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Global Steel Grade Encyclopedia

涵盖的行业或国家与地区类别

ASTM 国际材料与试验协会 | GJB 国家军用标准 | SAE 国际 动力机械工程师协会 | EU 前欧洲标准化 | AISI 美国钢铁学会 | DIN 德国工业标准 | AMS 国际航空航天材料规范 | ISO 国际标准 | JASO 日本汽车标准组织

EN | JB | UNS | UNI | ASME | SS | GB | JIS

GENERAL

Uddeholm Ramax HH is a chromium alloyed stainless holder steel, which is supplied in the hardened and tempered condition.

Uddeholm Ramax HH is characterized by

- Good corrosion resistance
- Uniform hardness even in large dimensions
- Good indentation resistance
- Good machinability

These properties combine to give a steel with outstanding production performance. The practical benefits of **good corrosion resistance** can be summarized as follows:

- Lower mould maintenance cost
- Lower production costs since water cooling channels are unaffected by corrosion, ensuring consistent cycle time

The practical benefit of the **relatively high hardness** for a prehardened grade can be summarized as:

- less indentations
- less wear

leading to lower mould maintenance cost and longer llife.

Typical analysis %	C	Si	Mn	Cr	Mo	Ni	V	S	+N
	0.12	0.2	1.3	13.4	0.5	1.6	0.2	0.1	
Delivery condition	Hardened and tempered to approx. 320–350 HB								
Colour code	Black/brown with white line across								

APPLICATIONS

- Holders/bolsters for plastic moulds.
- Plastic and rubber moulds with low require ments on polishability
- Dies for plastic extrusion
- Constructional parts

PROPERTIES

PHYSICAL DATA

Hardened and tempered to ~340 HB. Data at room and elevated temperatures.

Temperature	20°C (68°F)	200°C (390°F)
Density kg/m³ lbs/in³	 7 700 0.280	 – –
Modulus of elasticity Mpa psi	 215 000 31.2 x 10^6	 205 000 29.7 x 10^6
Coefficient of thermal expansion per °C from 20°C per °F from 68°F	 – –	 10.8 x 10^{-6} 6.0 x 10^{-6}
Thermal conductivity* W/m °C Btu in/ft² h °F	 – –	 24 166
Specific heat capacity J/kg °C Btu/lb°F	 460 0.110	 –

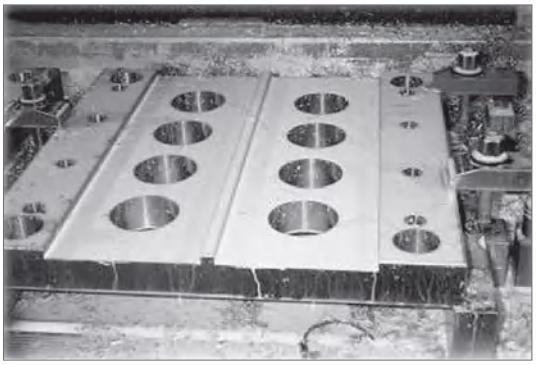
* Thermal conductivity is very difficult to measure. The scatter can be as high as ±15%

TENSILE STRENGTH

Approximate values. Samples were taken from a bar 255 x 60 mm (10 x 2.4") in length direction. Hardness: ~340 HB.

Testing temperature	20°C (68°F)	200°C (390°F)
Tensile strength Rm MPa psi	 1 140 1.65 x 10^5	 1 020 1.48 x 10^5
Yield strength $Rp_{0.2}$ MPa psi	 990 1.44 x 10^5	 920 1.33 x 10^5
Reduction of area Z, %	46	48
Elongation A_5, %	12	10

Note: The high sulphur content gives lower mechanical properties in the transverse compared with the longitudinal direction.



