

Uddeholm Corrax[®]

Also available for Additive Manufacturing

Uddeholm Corrax®

Uddeholm Corrax stainless mould steel has a unique set of properties that makes it the ultimate choice in a large number of demanding applications. Its superior resistance to corrosion combined with a hardness of up to 50 HRC makes it perfectly suited for moulds making:

- Medical parts
- Parts made of corrosive plastics, i.e. PVC
- Parts made of rubber as well as for moulds running in clean room environment

The mould user can count on two major advantages: The outstanding stainless properties of Uddeholm Corrax cut maintenance costs dramatically. Constant cycle time can be kept during very long runs of production. The mould maker benefits greatly by the very simple heat treatment needed to get hardnesses from 32 to 50 HRC.

Uddeholm Corrax is a part of the Uddeholm Stainless Concept.

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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".

Edition 15, 11.2025



GENERAL

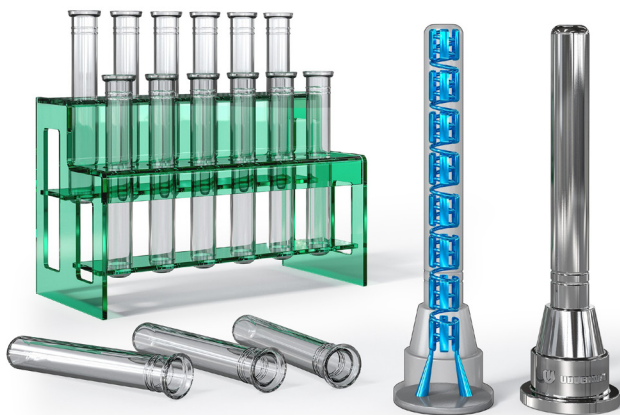
Compared with conventional corrosion resistant tool steel, Uddeholm Corrax has the following advantages:

- Flexible hardness, 34–50 HRC, achieved by an ageing treatment in the temperature range 425–600°C (790–1110°F)
- Extremely good dimensional stability during the ageing
- High uniformity of properties also for large dimensions
- Very good weldability, no preheating necessary
- No hard “white” layer after EDM
- Corrosion resistance superior to that of AISI 420 and W.-Nr. 1.2083

Typical analysis %	C	Si	Mn	Cr	Ni	Mo	Al	S
	0.03	0.3	0.3	12.0	9.2	1.0	1.6	+
Delivery condition	Solution treated to ~34 HRC							
Colour code	Black/grey							

APPLICATIONS

- Injection moulds for
 - corrosive plastics
 - rubber
 - medical and food industry
- Extrusion dies
- Plastic processing
 - screws
- Engineering parts
- Medical tools and parts



PROPERTIES

Physical data

Measured at room temperature on solution treated and aged material with a hardness of approximately 46-48 HRC.

Temperature	20°C (68°F)	200°C (390°F)	400°C (750°F)
Density kg/m ³ lbs/in ³	7 700 0.28	- -	- -
Modulus of elasticity N/mm ² psi	200 000 29 x 10 ⁶	190 000 28 x 10 ⁶	170 000 25 x 10 ⁶
Coefficient of thermal expansion per °C from 20°C per °F from 68°F	- -	11.7 x 10 ⁻⁶ 6.5 x 10 ⁻⁶	12.3 x 10 ⁻⁶ 6.8 x 10 ⁻⁶
Thermal conductivity W/m °C Btu in/ft ² h °F	- -	18 125	21 146

Mechanical data

Tensile strength

	Solution Treated	47 HRC	51 HRC
Yield Strength (Rp 0.2) MPa PSI	840	1480	1595
Tensile Strength (Rm) MPa PSI	1080	1525	1725
Elongation A5 %	14 %	12 %	7 %
Reduction of Area (Z)	68 %	50 %	7 %

