

# MOLDMAX HH

High strength beryllium copper mould alloy

COLD WORK

PLASTIC MOULDING

HOT WORK

HIGH PERFORMANCE STEEL



This information is based on our present state of knowledge and is intended to provide general notes on our products and their uses. It should not therefore be construed as a warranty of specific properties of the products described or a warranty for fitness for a particular purpose.

## General

Moldmax HH is a high-strength beryllium copper mould alloy made by Brush Wellman Inc. for plastics moulding applications. Its main properties include:

- high thermal conductivity
- good corrosion resistance
- good polishability
- good wear resistance
- good resistance to galling
- good machinability
- high strength and hardness
- excellent weldability.

Typical analysis %	Be 1,9	Co + Ni 0,25	Cu Bal.
Delivery condition	High hard = 40 HRC (Low hard = 30 HRC)		
Colour code	HH Black/Gold LH Red/Gold		

Moldmax HH is widely used for injection moulding tools or as cores and inserts in steel moulds. When used in steel mould it effectively cools hot spots, reducing or eliminating the need for cooling channels.



*Two halves of a Moldmax HH beryllium copper blow mould.*

Moldmax HH is available in wrought round and flat section, machined core pins, and welding wire.

Moldmax HH's high thermal conductivity, 3 to 5 times better than steel, ensures uniform, rapid heat removal, minimizing part distortion, warpage, poor replication of detail and similar defects. In many cases it can significantly reduce cycle times, even when used in a steel mould just for selected cores and inserts.

For mould applications which require even higher thermal conductivity than that of Moldmax HH, Protherm beryllium copper mould alloy is available, see separate technical brochure.

## Applications

The special properties of Moldmax HH beryllium copper alloy make it a suitable mould/core/insert material for a wide variety of moulding situations but especially where a combination of high thermal conductivity, corrosion resistance and good polishability are needed.

- Blow moulds: pinch offs, neck rings and handle inserts.
- Injection mould: moulds, cores, inserts.
- Injection nozzles and manifolds for hot runner systems.

# Properties

## PHYSICAL DATA

Data at room and elevated temperatures.

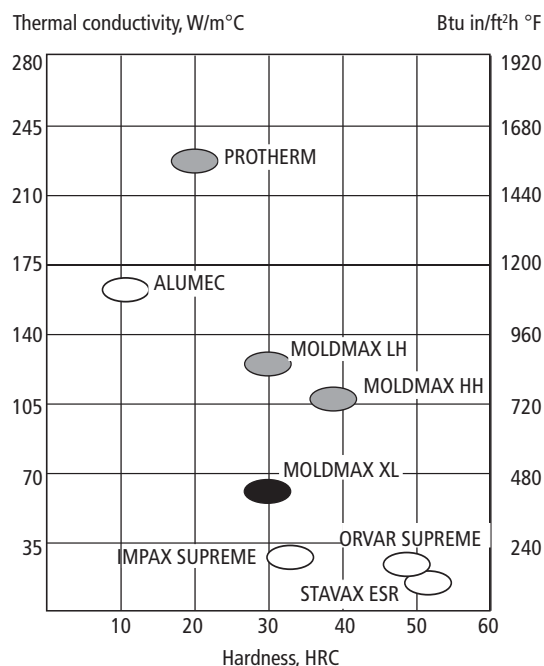
Temperature	20°C (68°F)	200°C (390°F)	300°C (570°F)
Density kg/m <sup>3</sup> lb/in <sup>3</sup>	8 350 0,302	8 275 0,299	8 220 0,297
Modulus of elasticity N/mm <sup>2</sup> psi	131 100 19 x 10 <sup>6</sup>	124 100 19 x 10 <sup>6</sup>	103 400 15 x 10 <sup>6</sup>
Coefficient of thermal expansion from °C to 20°C from °F to 68°F	– –	17 x 10 <sup>-6</sup> 9,7 x 10 <sup>-6</sup>	17,8 x 10 <sup>-6</sup> 9,9 x 10 <sup>-6</sup>
Thermal conductivity W/m°C HH 40 HRC LH 30 HRC	110 120	145 160	155 170
Btu in/ft <sup>2</sup> h °F HH 40 HRC LH 30 HRC	754 823	994 1097	1063 1166
Specific heat J/kg°C Btu/lb °F	380 0,091	480 0,114	535 0,128

## TENSILE STRENGTH AT ROOM TEMPERATURE

The tensile values are to be considered as approximate only.

