

COOLMOULD

UDDEHOLM COOLMOULD

|  |  <small>a voestalpine company</small> | REFERENCE STANDARD | | |
|---|---|--------------------|----------|-------------|
| | | AISI | Wnr. | JIS |
| ASSAB DF-3 | ARNE | O1 | 1.2510 | SKS 3 |
| ASSAB XW-10 | RIGOR | A2 | 1.2363 | SKD 12 |
| ASSAB XW-42 | SVERKER 21 | D2 | 1.2379 | (SKD 11) |
| CALMAX / CARMO | CALMAX / CARMO | | 1.2358 | |
| VIKING | VIKING / CHIPPER | | (1.2631) | |
| CALDIE | CALDIE | | | |
| ASSAB 88 | SLEIPNER | | | |
| ASSAB PM 23 SUPERCLEAN | VANADIS 23 SUPERCLEAN | (M3:2) | 1.3395 | (SKH 53) |
| ASSAB PM 30 SUPERCLEAN | VANADIS 30 SUPERCLEAN | (M3:2 + Co) | 1.3294 | SKH 40 |
| ASSAB PM 60 SUPERCLEAN | VANADIS 60 SUPERCLEAN | | (1.3292) | |
| VANADIS 4 EXTRA SUPERCLEAN | VANADIS 4 EXTRA SUPERCLEAN | | | |
| VANADIS 8 SUPERCLEAN | VANADIS 8 SUPERCLEAN | | | |
| VANCRON SUPERCLEAN | VANCRON SUPERCLEAN | | | |
| ELMAX SUPERCLEAN | ELMAX SUPERCLEAN | | | |
| VANAX SUPERCLEAN | VANAX SUPERCLEAN | | | |
| ASSAB 518 | | P20 | 1.2311 | |
| ASSAB 618 T | | (P20) | (1.2738) | |
| ASSAB 618 / 618 HH | | (P20) | 1.2738 | |
| ASSAB 718 SUPREME / 718 HH | IMPAX SUPREME / IMPAX HH | (P20) | 1.2738 | |
| NIMAX / NIMAX ESR | NIMAX / NIMAX ESR | | | |
| VIDAR 1 ESR | VIDAR 1 ESR | H11 | 1.2343 | SKD 6 |
| UNIMAX | UNIMAX | | | |
| CORRAX | CORRAX | | | |
| ASSAB 2083 | | 420 | 1.2083 | SUS 420J2 |
| STAVAX ESR | STAVAX ESR | (420) | (1.2083) | (SUS 420J2) |
| MIRRAX ESR | MIRRAX ESR | (420) | | |
| MIRRAX 40 | MIRRAX 40 | (420) | | |
| TYRAX ESR | TYRAX ESR | | | |
| POLMAX | POLMAX | (420) | (1.2083) | (SUS 420J2) |
| ROYALLOY | ROYALLOY | (420 F) | | |
| COOLMOULD | COOLMOULD | | | |
| ASSAB 2714 | | | 1.2714 | SKT 4 |
| ASSAB 2344 | | H13 | 1.2344 | SKD 61 |
| ASSAB 8407 2M | ORVAR 2M | H13 | 1.2344 | SKD 61 |
| ASSAB 8407 SUPREME | ORVAR SUPREME | H13 Premium | 1.2344 | SKD 61 |
| DIEVAR | DIEVAR | | | |
| QRO 90 SUPREME | QRO 90 SUPREME | | | |
| FORMVAR | FORMVAR | | | |

() - modified grade

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Edition 20210505

GENERAL

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 | | |

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.

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

Coolmould's high thermal conductivity, 3 to 5 times better than steel, ensures uniform, rapid heat removal, minimising 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 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 off, 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.

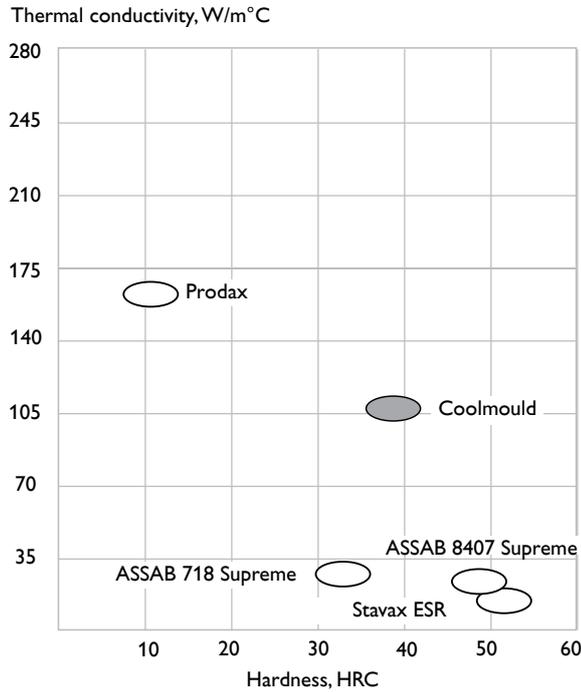
| Temperature | 20 °C | 200 °C | 300 °C |
|---|---------|-----------------------|-------------------------|
| Density kg/m ³ | 8 350 | 8 275 | 8 220 |
| Modulus of elasticity N/mm ² | 131 100 | 124 100 | 103 400 |
| Coefficient of thermal expansion per °C from 20 °C | - | 17 x 10 ⁻⁶ | 17.8 x 10 ⁻⁶ |
| Thermal conductivity W/m °C | 105 | 145 | 155 |
| Specific heat J/kg °C | 380 | 480 | 535 |