Compressive strength

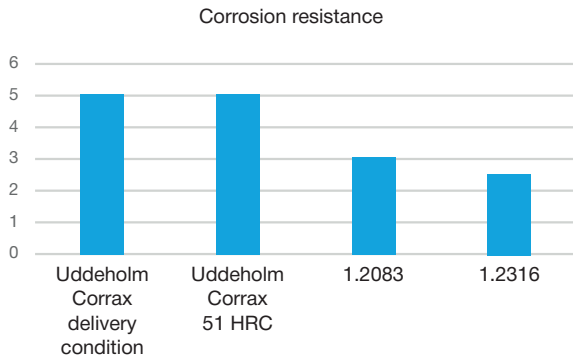
	Solution Treated	47 HRC	51 HRC
Compressive Strength MPa PSI	895	1630	1760

Toughness

Charpy-V (J)	Solution Treated	47 HRC	51 HRC
ST-2 direction	15	7	4
LT-2 direction	100	23	4

Corrosion resistance

Uddeholm Corrax has a very good corrosion resistance, better than the corrosion resistant standard grades used for plastic moulding. The corrosion resistance is the same in all heat treated conditions (except after nitriding).



Uddeholm Corrax will withstand attacks from most corrosive plastics and diluted acids.

A mould made of Uddeholm Corrax will also have good resistance to humid working and storage conditions. Uddeholm Corrax also shows better resistance to stress corrosion cracking than standard hardenable corrosion resistant steel grades, like AISI 420 types.

HEAT TREATMENT

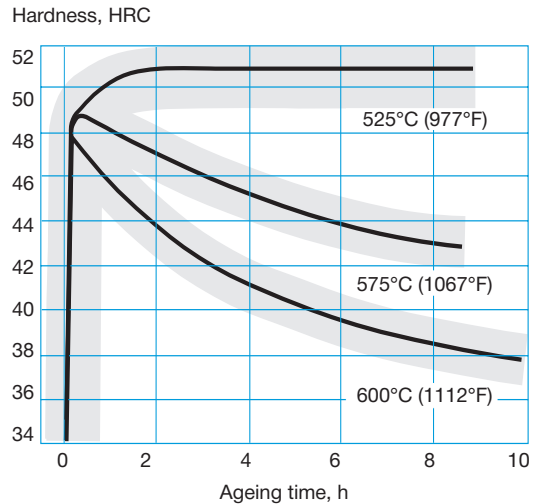
Uddeholm Corrax is delivered in solution treated condition and can be used in the as-delivered condition. When, however, the steel is to be heat treated to a higher hardness, the following instructions may be helpful.

Stress relieving

Stress relieving can not be performed as for other steel grades since an increase in temperature results in a higher hardness because of ageing effect.

Ageing

Higher hardness is obtained by ageing. Suitable ageing parameters can be obtained from the figure showing hardness during ageing time. Ageing time means the time at the ageing temperature after the tool is fully heated through.



When the ageing time is reached, cool the tool in air to room temperature. Ageing at high temperature gives a better toughness compared with ageing to the same hardness at a lower temperature.

Ageing recommendation

Ageing temperature/time	Hardness
525°C/4 h (977°F/4 h)*	49–52 HRC
575°C/4 h (1067°F/4 h)	44–47 HRC
600°C/4 h (1112°F/4 h)	40–43 HRC

* Ageing 49–52 HRC is only recommended when toughness is not important

If Uddeholm Corrax is used at temperatures higher than 200°C (390°F) the solution treated condition (delivery condition) is not recommended because ageing can occur during use.

Solution treatment

It is possible to solution treat Uddeholm Corrax, if aged, in order to get back to the delivery condition.

Solution treatment should be done at 850°C (1560°F), holding time 30 minutes. Cool in air to at least room temperature.

To reduce the amount of retained austenite to a minimum. Sub-zero treatment is recommended directly after solution treatment.

Dimensional change

Uddeholm Corrax is not subjected to any phase transformations during heat treatment which keeps distortion at a minimum.

Ageing results in a small and uniform decrease in volume. The following shrinkage can be expected during ageing.