Hardness	HH 40 HRC	LH 30 HRC
Tensile strength, R <sub>m</sub> N/mm <sup>2</sup> psi	1 280 185 000	1 170 170 000
Compressive yield strength, R <sub>c0,2</sub> N/mm <sup>2</sup> psi	1 070 155 000	970 140 000
Elongation, A <sub>5</sub> %	6	8

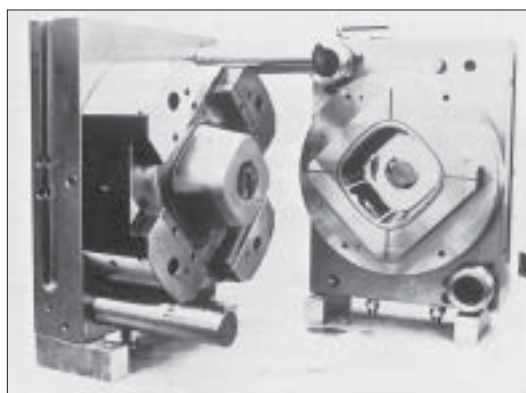
Relation between strength and heat conductivity for different mould material.



Note: Increasing alloying content gives a higher strength, but a lower thermal conductivity. However, this is only valid when comparing material within one material group i.e. steel must be compared with steel and copper with copper alloys.

## Heat treatment

Moldmax HH is delivered in the heat treated condition—additional heat treatment is not normally required.



# Machining

Moldmax HH has a good machinability and can be machined with conventional cutting tools. Perform machining wet to avoid breathing metal dust.

The cutting data below, for Moldmax HH, are to be considered as guiding values which must be adapted to existing local conditions.

## TURNING

Cutting data parameters	Turning with carbide		Turning with high speed steel
	Rough turning	Fine turning	
Cutting speed, $v_c$ m/min f.p.m.	270–300 890–990	300–370 990–1220	60–90 200–300
Feed, $f_z$ mm/rev i.p.r	0,3–0,6 0,012–0,023	–0,3 –0,012	–0,3 –0,012
Depth of cut, $a_p$ mm inch	2–6 0,08–0,23	–2 –0,08	–2 –0,08
Carbide designation ISO	K20	K20	–

Use tools with generous positive rake angles.

## MILLING

### Face and square shoulder face milling

Cutting data parameters	Milling with carbide		Milling with high speed steel
	Rough milling	Fine milling	
Cutting speed, $v_c$ m/min f.p.m.	100–150 330–490	150–200 490–660	45–60 150–200
Feed, $f_z$ mm/tooth in/tooth	0,2–0,4 0,008–0,016	0,1–0,2 0,004–0,008	–0,1 –0,004
Depth of cut, $a_p$ mm inch	2–5 0,08–0,20	–2 –0,08	–2 –0,08
Carbide designation ISO	K20	K20	–

Use tools with positive rake angles when milling with carbide.

## End milling

Cutting data parameters	Type of milling		
	Solid carbide	Carbide indexable insert	High speed steel
Cutting speed, $v_c$ m/min f.p.m.	80–100 260–330	150–200 490–660	45–60 <sup>1)</sup> 150–200
Feed, $f_z$ mm/tooth in/tooth	0,010–0,10 <sup>2)</sup> 0,0004–0,004	0,08–0,20 <sup>2)</sup> 0,003–0,008	0,05–0,35 <sup>2)</sup> 0,002–0,014
Carbide designation ISO	–	K20	–

<sup>1)</sup> For coated HSS end mill an increased cutting speed of ~30% can be used.

