit worldwide. An extensive assortment of cold work, plastic mould and high speed steels provides our customers with a definitive competitive advantage.

BOHLER MICROCLEAN have the following advantages:

- extremely high wear resistance
- excellent corrosion resistance
- optimum grindability
- easily polishable to a high mirror finish
- High toughness
- Only minor isotropic dimensional changes
- Repeatable production processes
- Better resistance to vibrations
- More resistance to mechanical shocks

enable

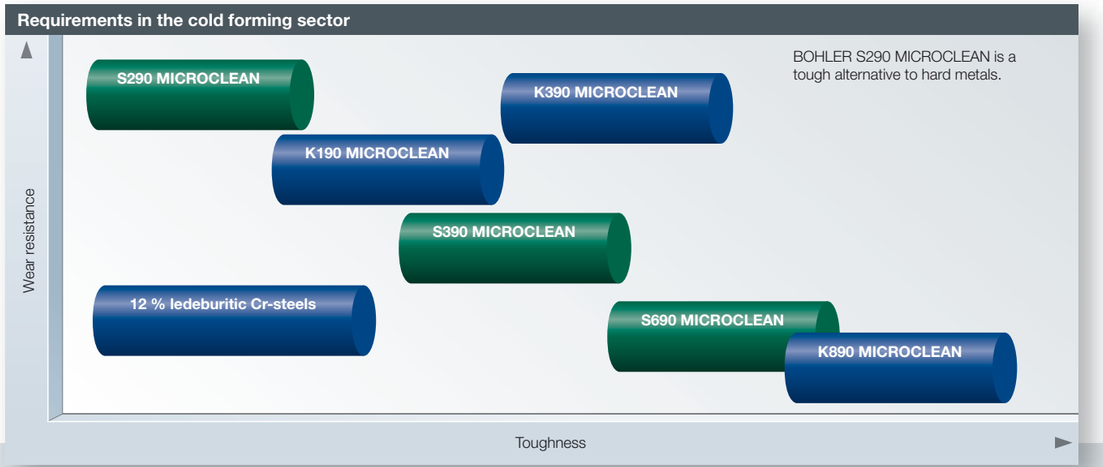
- high precision components
- long tool life
- consistant tool life

ensuring

- **increased productivity**
- **reduced unit costs**

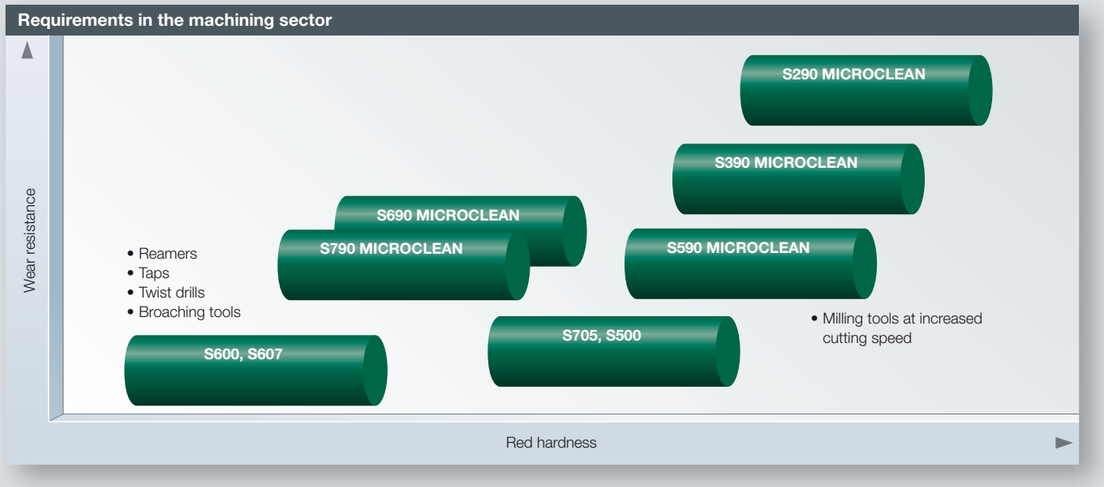
Requirements in the cold forming sector

The service life of a cold work tool depends on the **wear resistance, toughness** and **compressive strength** of the tool material.



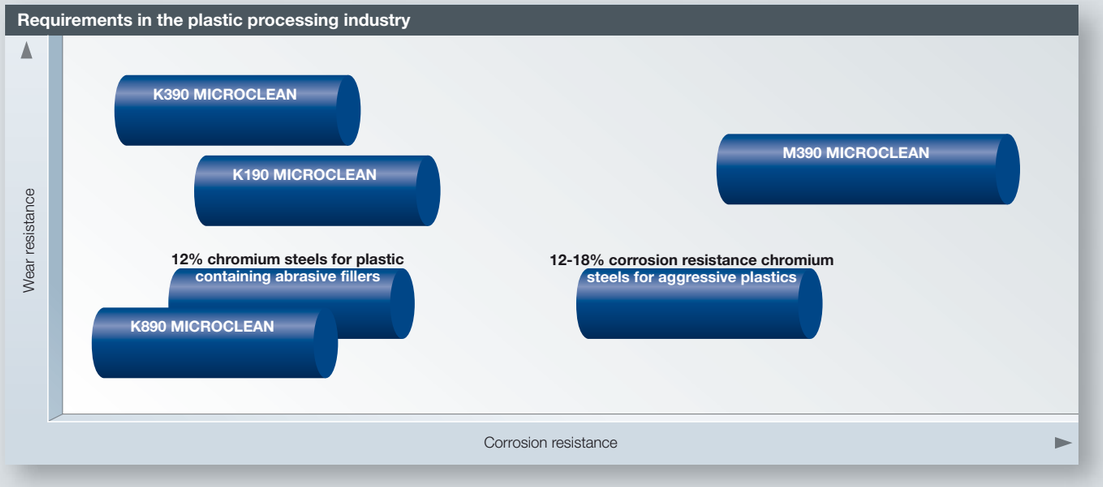
Requirements in the machining sector

The efficiency of a machining tool depends on the **wear resistance, red hardness, toughness** and **compressive strength** of the tool material.



