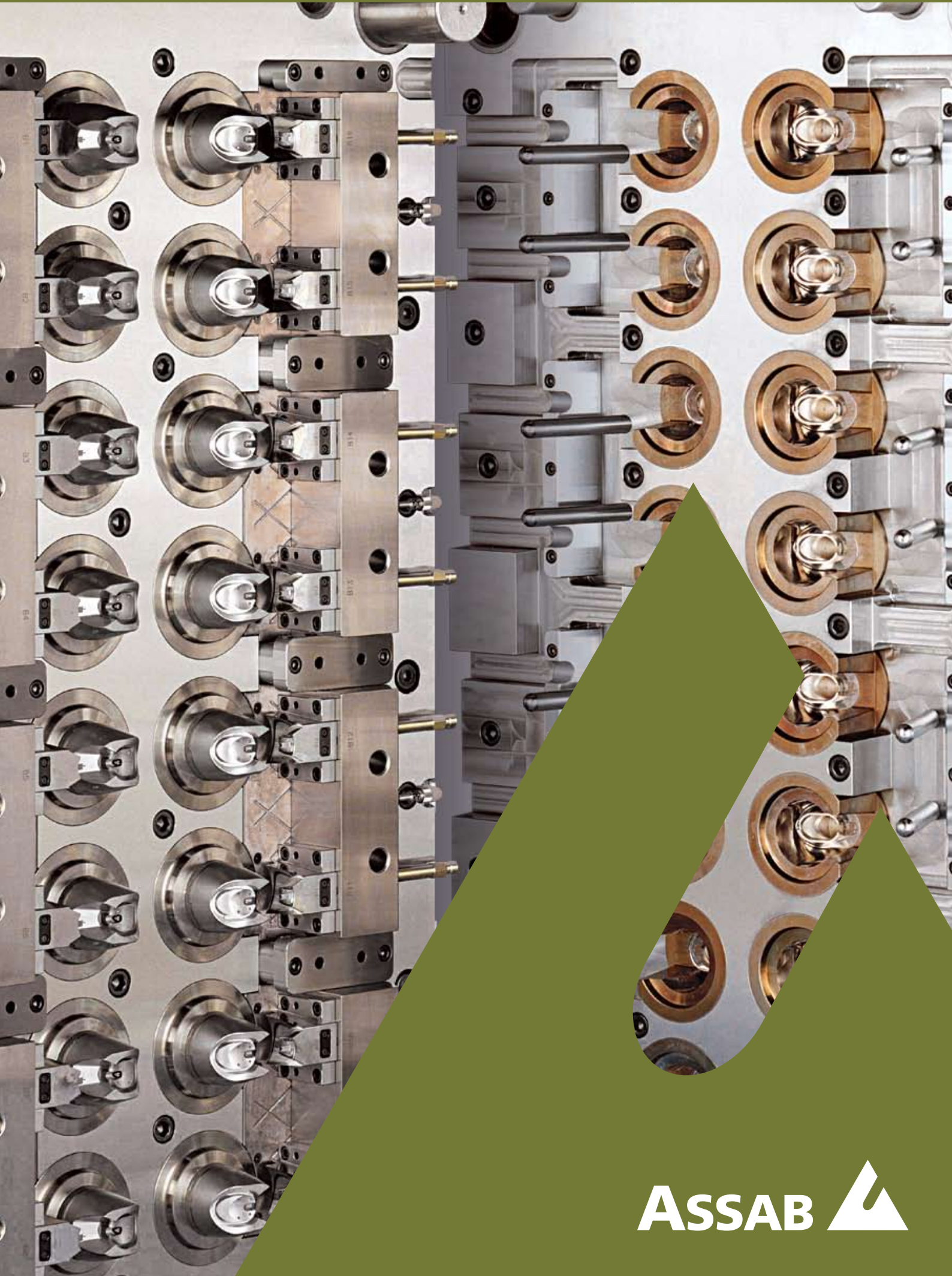




**ASSAB 718 HH**

**UDDEHOLM**  
IMPAX HH



**ASSAB** 

		REFERENCE STANDARD		
		AISI	DIN	JIS
DF-2	ARNE	O1	1.2510	SKS 3
DF-3		O1	1.2510	SKS 3
XW-5	SVERKER 3	D6 (D3)	(1.2436)	(SKD 2)
XW-10	RIGOR	A2	1.2363	SKD 12
XW-41	SVERKER 21	D2	1.2379	SKD 11
XW-42		D2	1.2379	SKD 11
CARMO	CARMO			
CALMAX	CALMAX			
CALDIE	CALDIE			
ASSAB 88	SLEIPNER			
ASP 23	VANADIS 23	(M3:2)	1.3344	SKH 53
ASP 30	VANADIS 30	M3:2 + Co	1.3244	SKH 40
ASP 60	VANADIS 60		1.3241	
VANADIS 4 EXTRA	VANADIS 4 EXTRA			
VANADIS 6	VANADIS 6			
VANADIS 10	VANADIS 10			
VACRON 40	VANCRON 40			
618		P20 Mod.	1.2738	
618 HH		P20 Mod.	1.2738	
618 T		P20 Mod.	1.2738 Mod.	
718 SUPREME	IMPAX SUPREME	P20 Mod.	1.2738	
718 HH	IMPAX HH	P20 Mod.	1.2738	
NIMAX	NIMAX			
UNIMAX	UNIMAX			
CORRAX	CORRAX			
STAVAX ESR	STAVAX ESR	420 Mod.	1.2083 ESR	SUS 420J2
MIRRAX ESR	MIRRAX ESR	420 Mod.		
POLMAX	POLMAX			
ELMAX	ELMAX			
RAMAX LH	RAMAX LH	420 F Mod.		
RAMAX HH	RAMAX HH	420 F Mod.		
ROYALLOY				
PRODAX				
PT18	MOLDMAX SC			
MMXL	MOLDMAX XL			
MM40	MOLDMAX HH			
ALVAR 14	ALVAR 14		1.2714	SKT 4
8407 2M	ORVAR 2M	H13	1.2344	SKD 61
8407 SUPREME	ORVAR SUPREME	H13 Premium	1.2344 ESR	SKD 61
DIEVAR	DIEVAR			
HOTVAR	HOTVAR			
QRO 90 SUPREME	QRO 90 SUPREME			
705		4340	1.6582	SNCM8
709		4340	1.7225	SCM4
760		1050	1.1730	S50C