<sup>2)</sup> Depending on radial depth of cut and cutter diameter.

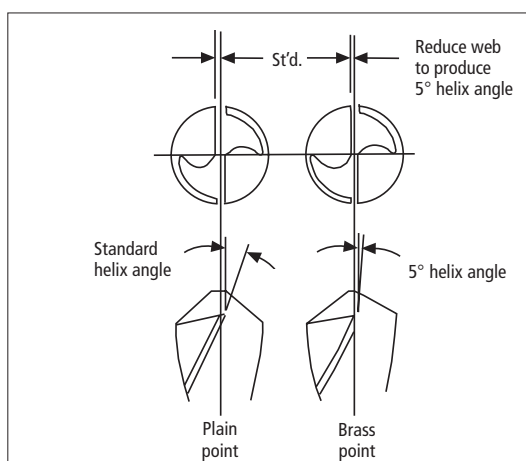
## DRILLING

### High speed steel twist drill

Drill diameter		Cutting speed $v_c$		Feed	
mm	inch	m/min	f.p.m.	mm/r	i.p.r
–5	–3/16	30–40	100–130	0,03–0,08	0,001–0,003
5–10	3/16–3/8	30–40	100–130	0,08–0,15	0,003–0,006
10–15	3/8–5/8	30–40	100–130	0,15–0,20	0,006–0,008
15–20	5/8–3/4	30–40	100–130	0,20–0,25	0,008–0,010

When drilling holes deeper than 1 x drill diameter use "Peckdrilling" and retract the drill after each 5 mm drilled depth.

Standard HSS drills can be used but for best performance the tip should be altered to a "brass point" according to the figure below.



## THREADING WITH TAP

When tapping Moldmax HH use taps with straight flutes. Use same kind of taps when tapping blind holes. Suitable cutting speed 6–8 m/min. Use cutting compound or cutting oil.

## GRINDING

Conventional grinding wheels can be used when grinding Moldmax HH. Surface grinding, use A 54 LV-type of wheels. Cylindrical grinding, use A 60 LV-type of wheels.

**All grinding should be done wet to avoid breathing metal dust.**

## Surface treatments

To enhance the surface properties of Moldmax HH, standard treatments can be applied.

Treatment	Benefits
Hard chrome	Wear resistance, corrosion resistance, hardness.
Electroless (chemical) Nickel	Hardness, wear resistance, surface release, corrosion resistance.
Electroless Nickel with Teflon	Hardness, wear resistance, surface release
PVD: Titanium Nitride Chromium Nitride	Superior wear resistance, surface release.

*Note: Treatment temperature should not exceed 320°C (610°F).*

## EDM

While Moldmax HH's high thermal conductivity makes it slower to EDM than mould steel, EDM'ing presents no significant problem.

**Proper ventilation with an effective exhaust system is essential to prevent fumes in the air.**



## Welding

Moldmax HH can easily be welded if good care is taken and good welding practices are followed. The area to be welded should be thoroughly cleaned with a degreasing solvent. The always present oxidized layer should be removed using aggressive brushing, sand blasting or acid pickling immediately prior to the welding.

For best results TIG (GTAW) or MIG (GMAW) is recommended. Suitable welding consumables are available for welding Moldmax HH.

The weld and the surrounding area will show a lower hardness. If the strength of the weld is crucial, the whole part needs to be re-heat treated including solution annealing, quenching and age-hardening. After such a treatment the weld will have the same strength as the base material. For more information, contact your local Uddeholm office.

**Welding operations should be carried out using properly designed local exhaust ventilation to draw all fumes away from the operator and through an appropriate filter before venting outside of the work area.**

## Polishing

Moldmax HH has very good polishability and highly glossy surfaces are readily achievable. The following steps can serve as guidelines:

1. After grinding, pre-polish using successively finer grit stones ending with a 600 grit.
2. Polish with diamond paste grade 15 to obtain a dull satin looking surface.
3. Polish with a grade 6 diamond paste.
4. Polish with a grade 3 diamond paste.
5. If necessary, hand finish with a #1 grade diamond paste.