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 | 1 280 |
| Yield strength, R _{p0.2} N/mm ² | 1 070 |
| 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

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

MACHINING

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 parameter | Turning with carbide | | Turning with high speed steel |
|-------------------------------|----------------------|--------------|-------------------------------|
| | Rough turning | Fine turning | |
| Cutting speed (V_c) m/min | 270 – 300 | 300 – 370 | 60 – 90 |
| Feed (f) mm/rev | 0.3 – 0.6 | ≤ 0.3 | ≤ 0.3 |
| Depth of cut (a_p) mm | 2 – 6 | ≤ 2 | ≤ 2 |
| Carbide designation ISO | K20 | K20 | - |

Use tools with generous positive rake angles

MILLING

FACE AND SQUARE SHOULDER FACE MILLING

| Cutting data parameter | Milling with carbide | | Milling with high speed steel |
|-------------------------------|----------------------|--------------|-------------------------------|
| | Rough milling | Fine milling | |
| Cutting speed (V_c) m/min | 100 – 150 | 150 - 200 | 45 - 60 |
| Feed (f) mm/tooth | 0.2 – 0.4 | 0.1 – 0.2 | ≤ 0.1 |
| Depth of cut (a_p) mm | 2 – 5 | ≤ 2 | ≤ 2 |
| Carbide designation ISO | K20 | K20 | - |

Use tools with positive rake angles when milling with carbide

END MILLING

| Cutting data parameter | Type of milling | | |
|-------------------------------|---------------------------|--------------------------|--------------------------|
| | Solid carbide | Carbide indexable insert | High speed steel |
| Cutting speed (V_c) m/min | 80 – 100 | 150 - 200 | 45 - 60 ¹ |
| Feed (f) mm/tooth | 0.010 – 0.10 ² | 0.08 – 0.20 ² | 0.05 – 0.35 ² |
| 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

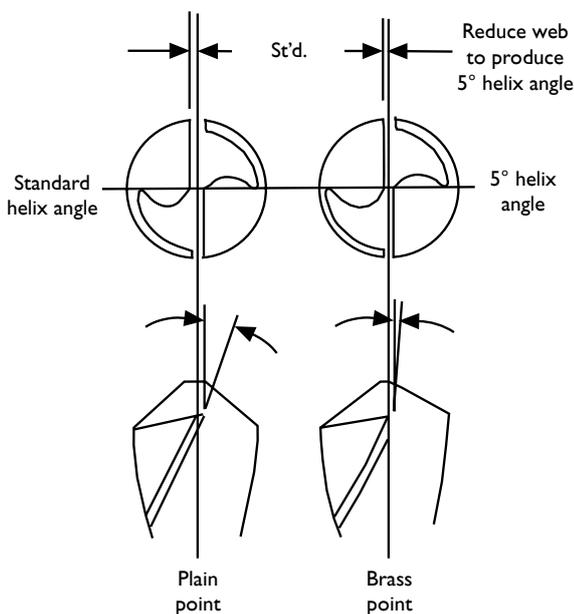
DRILLING

HIGH SPEED STEEL TWIST DRILL

| Drill diameter mm | Cutting speed (V_c) m/min | Feed (f) mm/rev |
|-------------------|-------------------------------|-----------------|
| ≤ 5 | 30 – 40 | 0.03 – 0.08 |
| 5 – 10 | 30 – 40 | 0.08 – 0.15 |
| 10 – 15 | 30 – 40 | 0.15 – 0.20 |
| 15 – 20 | 30 – 40 | 0.20 – 0.25 |

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 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 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 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

ELECTRICAL DISCHARGE MACHINING — EDM

While 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

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 oxidised 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 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 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.

POLISHING

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

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

Make sure, during the machining of 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”.