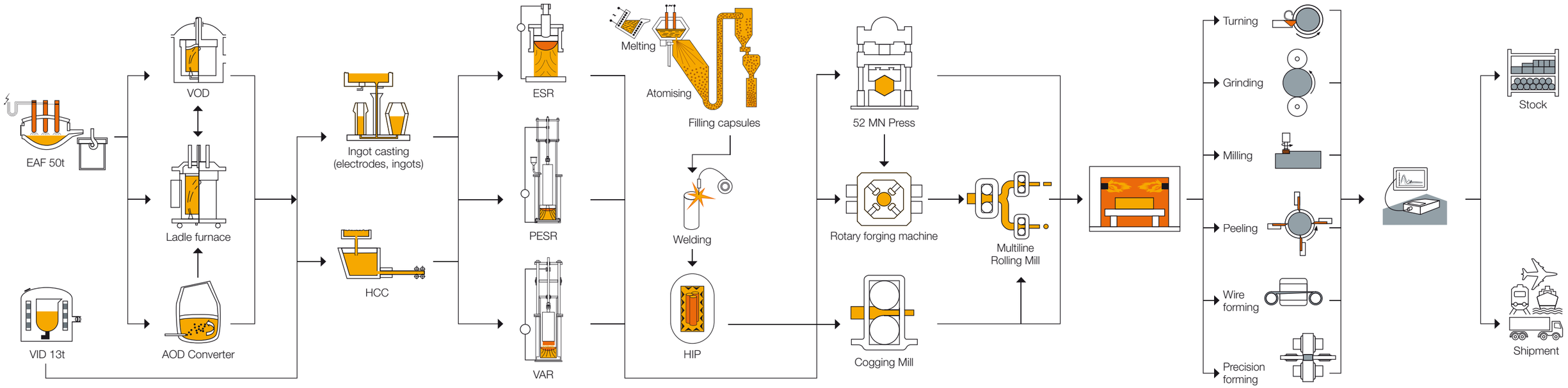
Requirements in the plastic processing industry

The major factors which influence the tool performance in the plastics processing industry are **wear resistance, corrosion resistance, toughness** and **polishability**.

