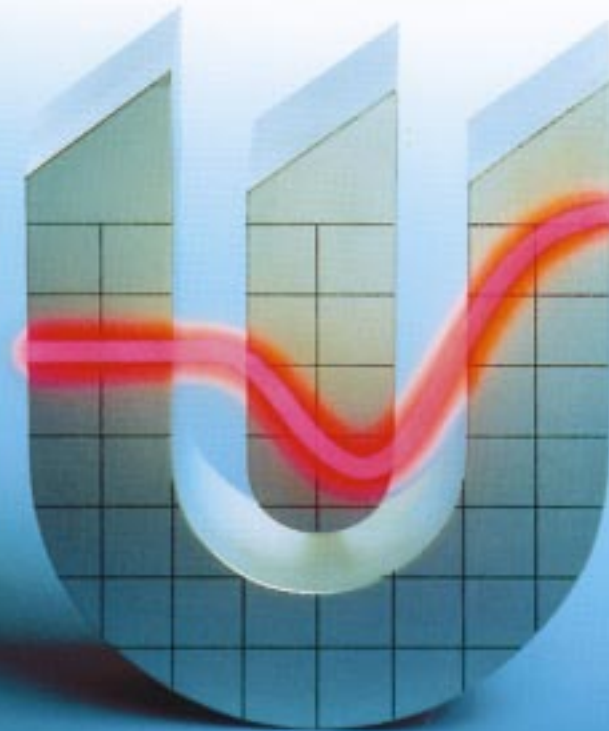




RAMAX[®] S
**Prehardened
stainless holder steel**



 **UDDEHOLM**

Great Tooling Starts Here!

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.

General

RAMAX S is a chromium alloyed stainless holder steel, which is supplied in the hardened and tempered condition.

RAMAX S is characterized by

- Excellent machinability
- Good corrosion resistance
- Uniform hardness in all dimensions
- Good indentation resistance.

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

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

The practical benefits of the **excellent machinability** can be summarized as follows:

- Lower mold production costs due to:
- less wear of the cutting edges in the milling and drilling operations
- increased cutting speed can be used giving shorter machining time.

RAMAX S is supplied in the premachined condition which offers the following cost saving advantages:

- Less machining needed
- Saving of weight
- Machining tolerances on the nominal size
- Absence of scale minimizes tool and machine wear
- Surfaces free from decarburization.

Typical analysis %	C	Si	Mn	Cr	S
	0,33	0,35	1,35	16,7	0,12
Standard specification	(AISI 420 F)				
Delivery condition	Hardened and tempered to ~ 340 HB				
Color code	Black/brown				

Applications

- Holders/bolsters for plastic molds. RAMAX S in combination with STAVAX ESR or ELMAX as insert material gives a completely corrosion resistant mold.
- Plastic and rubber molds with low requirements on polishability.
- Dies and callipers for plastic extrusion.
- Constructional parts.

Properties

PHYSICAL DATA

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

Temperature	68°F (20°C)	390°F (200°C)
Density, kg/m ³ lbs/in ³	7 800 0,282	7 750 0,280
Modulus of elasticity N/mm ² psi	200 000 29,0 x 10 ⁶	190 000 27,6 x 10 ⁶
Coefficient of thermal expansion per °F from 68°F per °C from 20°C	– –	6,1 x 10 ⁻⁶ 11,0 x 10 ⁻⁶
Thermal conductivity*) Btu in/ft ² h °F W/m °C	– –	159 23
Specific heat capacity Btu/lb °F J/kg °C	0,110 460	– –

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

IMPACT STRENGTH

Approximate values. Samples were taken from a round bar 1,1" (28 mm). Hardness: 340 HB.

Testing temperature	68°F (20°C)	390°F (200°C)
Impact strength KV, joule	15	25

TENSILE STRENGTH

Approximate values. Samples were taken from a round bar 1,1" (28 mm). Hardness: 340 HB.

Testing temperature	68°F (20°C)	390°F (200°C)
Tensile strength Rm, N/mm ² psi	1100 159 500	1000 145 000
Yield strength Rp0,2 N/mm ² psi	910 132 000	820 119 000
Reduction of area Z %	30	30
Elongation A ₅ %	10	10

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

CORROSION RESISTANCE

Holders made from RAMAX S will have good resistance to rusting caused by humid working and storage conditions and when molding corrosive plastics under normal production conditions.

