

HOLDAX

Prehardened holder steel

COLD WORK

PLASTIC MOULDING

HOT WORK

HIGH PERFORMANCE STEEL



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

Holdax is a vacuum-degassed chromium-molybdenum-alloyed steel which is supplied in the hardened and tempered condition.

Holdax is characterized by

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

Holdax is supplied premachined which offers the following advantages compared with un-machined material:

- Saving of weight
- Non-decarburized surface
- Exact nominal size (plus tolerance)
- Less machining
- Absence of scale minimizes machine and tool wear.

Typical analysis %	C 0,40	Si 0,4	Mn 1,5	S 0,07	Cr 1,9	Mo 0,2
Standard specification	AISI 4130–35 improved, W.-Nr. 1.2312					
Delivery condition	Hardened and tempered to 290–330 HB					
Colour code	Yellow/blue					

Applications

- Holders/bolsters for plastic moulds and die casting dies
- Plastics and rubber moulds with low requirements on polishability
- Support plates
- Constructional parts.



Properties

PHYSICAL DATA

Hardened and tempered to 310 HB.

Temperature	20°C (68°F)	200°C (390°F)
Density, kg/m ³ lbs/in ³	7800 0,282	7750 0,280
Coefficient of thermal expansion per °C from 20°C per °F from 68°F	–	12,7 x 10 ⁻⁶ 6,1 x 10 ⁻⁶
Thermal conductivity W/m °C Btu in/ft ² h °F	–	33 225
Modulus of elasticity N/mm ² p.s.i.	200 000 29,0 x 10 ⁶	195 000 28,3 x 10 ⁶
Specific heat capacity J/kg °C Btu/lb°F	460 0,110	–

MECHANICAL PROPERTIES

The tensile and compressive strength depends on the delivery hardness.

Tensile strength

Tensile strength, R _m	800–1100 N/mm ² 116 000–159 000 p.s.i.
Yield strength, R _{p0,2}	750–950 N/mm ² 109 000–138 000 p.s.i.

At 200°C (390°F) the tensile strength and the yield strength are approx. 100 N/mm² lower than at room temperature.

Compressive strength

Yield strength, R _{c0,2}	850–1000 N/mm ² 123 000–145 000 p.s.i.
-----------------------------------	--

The high sulphur content gives worse mechanical properties in the transverse direction compared with the longitudinal direction.

Deep cavities are quickly and easily machined in holder blocks made of Holdax, due to its excellent machining properties.

Heat treatment

Holdax is intended for use in the as-delivered condition. 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 720°C (1330°F), holding time 2 hours. Cool in furnace at 10°C (50°F) per hour to 600°C (1110°F), then freely in air.

STRESS TEMPERING

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

HARDENING

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

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

Austenitizing temperature: 850°C (1560°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

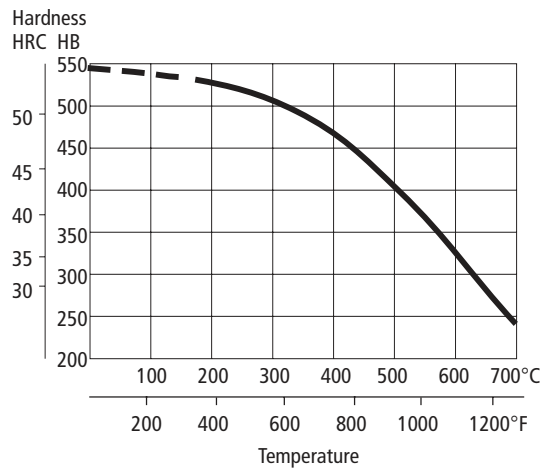
- Forced air/atmosphere (only for small tools)
- Oil
- Martempering bath 450–550°C (840–1020°F) max. 4 min., then cool in forced air.

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

The diagram below is valid for small samples (15 x 15 x 40 mm) quenched in air.
Austenitizing temperature: 850°C (1560°F), 30 min.
Holding time: 2 + 2 h.



FLAME AND INDUCTION HARDENING

Holdax can be flame or induction hardened to a hardness of approximate 50 HRC. Cooling in air is preferable. However, small tools sometimes require forced air cooling. Temper immediately after hardening.

Further information is given in the Uddeholm brochure "Flame hardening of Impax Supreme".

NITRIDING AND NITROCARBURIZING

Nitriding gives a hard surface layer which is very resistant to wear and erosion. A nitrided surface also increases the corrosion resistance.

