

MOLDMAX XL®

High strength copper 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 XL is a high-strength, high thermal conductivity copper alloy manufactured under patents by Brush Wellman Inc.. It is intended for use in a wide variety of plastic injection moulds. Its main properties include:

- high thermal conductivity
- excellent machinability
- good corrosion resistance
- good wear resistance
- high impact strength
- excellent resistance to galling
- large cross sectional availability.

Typical analysis %	Ni 9	Sn 6	Cu Balance
Delivery condition	Pre-hardened 28–32 HRC		
Colour code	Gold/light blue		

Moldmax XL combines high levels of strength and thermal conductivity. It effectively reduces hot spots, minimizing cycle times and improving as-moulded part tolerances.

Moldmax XL has consistent hardness throughout even the largest cross section, providing predictable strength in deep sections and excellent machinability. At the same time it offers impact strengths suitable for complex designs.

Applications

Moldmax XL is designed to be used primarily for core inserts in larger injection moulds. Tools incorporating Moldmax XL inserts provide numerous advantages to both the mould maker and injection moulder.

With over twice the thermal conductivity of a typical pre-hardened tool steel, Moldmax XL allows cycle times to be significantly reduced. It also minimizes temperature differences from one area of a mould to another, resulting in tighter as-moulded tolerances and less post mould warpage and shrinkage. This yields better part tolerances and reduces rejections.

A Moldmax XL core will reach thermal equilibrium much more rapidly than an identical steel insert, allowing production to commence in less time and with reduced scrap. This makes short runs a more economical alternative.

Moldmax XL will also react more rapidly to process changes, providing enhanced control over the moulding process. Finally, the higher thermal conductivity allows the mould to be run at a higher temperature yielding lower injection pressures, minimizing condensation and ultimately resulting in greater efficiency without increasing cycle time.

Properties

PHYSICAL DATA

Pre-hardened to 30 HRC. Data at room and elevated temperatures.

Temperature	20°C (68°F)	200°C (390°F)	300°C (570°F)
Density kg/m ³ lb/in ³	8 900 0,322	8 810 0,317	8 760 0,316
Modulus of elasticity N/mm ² psi	117 200 17 x 10 ⁶	N/A N/A	N/A N/A
Coefficient of thermal expansion from °C to 20°C from °F to 68°F	– –	16 x 10 ⁻⁶ 9,5 x 10 ⁻⁶	16.5 x 10 ⁻⁶ 9,7 x 10 ⁻⁶
Thermal conductivity W/m ² °C Btu in/ft ² h °F	60 425	80 635	95 725
Specific heat J/kg°C Btu/lb °F	381 0,091	410 0,097	432 0,103

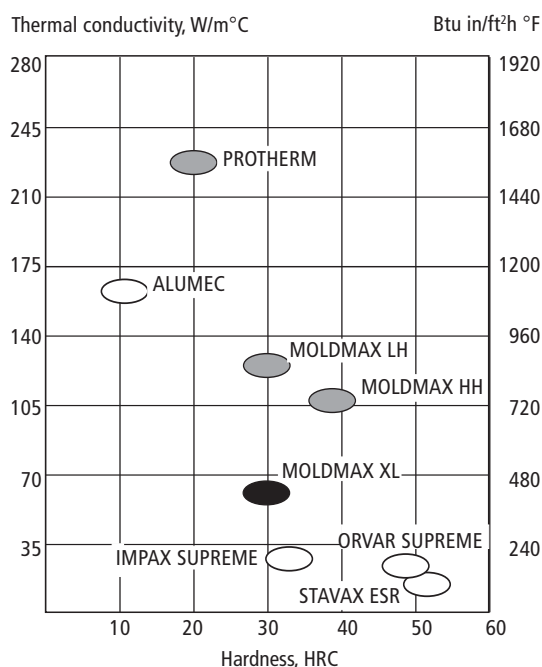


TENSILE STRENGTH AT ROOM TEMPERATURE

The tensile values are to be considered as approximate only.

	Hardness 30 HRC
Compressive yield strength, $R_{c0,2}$	655 N/mm ² 95 000 psi
Tensile yield strength, $R_{p0,2}$	690 N/mm ² 100 000 psi
Tensile strength, R_m	760 N/mm ² 110 000 psi
Elongation A_5	5 %

Comparison of mould materials



CORROSION RESISTANCE

Moldmax XL forms a tightly adherent oxide film and is inherently corrosion resistant, however, measures should be taken to prevent damage during storage.

Many resins contain components or additives that can be corrosive, especially in the presence of water. Moulds should be dried by increasing mould temperature at the end of the run. Mould water lines and noses should be blown dry prior to disconnection. Denatured alcohol can be used to clean the mould surfaces as well as absorb any moisture present. Commercially available mould protectants may be used, but must not be applied over moisture. Avoid the use of any products which contain ammonia or sulphur.

Moulds should be cleaned periodically, especially in the vent areas. Corrosive elements tend to condense in the vents and can cause damage.

Machining recommendations

Moldmax XL has a very good machinability and can be machined with conventional cutting tools.