Heat treatment

RAMAX S 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 is to be followed

SOFT ANNEALING

Protect the steel and heat through to 1580°F (860°C). Cool at 35°F (20°C) per hour to 1200°F (650°C), then freely in air.

STRESS RELIEVING

After rough machining the tool should be heated through to max. 1020°F (550°C), holding time 2 hours, then cool freely in air.

HARDENING

Note: The steel should be fully soft annealed before hardening.

Preheating temperature: 930–1110°F (500–600°C).

Austenitizing temperature: 1830–1890°F (1000–1030°C).

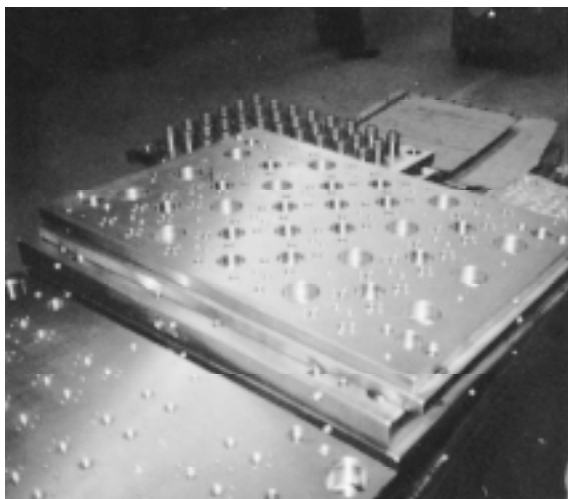
The steel should be heated through to the austenitizing temperature and held at temperature for 30 minutes.

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

QUENCHING MEDIA

- Circulating atmosphere/gas
- Oil
- Martempering bath 390–1020°F (200–550°C), then cool in air.

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

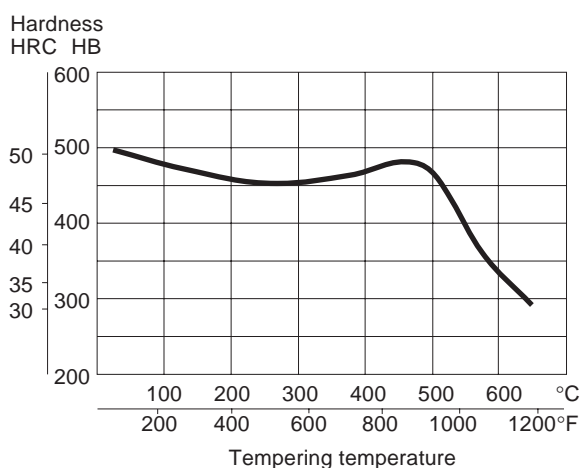


TEMPERING

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 360°F (180°C). Holding time at temperature minimum 2 hours.

The diagram is valid for small samples quenched in air.

Austenitizing temperature: 1890°F (1030°C), 30 min. Holding time: 2 + 2 h



Holder block in RAMAX S.

Machining

The cutting data below are to be considered as guiding values which must be adapted to existing local conditions.

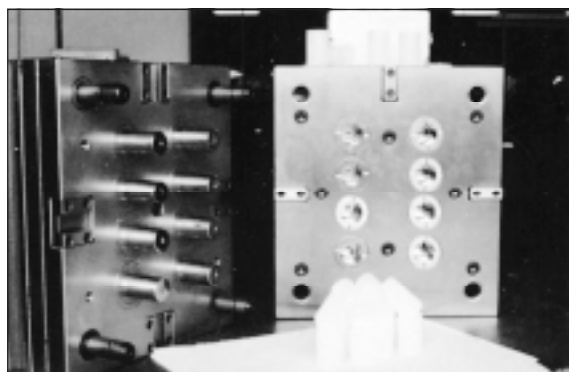
TURNING

Cutting data parameters	Turning with carbide		Turning with high speed steel
	Rough turning	Fine turning	Fine turning
Cutting speed (v_c) f.p.m. m/min	295–395 90–120	395–525 120–160	65 20
Feed (f) i.p.r. mm/r	0,012–0,023 0,3–0,6	$\leq 0,012$ $\leq 0,3$	$\leq 0,012$ $\leq 0,3$
Depth of cut (a_p) inch mm	0,08–0,23 2–6	$\leq 0,08$ ≤ 2	$\leq 0,08$ ≤ 2
Carbide designation US ISO	C6–C5 P20–P40 Coated carbide	C7 P10–P15 Coated carbide or cermet	– –