For best result the following steps should be followed:

1. Rough machining
2. Stress tempering at 550°C (1020°F)
3. Fine machining
4. Nitriding.

Following surface hardness and nitriding depths will be achieved after nitriding/nitrocarburizing.

	Temperature		Time h	Surface hardness HV	Depth of case approx.	
	°C	°F			mm	in.
Gas-nitriding	510	950	10	750	0,20	0,008
	510	950	30	750	0,30	0,012
	510	950	60	750	0,40	0,016
Ion-nitriding	480	895	10	750	0,20	0,008
	480	895	30	750	0,25	0,010
	480	895	60	750	0,35	0,014
Nitrocarburizing –gas –salt bath	580	1060	2,5	600	0,25	0,010
	580	1060	1	650	0,15	0,006

Machining recommendation

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 Fine turning
	Rough turning	Fine turning	
Cutting speed (v_c) m/min. f.p.m.	140–190 460–620	190–240 620–790	20–25 65–80
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 0,002–0,012
Dept 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–P20 Coated carbide or cermet	–

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	18–20*	60–65*	0,08–0,20	0,003–0,008
5–10	3/16–3/8	18–20*	60–65*	0,20–0,30	0,008–0,012
10–15	3/8–5/8	18–20*	60–65*	0,30–0,35	0,012–0,014
15–20	5/8–3/4	18–20*	60–65*	0,35–0,40	0,014–0,016

* For coated HSS drills $v_c = 32–34$ m/min (105–112 f.p.m.).

Carbide drills

Cutting data parameters	Type of drill		
	Indexable insert	Solid carbide	Brazed carbide ¹⁾
Cutting speed (v_c) m/min. f.p.m.	120–150 390–490	200–220 655–720	70–90 230–295
Feed (f) mm/r i.p.r.	0,05–0,25 ²⁾ 0,002–0,010 ²⁾	0,10–0,25 ²⁾ 0,004–0,010 ²⁾	0,15–0,25 ²⁾ 0,006–0,010 ²⁾

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

²⁾ Depending on drill diameter.

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.	80–150 260–490	150–190 490–620
Feed (f_z) mm/tooth in/tooth	0,2–0,4 0,008–0,016	0,1–0,2 0,004–0,008
Dept of cut (a_p) mm inch	2–4 0,08–0,16	–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 insert	High speed steel
Cutting speed (v_c) m/min. f.p.m.	70–110 230–360	80–120 260–390	20–25 ¹⁾ 65–80 ¹⁾
Feed (f_z) mm/tooth in/tooth	0,03–0,20 ²⁾ 0,001–0,008	0,08–0,20 ²⁾ 0,003–0,008	0,05–0,35 ²⁾ 0,002–0,014
Carbide designation ISO	K10, P40	P20–P30	–

¹⁾ For coated HSS end mill $v_c = 40–45$ m/min. (130–148 f.p.m.).

²⁾ Depending on radial depth of cut and cutting diameter.

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	Prehardend condition
Face grinding straight wheel	A 46 HV
Face grinding segments	A 24 GV
Cylindrical grinding	A 60 KV
Internal grinding	A 60 JV
Profile grinding	A 100 LV

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	200–250°C (390–480°F)	200–250°C (390–480°F)
Welding consumables	IMPAX TIG-WELD	IMPAX WELD
Hardness after welding	320–350 HB	320–350 HB

Holdax 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 steels, including the publication "Steels for Moulds".

UDDEHOLM EUROPE**AUSTRIA**

UDDEHOLM
Hansaallee 321
D-40549 Düsseldorf
Telephone: +49 211 535 10
Telefax: +49 211 535 12 80

BELGIUM

UDDEHOLM N.V.
Waterstraat 4
B-9160 Lokeren
Telephone: +32 9 349 11 00
Telefax: +32 9 349 11 11

CROATIA

BOHLER UDDEHOLM Zagreb
d.o.o za trgovinu
Zitnjak b.b
10000 Zagreb
Telephone: +385 1 2459 301
Telefax: +385 1 2406 790

CZECHIA

BOHLER UDDEHOLM CZ s.r.o.
Division Uddeholm
U silnice 949
161 00 Praha 6 Ruzyně
Czech Republic
Telephone: +420 233 029 850
Telefax: +420 233 029 859

DENMARK

UDDEHOLM A/S
Kokmose 8, Bramdrupdam
DK-6000 Kolding
Telephone: +45 75 51 70 66
Telefax: +45 75 51 70 44

ESTONIA

UDDEHOLM TOOLING AB
Silikatsiidi 7
EE-0012 Tallinn
Telephone: +372 655 9180
Telefax: +372 655 9181

