



*Uddeholm RoyAlloy is produced by Edro Specialty Steels, Inc., a division of the voestalpine Group.  
RoyAlloy is covered by Edro Patents #6,045,633 and #6,358,344.*

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 2, 03.2012

The latest revised edition of this brochure is the English version,  
which is always published on our web site [www.uddeholm.com](http://www.uddeholm.com)



SS-EN ISO 9001  
SS-EN ISO 14001

## General

Uddeholm RoyAlloy is a patented free machining stainless holder steel, which is supplied in the prehardened condition.

Uddeholm RoyAlloy is characterised by:

- Excellent machinability
- Good dimensional stability
- Excellent weldability
- Good corrosion resistance
- Good ductility
- Uniform hardness in all dimensions
- Smooth as-rolled surfaces
- Good indentation resistance

Note: Uddeholm RoyAlloy is ultrasonic tested.

Typical analysis %	C	Si	Mn	Cr	S	Cu	N
	0.05	0.4	1.2	12.6	0.12	+	+
Standard specification	None (patented)						
Delivery condition	Hardened and tempered to 290–330 HB						
Colour code	Yellow/blue with a black line across						

## Applications

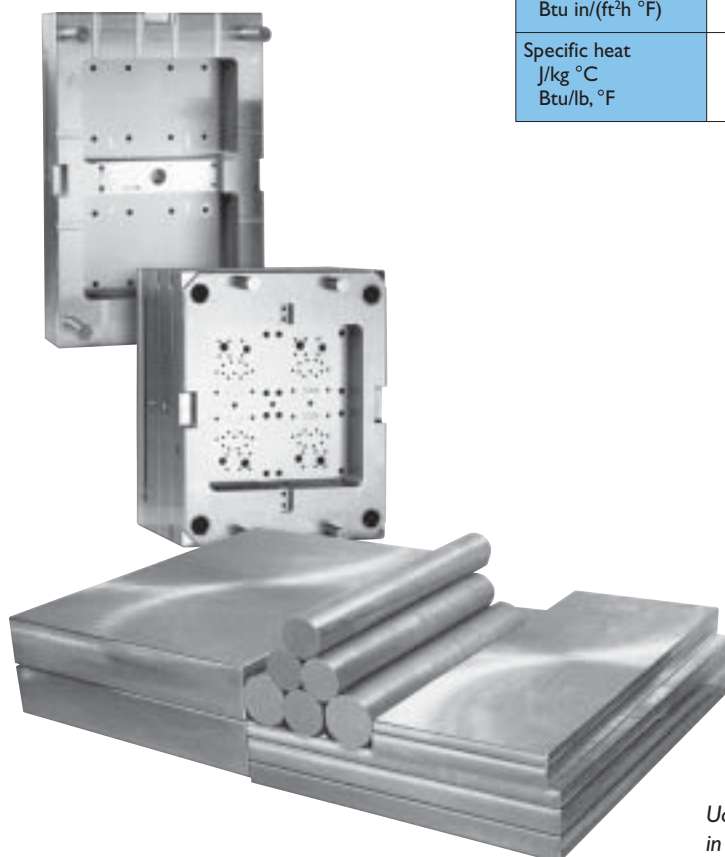
- Mould bases (holders/bolsters, cavity plates, support/backing plates, ejector plates)
- Plastic and rubber moulds with low demands on surface finish
- Dies for plastic extrusion
- Constructional parts

## Properties

### Physical data

Prehardened to 320 HB.

Temperature	20°C (68°F)	100°C (212°F)	200°C (392°F)
Density kg/m <sup>3</sup> lbs/in <sup>3</sup>	7 800 0.284	–	7 750 0.282
Modulus of elasticity MPa psi	200 000 29 × 10 <sup>6</sup>	–	190 000 27.6 × 10 <sup>6</sup>
Coefficient of thermal expansion /°C from 20°C /°F from 68°F	–	–	11.0 × 10 <sup>-6</sup> 6.1 × 10 <sup>-6</sup>
Thermal conductivity W/m °C Btu in/(ft <sup>2</sup> h °F)	–	27.5 191	28 194
Specific heat J/kg °C Btu/lb, °F	–	500 0.120	540 0.129



Uddeholm RoyAlloy is available in both flats and rounds.

## Mechanical properties

### IMPACT STRENGTH

The energy absorption at impact testing depends on the test material (bar size and delivered hardness), test temperature and specimen (type, location, and orientation in the bar).

Charpy-V-notch impact toughness at room temperature tested in the LT-direction. Plate thickness 76 mm (3").