MILLING

Face and square shoulder face milling

Cutting data parameters	Milling with carbide		Milling with high speed steel
	Rough milling	Fine milling	Fine milling
Cutting speed (v_c) f.p.m. m/min	230–330 70–100	330–490 100–150	65 20
Feed (f_z) inch/tooth mm/tooth	0,008–0,016 0,2–0,4	0,004–0,008 0,1–0,2	0,004 0,1
Depth of cut (a_p) inch mm	0,08–0,20 2–5	$\leq 0,08$ ≤ 2	$\leq 0,08$ ≤ 2
Carbide designation US ISO	C6–C5 P10–P40 Coated carbide	C7–C6 P10–P20 Coated carbide	– –



End milling

Cutting data parameters	Type of end mill		
	Solid carbide	Carbide indexable insert	High speed steel
Cutting speed (v_c) f.p.m. m/min	200 60	330–395 100–120	100 ¹⁾ 30 ¹⁾
Feed (f_z) inch/tooth mm/tooth	0,002–0,015 ²⁾ 0,05–0,40 ²⁾	0,004–0,008 ²⁾ 0,1–0,2 ²⁾	0,002–0,015 ²⁾ 0,05–0,40 ²⁾
Carbide designation US ISO	C5 K10, P40	C6 P20–P30	– –

¹⁾ For coated HSS end mill $v_c \approx 150$ f.p.m. (≈ 45 m/min).

²⁾ Depending radial depth of cut and cutter diameter.

DRILLING

High speed steel twist drill

Drill diameter		Cutting speed (v_c)		Feed (f)	
inch	mm	f.p.m.	m/mm	i.p.r.	mm/r
$\leq 0,20$	≤ 5	50*	15*	0,003–0,008	0,08–0,20
0,20–0,40	5–10	50*	15*	0,008–0,012	0,20–0,30
0,40–0,60	10–15	50*	15*	0,012–0,014	0,30–0,35
0,60–0,80	15–20	50*	15*	0,014–0,016	0,35–0,40

*) For TiN coated HSS drills $v_c = 60$ f.p.m. (18 m/min).

Carbide drill

Cutting data parameters	Type of drill		
	Indexable insert	Solid carbide	Brazed carbide ¹⁾
Cutting speed (v_c) f.p.m. m/min	425 130	180 55	130 40
Feed (f) i.p.r. mm/r	0,002–0,010 ²⁾ 0,05–0,25	0,004–0,010 ²⁾ 0,10–0,25	0,006–0,010 ²⁾ 0,15–0,25

¹⁾ Drill with internal cooling channels and brazed carbide tip.

²⁾ Depending on drill diameter.

GRINDING

A general grinding wheel recommendation is given below. More information can be found in the Uddeholm brochure "Grinding of Tool Steel".

Type of grinding	As delivered condition
Surface grinding straight wheel	A 46 HV
Surface grinding segments	A 24 GV
Cylindrical grinding	A 46 LV
Internal grinding	A 46 JV
Profile grinding	A 100 LV

Holder block in RAMAX S and mold inserts in STAVAX ESR. An ideal combination for long production runs.

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	MMA (SMAW)
Working temperature	390–480°F 200–250°C	390–480°F 200–250°C
Welding consumables	STAVAX TIG-WELD	STAVAX WELD
Hardness after welding	54–56 HRC	54–56 HRC
Weld hardness after tempering 2x1 h at 1060°F (570°C*)	41–43 HRC	41–43 HRC

**) A higher tempering temperature will decrease the hardness of the base material.*

RAMAX S has a high sulfur content, which means an increased risk for hot cracking during welding. To minimize the risk, keep the molten pool as small 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 steels, including the publication “Steels for Molds”.