FINLAND

OY UDDEHOLM AB
Ritakuja 1, PL 57,
FIN-01741 VANTAA
Telephone: +358 9 290 490
Telefax: +358 9 2904 9249

FRANCE

UDDEHOLM S.A.
12 Rue Mercier, Z.I. de Mitry-Compans
F-77297 Mitry Mory Cedex
Telephone: +33 (0)1 60 93 80 10
Telefax: +33 (0)1 60 93 80 01

Branch office

UDDEHOLM S.A.
77bis, rue de Vesoul
La Nef aux Métiers
F-25000 Besançon
Telephone: +33 381 53 12 19
Telefax: +33 381 53 13 20

GERMANY

UDDEHOLM
Hansaallee 321
D-40549 Düsseldorf
Telephone: +49 211 535 10
Telefax: +49 211 535 12 80

Branch offices

UDDEHOLM
Falkenstrasse 21
D-65812 Bad Soden/TS.
Telephone: +49 6196 659 60
Telefax: +49 6196 659 625

UDDEHOLM

Albstraße 10
D-73765 Neuhausen
Telephone: +49 715 898 65-0
Telefax: +49 715 898 65-25

GREAT BRITAIN, IRELAND

UDDEHOLM UK LIMITED
European Business Park
Taylors Lane, Oldbury
West Midlands B69 2BN
Telephone: +44 121 552 55 11
Telefax: +44 121 544 29 11

Dublin Telephone: +353 1 45 14 01

GREECE

UDDEHOLM STEEL TRADING

COMPANY
20, Athinon Street
G-Piraeus 18540
Telephone: +30 2 10 41 72 109/41 29 820
Telefax: +30 2 10 41 72 767

SKLERO S.A.

Steel Trading Comp. and
Hardening Shop
Frixou 11/Nikif. Ouranou
G-54627 Thessaloniki
Telephone: +30 31 51 46 77
Telefax: +30 31 54 12 50

HUNGARY

UDDEHOLM TOOLING/BOK
Dunaharaszti, Jedlik Ányos út 25
H-2331 Dunaharaszti 1.Pf. 110
Telephone/Telefax: +36 24 492 690

ITALY

UDDEHOLM Italia S.p.A.
Via Palizzi, 90
I-20157 Milano
Telephone: +39 02 35 79 41
Telefax: +39 02 390 024 82

LATVIA

UDDEHOLM TOOLING AB
Deglava street 50
LV-1035 Riga
Telephone: +371 7 701 983, -981, -982
Telefax: +371 7 701 984

LITHUANIA

UDDEHOLM TOOLING AB
BE PLIENAS IR METALAI
T. Masiulio 18b
LT-3014 Kaunas
Telephone: +370 37 370613, -669
Telefax: +370 37 370300

THE NETHERLANDS

UDDEHOLM B.V.
Isolatorweg 30
NL-1014 AS Amsterdam
Telephone: +31 20 581 71 11
Telefax: +31 20 684 86 13

NORWAY

UDDEHOLM A/S
Jernkroken 18
Postboks 85, Kalbakken
N-0902 Oslo
Telephone: +47 22 91 80 00
Telefax: +47 22 91 80 01

POLAND

INTER STAL CENTRUM
Sp. z. o.o./Co. Ltd.
ul. Kolejowa 291, Dziekanów Polski
PL-05-092 Lomianki
Telephone: +48 22 429 2260
Telefax: +48 22 429 2266

PORTUGAL

F RAMADA Aços e Industrias S.A.
P.O. Box 10
P-3881 Ovar Codex
Telephone: +351 56 58 61 11
Telefax: +351 56 58 60 24

ROMANIA

BÖHLER Romania SRL
Uddeholm Branch
Str. Atomistilor Nr 14A
077125 Magurele Jud Ilfov
Telephone: +40 214 575007
Telefax: +40 214 574212

RUSSIA

UDDEHOLM TOOLING CIS
25 A Bolshoy pr PS
197198 St. Petersburg
Telephone: +7 812 233 9683
Telefax: +7 812 232 4679

SLOVAKIA

UDDEHOLM Slovakia
Nástrojové ocele, s.r.o
KRÁČINY 2
036 01 Martin
Telephone: +421 842 4 300 823
Telefax: +421 842 4 224 028

SLOVENIA

UDDEHOLM Italia S.p.A.