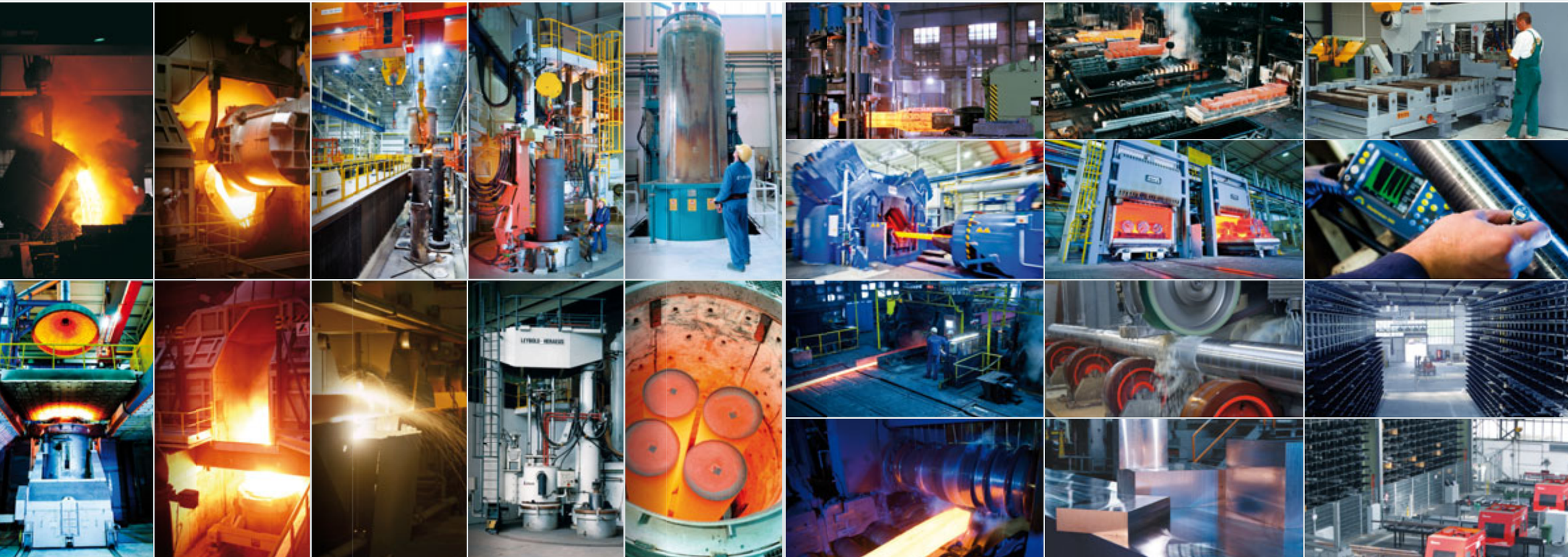


FLOW OF MATERIAL

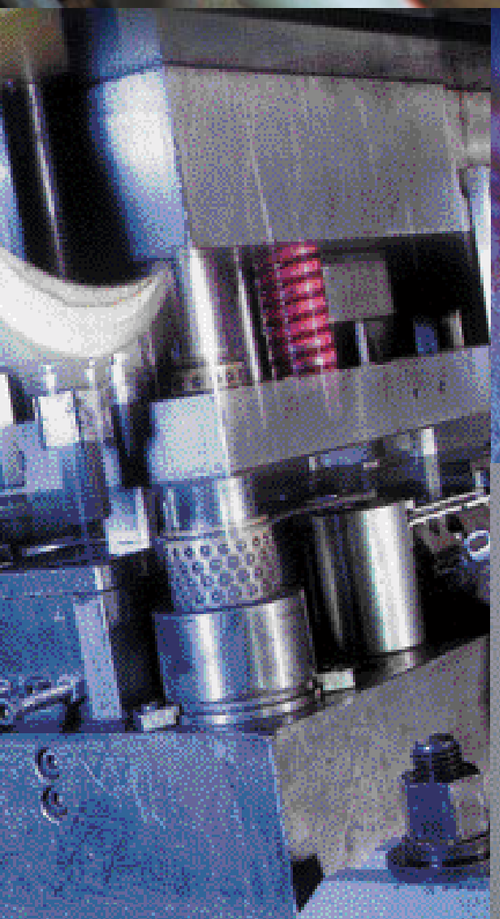
STATE OF THE ART TECHNOLOGY

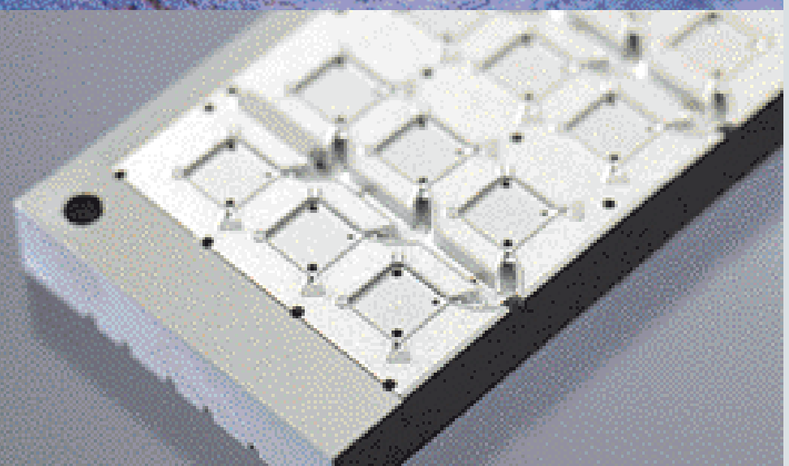


Melting | Secondary metallurgy | Casting | Remelting | Powder metallurgy | Rolling and Forging | Heat Treatment | Machining | Testing | Dispatch



POWDER METALLURGY





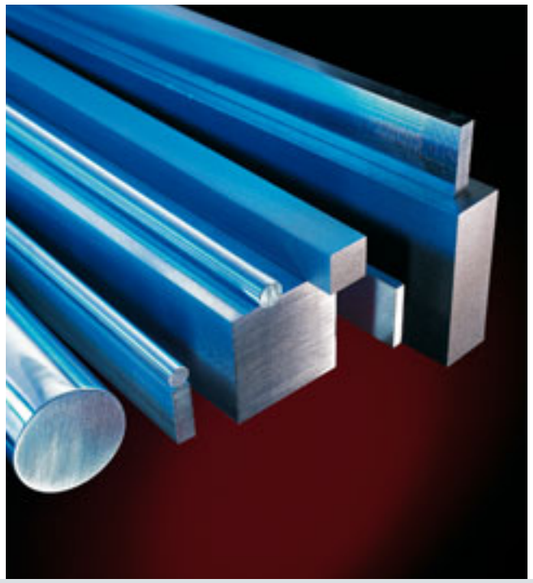
PRODUCT RANGE

Materials

High speed steels

Tool steels
- Cold work tool steels
- Hot work tool steels
- Plastic mould steels

Special materials
- Special constructional steels
- Stainless steels
- Creep resisting steels
- Heat resisting steels
- Valve steels
- Steels with special physical properties
- Steels for particular applications
- Ni base alloys



Products

BAR STEEL rolled

round:			12.5 – 150	mm
square:			15 – 150	mm
flat:	width		thickness	
	15 – 60	mm	5 – 41	mm
	60 – 200	mm	5 – 86	mm
	100 – 300	mm	15 – 80	mm

ROLLED WIRE

rolled (dia.)	5.0 – 13.5	mm
drawn (wire, bar steel):	0.6 – 13.3	mm Ø
round (bar steel):	2.0 – 28.0	mm Ø
peeled (wire):	4.5 – 13.0	mm Ø
BHT (hardened and tempered) bar steel:	3.0 – 20.0	mm Ø
flat or profiled wire:	0.5 – 40.0	mm^2

BAR STEEL forged

round:		101 – 1150	mm
square:		110 – 1150	mm
flat:	width	thickness	
	107	70	mm minimum
	1600	1150	mm maximum

Ratio width/thickness maximum 10:1

BAR STEEL pre-machined
IBO ECOMAX 12.5 – 315 mm
(on request up to 900 mm)

BRIGHT STEEL
BRIGHT STEELground and polished
ECOBLANKpeeled and polished
ECOFINISHband ground

Surface finish: black
(abrasive blasted); pickled; machined (turned, peeled, polished h 12 – h 9); ground – polished

Forgings
Open-die forgings of a gross weight of up to 45t: unmachined, premachined, machined ready for mounting: drop forgings: machined. Machining of rolled, forged an cast components on state-of-the-art machines.

Industries
aviation industry, turbine construction, toolmaking industry, general mechanical engineering, offshore industry, energy engineering, automotive industry, medical technology

HIGH SPEED STEELS

HIGH SPEED STEEL

Comparison of the major high speed steel properties
(This comparison does not take into account the various stress conditions imposed on the tool in different kinds of application. Comparisons also depend very much on the heat treatment conditions. Our technical sales staff will be glad to assist you in any questions concerning the application and heat treatment of our steels.)