Ageing	Dimensional change %		
	Longitudinal direction	Transversal direction	Short transversal direction
525°C / 2h (977°F / 2h)	-0.08	-0.08	-0.08
575°C / 2h (1067°F / 2h)	-0.1	-0.09	-0.1

CUTTING DATA RECOMMENDATIONS

The cutting data below are to be considered as guiding values which must be adapted to existing local conditions. More information can be found in the Uddeholm publication "Cutting data recommendations".

The recommendations, in the following tables, are valid for Uddeholm Corrax in solution treated condition approx. 34 HRC.

Turning

Cutting data parameters	Turning with carbide		Turning with high speed steel
	Rough turning	Fine turning	Fine turning
Cutting speed (v_c) m/min f.p.m.	110–160 360–525	160–210 525–690	13–18 43–59
Feed (f) mm/rev i.p.r.	0.2–0.4 0.008–0.016	0.05–0.2 0.002–0.008	0.05–0.2 0.002–0.008
Depth of cut (a_p) mm inch	2–4 0.08–0.16	0.5–2 0.02–0.08	0.5–3 0.02–0.12
Carbide designation ISO	P20–P40 Coated carbide	P10 Coated carbide or cermet	-

Milling

Face- and square shoulder milling

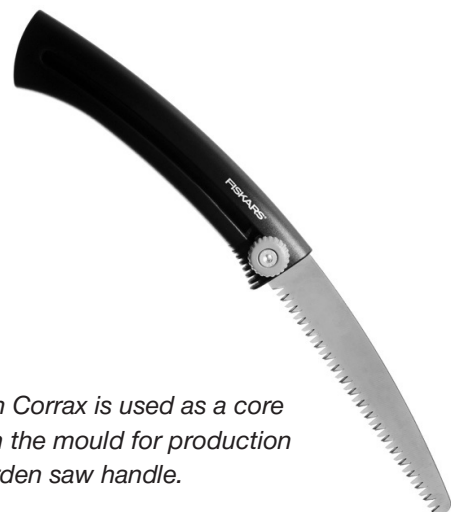
Cutting data parameters	Milling with carbide	
	Rough milling	Fine milling
Cutting speed (v_c) m/min f.p.m.	70–90 230–295	90–110 295–360
Feed (f_z) mm/tooth inch/tooth	0.2–0.4 0.008–0.016	0.1–0.2 0.004–0.008
Depth of cut (a_p) mm inch	2–5 0.08–0.20	–2 –0.08
Carbide designation ISO	P20–P40 Coated carbide	P10–P20 Coated carbide or cermet

End milling

Cutting data parameters	Type of milling		
	Solid carbide	Carbide indexable	High speed steel
Cutting speed (v_c) m/min f.p.m.	60–100 200–238	70–110 230–360	20–25 ¹⁾ 66–82 ¹⁾
Feed (f_z) mm/tooth inch/tooth	0.006–0.20 ²⁾ 0.0002–0.008 ²⁾	0.06–0.20 ²⁾ 0.002–0.008 ²⁾	0.01–0.35 ²⁾ 0.0004–0.014 ²⁾
Carbide designation ISO	-	P20–P30	-

¹⁾ For coated HSS end mill $v_c = 35–45$ m/min. (115–148 f.p.m.)

²⁾ Depending on radial depth of cut and cutter diameter



Uddeholm Corrax is used as a core material in the mould for production of this garden saw handle.

ADDITIVE MANUFACTURING

Uddeholm Corrax is also available for additive manufacturing, powder for processing Laser Powder Bed Fusion (LPBF) and Laser Metal Deposition (LMD). This powder is a gas atomized Uddeholm Corrax product with physical and mechanical properties within the normal variation as the conventional material. However, some of the mechanical properties are also improved, for example charpy-v.

GENERAL

Uddeholm Corrax for AM offers several advantages compared to most tool steels for Additive Manufacturing:

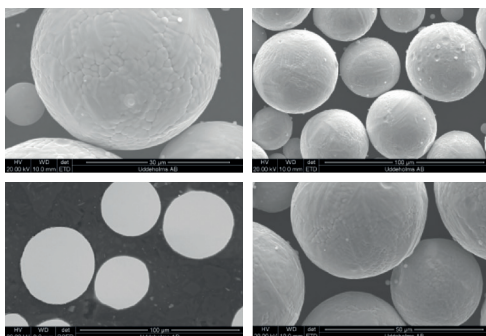
- Excellent corrosion resistance
- Excellent polishability
- Flexible hardness, 36-50 HRC, achieved by an aging treatment in the temperature range 425-600°C (790-1110°F)
- Good dimensional stability during the aging treatment
- No hard “white” layer after EDM
- Easy to process in laser powder-bed as well as laser metal deposition equipment.