As in all polishing, work thoroughness and cleanliness are of utmost importance. In order to avoid overpolishing, or "orange peel" effect, do not polish longer than necessary to achieve an even looking surface.

## Safe handling

Moldmax HH is a copper-alloy with a content of  $\approx 2\%$  Beryllium.

Make sure, during the machining of Moldmax HH, to avoid breathing metal dust fume or mist. Perform machining, grinding and polishing wet when possible. If dry operation is needed use ventilation to capture the dust.

Further information can be found in our "Material Safety" data sheets.

## Further information

Contact your local Uddeholm office for additional information on selection, heat treatment, application and availability of Uddeholm tooling materials.

## UDDEHOLM EUROPE

### AUSTRIA

UDDEHOLM  
Hansaallee 321  
D-40549 Düsseldorf  
Telephone: +49 211 535 10  
Telefax: +49 211 535 12 80

### BELGIUM

UDDEHOLM N.V.  
Waterstraat 4  
B-9160 Lokeren  
Telephone: +32 9 349 11 00  
Telefax: +32 9 349 11 11

### CROATIA

BOHLER UDDEHOLM Zagreb  
d.o.o za trgovinu  
Zitnjak b.b  
10000 Zagreb  
Telephone: +385 1 2459 301  
Telefax: +385 1 2406 790

### CZECHIA

BOHLER UDDEHOLM CZ s.r.o.  
Division Uddeholm  
U silnice 949  
161 00 Praha 6 Ruzyně  
Czech Republic  
Telephone: +420 233 029 850,8  
Telefax: +420 233 029 859

### DENMARK

UDDEHOLM A/S  
Kokmose 8, Bramdrupdam  
DK-6000 Kolding  
Telephone: +45 75 51 70 66  
Telefax: +45 75 51 70 44

### ESTONIA

UDDEHOLM TOOLING AB  
Silikatsiidi 7  
EE-0012 Tallinn  
Telephone: +372 655 9180  
Telefax: +372 655 9181

### FINLAND

OY UDDEHOLM AB  
Ritakuja 1, PL 57,  
FIN-01741 VANTAA  
Telephone: +358 9 290 490  
Telefax: +358 9 2904 9249

### FRANCE

UDDEHOLM S.A.  
12 Rue Mercier, Z.I. de Mitry-Compans  
F-77297 Mitry Mory Cedex  
Telephone: +33 (0)1 60 93 80 10  
Telefax: +33 (0)1 60 93 80 01

#### Branch office

UDDEHOLM S.A.  
77bis, rue de Vesoul  
La Nef aux Métiers  
F-25000 Besançon  
Telephone: +33 381 53 12 19  
Telefax: +33 381 53 13 20

### GERMANY

UDDEHOLM  
Hansaallee 321  
D-40549 Düsseldorf  
Telephone: +49 211 535 10  
Telefax: +49 211 535 12 80

#### Branch offices

UDDEHOLM  
Falkenstrasse 21  
D-65812 Bad Soden/TS.  
Telephone: +49 6196 659 60  
Telefax: +49 6196 659 625

### UDDEHOLM

Albstraße 10  
D-73765 Neuhausen  
Telephone: +49 715 898 65-0  
Telefax: +49 715 898 65-25

### GREAT BRITAIN, IRELAND

UDDEHOLM UK LIMITED  
European Business Park  
Taylors Lane, Oldbury  
West Midlands B69 2BN  
Telephone: +44 121 552 55 11  
Telefax: +44 121 544 29 11

Dublin Telephone: +353 1 45 14 01

### GREECE

UDDEHOLM STEEL TRADING  
COMPANY  
20, Athinon Street  
G-Piraeus 18540  
Telephone: +30 2 10 41 72 109/41 29 820  
Telefax: +30 2 10 41 72 767