BOHLER grade	Red hardness	Wear resistance	Toughness	Grindability	Compressive strength
BÖHLER S500	★★★★	★★	★★	★★★	★★★★
BÖHLER S600	★★★	★★	★★★	★★★	★★★
BÖHLER S705	★★★	★★	★★★	★★★	★★★
BÖHLER S290 MICROCLEAN	★★★★★	★★★★★	★	★	★★★★★
BÖHLER S390 MICROCLEAN	★★★★	★★★★	★★★★	★★★	★★★★
BÖHLER S590 MICROCLEAN	★★★★	★★★	★★★	★★★	★★★★
BÖHLER S690 MICROCLEAN	★★	★★★	★★★★★	★★★	★★★
BÖHLER S790 MICROCLEAN	★★	★★	★★★★	★★★	★★★

BOHLER grade	Chemical composition in %										Standards	
	C	Si	Mn	Cr	Mo	Ni	V	W	Co	Others	EN / DIN	AISI
BÖHLER S500	1.10	0.50	0.25	3.90	9.20	–	1.00	1.40	7.80	–	1.3247 HS2-9-1-8	M42
BÖHLER S600	0.90	max. 0.45	max. 0.40	4.10	5.00	–	1.80	6.20	–	–	1.3343 HS6-5-2C	~ M2 reg. C
BÖHLER S705	0.92	0.40	0.30	4.10	5.00	–	1.90	6.20	4.80	–	1.3243 HS6-5-2-5	(~ M35) ~ M41
BÖHLER S290 MICROCLEAN	2.00	0.50	0.30	3.80	2.50	–	5.10	14.30	11.00	–	Patent	–
BÖHLER S390 MICROCLEAN	1.64	0.45	0.30	4.80	2.00	–	4.80	10.40	8.00	–	–	–
BÖHLER S590 MICROCLEAN	1.29	0.60	0.30	4.20	5.00	–	3.00	6.30	8.40	–	1.3244 HS6-5-3-8	–
BÖHLER S690 MICROCLEAN	1.35	0.60	0.30	4.10	5.00	–	4.10	5.90	–	–	~ 1.3351 ~ HS6-5-4	~ M4
BÖHLER S790 MICROCLEAN	1.29	0.60	0.30	4.20	5.00	–	3.00	6.30	–	–	1.3345 HS6-5-3C	~ M3 Cl.2

BOHLER grade	Hardness after annealing	Hardening temperature	Quenchant	Obtainable hardness after tempering
BÖHLER S500	max. 280 HBW	1160 – 1180 °C	Oil, Air, Salt bath (500 – 550 °C), Gas	67 – 69 HRc
BÖHLER S600	max. 280 HBW	1190 – 1230 °C	Oil, Air, Salt bath (500 – 550 °C), Gas	64 – 66 HRc
BÖHLER S705	max. 280 HBW	1190 – 1230 °C	Oil, Air, Salt bath (500 – 550 °C), Gas	64 – 66 HRc
BÖHLER S290 MICROCLEAN	max. 350 HBW	1150 – 1210 °C 1150 – 1190 °C	Salt Bath Gas	66 – 70 HRc
BÖHLER S390 MICROCLEAN	max. 300 HBW	1150 – 1230 °C	Oil, Air, Salt bath (500 – 550 °C), Gas	65 – 69 HRc
BÖHLER S590 MICROCLEAN	max. 300 HBW	1075 – 1180 °C	Oil, Air, Salt bath (500 – 550 °C), Gas	65 – 67 HRc
BÖHLER S690 MICROCLEAN	max. 280 HBW	1150 – 1200 °C	Oil, Air, Salt bath (500 – 550 °C), Gas	64 – 66 HRc
BÖHLER S790 MICROCLEAN	max. 280 HBW	1050 – 1180 °C	Oil, Air, Salt bath (500 – 550 °C), Gas	64 – 66 HRc

COLD WORK TOOL STEELS

COLD WORK TOOL STEEL

BOHLER grade	Chemical composition in %										Standards	
	C	Si	Mn	Cr	Mo	Ni	V	W	Co	Others	DIN / EN	AISI
BÖHLER K100	2.00	0.25	0.35	11.50	–	–	–	–	–	–	1.2080 X210Cr12	~ D3
BÖHLER K105	1.60	0.33	0.30	11.50	0.60	–	0.30	0.50	–	–	1.2601 X165CrMoV12	–
BÖHLER K107	2.10	0.25	0.38	11.50	–	–	–	0.70	–	–	1.2436 X210CrW12	(~ D6)
BÖHLER K110	1.55	0.30	0.30	11.30	0.75	–	0.75	–	–	–	1.2379 X153CrMoV12	D2
BÖHLER K190 MICROCLEAN	2.30	12.50	1.10	–	4.00	–	–	0.60	0.30	–	–	–
BÖHLER K245	0.63	1.05	1.05	0.60	–	–	–	–	–	–	1.2101 62SiMnCr4	–
BÖHLER K340 ISODUR	1.10	0.90	0.40	8.30	2.10	–	0.50	–	–	Al, Nb	Patent	–
BÖHLER K353	0.82	0.70	0.40	8.00	1.60	–	0.60	–	–	Al	Patent	–
BÖHLER K360 ISODUR	1.25	0.90	0.35	8.75	2.70	–	1.18	–	–	Al, Nb	Patent	–
BÖHLER K390 MICROCLEAN	2.47	0.55	0.40	4.20	3.80	–	9.00	1.00	2.00	–	Patent	–
BÖHLER K455	0.63	0.60	0.30	1.10	–	–	0.18	2.00	–	–	1.2550 60WCrV7	~ S1
BÖHLER K460	0.95	0.25	1.10	0.55	–	–	0.10	0.55	–	–	1.2510 100MnCrW4	O1
BÖHLER K490 MICROCLEAN	1.40	–	–	6.40	1.50	–	3.70	3.50	–	Nb	–	–
BÖHLER K890 MICROCLEAN	0.85	0.55	0.40	4.35	2.80	–	2.10	2.55	4.50	–	Patent	–