Application

- Injection moulds for
 - corrosive plastics
 - rubber
 - medical and food industry
- Plastizing technologies
 - screws
- Engineering parts
- Medical tools and parts

Powder characteristics

The chemical composition is the same as for bar material for the core elements and a maximum Oxygen level of 200 ppm on the powder.



SEM images of Uddeholm Corrax powder.

Shape distribution and density

Sphericity	0.93
Aspect Ratio	0.88
Apparent density	4.3 g/cm ³
Tap density	4.7 g/cm ³
True density	7.61 g/cm ³

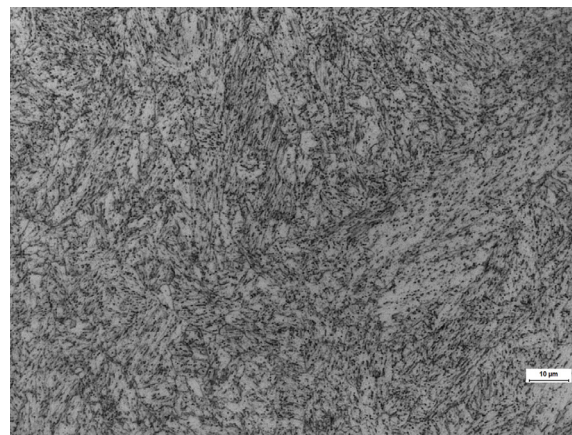
Particle size and distribution

Uddeholm Corrax for AM is sieved between 20 and 50 µm to a size distribution that suits most additive manufacturing equipment.

Typical values

D10	D50	D90
25	38	48

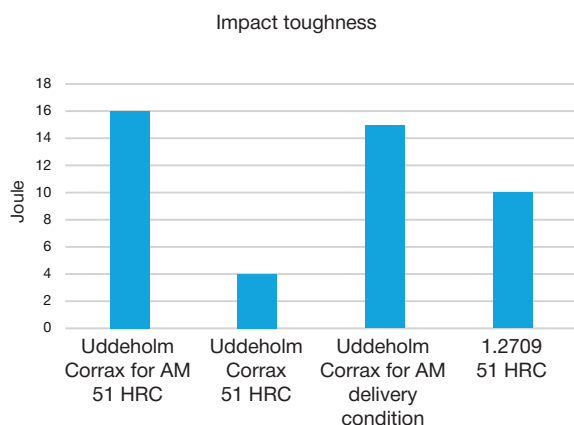
Microstructure



Microstructure in solution treated and aged condition, magnification 1000x.

Impact toughness

Uddeholm Corrax for AM does not contain any manganese sulfides, which improves the charpy-v values significantly.



Physical data

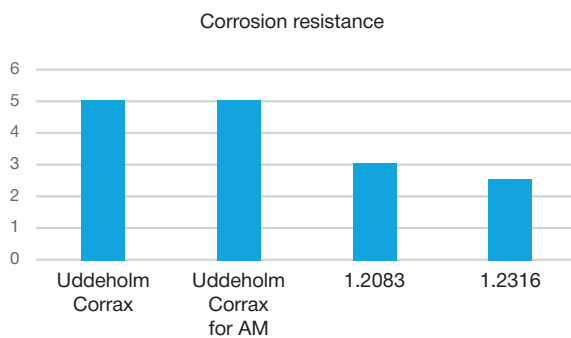
Temperature	20°C (68°F)	200°C (390°F)	400°C (750°F)
Density kg/m ³ lbs/in ³	7 700 0.28	- -	- -
Modulus of elasticity N/mm ² psi	200 000 29 x 10 ⁶	190 000 28 x 10 ⁶	170 000 25 x 10 ⁶
Coefficient of thermal expansion per°C from 20°C per°F from 68°F	- -	11.7 x 10 ⁻⁶ 6.5 x 10 ⁻⁶	12.3 x 10 ⁻⁶ 6.8 x 10 ⁻⁶
Thermal conductivity W/m °C Btu in/ft ² h °F	- -	18 125	21 146

