

IMPAX Hi Hard

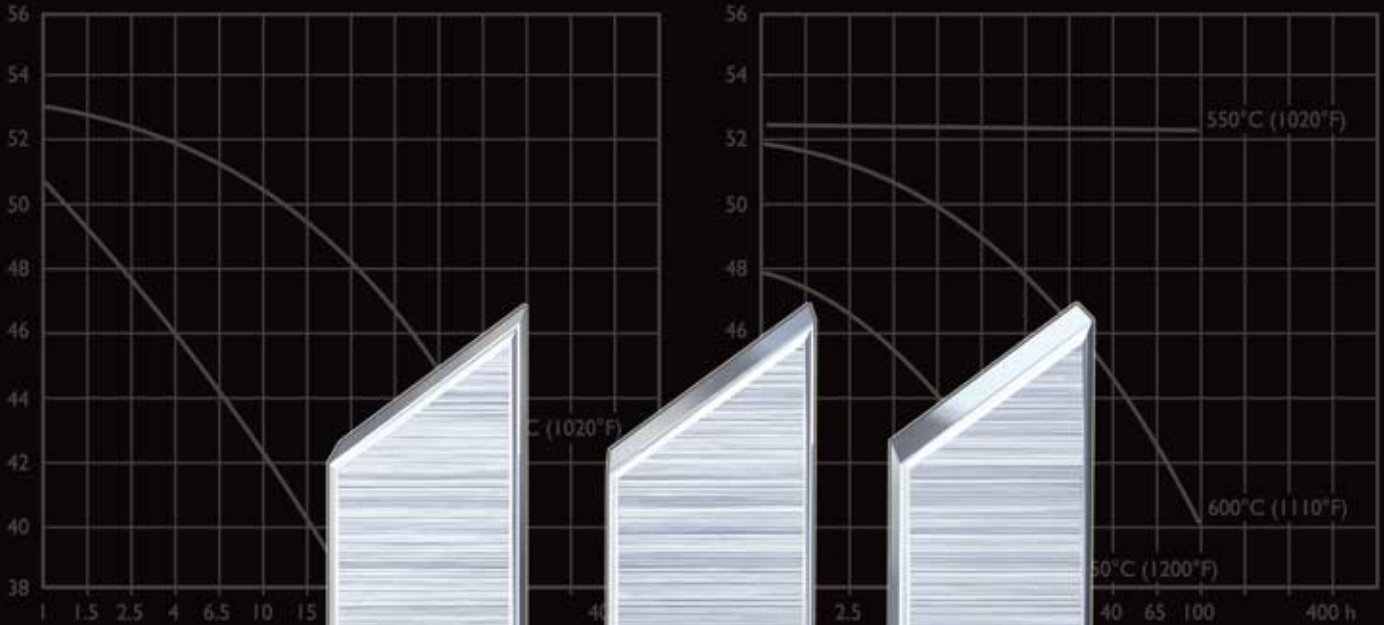
Prehardened mould steel

COLD WORK

PLASTIC MOULDING

HOT WORK

HIGH PERFORMANCE STEEL



Typical analysis %	C 2,05	Cr 1,5	W 0,2	Typical analysis %	Mn 0,8	Cr 4,5	W 0,2
Standard specification	AISI D6, (EN 1.2716)			Standard specification	DIN 1.2716 (W.Nr. 1.2796)		
Delivery condition	Soft annealed			Delivery condition	Soft annealed to approx. 200 HB		
Colour code	Red			Colour code	Red		

Temperature	20°C (68°F)	200°C (390°F)	400°C (750°F)
Density kg/m ³ lbs/m ³	7 770 0,281	7 700 0,277	7 650 0,275
Modulus of elasticity N/mm ² psi	194 000 28,1 × 10 ⁶	188 000 27,3 × 10 ⁶	173 000 25,1 × 10 ⁶
Coefficient of thermal expansion per °C from 20°C per °F from 68°F	to 100°C 11,7 × 10 ⁻⁶ to 212°F 6,5 × 10 ⁻⁶	to 200°C 12 × 10 ⁻⁶ to 400°F 6,7 × 10 ⁻⁶	to 400°C 13,0 × 10 ⁻⁶ to 750°F 7,3 × 10 ⁻⁶
Thermal conductivity W/m °C Btu in (ft ² h°F)	-	27 187	32 221
Specific heat K/kg °C Btu/lbs °F	455 0,109	525 0,126	608 0,145

General

IMPAX Hi Hard is a prehardened mould steel with a higher hardness, 360–400 HB, than well-known IMPAX SUPREME. The higher hardness gives an increased resistance to wear and indentations which means enhanced mould life.

The chemical composition and way of manufacture is the same as for IMPAX SUPREME which means that IMPAX Hi Hard has the same very good polishability and etchability that is characteristic for IMPAX SUPREME.