Hardness	320 HB
Impact energy J ft • lbs	22 16

### COMPRESSIVE STRENGTH

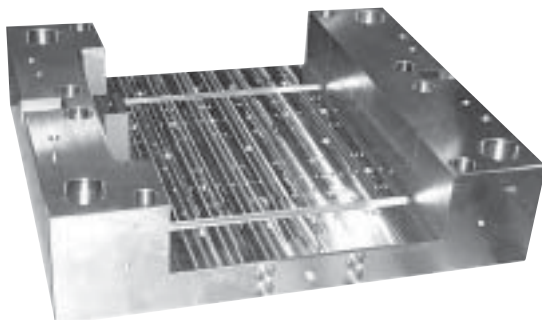
Approximate values.

Hardness	320 HB
Compressive strength, $R_{c0.2}$ MPa psi	760 110 100

### TENSILE STRENGTH

Approximate values. Longitudinal specimens tested at room temperature.

Hardness	320 HB
Yield strength, $R_{p0.2}$ MPa psi	890 129 000
Tensile strength, $R_m$ MPa psi	1 070 155 100
Elongation, A5 %	12
Reduction of area, Z %	34



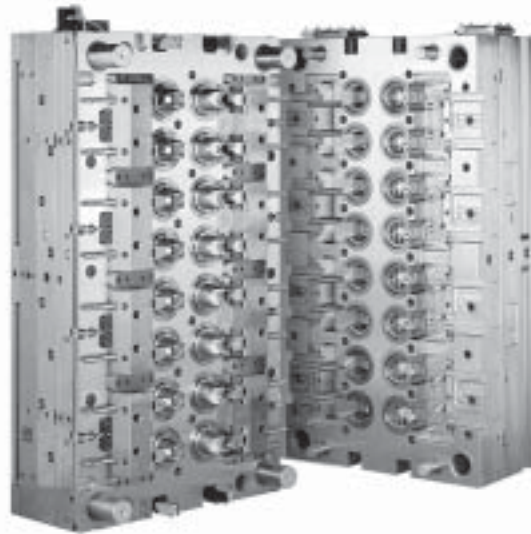
## Corrosion resistance

Uddeholm RoyAlloy was developed with a chemical composition adjusted to sufficiently provide good corrosion resistance during tool operation and storage. Tools made from Uddeholm RoyAlloy will have good resistance to corrosion caused by humid working and storage condition, and when moulding corrosive plastics under normal production conditions.

## Heat treatment

Uddeholm RoyAlloy is supplied in the prehardened condition with through-hardness of 290–330 HB. Each plate is carefully hardness-tested to ensure consistency.

Uddeholm RoyAlloy is intended for use in prehardened condition (i.e. delivery condition), no further heat treatment is generally required.



*Uddeholm RoyAlloy is the preferred steel of choice of many mould makers and end users. Uddeholm RoyAlloy provides enhanced machinability, improved dimensional stability and superior surface finishes compared with AISI 420F/W-Nr. 1.2085 type of steel.*

*Uddeholm RoyAlloy remains dimensionally stable even after extensive machining of 152 x 711 x 813 mm. 0.15 mm distortion, corner to corner.*

# Machining recommendations

The cutting data below are to be considered as guidelines and may require adjustments based on equipment, selection of cutting tools, etc.

Condition: prehardened approx. 320 HB

## Turning

Cutting data parameter	Turning with carbide		Turning with HSS* Fine turning
	Rough turning	Fine turning	
Cutting speed ( $v_c$ ) m/min f.p.m.	130–190 430–620	190–250 620–820	25–28 80–90
Feed ( $f$ ) mm/r i.p.r.	0.2–0.4 0.008–0.016	0.05–0.2 0.002–0.008	0.05–0.3 0.002–0.01
Depth of cut ( $a_p$ ) mm inch	2–4 0.08–0.16	0.5–2 0.02–0.08	0.5–3 0.02–0.1
Carbide designation ISO US	P20–P30 C6–C5 Coated carbide	P10–P20 C7–C6 Coated carbide or cermet	– –

\*HSS = High Speed Steel

## Milling

### FACE AND SQUARE SHOULDER MILLING

Cutting data parameter	Milling with carbide	
	Rough milling	Fine milling
Cutting speed ( $v_c$ ) m/min f.p.m.	130–190 430–620	190–250 620–820
Feed ( $f_z$ ) mm/tooth in/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 0.08–0.2	≤2 ≤0.08
Carbide designation ISO US	P20–P40 C6–C5 Coated carbide	P10–P20 C7–C6 Coated carbide or cermet

## END MILLING

Cutting data parameter	Type of end mill		
	Solid carbide	Carbide indexable insert	HSS
Cutting speed ( $v_c$ ) m/min f.p.m.	80–120 260–390	120–170 390–560	35–40 <sup>1)</sup> 115–130
Feed ( $f_z$ ) mm/tooth in/tooth	0.006–0.20 <sup>2)</sup> 0.0002–0.008 <sup>2)</sup>	0.06–0.20 <sup>2)</sup> 0.002–0.008 <sup>2)</sup>	0.01–0.35 <sup>2)</sup> 0.0004–0.014 <sup>2)</sup>
Carbide designation ISO US	–	P15–P40 C6–C5	–

<sup>1)</sup> For coated HSS end mill  $v_c = 60–66$  m/min (197–217 f.p.m.)