BOHLER grade	Hardness after annealing	Hardening temperature	Quenchant	Obtainable hardness	Average Rockwell C hardness after tempering at °C						
					100	200	300	400	500	520	550
BÖHLER K100	max. 248 HB	940 – 970 °C	Oil, Air (<25 mm Ø), Gas, Salt bath (220 – 250 °C / 500 – 550 °C)	57 – 62 HRc	64	62	59	57	–	–	–
BÖHLER K105	max. 250 HB	980 – 1010 °C	Oil, Air, Gas, Salt bath (500 – 550 °C)	63 – 65 HRc	64	62	60	58	–	–	–
BÖHLER K107	max. 250 HB	950 – 980 °C	Oil, Air, Gas, Salt bath (500 – 550 °C)	64 – 66 HRc	65	63	61	60	–	–	–
BÖHLER K110	max. 250 HB	1020 – 1040 °C	Oil, Air, Gas, Salt bath (220 – 250 °C / 500 – 550 °C)	58 – 61 HRc	63	61	59	58	–	–	–
BÖHLER K190 MICROCLEAN	max. 260 HB	1050 – 1150 °C	Oil, Air, Gas, Salt bath	62 – 67 HRc	see tempering chart						
BÖHLER K245	max. 235 HB	830 – 860 °C	Oil	59 – 62 HRc	61	60	57	51	–	–	–
BÖHLER K340 ISODUR	max. 235 HB	1040 – 1060 °C	Oil, Air, Gas, Salt bath	57 – 63 HRc	see tempering chart						
BÖHLER K353	max. 240 HB	1030 – 1060 °C	Oil, Air, Gas, Salt bath	55 – 61 HRc	see tempering chart						
BÖHLER K360 ISODUR	max. 250 HB	1040 – 1080 °C	Oil, Air, Gas, Salt bath	57 – 63 HRc	see tempering chart						
BÖHLER K390 MICROCLEAN	max. 280 HB	1030 – 1180 °C	Oil, Gas	58 – 64 HRc	see tempering chart						
BÖHLER K455	max. 225 HB	870 – 900 °C	Oil	53 – 59 HRc	60	59	56	53	–	–	–
BÖHLER K460	max. 220 HB	780 – 820 °C	Oil, Salt bath (200 – 250 °C)	63 – 65 HRc	64	62	58	52	–	–	–
BÖHLER K490 MICROCLEAN	max. 280 HB	1030 – 1080 °C	Oil, Gas	58 – 64 HRc	see tempering chart						
BÖHLER K890 MICROCLEAN	max. 280 HB	1030 – 1180 °C	Oil, Gas	58 – 64 HRc	see tempering chart						

HOT WORK TOOL STEELS

HOT WORK TOOL STEEL

BOHLER grade	Chemical composition in %										Standards	
	C	Si	Mn	Cr	Mo	Ni	V	W	Co	Others	DIN / EN	AISI
BÖHLER W300 ISOBLOC®	0.38	1.10	0.40	5.00	1.30	–	0.40	–	–	–	1.2343 X37CrMoV5-1	H11
BÖHLER W302 ISOBLOC®	0.39	1.10	0.40	5.20	1.30	–	0.95	–	–	–	1.2344 X40CrMoV5-1	H13
BÖHLER W303 ISODISC®	0.38	0.40	0.40	5.00	2.80	–	0.55	–	–	–	1.2367 X38CrMoV5-3	–
BÖHLER W320 ISOBLOC®	0.31	0.30	0.35	2.90	2.70	–	0.50	–	–	–	1.2365 32CrMoV12-28	~ H10
BÖHLER W350 ISOBLOC®	0.38	0.21	0.50	4.95	1.75	0.04	0.53	–	–	–	1.2343	H11
BÖHLER W360 ISOBLOC®	0.50	0.20	0.25	4.50	3.00	–	0.60	–	–	–	Patent	–
BÖHLER W400 VMR®	0.38	0.20	0.30	5.00	1.30	–	0.50	–	–	–	~ 1.2343 ~ X37CrMoV5-1	~ H11
BÖHLER W403 VMR®	0.38	0.20	0.25	5.00	2.80	–	0.65	–	–	–	~ 1.2367 ~ X38CrMoV5-3	–

BOHLER grade	Hardness after annealing	Hardening temperature	Quenchant	Obtainable hardness	Average Rockwell C hardness after tempering at °C					
					400	500	550	600	650	700
BÖHLER W300 ISOBLOC®	max. 205 HB	1000 – 1040 °C	Oil, Salt bath (500 – 550 °C) Air, Gas	52 – 56 HRc 50 – 54 HRc	53	54	52	48	38	30
BÖHLER W302 ISOBLOC®	max. 205 HB	1020 – 1080 °C	Oil, Salt bath (500 – 550 °C) Air, Gas	52 – 56 HRc 50 – 54 HRc	54	55	54	50	40	32
BÖHLER W303 ISODISC®	max. 205 HB	1030 – 1080 °C	Oil, Salt bath (500 – 550 °C) Air, Gas	52 – 56 HRc 50 – 54 HRc	52	54	53	50	44	35
BÖHLER W320 ISOBLOC®	max. 205 HB	1010 – 1050 °C	Oil, Salt bath, (500 – 550 °C), Gas	52 – 56 HRc	50	51	52	50	45	36
BÖHLER W350 ISOBLOC®	max. 240 HB	1020 °C (1010 °C*)	Oil, Salt bath (500 – 550 °C) Air, Gas	52 – 54 HRc 50 – 53 HRc	–	–	–	–	–	–
BÖHLER W360 ISOBLOC®	max. 205 HB	approx. 1050 °C	Oil, Salt bath (500 – 550 °C), Air, Gas	57 – 58 HRc	see tempering chart					
BÖHLER W400 VMR®	max. 205 HB	980 – 990 °C	Oil, Salt bath (500 – 550 °C) Air, Gas	52 – 54 HRc 50 – 53 HRc	53	54	52	48	38	30
BÖHLER W403 VMR®	max. 205 HB	1020 – 1030 °C	Oil, Salt bath (500 – 550 °C) Air, Gas	52 – 54 HRc 50 – 53 HRc	52	54	53	50	44	35