Via Palizzi, 90
I-20157 Milano
Telephone: +39 02 35 79 41
Telefax: +39 02 390 024 82

SPAIN

UDDEHOLM
Guifré 690-692
E-08918 Badalona, Barcelona
Telephone: +34 93 460 1227
Telefax: +34 93 460 0558

Branch office

UDDEHOLM
Barrio San Martin de Arteaga, 132
Pol.Ind. Torrelarragoiti
E-48170 Zamudio
(Bizkaia)
Telephone: +34 94 452 13 03
Telefax: +34 94 452 13 58

SWEDEN

UDDEHOLM TOOLING
SVENSKA AB
Aminogatan 25
SE-431 53 Mölndal
Telephone: +46 31 67 98 50
Telefax: +46 31 27 02 94

SWITZERLAND

HERTSCH & CIE AG
General Wille Strasse 19
CH-8027 Zürich
Telephone: +41 1 208 16 66
Telefax: +41 1 201 46 15

UDDEHOLM**NORTH AMERICA****USA**

UDDEHOLM
4902 Tollview Drive
Rolling Meadows IL 60008
Telephone: +1 847 577 22 20
Telefax: +1 847 577 80 28

UDDEHOLM

548 Clayton Ct.,
Wood Dale IL 60191
Telephone: +1 630 350 10 00
Telefax: +1 630 350 08 80

UDDEHOLM

9331 Santa Fe Springs Road
Santa Fe Springs, CA 90670
Telephone: +1 562 946 65 03
Telefax: +1 562 946 77 21

UDDEHOLM

220 Cherry Street
Shrewbury, MA 01545
Telephone: +1 508 845 1066
Telefax: +1 508 845 3471

CANADA

UDDEHOLM LIMITED
2595 Meadowvale Blvd.
Mississauga, Ontario L5N 7Y3
Telephone: +1 905 812 9440
Telefax: +1 905 812 8659

MEXICO

ACEROS BOHLER UDDEHOLM,
S.A. de C.V.
Calle 8 No 2, Letra "C"
Fraccionamiento Industrial Alce Blanco
C.P. 52787 Naucalpan de Juarez
Estado de Mexico
Telephone: +52 55 9172 0242
Telefax: +52 55 5576 6837

UDDEHOLM

Lerdo de Tejada No.542
Colonia Las Villas
66420 San Nicolas de Los Garza, N.L.
Telephone: +52 8-352 5239
Telefax: +52 8-352 5356

**UDDEHOLM
SOUTH AMERICA****ARGENTINA**

UDDEHOLM S.A
Mozart 40
1619-Centro Industrial Garin
Garin-Prov. Buenos Aires
Telephone: +54 332 744 4440
Telefax: +54 332 745 3222

BRAZIL

UDDEHOLM ACOS ESPECIAIS Ltda.
Estrada Yae Massumoto, 353
CEP 09842-160
Sao Bernardo do Campo - SP Brazil
Telephone: +55 11 4393 4560, -4554
Telefax: +55 11 4393 4561

**UDDEHOLM
SOUTH AFRICA**

UDDEHOLM Africa (Pty) Ltd.
P.O. Box 539
ZA-1600 Isando/Johannesburg
Telephone: +27 11-974 2781
Telefax: +27 11-392 2486

**UDDEHOLM
AUSTRALIA**

BOHLER-UDDEHOLM Australia
129-135 McCredie Road
Guildford NSW 2161
Private Bag 14
Telephone: +61 2 9681 3100
Telefax: +61 2 9632 6161

Branch offices

Sydney, Melbourne, Adelaide,
Brisbane, Perth, Newcastle,
Launceston, Albury, Townsville

ASSAB**ASSAB INTERNATIONAL**

Skytteholmsvägen 2
P O Box 42
SE-171 11 Solna
Sweden
Telephone: +46 8 564 616 70
Telefax: +46 8 25 02 37

Subsidiaries

India, Iran, Turkey, United Arab
Emirates
Distributors in
Africa, Latin America, Middle East

ASSAB PACIFIC

ASSAB Pacific Pte. Ltd
171, Chin Swee Road
No. 07-02, San Centre
Singapore 169877
Telephone: +65 534 56 00
Telefax: +65 534 06 55

Subsidiaries

China, Hong Kong, Indonesia, Japan,
Korea, Malaysia, Philippine Islands,
Singapore, Taiwan, Thailand

When the first idea pops into your head, throughout the development process to the release of the new product, we'll be your partner. As the world's leading supplier of tooling materials and related services, we can be trusted. Meet us under the Uddeholm and ASSAB brands, wherever in the world you have your business.



WWW.UDDEHOLM.COM

Edition: 4, 06.2005