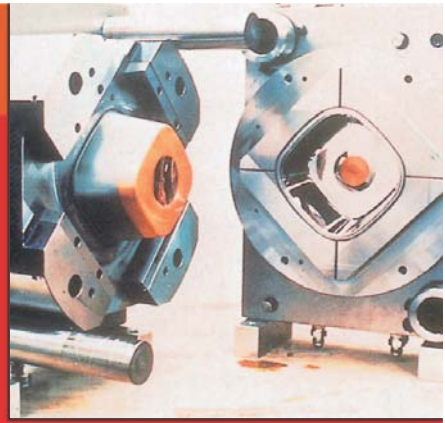


# MOLDMAX

High strength beryllium  
copper mould alloy



## General

*MOLDMAX* 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* 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* beryllium copper blow mould.

*MOLDMAX* is available in wrought round and flat section, machined core pins, and welding wire.

*MOLDMAX*'s high thermal conductivity, 3 to 4 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*, *PROTHERM* beryllium copper mould alloy is available, see separate technical brochure.

## Applications

The special properties of *MOLDMAX* 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.

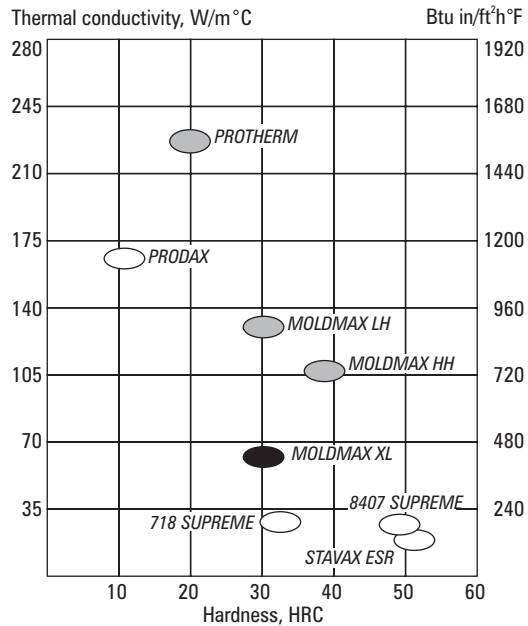
# Properties

## 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 per °C from 20 °C per °F from 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

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. That is, steel must be compared with steel and copper with copper alloys.

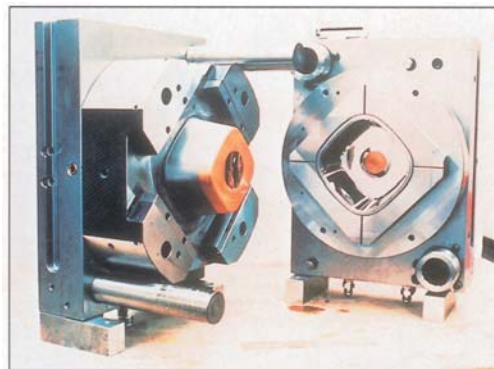
## TENSILE STRENGTH AT ROOM TEMPERATURE

The tensile values are to be considered as approximate only.

Hardness	HH 40 HRC	LH 30 HRC
Tensile strength, Rm N/mm <sup>2</sup> psi	1 280 185 000	1 170 170 000
Compressive yield strength, Rc0.2 N/mm <sup>2</sup> psi	1 070 155 000	970 140 000
Elongation, A <sub>5</sub> %	6	8

## Heat treatment

MOLDMAX is delivered in the heat treated condition - additional heat treatment is not normally required.



# Machining

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

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.	270 - 300 890 - 990	300 - 370 990 - 1220	60 - 90 200 - 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	-

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.