* for big dies

PLASTIC MOULD STEELS

PLASTIC MOULD STEEL

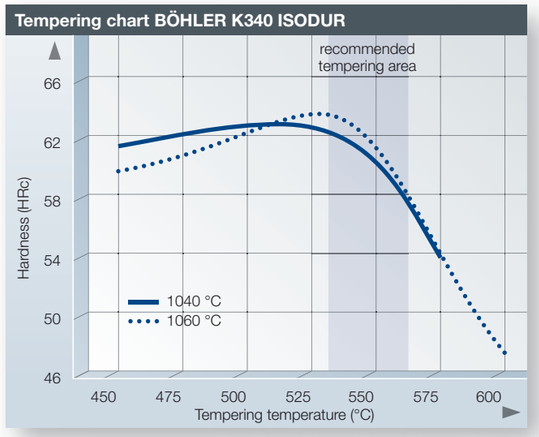
BOHLER grade	Chemical composition in %										Standards	
	C	Si	Mn	Cr	Mo	Ni	V	W	Co	Others	DIN / EN	AISI
BÖHLER M238	0.38	0.30	1.45	1.95	0.20	1.05	–	–	–	–	1.2738 40CrMnNiMo8-6-4	~ P20
BÖHLER M261 EXTRA	0.13	0.30	1.95	0.35	–	3.50	–	–	–	S=0.13, Al=1.75 Cu=1.20	–	–
BÖHLER M268 VMR®	0.38	0.30	1.50	2.00	0.20	1.10	–	–	–	–	~ 1.2738	~ P 20
BÖHLER M303 ISOPLAST®	0.28	0.25	0.65	14.50	0.95	0.85	–	–	–	+N	~ 1.2316 ~ X38CrMo16	–
BÖHLER M310 ISOPLAST®	0.38	0.70	0.43	14.25	–	–	0.20	–	–	–	~ 1.2083 ~ X42Cr13	~ 420
BÖHLER M315 EXTRA	0.05	0.30	0.95	12.60	–	0.45	–	–	–	S = 0.10 Cu = 0.40	Patent	–
BÖHLER M333 ISOPLAST®	0.28	0.30	0.30	13.50	–	–	–	–	–	+N	Patent	–
BÖHLER M340 ISOPLAST®	0.54	0.45	0.40	17.25	1.10	–	0.10	–	–	+N	Patent	–
BÖHLER M390 MICROCLEAN®	1.91	0.60	0.30	20.00	1.00	–	4.00	0.60	–	–	Patent	–

BOHLER grade	Hardness after annealing	Hardening temp. Quenchant	Supplied condition N/mm²	Average surface hardness after hardening Rockwell C	Normal assembly condition
BÖHLER M238	–	840 – 860 °C Oil	approx. 1000	–	hardened and tempered
BÖHLER M261 EXTRA	approx. 30 HRc solution annealed	560 – 580 °C Air	–	approx. 40	solution annealed and precipitation hardened
BÖHLER M268 VMR®	–	840 – 880 °C Oil	approx. 1200	–	hardened and tempered
BÖHLER M303 ISOPLAST®	–	1000 – 1020 °C / Oil, Gas, Salt bath (400 – 450 °C)	900 – 1120	– 48 – 53 Oil	hardened and tempered
BÖHLER M310 ISOPLAST® [1]	max. 200 HBW	1000 – 1050 °C Gas, Salt bath, Oil			hardened and tempered
BÖHLER M315 EXTRA	–	–	approx. 1000	–	hardened and tempered
BÖHLER M333 ISOPLAST® [1]	max. 220 HBW	980 – 1020 °C Oil, Gas	–	48 – 52	hardened and tempered
BÖHLER M340 ISOPLAST® [1]	max. 260 HBW	980 – 1000 °C Oil, Gas	–	53 – 58	hardened and tempered
BÖHLER M390 MICROCLEAN® [1]	max. 280 HBW	1120 – 1180 °C Oil, Gas, Salt bath	–	58 – 60	hardened and tempered

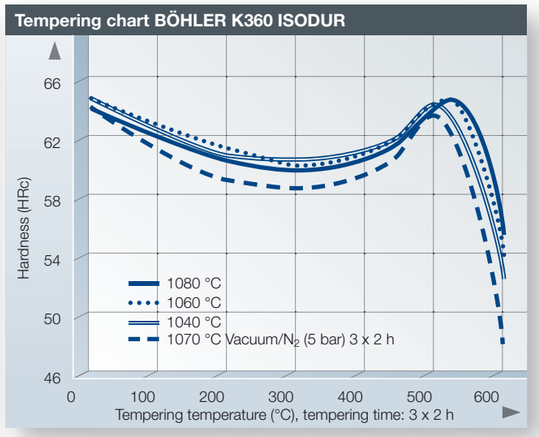
1) for certain applications sub zero treatment is recommended for dimensional stability