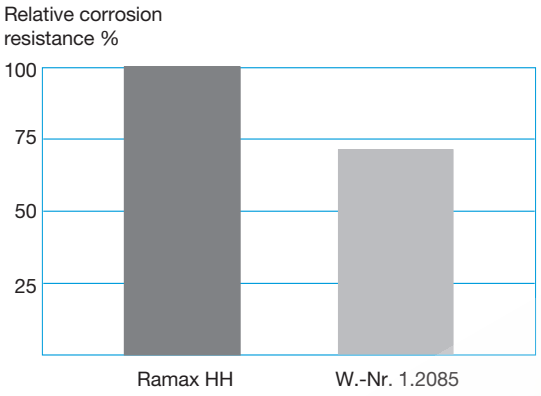
Holder plate.

CORROSION RESISTANCE

Holders made from Uddeholm Ramax HH will have good resistance to corrosion caused by humid working and storage conditions and when moulding corrosive plastics under normal production conditions.

In the graph below values from potentiodynamic polarization curves has been evaluated to show the difference in general corrosion resistance between Uddeholm Ramax HH and W.-Nr. 1.2085.

Specimen size: 20 x 15 x 3 mm (0.8 x 0.6 x 0.12")



HEAT TREATMENT

Uddeholm Ramax HH is intended for use in the as-delivered condition i.e. hardened and tempered to ~340 HB.

When the steel is to be heat treated to higher hardness, instructions below are to be followed.

However, note that an increased hardness yields a lower toughness.

SOFT ANNEALING

Protect the steel and heat through to 740°C (1365°F). Cool at 15°C (30°F) per hour to 550°C (1020°F), then freely in air.

STRESS RELIEVING

After rough machining the tool should be heated through to max. 530°C (985°F), holding time 2 hours, then cool freely in air.

HARDENING

Note: The steel should be annealed before hardening.
Preheating temperature: 500–600°C (930–1110°F).
Austenitizing temperature: 980–1020°C (1795–1870°F).

The steel should be heated through to the austenitizing temperature and held at temperature for 30 minutes.

Protect the tool against decarburization and oxidation during the hardening process.

QUENCHING MEDIA

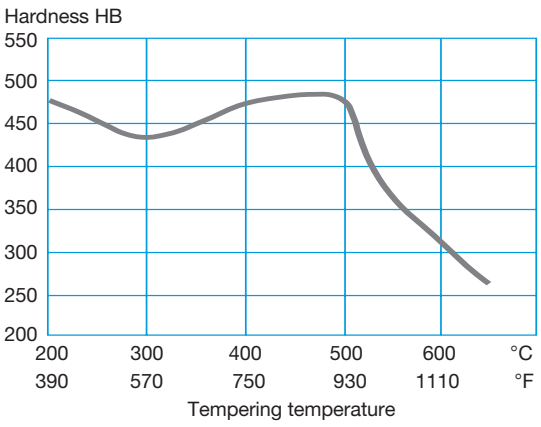
- Oil
- Fluidized bed or salt bath at 250–550°C (480–1020°F), then cool in air blast
- Vacuum with sufficient positive pressure
- High speed gas/circulating atmosphere

In order to obtain the optimum properties, the cooling rate should be as fast is possible within acceptable distortion limits. Temper the tool as soon as its temperature reaches 50–70°C (120–160°F).

TEMPERING

Choose the tempering temperature according to the hardness required by reference to the tempering graph. Temper twice with intermediate cooling to room temperature. Lowest tempering temperature 250°C (480°F). Holding time at temperature minimum 2 hours.

Austenitizing temperature: 1000°C (1830°F), 30 minutes
Holding time: 2 + 2h



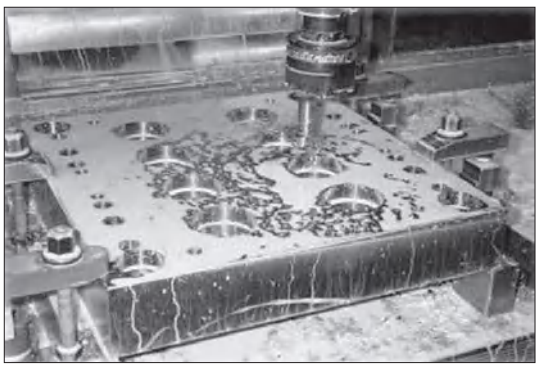
MACHINING RECOMMENDATIONS

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”.