The cutting data below 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.	300–400 990–1300	400–500 1300–1640	70–100 200–300
Feed, f 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	–
US	C2	C2	–

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.	200–300 660–990	300–400 990–1300	55–70 180–230
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 US	K20 C2	K20 C2	– –

Use tools with positive rake angles.

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.	300–700 ¹⁾ 990–2300	300–900 ¹⁾ 990–2950	50–70 ²⁾ 165–230
Feed, f_z mm/tooth in/tooth	0,010–0,10 ³⁾ 0,0004–0,004	0,08–0,20 ³⁾ 0,003–0,008	0,05–0,35 ³⁾ 0,002–0,014
Carbide designation ISO US	– –	K20 C2	– –

¹⁾ Depending on radial depth of cut

²⁾ For coated HSS end mill an increased cutting speed of ~30% can be used.

³⁾ Depending on radial depth of cut and cutter diameter.

DRILLING

High speed steel twist drill

Drill diameter		Cutting speed v_c		Feed, f	
mm	inch	m/min	f.p.m.	mm/rev	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

* For coated HSS drill $v_c \sim 60$ m/min. (197 f.p.m.)

Carbide drill

Cutting data parameters	Type of drill		
	Indexable insert	Solid carbide	Brazed carbide ¹⁾
Cutting speed, v_c m/min f.p.m.	300–500 990–1640	300–500 990–1640	250–400 820–1300
Feed, f mm/rev i.p.r.	0,05–0,15 ²⁾ 0,002–0,006 ²⁾	0,05–0,30 ²⁾ 0,002–0,012 ²⁾	0,10–0,30 ²⁾ 0,004–0,012 ²⁾

¹⁾ Drill with internal cooling channels and brazed tip.

²⁾ Depending on drill diameter.

TAPPING

When tapping Moldmax XL use taps with straight flutes. Use same kind of taps when tapping blind holes. Use cutting compound or cutting oil. TiCN coated taps work well.

GRINDING

Moldmax XL can be ground using both conventional Al₂O₃ and SiC grinding wheels.

For surface grinding with a straight wheel, use A 46 LV or C 46 LV type. For cylindrical grinding with a straight wheel, use A 60 LV or C 60 LV type. Use plenty of coolant when grinding.

Surface treatments

Standard surface modifications can be applied to enhance the surface properties of Moldmax XL¹⁾

Treatment	Benefits in order of priority
Hard chrome	Wear resistance, hardness, surface release, corrosion resistance.
Electroless Nickel	Corrosion resistance, hardness, wear resistance, surface release.
Electroless Nickel with Teflon	Hardness, wear resistance, surface release.
PVD (low temp.) ²⁾ – Titanium Nitride – Chromium Nitride	Superior wear resistance, surface release.

¹⁾ The passive oxide layer should be removed just prior to coating.

²⁾ Treatment temperature should not exceed 315°C (600°F).

EDM

While Moldmax XL's high thermal conductivity makes it slower to EDM than mould steels, sinker and wire EDM'ing present no significant problems. The recast layer which is formed during EDM is soft, shallow and easily removed.

Both copper and graphite electrodes can be used to EDM Moldmax XL. Copper has better wear resistance but graphite is more machinable. Negative electrode polarity is most effective when working with graphite. For the best surface finish, switch to positive polarity during finish EDM. When working with copper electrodes the polarity shall be positive during the whole process.

Welding

Moldmax XL can be welded using good welding practices. However, because of the unique chemistry and hardening mechanism for Moldmax XL, colour matching of weldments in high polish and/or textured areas may be difficult.

Proper joint preparation and cleaning procedures must be used prior to welding. For best results TIG is recommended. For an equivalent hardness in the weldment, Weld-Pak copper-beryllium filler rod is recommended (using the instructions for Weld-Pak). If a similar chemistry is desired, the XL Pak filler rod is recommended using the welding parameters described in the following table.



Filler rod	XL Pak 1/16" dia.
Welding electrode	EWTH2 1/8" dia. 2% thoriated tungsten with a pointed tip (20–25° included angle)
Shielding gas	Argon 25 cfh
Pre-heating temperature	None required
Maximum interpass temperature	150°C (300°F)
Power source	Direct current with negative electrode polarity
As welded hardness	55 HRB
Post-weld heat	385°C (725°F) for 180 minutes at treatment/hardness temperature / 25–26 HRC

Note: During post-weld heat treatment, temperature should be maintained within $\pm 20^{\circ}\text{C}$ (10°F) of 385°C (725°F). Time and temperature must be tightly controlled to prevent change in dimensions or loss of hardness. A drop of 1–2 HRC can be expected within the tool when this procedure is used.

For more information, contact your local Uddeholm office.

Polishing

Moldmax XL 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.

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

CZECHIA

BOHLER UDDEHOLM CZ s.r.o.
Division Uddeholm
U silnice 949
161 00 Praha 6 Ruzyne
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
Silikatsiidid 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 Polski, 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

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
KRÁČINY 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

7900 Hub Parkway
Cleveland OH 44125
Telephone: +1 216 524 87 70
Telefax: +1 216 642 10 42

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.



WWW.UDDEHOLM.COM

Edition: 4, 11.2004