<sup>2)</sup> Depending on radial depth of cut and cutter diameter

## Drilling

### HIGH SPEED STEEL TWIST DRILLS

Drill diameter		Cutting speed ( $v_c$ )		Feed ( $f$ )	
mm	inch	m/min	f.p.m.	mm/r	i.p.r.
–5	–3/16	17–19*	56–62*	0.05–0.10	0.002–0.004
5–10	3/16–3/8	17–19*	56–62*	0.10–0.20	0.004–0.008
10–15	3/8–5/8	17–19*	56–62*	0.20–0.25	0.008–0.010
15–20	5/8–3/4	17–19*	56–62*	0.25–0.30	0.010–0.014

\* For coated HSS drill  $v_c = 29–31$  m/min (95–102 f.p.m.)

### CARBIDE DRILL

Cutting data parameter	Type of drill		
	Indexable insert	Solid carbide	Carbide tip <sup>1)</sup>
Cutting speed ( $v_c$ ) m/min f.p.m.	215–240 715–790	110–130 360–427	70–110 230–360
Feed ( $f$ ) mm/r i.p.r.	0.05–0.15 <sup>2)</sup> 0.002–0.006 <sup>2)</sup>	0.10–0.25 <sup>3)</sup> 0.004–0.010 <sup>3)</sup>	0.15–0.25 <sup>4)</sup> 0.006–0.010 <sup>3)</sup>

<sup>1)</sup> Drill with replaceable or brazed carbide tip

<sup>2)</sup> Feed rate for drill diameter 20–40 mm (0.8"–1.6")

<sup>3)</sup> Feed rate for drill diameter 5–20 mm (0.2"–0.8")

<sup>4)</sup> Feed rate for drill diameter 10–20 mm (0.4"–0.8")

## Grinding

A general grinding wheel recommendation is given below. More information can be found in the Uddeholm publication "Grinding of tool steel".

Type of grinding	Delivery condition
Face grinding straight wheel	A 46 HV
Face grinding segments	A 36 GV
Cylindrical grinding	A 60 KV
Internal grinding	A 60 JV
Profile grinding	A 120 JV

## Welding

Uddeholm RoyAlloy is readily weldable with RoyAlloy filler metal or several standard stainless filler metals, using TIG (GTAW) and MMA (SMAW) processes.

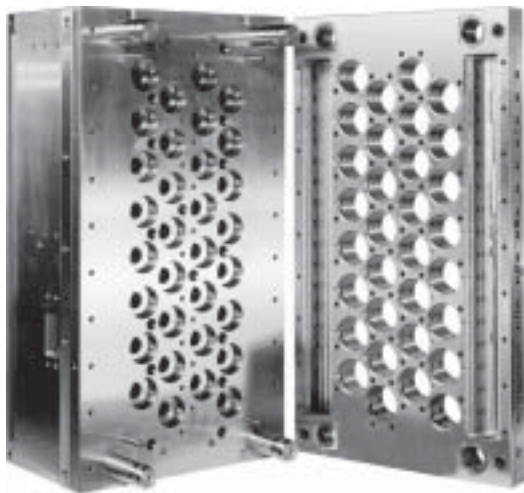
For best results, use Uddeholm RoyAlloy welding electrodes. To provide an optimal match with the base metal in terms of chemical composition and mechanical properties Uddeholm RoyAlloy filler material is recommended. The weld metal hardness after welding will become 34–38 HRC. The welding consumable, as TIG filler rod, is available in Ø 0,9 mm and Ø 1,8 mm.

Neither preheating nor postheating is necessary. Uddeholm RoyAlloy does not develop an overhardened heat-affected zone (HAZ) around the weld deposit. This eliminates the concern of weld-induced cracking during repair or, subsequently, during service.

Stress relieving is recommended for large weld repairs to reduce residual stresses. Max. stress relieving temperature 485°C.

## Further information

Please contact your local Uddeholm office for further information on the selection, heat treatment and application of Uddeholm tool steel, including the publication “Steel for Moulds”.







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. ASSAB is our exclusive sales channel, representing Uddeholm in the Asia Pacific area.

Together we secure our position as the world's leading supplier of tooling materials. We act worldwide, so there is always an Uddeholm or ASSAB representative close at hand to give local advice and support. For us it is all a matter of trust – in long-term partnerships as well as in developing new products. Trust is something you earn, every day.

For more information, please visit [www.uddeholm.com](http://www.uddeholm.com), [www.assab.com](http://www.assab.com) or your local website.