Mechanical data AM

	51 HRC (Uddeholm Corrax for AM)
Yield Strength (Rp 0.2) MPa PSI	1740
Tensile Strength (Rm) MPa PSI	1790
Elongation A5%	7 %

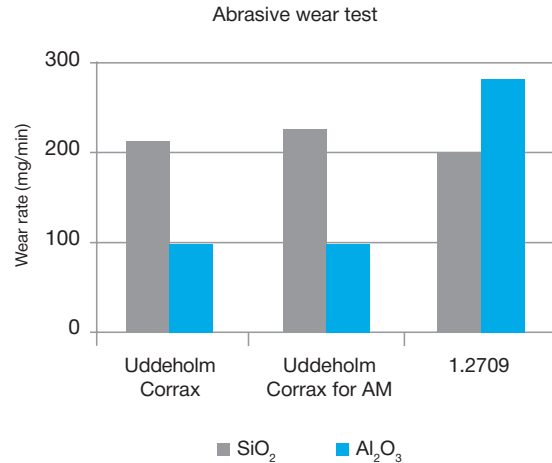
Corrosion resistance

Uddeholm Corrax for AM has similar corrosion resistance to bar material.



Wear resistance

Due to high hardness and fine microstructure Uddeholm Corrax for AM has an excellent wear resistance towards most media.



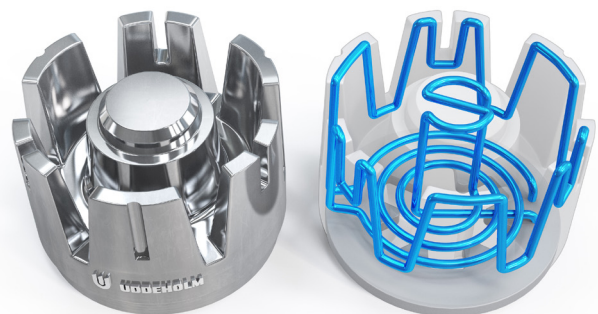
SiO₂ paper tested in dry condition.

Al₂O₃ tested in wet condition.

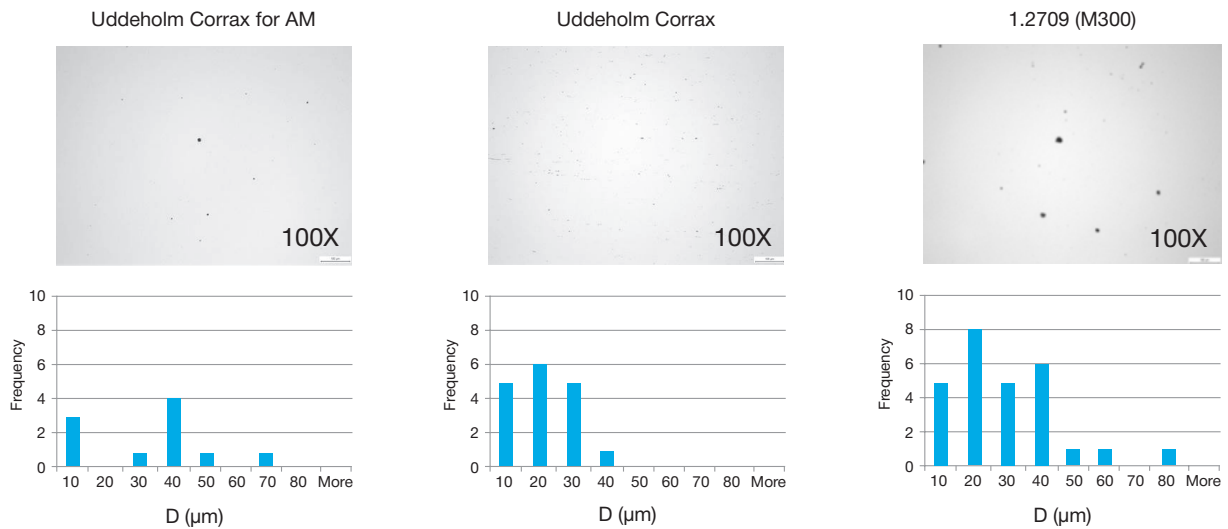
Note: Low values are desirable.