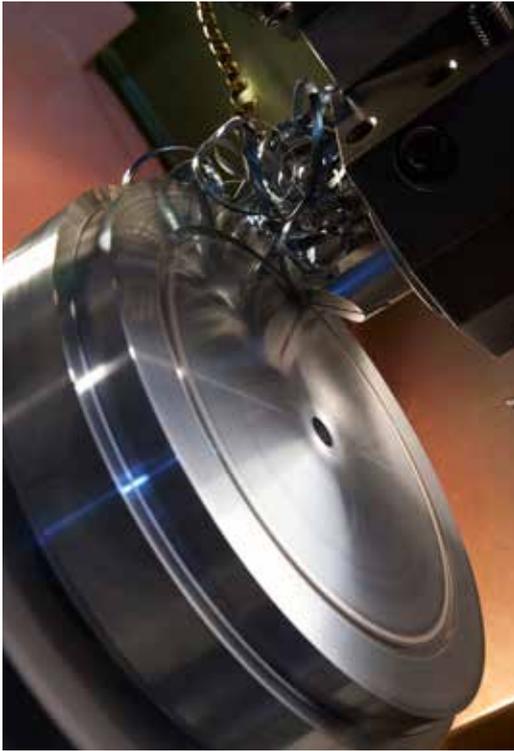
Further information

For further information, i.e., steel selection, heat treatment, application and availability, please contact our ASSAB office nearest to you.

ASSAB

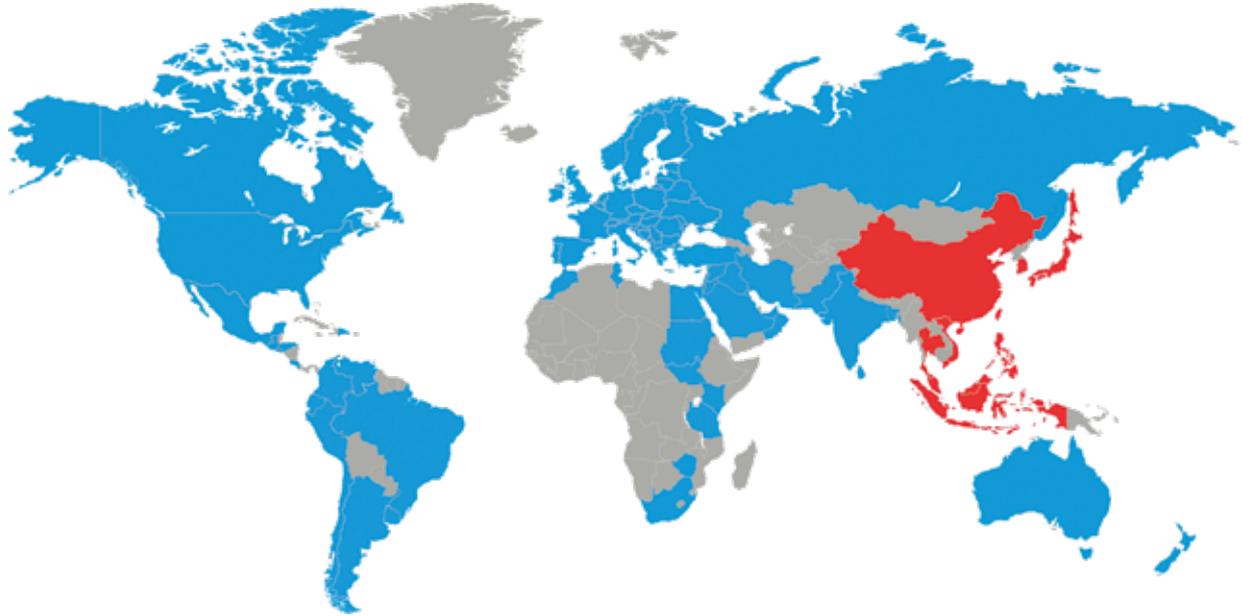
SUPERIOR TOOLING SOLUTIONS

A ONE-STOP SHOP



ASSAB is unmatched as a one-stop product and service provider that offers superior tooling solutions. In addition to the supply of tool steel and other special steel, our range of comprehensive value-added services, such as machining, heat treatment and coating services, span the entire supply chain to ensure convenience, accountability and optimal usage of steel for customers. We are committed to achieving solutions for our customers, with a constant eye on time-to-market and total tooling economy.





Choosing the right steel is of vital importance. ASSAB engineers and metallurgists are always ready to assist you in your choice of the optimum steel grade and the best treatment for each application. ASSAB not only supplies steel products with superior quality, we offer state-of-the-art machining, heat treatment and surface treatment services to enhance steel properties to meet your requirement in the shortest lead time. Using a holistic approach as a one-stop solution provider, we are more than just another tool steel supplier.

ASSAB and Uddeholm are present on every continent. This ensures you that high quality tool steel and local support are available wherever you are. Together we secure our position as the world's leading supplier of tooling materials.

For more information, please visit
www.assab.com