TURNING

Cutting data parameters	Turning with carbide Rough turning	Turning with carbide Fine turning	Turning with HSS Fine turning
Cutting speed (v_c) m/min. f.p.m.	110–160 360–525	160–210 525–690	18–23 59–75
Feed (f) mm/rev i.p.r.	0.2–0.4 0.008–0.016	0.05–0.2 0.002–0.008	0.05–0.3 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 0.02–0.12
Carbide designation ISO US	P20–P30 C6–C5 Coated carbide	P10 C7 Coated carbide or cermet	–

HSS = High Speed Steel



Machinability is a critical property during manufactring of holder plates.

MILLING

FACE AND SQUARE SHOULDER MILLING

Cutting data parameters	Milling with carbide Rough milling	Milling with carbide Fine milling
Cutting speed (v_c) m/min f.p.m.	110–160 360–525	160–200 525–656
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 0.08–0.2	≤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 parameters	Type of milling: Solid carbide	Type of milling: Carbide indexable insert	Type of milling: High speed steel
Cutting speed (v_c) m/min f.p.m.	70–100 230–328	100–140 328–460	30–35[1] 98–115[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 US	–	P15–P40 C6–C5	–

[1] For coated HSS end mill v_c = 50–55 m/min. (164–180 f.p.m)

[2] Depending on radial depth of cut and cutter diameter

DRILLING

HIGH SPEED STEEL TWIST DRILL

Drill diameter inch	Drill diameter mm	Cutting speed (v_c) f.p.m.	Cutting speed (v_c) m/min	Feed (f) i.p.r.	Feed (f) mm/rev
–3/16	≤5	46–52*	14–16*	0.002–0.004	0.05–0.10
3/16–3/8	5–10	46–52*	14–16*	0.004–0.008	0.10–0.20
3/8–5/8	10–15	46–52*	14–16*	0.008–0.010	0.20–0.25
5/8–3/4	15–20	46–52*	14–16*	0.010–0.012	0.25–0.30

* For coated HSS drill v_c = 24–26 m/min. (79–85 f.p.m.)

CARBIDE DRILL

Cutting data parameters	Type of drill		
	Indexable insert	Solid carbide	Carbide tipped[1]
Cutting speed (v_c) m/min	180–200	90–110	60–90
f.p.m.	590–656	295–360	197–295
Feed (f) mm/rev	0.05–0.15[2]	0.08–0.20[3]	0.15–0.25[4]
i.p.r.	0.002–0.006[2]	0.003–0.008[3]	0.006–0.01[4]

[1] Drill with replaceable or brazed carbide tip
[2] Feed rate for drill diameter 20–40 mm (0.8”–1.6”)
[3] Feed rate for drill diameter 5–20 mm (0.2”–0.8”)
[4] 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	Wheel recommendation
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

POLISHABILITY

As other sulphurized steel the polishability is affected by the higher amount of sulphide inclusions and for that reason Uddeholm Ramax HH should only be used in tools with low to moderate demands on polishability.

WELDING

Good results when welding tool steel can be achieved if proper precautions are taken during welding (elevated working temperature, joint preparation, choice of consumables and welding procedure).

Welding method	TIG (GTAW)		MMA (SMAW
Working temperature	200–250°C (390–480°F)		200–250°C (390–480°F)
Welding consumables	STAVAX TIG-WELD	Austenitic stainless steel Type ER312	Austenitic stainless steel Type E312
Hardness after welding	54–56 HRC	28–30 HRC	28–30 HRC
Hardness after tempering* 2 x 2h at 530°C (990°F)	50–52 HRC	28–30 HRC	28–30 HRC
1 x 2h at 600°C (1220°F)	41–43 HRC	–	–

* A tempering temperature higher than 530°C (990°F) causes a reduction of the base material hardness. Tempering at 600°C (1220°F) reduce the hardness of the base material with 2–3 HRC.

Uddeholm Ramax HH has a high sulphur content, which means an increased risk for hot cracking during welding. To minimize the risk, keep the dilution as low as possible.

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

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”.