Surface finish

Because Uddeholm Corrax for AM does not contain any sulfides, it has a significantly better polishability compared to bar material. Uddeholm Corrax for AM offers extremely high polishing quality that results in excellent surface finish and a high gloss polished surface. With its low amount of porosity and inclusions, Uddeholm Corrax for AM gives perfect surfaces for high demanding tooling applications.



Polished surface quality



Optical microscope images of polished surfaces and pit density measurements.

AM Processing

Machine	EOS M290			
Layer thickness	30 μm	40 μm	50 μm	60 μm
Laser Power	198 W	225 W	312 W	293 W
Scan Speed	1035,1 mm/s	948,1 mm/s	1008,6 mm/s	990,3 mm/s
Hatch Distance	0,0907 mm	0,0975 mm	0,1141 mm	0,0904 mm

Use base plate and hybrid material of similar thermal properties e.g. Uddeholm Corrax.

The density of the printed material is greater than 99.5%.

POST PROCESSING

In the as-build condition Uddeholm Corrax for AM material can contain up to 20% retained austenite. The retained austenite content can be reduced to about 4%.

Stress Relieving

No stress relieving should be carried out after the AM process.

Grinding and polishing

A general grinding wheel recommendation is displayed in the table to the right. More information can be found in the Uddeholm publication "Grinding of Tool Steel".

Type of grinding	Delivery condition and aged condition
Face grinding straight wheel	A 46 GV
Face grinding segments	A 36 FV
Cylindrical grinding	A 60 JV
Internal grinding	A 60 IV
Profile grinding	A 120 JV

When good surface finish is required a SiC-wheel could be an alternative.

Uddeholm Corrax for AM exhibits excellent polishability behavior in both as-built and heat treated conditions. A slightly different and more demanding technique is needed when polishing corrosion-resistant tool steels, and usually more steps are required between fine grinding and polishing stages.

But on the contrary, for Uddeholm Corrax for AM after rough and fine grinding it is possible to achieve high quality gloss surface finish with only three steps between lapping and polishing stages. For more detailed recommendations please refer to the "Uddeholm polishing of mould steel" data sheet.



Surface coating

PVD-coatings can be used to increase the hardness and wear resistance of the surface. However, PVD-coatings may also increase the risk of corrosion.

For corrosive environment it is recommended to use multilayer coatings e.g. multilayer CrN, or coating from sputtering technology as it generates much less defects as compared to arc technology.

Low temperature plasma nitriding can be performed to increase surface hardness while maintaining corrosion properties, but the process temperature should not exceed 450°C.

For further information please contact your local Uddeholm sales office.

Texturing

Texturing can be made by direct laser cutting. For chemical etching is a ferritic acid recommended.

LASER METAL DEPOSITION

The powder is available for laser metal deposition in the size fraction 50-150µm that works for most laser metal deposition equipment. Uddeholm Corrax for AM is easy to process and will in the as-cladded condition have a hardness of about 35 HRC.

With ageing at 525°C Uddeholm Corrax for AM gets a hardness of 48 HRC and the same excellent corrosion resistance as conventionally produced Uddeholm Corrax.

APPROVALS

Medical

Uddeholm Corrax for AM has been tested and approved for toxicology according to ISO 10993.

OTHER PRODUCTS AND SERVICES

Build plates

To get optimal quality of your hybrid builds is the best choice to use Uddeholm Corrax plates. The build will then have the same properties throughout the part. Pre-machined buildplates are available in suitable dimensions.