TEMPERING CHARTS

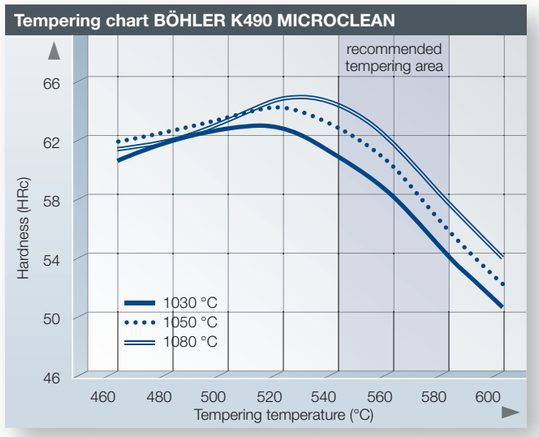
Tempering chart BÖHLER K340 ISODUR



Tempering chart BÖHLER K360 ISODUR



Tempering chart BÖHLER K490 MICROCLEAN

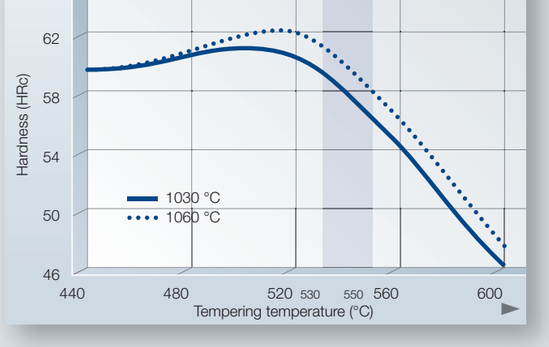


Sample size: round 35 x 15 mm

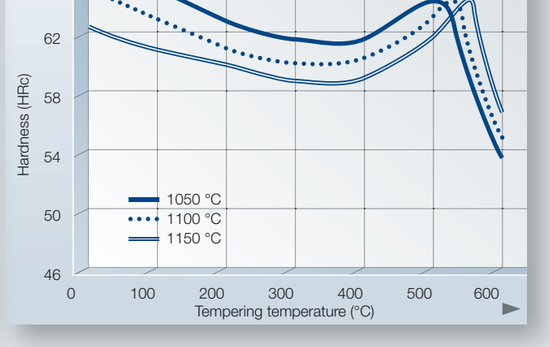
One of the remarkable features of BÖHLER K490 MICROCLEAN is its flexibility in heat treatment:

- We recommend the same hardening temperatures as with widely used cold work tool steels (e.g. 1.2379/D2)
- Very stable mechanical properties, regardless of the hardening temperature (1030 – 1080 °C)

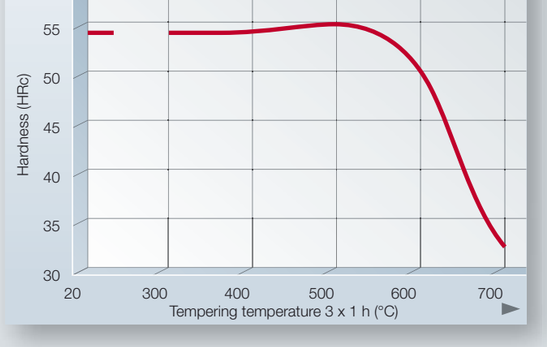
Tempering chart BÖHLER K353



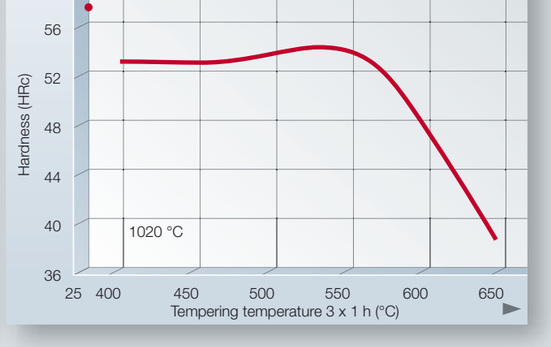
Tempering chart BÖHLER K190 MICROCLEAN



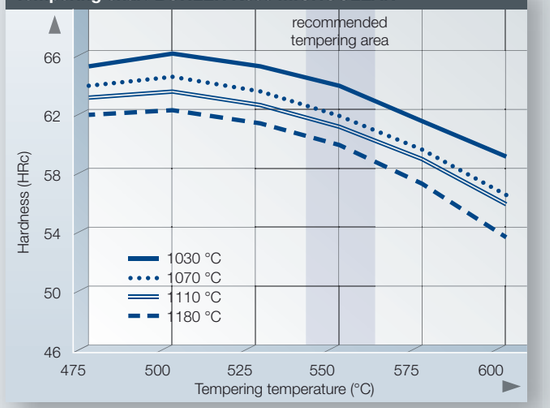
Tempering chart BÖHLER W302 ISOBLOC



Tempering chart BÖHLER W350 ISOBLOC

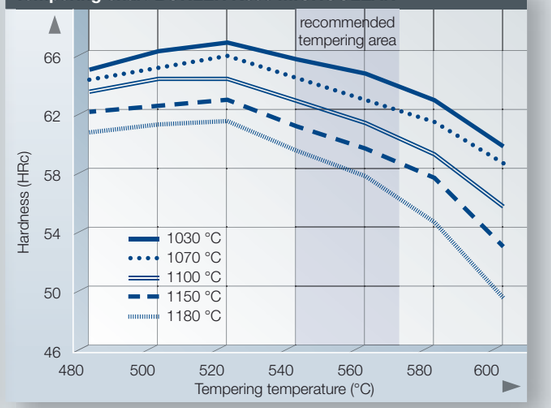


Tempering chart BÖHLER K390 MICROCLEAN



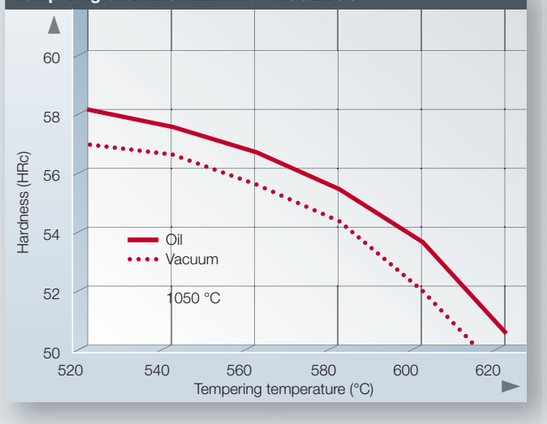
hardened in vacuum furnace: N_2 cooling, 5 bar

