Moldmax® HH
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.

Classified according to EU Directive 1999/45/EC.
For further information see our “Material Safety Data Sheets”.
Moldmax HH is a high-strength beryllium copper mould alloy, made by Materion Brush Performance Alloys, 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

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.

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.

### 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

### PHYSICAL DATA

Data at room and elevated temperatures.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>20°C (68°F)</th>
<th>200°C (390°F)</th>
<th>300°C (570°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density kg/m³</td>
<td>8.350</td>
<td>8.275</td>
<td>8.220</td>
</tr>
<tr>
<td></td>
<td>lb/in³</td>
<td>0.302</td>
<td>0.299</td>
</tr>
<tr>
<td>Modulus of elasticity N/mm²</td>
<td>131 x 10⁶</td>
<td>124 x 10⁶</td>
<td>105 x 10⁶</td>
</tr>
<tr>
<td>psi</td>
<td>19 x 10⁶</td>
<td>19 x 10⁶</td>
<td>15 x 10⁶</td>
</tr>
<tr>
<td>Coefficient of thermal expansion from °C to 20°C</td>
<td>–</td>
<td>17 x 10⁻⁶</td>
<td>17.8 x 10⁻⁶</td>
</tr>
<tr>
<td>from °F to 68°F</td>
<td>–</td>
<td>9.7 x 10⁻⁶</td>
<td>9.9 x 10⁻⁶</td>
</tr>
<tr>
<td>Thermal conductivity W/m°C</td>
<td>105</td>
<td>145</td>
<td>155</td>
</tr>
<tr>
<td>Btu in/ft²h °F</td>
<td>754</td>
<td>994</td>
<td>1063</td>
</tr>
<tr>
<td>Specific heat J/kg°C</td>
<td>380</td>
<td>480</td>
<td>535</td>
</tr>
<tr>
<td>Btu/lb °F</td>
<td>0.091</td>
<td>0.114</td>
<td>0.128</td>
</tr>
</tbody>
</table>

### TENSILE STRENGTH AT ROOM TEMPERATURE

The tensile values are to be considered as approximate only.

<table>
<thead>
<tr>
<th>Hardness</th>
<th>40 HRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile strength, Rm N/mm²</td>
<td>1 280</td>
</tr>
<tr>
<td>psi</td>
<td>185 000</td>
</tr>
<tr>
<td>Yield strength, Rc0,2 N/mm²</td>
<td>1 070</td>
</tr>
<tr>
<td>psi</td>
<td>155 000</td>
</tr>
<tr>
<td>Elongation, A₅ %</td>
<td>6</td>
</tr>
</tbody>
</table>
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, in following tables, are to be considered as guiding values which must be adapted to existing local conditions.

TURNING

<table>
<thead>
<tr>
<th>Cutting data parameters</th>
<th>Turning with carbide</th>
<th>Turning with high speed steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting speed, $v_c$</td>
<td>Rough turning</td>
<td>Fine turning</td>
</tr>
<tr>
<td>m/min f.p.m.</td>
<td>270–300</td>
<td>300–370</td>
</tr>
<tr>
<td>Feed, $f$</td>
<td>0.3–0.8</td>
<td>–0.3</td>
</tr>
<tr>
<td>mm/rev</td>
<td>0.012–0.023</td>
<td>–0.012</td>
</tr>
<tr>
<td>Depth of cut, $a_p$</td>
<td>2–6</td>
<td>–2</td>
</tr>
<tr>
<td>mm</td>
<td>0.08–0.23</td>
<td>–0.08</td>
</tr>
</tbody>
</table>

Use tools with generous positive rake angles.

MILLING

FACE AND SQUARE SHOULDER

FACE MILLING

<table>
<thead>
<tr>
<th>Cutting data parameters</th>
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<tbody>
<tr>
<td>Cutting speed, $v_c$</td>
<td>Rough milling</td>
<td>Fine milling</td>
</tr>
<tr>
<td>m/min f.p.m.</td>
<td>100–150</td>
<td>150–200</td>
</tr>
<tr>
<td>Feed, $f$</td>
<td>0.2–0.4</td>
<td>1.0–1.2</td>
</tr>
<tr>
<td>mm/tooth</td>
<td>0.008–0.016</td>
<td>0.004–0.008</td>
</tr>
<tr>
<td>Depth of cut, $a_p$</td>
<td>2–5</td>
<td>–2</td>
</tr>
<tr>
<td>mm</td>
<td>0.08–0.20</td>
<td>–0.08</td>
</tr>
</tbody>
</table>

Use tools with positive rake angles when milling with carbide.

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.

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FACE AND SQUARE SHOULDER

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**END MILLING**

<table>
<thead>
<tr>
<th>Cutting parameters</th>
<th>Solid</th>
<th>Carbide indexable insert</th>
<th>High speed steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting speed, ( v_c ) m/min f.p.m.</td>
<td>80–100</td>
<td>260–330</td>
<td>45–60(^1)</td>
</tr>
<tr>
<td>Feed, ( f ) mm/tooth in/tooth</td>
<td>0.010–0.10</td>
<td>0.0004–0.004</td>
<td>0.05–0.35(^2)</td>
</tr>
<tr>
<td>Carbid designation ISO</td>
<td>–</td>
<td>K20</td>
<td>–</td>
</tr>
</tbody>
</table>

\(^1\) For coated HSS end mill an increased cutting speed of ~30% can be used

\(^2\) Depending on radial depth of cut and cutter diameter

**DRILLING**

**HIGH SPEED STEEL TWIST DRILL**

<table>
<thead>
<tr>
<th>Drill diameter (mm)</th>
<th>Cutting speed ( v_c ) m/min</th>
<th>Feed ( f ) mm/r</th>
<th>ISO</th>
</tr>
</thead>
<tbody>
<tr>
<td>–5</td>
<td>30–40</td>
<td>0.03–0.08</td>
<td>–</td>
</tr>
<tr>
<td>5–10</td>
<td>3/16</td>
<td>0.08–0.15</td>
<td>–</td>
</tr>
<tr>
<td>10–15</td>
<td>3/8–5/8</td>
<td>0.15–0.20</td>
<td>–</td>
</tr>
<tr>
<td>15–20</td>
<td>5/8–3/4</td>
<td>0.20–0.25</td>
<td>–</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard chrome</td>
<td>Wear resistance, corrosion resistance, hardness.</td>
</tr>
<tr>
<td>Electroless (chemical) Nickel</td>
<td>Hardness, wear resistance, surface release, corrosion resistance.</td>
</tr>
<tr>
<td>Electroless Nickel with Teflon</td>
<td>Hardness, wear resistance, surface release.</td>
</tr>
<tr>
<td>PVD: Titanium Nitride</td>
<td>Superior wear resistance, surface release.</td>
</tr>
<tr>
<td>Chromium Nitride</td>
<td></td>
</tr>
</tbody>
</table>

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 out-side of the work area.

SAFE HANDLING

Moldmax HH is a copper-alloy with a content of ~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 material.

Chair mould.
Uddeholm is present on every continent. This ensures you high-quality Swedish tool steel and local support wherever you are. We secure our position as the world’s leading supplier of tooling materials.
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For more information, please visit www.uddeholm.com