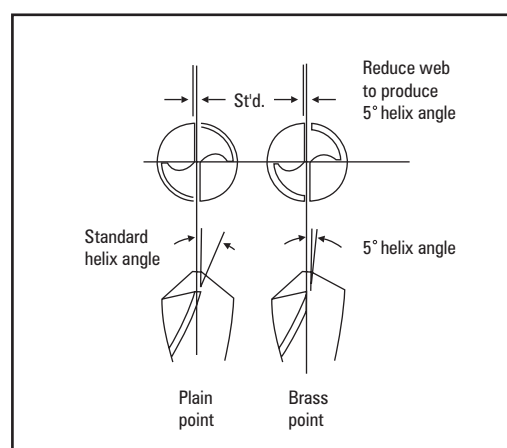
## DRILLING

### High speed steel twist drill

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

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, 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*. 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*, 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).*

**Welding**

*MOLDMAX* 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*.

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.

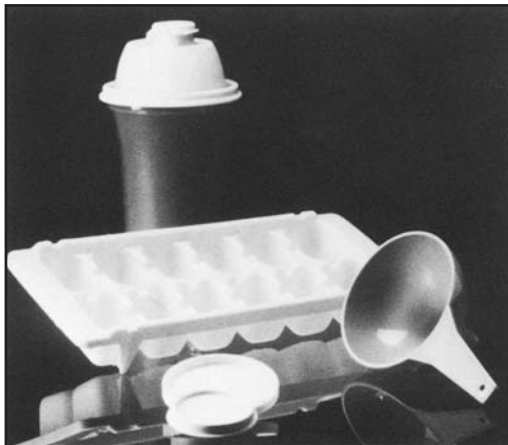
For more information, contact your local ASSAB office.

**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.**

**EDM**

While *MOLDMAX*'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.**



**Polishing**

*MOLDMAX* 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* is a copper-alloy with a content of =2% Beryllium.

Make sure, during the machining of *MOLDMAX*, 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 ASSAB office for additional information on selection, heat treatment, application and availability of ASSAB tooling materials.

## Group Head Office

ASSAB Pacific Pte. Ltd.  
171 Chin Swee Road  
#07-02, SAN Centre  
Singapore 169877  
Tel : 65 6534 5600  
Fax : 65 6534 0655

## CHINA

**Beijing \***  
ASSAB Tooling (Beijing) Co., Ltd.  
No. 10A, Rong Jing Dong Jie  
Beijing Economic Development Area  
Beijing 100176, China  
Tel : 86 10 6786 5588  
Fax : 86 10 6786 2988

**Changzhou †**  
Room 3837, Building 1  
No. 15 Huangshan Road  
Changzhou 213022, China  
Tel : 86 519 5123 731  
Fax : 86 519 5123 732

**Chongqing †**  
ASSAB Tooling Technology (Chongqing) Co., Ltd.  
Plant C, Automotive Industrial Park, Jingkai Park  
Chongqing Economic & Technological Development Zone  
Chongqing 401120, China  
Tel : 86 23 6745 5698  
Fax : 86 23 6745 5699

**Dalian \***  
No. 9-2# Workshop, 26# Area,  
Dalian Economic & Technical Development Zone  
Dalian 116600, China  
Tel : 86 411 8761 8080  
Fax : 86 411 8761 9595

**Dongguan \***  
ASSAB Tooling (Dongguan) Co., Ltd.  
Northern District  
Song Shan Lake Science & Technology Industrial Park  
Dongguan 523808, China  
Tel : 86 769 2289 7888  
Fax : 86 769 2289 9368/9312

**Hangzhou †**  
Room 1-1802, No. 3 Yuan, Jinjiangjiayuan  
Hangzhou 310016, China  
Tel : 86 571 8656 6112  
Fax : 86 571 8656 6113

**Ningbo \***  
ASSAB Tooling Technology (Ningbo) Co., Ltd.  
No. 218 Longjiaoshan Road  
Vehicle Part Industrial Park  
Ningbo Economic & Technical Development Zone  
Ningbo 315806, China  
Tel : 86 574 8680 7188  
Fax : 86 574 8680 7166

**Qingdao †**  
Room 2521, Kexin Mansion  
No. 228 Liaoning Road, Shibei District  
Qingdao 266012, China  
Tel : 86 532 8382 0930  
Fax : 86 532 8383 0937

