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Global Steel Grade Encyclopedia

涵盖的行业或国家与地区类别

ASTM	GJB	SAE	EU	AISI	DIN	AMS	ISO	JASO
国材料与试验协会	国家军用标准	动力机械工程师协会	前欧洲标准化	美国钢铁学会	德国工业标准	空航天材料规范	国际标准	日本汽车标准组织
EN	JB	UNS	UNI	ASME	SS	GB	JIS	
欧洲标准	国机械行业标准	统一编号系统	意大利标准	美国机械工程师协会	瑞典标准	国家标准	日本工业标准	

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.

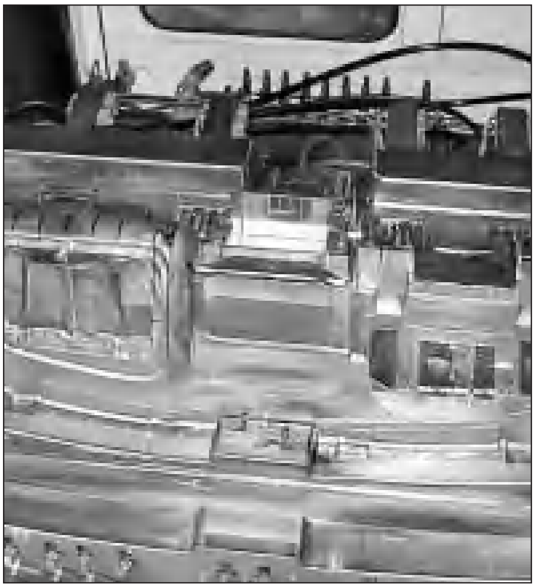
Moldmax XL will also react more rapidly to process changes, providing enhanced control over the moulding process. Finally, the higher thermal conductivity allows the mould to be run at a higher temperature yielding lower injection pressures, minimizing condensation and ultimately resulting in greater 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	8 900	8 810	8 760
lb/in^3	0,322	0,317	0,316
Modulus of elasticity			
N/mm^2	117 200	N/A	N/A
psi	17 x 10^6	N/A	N/A
Coefficient of thermal expansion			
from°C to 20°C	–	16 x 10^{-6}	16.5 x 10^{-6}
from °F to 68°F	–	9,5 x 10^{-6}	9,7 x 10^{-6}
Thermal conductivity			
W/m°C	60	80	95
Btu in/ft^{2}h °F	425	635	725
Specific heat			
J/kg°C	381	410	432
Btu/lb °F	0,091	0,097	0,103

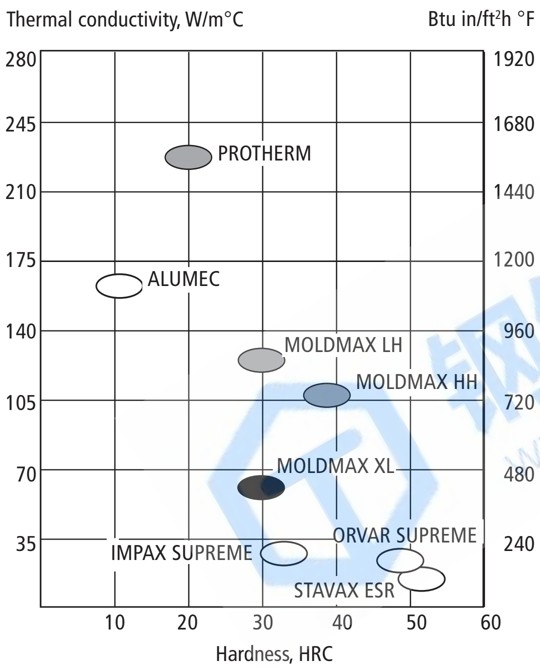


TENSILE STRENGTH AT ROOM TEMPERATURE

The tensile values are to be considered as approximate only.

	Hardness 30 HRC
Compressive yield strength, $R_{c0,2}$	655 N/mm² 95 000 psi
Tensile yield strength, $R_{p0,2}$	690 N/mm² 100 000 psi
Tensile strength, R_m	760 N/mm² 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 Rough turning	Turning with carbide Fine turning	Turning with high speed steel
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 US	K20 C2	K20 C2	– –

Use tools with generous positive rake angles.

MILLING

Face and square shoulder face milling

Cutting data parameters	Milling with carbide Rough milling	 Fine milling	Milling with high speed steel
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 mm	Drill diameter inch	Cutting speed v_c, m/min	Cutting speed v_c, f.p.m.	Feed, f mm/rev	Feed, f 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 ~60 m/min. (197 f.p.m.)*

Carbide drill

Cutting data parameters	Type of dril 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] 0,002–0,0122[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 Al_2O_3 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 XL[1]

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

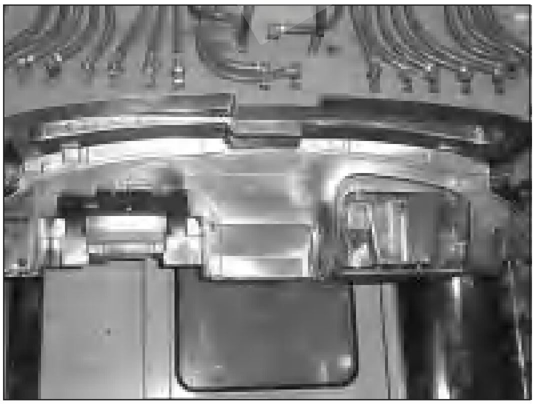
While Moldmax XL's high thermal conductivity makes it slower to EDM than mould steels, sinker and wire EDM'ing present no significant problems. The recast layer which is formed during EDM is soft, shallow and easily removed.

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 ±20°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.