IMPAX Hi Hard is manufactured to consistently high quality standards with a very low sulphur content, giving a steel with the following characteristics:

- Good polishing and photo-etching properties
- High purity and good homogeneity
- Uniform hardness.

Note: IMPAX Hi Hard is 100% ultrasonic tested.

Approx. analysis %	C 0,37	Si 0,3	Mn 1,4	Cr 2,0	Ni 1,0	Mo 0,2	S <0,010
Standard spec.	AISI P20 modified						
Delivery condition	Hardened and tempered to 360–400 HB						
Colour code	Brown						

Applications

IMPAX Hi Hard is used for the same applications as IMPAX SUPREME, but mainly when demands on strength and wear resistance are somewhat higher:

- Injection moulds for thermoplastics
- Extrusion dies for thermoplastics
- Blow moulds
- Structural components, shafts.

Properties

PHYSICAL DATA

Delivery condition.

Temperature	20°C (68°F)	200°C (390°F)
Density, kg/m ³ lbs/in ³	7 800 0,282	7 750 0,280
Coefficient of thermal expansion per °C from 20° per °F from 68°F	– –	12,7 x 10 ⁻⁶ 7,0 x 10 ⁻⁶
Thermal conductivity W/m °C Btu in/ft ² h °F	29,0 202	30,0 205
Modulus of elasticity N/mm ² psi	205 000 29,7 x 10 ⁶	200 000 29,0 x 10 ⁶
Specific heat capacity J/kg °C Btu/lb °F	460 0,110	– –

MECHANICAL PROPERTIES

Tensile strength

Approx. values. Hardness: 370 HB.

Testing temperature	20°C (68°F)
Ultimate tensile strength, R _m N/mm ²	1180
Yield strength, R _{p0,2} N/mm ²	1090

Compressive strength

Compressive yield strength, R _{c0,2} N/mm ²	~1150
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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). If welding is performed with IMPAX WELD or TIG-WELD a lower hardness will be achieved on weld compared with the high hard base material (see table below).

Welding method	TIG	MMA (SMAW)
Working temperature	200–250°C (390–480°F)	200–250°C (390–480°F)
Consumables	IMPAX TIG-WELD	IMPAX WELD
Hardness after welding	320–350 HB	320–350 HB

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

Machining recommendations – IMPAX Hi Hard

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

Condition: hardened and tempered to 360–400 HB

TURNING

Cutting data parameters	Turning with carbide	
	Rough turning	Fine turning
Cutting speed, (v_c) m/min. f.p.m.	100–150 328–492	150–200 492–656
Feed (f) mm/r i.p.r.	0,2–0,4 0,012–0,024	0,05–0,2 –0,012
Depth of cut, (a_p) mm inch	2–4 0,08–0,16	–2 –0,08
Carbide designation ISO US	P20–P30 C6–C5 Coated carbide	P10 C7 Coated carbide or cermet

DRILLING

High speed steel twist drill*

Drill diameter		Cutting speed (v_c)		Feed (f)	
mm	inch	m/min	f.p.m.	mm/r	i.p.r.
–5	–3/16	14	46	0,05–0,15	0,002–0,006
5–10	3/16–3/8	14	46	0,15–0,25	0,006–0,010
10–15	3/8–5/8	14	46	0,25–0,30	0,010–0,012
15–20	5/8–3/4	14	46	0,30–0,35	0,012–0,014

* Coated HSS, uncoated HSS drill is not recommended

Carbide drill

Cutting data parameters	Type of drill		
	Indexable insert	Solid carbide	Brazed carbide ¹⁾
Cutting speed, (v_c) m/min. f.p.m.	140–160 459–525	90–120 295–394	50–70 164–230
Feed (f) mm/r i.p.r.	0,03–0,12 ²⁾ 0,001–0,005 ²⁾	0,05–0,20 ²⁾ 0,002–0,008 ²⁾	0,10–0,20 ²⁾ 0,004–0,008 ²⁾

¹⁾ Drill with internal cooling channels and brazed 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.	80–100 262–328	100–130 328–426
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 US	P20–P40 C6–C5 Coated carbide	P10 C7 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.	50–90 164–295	50–90 164–295	15–20 ¹⁾ 49–66 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	K10, P40 C3, C5	P20–P30 C6–C5	– –

¹⁾ Coated HSS, uncoated HSS is not recommended

²⁾ Depending on radial depth of cut and cutter 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	Wheel recommendation
Surface grinding straight wheel	A 46 HV
Surface grinding segments	A 36 GV
Cylindrical grinding	A 60 KV
Internal grinding	A 60 IV
Profile grinding	A 120 JV

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 of fitness for a particular purpose.