**Shanghai \***  
ASSAB Tooling Technology (Shanghai) Co., Ltd.  
No. 4088 Humin Road, Xinzhuang Industrial Zone  
Shanghai 201108, China  
Tel : 86 21 2416 9688  
Fax : 86 21 2416 9676

**Suzhou †**  
Room 102, No. 1 Xinxin Garden  
Suzhou Industrial Zone  
Suzhou 215021, China  
Tel : 86 512 6761 6690  
Fax : 86 512 6252 9227

**Tianjin †**  
No. 12 Puwangli, Wanda Xincheng  
Xinyibai Road, Beichen District  
Tianjin 300402, China  
Tel : 86 22 2672 0006  
Fax : 86 22 2672 2318

**Xiamen \***  
ASSAB Tooling (Xiamen) Co., Ltd.  
First Floor Universal Workshop  
No. 30 Huli Zone  
Xiamen 361006, China  
Tel : 86 592 562 4678  
Fax : 86 592 568 3703

*Other offices in Chengdu, Cixi Ningbo,  
Huangyan, Wenzhou and Wuhan.*

**HONG KONG †**  
ASSAB Steels (HK) Ltd.  
Room 1701-1706  
Grand Central Plaza, Tower 2  
138 Shatin Rural Committee Road  
Shatin, N.T., Hong Kong  
Tel : 852 2487 1991  
Fax : 852 2489 0938

## INDONESIA

**Jakarta \***  
PT. ASSAB Steels Indonesia  
Jl. Rawagelam III No. 5  
Kawasan Industri Pulogadung  
Jakarta 13930, Indonesia  
Tel : 62 21 461 1314  
Fax : 62 21 461 1306

**Medan \***  
Komplek Griya Riatur Indah  
Blok A No. 138, Jl. T. Amir Hamzah  
Halvetia Timur, Medan 20124  
North Sumatera, Indonesia  
Tel : 62 61 847 7935 / 6  
Fax : 62 61 847 0035

**Surabaya \***  
Jl. Berbek Industri I/23  
Surabaya Industrial Estate, Rungkut  
Surabaya 60293, East Java, Indonesia  
Tel : 62 31 843 2277  
Fax : 62 31 843 2040

*Other offices in Bandung,  
Semarang and Tangerang.*

## JAPAN

**Tokyo †**  
Uddeholm KK  
Atago East Building  
3-16-11 Nishi Shinbashi  
Minato-ku, Tokyo, 105-0003 Japan  
Tel : 81 3 5473 4641  
Fax : 81 3 5473 7691

**Fukuroi Distribution Centre \***  
38-1 Kihara, Fukuroi-shi  
Shizuoka 437-0046 Japan  
Tel : 81 538 43 9240  
Fax : 81 538 43 9244

**Nagoya †**  
Sumitomo Seimei New Tower Building  
3-15-31 Aoi, Higashi-ku, Nagoya  
Aichi, 461-0004 Japan  
Tel : 81 52 979 5081  
Fax : 81 52 933 6461

**Osaka †**  
Shin Osaka Central Tower  
7-1-26 Nishinakajima, Yodogawa-ku  
Osaka, 532-0011 Japan  
Tel : 81 6 6307 7621  
Fax : 81 6 6307 7627

## KOREA

**Incheon \***  
ASSAB Steels (Korea) Co., Ltd.  
116B-8L, 687-8, Kojan-dong,  
Namdong-ku  
Incheon 405-310, Korea  
Tel : 82 32 821 4300  
Fax : 82 32 821 3311

**Busan \***  
14B-5L, 1483-9, Songjeong-dong,  
Kangseo-ku, Busan 618-270, Korea  
Tel : 82 51 831 3315  
Fax : 82 51 831 3319