Tempering chart BÖHLER K890 MICROCLEAN

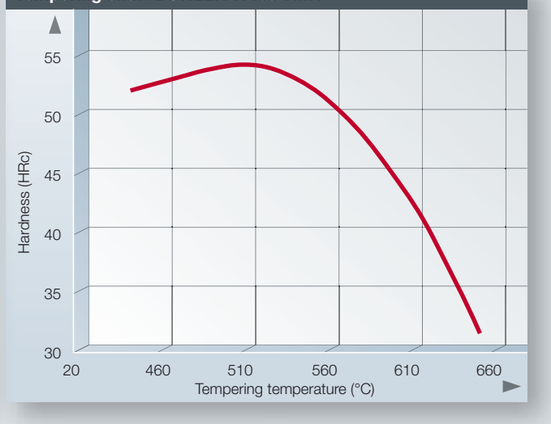


hardened in vacuum furnace: N_2 cooling, 5 bar

Tempering chart BÖHLER W360 ISOBLOC



Tempering chart BÖHLER W403 VMR



SPECIAL MATERIALS

SPECIAL
MATERIALS

Ni-Based superalloys

Grade	DIN	UNS	AISI	AMS
BÖHLER L004	2.4610	N06455	–	–
BÖHLER L022	2.4602	N06022	–	–
BÖHLER L090	2.4632	N07090	–	5829
BÖHLER L080A	2.4952	N07080	–	–
BÖHLER L276	2.4819	N10276	–	–
BÖHLER L303	2.4654	N07001	–	5704, 5706, 5707, 5708, 5709
BÖHLER L625	2.4856	N06625	–	5666
BÖHLER L718	2.4668	N07718	–	5662, 5663
BÖHLER L751	2.4669	07551	–	–
BÖHLER L901	2.4662	N09901	–	5660, 5661
BÖHLER L925	–	N09925	–	–
BÖHLER LHX	2.4665	N06002	–	5754

Low alloy steels

Grade	DIN	UNS	AISI	AMS
BÖHLER E105	~ 1.6657	–	–	6265
BÖHLER E108	1.6722	–	–	–
BÖHLER P800	–	–	–	–
BÖHLER V118S1	1.6745	–	–	–
BÖHLER V124SC	1.6944	G43400	–	6414
BÖHLER V129SA	1.6952	–	–	–
BÖHLER V132	–	–	–	6257, 6419
BÖHLER V141	–	–	–	–
BÖHLER V145	1.6604	–	–	–
BÖHLER V145SC	1.6580	–	–	–
BÖHLER V149	~ 1.6922	–	4333	–
BÖHLER V180	–	–	–	–
BÖHLER V354	1.7734 1.7736	–	–	–
BÖHLER V358	1.8523	–	–	–
BÖHLER V361	~ 1.7765	–	–	6481
BÖHLER V460	–	–	–	–
BÖHLER V720	1.6354	–	–	6514
BÖHLER V723	1.6359	–	–	6512

Stainless-, acid- and heatresistant steels

Grade	DIN	UNS	AISI	AMS
BÖHLER A220	1.4435	S31603	316LUG	–
BÖHLER A405	1.4466	S31050	310 MoLN	–
BÖHLER A750	1.4546 1.4550	N07090	–	5512, 5646
BÖHLER A903	1.4462	S31803 S32205	F51	–
BÖHLER A911SA	1.4501	S32760	F55	–
BÖHLER A913	1.4410	S32750	F53	–
BÖHLER A926	1.4507	S32550	F61	–
BÖHLER A965SA	1.4547	S31254	F44	–
BÖHLER A970	1.4529	N08926	–	–
BÖHLER H525	1.4841	S31400	314	–
BÖHLER N114	1.4002	–	–	–
BÖHLER N352	1.4044	–	–	–
BÖHLER N360	1.4108	–	–	5898
BÖHLER N400	1.4313	S41500	F6NM	–
BÖHLER N403	1.4313	–	–	–
BÖHLER N404	1.4418	–	–	–
BÖHLER N685	1.2361 1.4112	S44003	–	–
BÖHLER N690	1.4528	–	–	–
BÖHLER N695	1.3544	S44004	–	5618, 5630
BÖHLER N700	1.4542 1.4548	S17400	630	5622, 5643
BÖHLER N701	1.4545	S15500	XM 12	5659
BÖHLER N709	1.4534	S13800	–	5629
BÖHLER P511	–	S20910	XM 19	–
BÖHLER P513	–	S21800	–	–

Stainless-, acid- and heatresistant steels

Grade	DIN	UNS	AISI	AMS
BÖHLER P558	1.3808	S29225	–	–
BÖHLER R100	~ 1.3505	–	–	6444
BÖHLER R250	~ 1.3551	–	–	6491
BÖHLER R350	–	–	–	6278
BÖHLER T200	1.4943 1.4944 1.4980	S66286	660	5731, 5732
BÖHLER T240	1.4962	–	–	–
BÖHLER T262	1.4986	–	–	–
BÖHLER T504	–	–	422 / 616	–
BÖHLER T505SA	–	–	–	–
BÖHLER T505SC	1.4906	–	–	–
BÖHLER T550	1.4922 1.4923 1.4926 1.4934	–	–	–
BÖHLER T552	1.4933 1.4938 1.4939	S64152	–	5719
BÖHLER T560	1.4913	–	–	–
BÖHLER T602	1.4120 ~ 1.4921	–	–	–
BÖHLER T608SA	–	–	–	–
BÖHLER T651	1.4021	–	420	–
BÖHLER T655SC	–	–	403	–
BÖHLER T656	–	–	403Cb	–
BÖHLER T670	1.4594	S45000	–	–
BÖHLER T671SA	–	–	–	–
BÖHLER T671SB	–	–	–	–

BÖHLER

SPECIAL STEEL FOR THE WORLD´S TOP PERFORMERS

Your partner:

BÖHLER International GmbH
Modecenterstraße 14/BC/2
1030 Wien, Austria
Phone: +43-1-33 143-0
Fax: +43-1-37 419 00 100
E-Mail: export@bohler-international.com
www.bohler-international.com

..... - 09.2013 - 1.000 CD - NOS