

Uddeholm **Coolmould®**

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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".
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GENERAL

Uddeholm Coolmould is a high-strength beryllium copper mould alloy 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	Aged to ~40 HRC		
Colour code	Black/Gold		

Uddeholm Coolmould 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.

Uddeholm Coolmould is available in wrought round and flat section, machined core pins, and welding wire.

Uddeholm Coolmould'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 Uddeholm Coolmould 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.

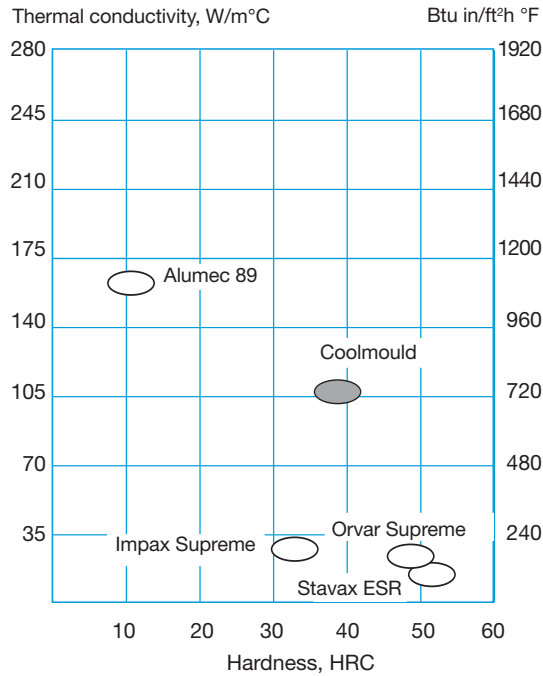
Temperature	20°C (68°F)	200°C (390°F)	300°C (570°F)
Density kg/m ³ lb/in ³	8 350 0.302	8 275 0.299	8 220 0.297
Modulus of elasticity N/mm ² psi	131 100 19 x 10 ⁶	124 100 19 x 10 ⁶	103 400 15 x 10 ⁶
Coefficient of thermal expansion from °C to 20°C from °F to 68°F	- -	17 x 10 ⁻⁶ 9.7 x 10 ⁻⁶	17.8 x 10 ⁻⁶ 9.9 x 10 ⁻⁶
Thermal conductivity W/m°C Btu in/ft ² h °F	105 754	145 994	155 1063
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	40 HRC
Tensile strength, R _m N/mm ² psi	1 280 185 000
Yield strength, R _{c0.2} N/mm ² psi	1 070 155 000
Elongation, A ₅ %	6

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

Uddeholm Coolmould is delivered in the heat treated condition—additional heat treatment is not normally required.

MACHINING

Uddeholm Coolmould 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

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 ¹⁾ 150–200
Feed, f_z mm/tooth in/tooth	0.010–0.10 ²⁾ 0.0004–0.004	0.08–0.20 ²⁾ 0.003–0.008	0.05–0.35 ²⁾ 0.002–0.014
Carbide designation ISO	–	K20	–

- 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

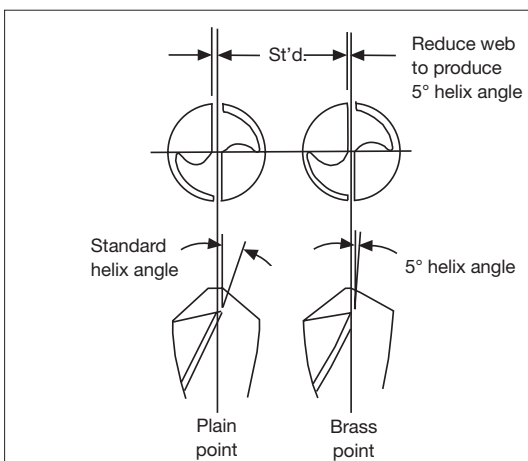
DRILLING

HIGH SPEED STEEL TWIST DRILL

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 Uddeholm Coolmould 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 Uddeholm Coolmould. 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 Uddeholm Coolmould, 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 Uddeholm Coolmould’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

Uddeholm Coolmould 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 Uddeholm Coolmould.

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

Uddeholm Coolmould 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

Uddeholm Coolmould is a copper-alloy with a content of ~2% Beryllium.

Make sure, during the machining of Uddeholm Coolmould, 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.

Uddeholm is the world's leading supplier of tooling materials. This is a position we have reached by improving our customers' everyday business. Long tradition combined with research and product development equips Uddeholm to solve any tooling problem that may arise. It is a challenging process, but the goal is clear – to be your number one partner and tool steel provider.

Our presence on every continent guarantees you the same high quality wherever you are. We act worldwide. For us it is all a matter of trust – in long-term partnerships as well as in developing new products.

For more information, please visit www.uddeholm.com