*Another office in Daegu.*

## MALAYSIA

**Head Office / KL Sales \***  
ASSAB Steels (Malaysia) Sdn. Bhd.  
Lot 19, Jalan Perusahaan 2  
Batu Caves Industrial Estate  
68100 Batu Caves  
Selangor, Malaysia  
Tel : 60 3 6189 0022  
Fax : 60 3 6189 0055

**Butterworth \***  
Plot 146a  
Jalan Perindustrian Bukit Minyak 7  
Kawasan Perindustrian Bukit Minyak  
14000 Bukit Mertajam, SPT Penang  
Tel : 60 4 507 2020  
Fax : 60 4 507 6323

**Johor \***  
No. 8, Jalan Persiaran Teknologi  
Taman Teknologi  
81400 Senai  
Johor DT, Malaysia  
Tel : 607 598 0011  
Fax : 607 599 4890

## PHILIPPINES \*

Associated Swedish Steels Phils., Inc.  
No. 3 E. Rodriguez Jr. Avenue  
Bagong Ilog, Pasig City  
Philippines  
Tel : 632 671 1953 / 2048  
Fax : 632 671 1349

*Another office in Cebu.*

## SINGAPORE \*

ASSAB Steels Singapore (Pte.) Ltd.  
18 Penjuru Close  
Singapore 608616  
Tel : 65 6862 2200  
Fax : 65 6862 0162

## TAIWAN

**Taipei \***  
ASSAB Steels Taiwan Co., Ltd.  
No. 112, Wu Kung 1st Rd.,  
Wu Ku Industry Zone  
Taipei 248-87, Taiwan (R.O.C.)  
Tel : 886 2 2299 2849  
Fax : 886 2 2299 0147/2348

**Nantou \***  
No. 10, Industry South 5th Rd.,  
Nan Kang Industry Zone  
Nantou 540-66, Taiwan (R.O.C.)  
Tel : 886 49 225 1702  
Fax : 886 49 225 3171

**Tainan \***  
No. 180, Yan He Street  
Yong Kang City  
Tainan 710-82, Taiwan (R.O.C.)  
Tel : 886 6 242 6838  
Fax : 886 6 242 6783

## THAILAND \*

ASSAB Steels (Thailand) Ltd.  
9/8 Soi Theedindhai, Taeparak Road  
Bangplee, Samutprakarn 10540  
Thailand  
Tel : 66 2 385 5937  
66 2 757 5017  
Fax : 66 2 385 5943

## VIETNAM \*

Cam Nguyen Steel Co., Ltd.  
90/8, Block 5, Tan Thai Nhat Ward  
District 12, Ho Chi Minh City  
Vietnam  
Tel : 84 8 5920 920  
Fax : 84 8 5920 000

*\* Sales office with warehouse  
and/or value added services.*

*† Sales office only.*

**ASSAB TOOL STEELS** have been in Asia for more than 60 years. Our customers associate ASSAB brand with tooling materials that are high in quality and consistency.

The ASSAB sales companies and distributors offer you well assorted stocks in a number of places covering the Asia Pacific region.

Besides providing you with the right tool steel for every type of tool, we can help you with machine service and heat treatment.

Our engineers and metallurgists are always ready to assist you in your choice of the optimum steel grade and the best treatment for each application. We also carry out material examinations at our local mini laboratories, and at the central laboratory in Sweden.

Our steel mill in Sweden, Uddeholm Tooling, is one of the few steelworks in the world that is dedicated to the manufacture of tool steels only. Uddeholm Tooling is certified to **ISO 9001** and **ISO 14001**.



*Our forging press is one of the most modern of its kind in the world.*

Besides tool steels, the ASSAB services for tool makers include:

- Welding electrodes for repair welding of tools.
- High strength aluminium for tooling purposes.
- Copper alloys (e.g. beryllium copper) for inserts in moulds.
- Alloy machinery steels.
- Cold rolled strip steels for saws, compressor valves, coater blades, etc.
- High Performance Steels (HPS)

**ASSAB**   
**ASSAB PACIFIC GROUP**