### SKLERO S.A.

Steel Trading Comp. and  
Hardening Shop  
Frixou 11/Nikif. Ouranou  
G-54627 Thessaloniki  
Telephone: +30 31 51 46 77  
Telefax +30 31 54 12 50

### HUNGARY

UDDEHOLM TOOLING/BOK  
Dunaharaszti, Jedlik Anyos út 25  
H-2331 Dunaharaszti 1.Pf. 110  
Telephone/Telefax: +36 24 492 690

### ITALY

UDDEHOLM Italia S.p.A.  
Via Palizzi, 90  
I-20157 Milano  
Telephone: +39 02 35 79 41  
Telefax: +39 02 390 024 82

### LATVIA

UDDEHOLM TOOLING AB  
Deglava street 50  
LV-1035 Riga  
Telephone: +371 7 701 983, -981, -982  
Telefax: +371 7 701 984

### LITHUANIA

UDDEHOLM TOOLING AB  
BE PLIENAS IR METALAI  
T. Masiulio 18b  
LT-3014 Kaunas  
Telephone: +370 37 370613, -669  
Telefax: +370 37 370300

### THE NETHERLANDS

UDDEHOLM B.V.  
Isolatorweg 30  
NL-1014 AS Amsterdam  
Telephone: +31 20 581 71 11  
Telefax: +31 20 684 86 13

### NORWAY

UDDEHOLM A/S  
Jernkroken 18  
Postboks 85, Kalbakken  
N-0902 Oslo  
Telephone: +47 22 91 80 00  
Telefax: +47 22 91 80 01

### POLAND

INTER STAL CENTRUM  
Sp. z.o.o./Co. Ltd.  
Dziekanow Polskii, ul. Kolejowa 291,  
PL-05-092 Lomianki  
Telephone: +48 22 751 5675  
Telefax: +48 22 751 5670

### PORTUGAL

F RAMADA Aços e Industrias S.A.  
P.O. Box 10  
P-3881 Ovar Codex  
Telephone: +351 56 58 61 11  
Telefax: +351 56 58 60 24

### ROMANIA

BÖHLER Romania SRL  
Uddeholm Branch  
Str. Atomistilor Nr 14A  
077125 Magurele Jud Ilfov  
Telephone: +40 214 575007  
Telefax: +40 214 574212

### RUSSIA

UDDEHOLM TOOLING CIS  
25 A Bolshoy pr PS  
197198 St. Petersburg  
Telephone: +7 812 233 9683  
Telefax: +7 812 232 4679

### SLOVAKIA

UDDEHOLM Slovakia  
Nástrojové ocele, s.r.o  
KRÁCINY 2  
036 01 Martin  
Telephone: +421 842 4 300 823  
Telefax: +421 842 4 224 028

### SLOVENIA

UDDEHOLM Italia S.p.A.  
Via Palizzi, 90  
I-20157 Milano  
Telephone: +39 02 35 79 41  
Telefax: +39 02 390 024 82

### SPAIN

UDDEHOLM  
Guifré 690-692  
E-08918 Badalona, Barcelona  
Telephone: +34 93 460 1227  
Telefax: +34 93 460 0558

#### Branch office

UDDEHOLM  
Barrio San Martin de Arteaga, 132  
Pol.Ind. Torrelarragoiti  
E-48170 Zamudio  
(Bizkaia)  
Telephone: +34 94 452 13 03  
Telefax: +34 94 452 13 58

### SWEDEN

UDDEHOLM TOOLING  
SVENSKA AB  
Aminogatan 25  
SE-431 53 Mölndal  
Telephone: +46 31 67 98 50  
Telefax: +46 31 27 02 94

### SWITZERLAND

HERTSCH & CIE AG  
General Wille Strasse 19  
CH-8027 Zürich  
Telephone: +41 1 208 16 66  
Telefax: +41 1 201 46 15