FURTHER INFORMATION

Please, contact your local Uddeholm office for further information on the selection, heat treatment, application and availability of Uddeholm tool steels.

WELDING

Good results when welding can be achieved if proper precautions are taken (joint preparation, choice of consumables and welding procedure). If the tool is to be polished, it is necessary to use a filler material that has the same chemical composition as the base material.

Further information is given in the Uddeholm brochure "Welding of Tool Steel".

Welding method	TIG	MIG	LASER
Preheating temperature*	Welding can be done at room temperature when welding in delivery condition and/or severe restraint conditions exist		
Filler metals	Corrax TIG Weld TURBALOY 13-8 Mo	Corrax MIG Weld	Mirrax Laser Weld
Maximum inter-pass temperature	300°C (570°F)		-
Post welding cooling	20 - 40°, 35 - 70°F C/h the first 2 hours then freely in air <70°C, 160°F		7 %
Hardness after welding	30 - 35 HRC		
Heat treatment after welding	See the full welding recommendations document		

* Preheating temperature must be established throughout the die and must be maintained for the entirety of the welding process, to prevent weld cracking.

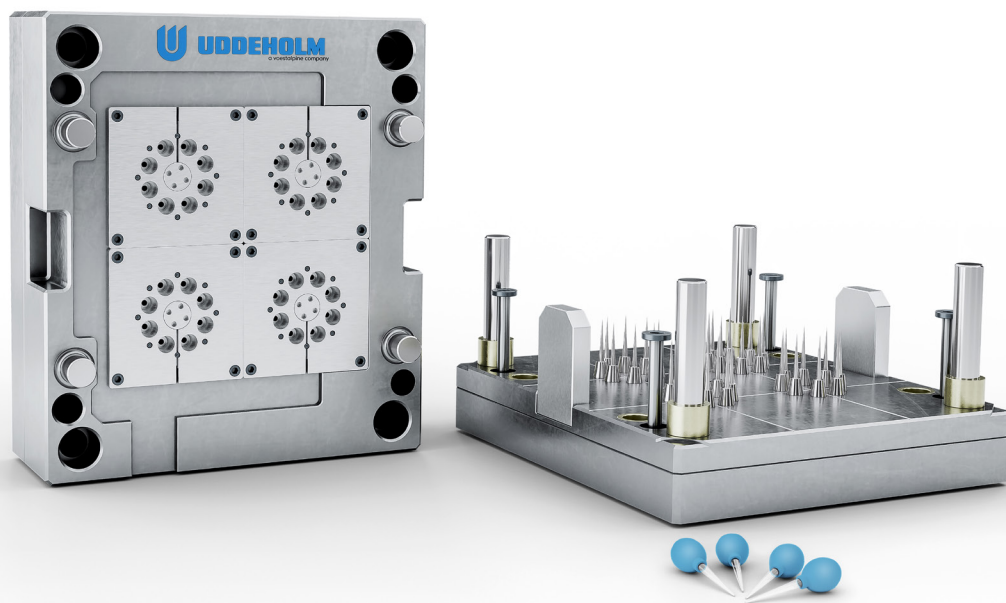
ELECTRICAL DISCHARGE MACHINING – EDM

Uddeholm Corrax for AM can be EDM'd in the same way as ordinary tool steels. The "white layer" will, however, not be as hard and is therefore more easily removed.

Following the EDM process, the applicable die surfaces are covered with a resolidified layer (white layer) and a rehardened and untempered layer, both of which are very brittle and therefore detrimental to die performance. If EDM is used the white layer must be completely removed mechanically by grinding or stoning.

After the finish machining the tool should also be given an additional temper at approximately 25°C (50°F) below the highest previous tempering temperature.

Further information is given in the Uddeholm brochure "EDM of Tool Steel".



Mould for injection moulding

Manufacturing solutions for generations to come

SHAPING THE WORLD®

We are shaping the world together with the global manufacturing industry. Uddeholm manufactures steel that shapes products used in our every day life. We do it sustainably, fair to people and the environment. Enabling us to continue shaping the world
– today and for generations to come.