### HANS KOHLER AG

Claridenstrasse 20  
CH-8002 Zürich  
Telephone: +41 1 207 11 11  
Telefax: +41 1 207 11 10

### UDDEHOLM

### NORTH AMERICA

### USA

UDDEHOLM  
4902 Tollview Drive  
Rolling Meadows IL 60008  
Telephone: +1 847 577 22 20  
Telefax: +1 847 577 80 28

### UDDEHOLM

548 Clayton Ct.,  
Wood Dale IL 60191  
Telephone: +1 630 350 10 00  
Telefax: +1 630 350 08 80

### UDDEHOLM

9331 Santa Fe Springs Road  
Santa Fe Springs, CA 90670  
Telephone: +1 562 946 65 03  
Telefax: +1 562 946 77 21

### UDDEHOLM

220 Cherry Street  
Shrewbury, MA 01545  
Telephone: +1 508 845 1066  
Telefax: +1 508 845 3471

### CANADA

UDDEHOLM LIMITED  
2595 Meadowvale Blvd.  
Mississauga, Ontario L5N 7Y3  
Telephone: 905 812 9440  
Telefax: 905 812 8659

### MEXICO

UDDEHOLM  
Calle Ocho no 2, Letra "C"  
Fracc. Industrial Alce Blanco  
53370 Naucalpan de Juarez  
Estado de Mexico  
Telephone: +52 5-576 5422  
Telefax: +52 5-576 2139

### UDDEHOLM

Lerdo de Tejada No.542  
Colonia Las Villas  
66420 San Nicolas de Los Garza, N.L.  
Telephone: +52 8-352 5239  
Telefax: +52 8-352 5356

## UDDEHOLM SOUTH AMERICA

### ARGENTINA

UDDEHOLM S.A.  
Mozart 40  
1619-Centro Industrial Garin  
Garin-Prov. Buenos Aires  
Telephone: +54 332 744 4440  
Telefax: +54 332 745 3222

### BRAZIL

UDDEHOLM ACOS ESPECIAIS Ltda.  
Estrada Yae Massumoto, 353  
CEP 09842-160  
Sao Bernardo do Campo - SP Brazil  
Telephone: +55 11 4393 4560, -4554  
Telefax: +55 11 4393 4561

### UDDEHOLM

### SOUTH AFRICA

UDDEHOLM Africa (Pty) Ltd.  
P.O. Box 539  
ZA-1600 Isando/Johannesburg  
Telephone: +27 11-974 2781  
Telefax: +27 11-392 2486

### UDDEHOLM

### AUSTRALIA

BOHLER-UDDEHOLM Australia  
129-135 McCredie Road  
Guildford NSW 2161  
Private Bag 14  
Telephone: +61 2 9681 3100  
Telefax: +61 2 9632 6161

#### Branch offices

Sydney, Melbourne, Adelaide,  
Brisbane, Perth, Newcastle,  
Launceston, Albury, Townsville

### ASSAB

### ASSAB INTERNATIONAL

Skytteholmsvägen 2  
P O Box 42  
SE-171 11 Solna  
Sweden  
Telephone: +46 8 564 616 70  
Telefax: +46 8 25 02 37

#### Subsidiaries

India, Iran, Turkey, United Arab  
Emirates

#### Distributors in

Africa, Latin America, Middle East

### ASSAB PACIFIC

ASSAB Pacific Pte. Ltd  
171, Chin Swee Road  
No. 07-02, San Centre  
Singapore 169877  
Telephone: +65 534 56 00  
Telefax: +65 534 06 55

#### Subsidiaries

China, Hong Kong, Indonesia, Japan,  
Korea, Malaysia, Philippine Islands,  
Singapore, Taiwan, Thailand

When the first idea pops into your head, throughout the development process to the release of the new product, we'll be your partner. As the world's leading supplier of tooling materials and related services, we can be trusted. Meet us under the Uddeholm and ASSAB brands, wherever in the world you have your business.