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.

Edition 080718

## General

718 Hi Hard is a prehardened mould steel, which offers the following benefits:

- No hardening risks
- No hardening costs
- Time saving (i.e., no waiting for heat treatment)
- Lower tool cost (e.g., no distortion to rectify)
- Modifications easily carried out
- Can be subsequently nitrided to increase surface wear resistance and locally flame hardened to reduce surface damage

718 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
- Good machinability
- High purity and good homogeneity
- Uniform hardness

Note: 718 Hi Hard is 100% ultrasonic tested.

Heavier sections are supplied premachined, which offers the following advantages compared with unmachined material:

- Saving of weight
- Free of decarburised surface
- Exact nominal size (plus tolerance)
- Less machining
- Absence of scale minimises machine and tool wear

Typical analysis %	C	Si	Mn	Cr	Ni	Mo	S
	0.37	0.3	1.4	2.0	1.0	0.2	<0.010
Standard specification	AISI P20 modified, WNr. 1.2738						
Delivery condition	Hardened and tempered to 340 - 380 HB						
Colour code	Yellow / Green						

## Applications

- Injection moulds for thermoplastics
- Extrusion dies for thermoplastics
- Blow moulds
- Forming tools, press-brake dies (possibly flame hardened or nitrided)
- Aluminium die casting prototype dies
- Structural components, shafts

## Properties

### PHYSICAL PROPERTIES

Delivery condition.

Temperature	20°C	200°C	400°C
Density kg/m <sup>3</sup>	7 800	7 750	7 700
Modulus of elasticity MPa	205 000	200 000	185 000
Coefficient of thermal expansion per °C from 20°C	-	12.7 × 10 <sup>-6</sup>	13.6 × 10 <sup>-6</sup>
Thermal conductivity W/m °C	29	30	31
Specific heat J/kg °C	460	-	-

### MECHANICAL PROPERTIES

Tensile strength and compressive strength depend on the hardness in the delivered condition.

#### Tensile strength

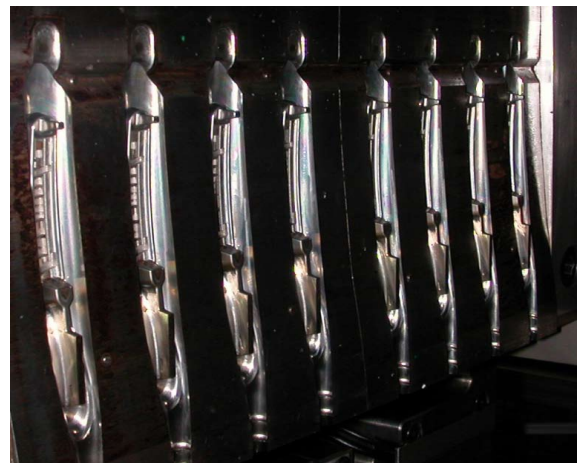
Approximate tensile strength at room temperature.

Hardness	340 HB	370 HB
Tensile strength, R <sub>m</sub>	1110 MPa	1180 MPa
Yield strength, R <sub>p0.2</sub>	985 MPa	1090 MPa

#### Comprehensive strength

Approximate comprehensive strength at room temperature.

Hardness	340 HB	370 HB
Comprehensive yield strength, R <sub>c0.2</sub>	1000 MPa	1150 MPa



Multiple cavities injection mould for making toothbrush handles.



# Machining recommendations

The cutting data below are to be considered as guiding values and as starting points for developing your own best practice.

**Condition: Prehardened condition ~360 HB**

## TURNING

Cutting data parameters	Turning with cable		Turning with HSS <sup>†</sup>
	Rough turning	Fine turning	Fine turning
Cutting speed ( $v_c$ ) m/min	100 - 150	150 - 200	10 - 15
Feed (f) mm/r	0.2 - 0.4	0.05 - 0.2	0.05 - 0.3
Depth of cut ( $a_p$ ) mm	2 - 4	0.5 - 2	0.5 - 2.5
Carbide designation ISO	P20 - P30 Coated carbide	P10 Coated carbide	-

<sup>†</sup> High speed steel

## DRILLING

**High speed steel twist drill\***

Drill diameter mm	Cutting speed ( $v_c$ ) m/min	Feed (f) mm/r
≤ 5	18 - 20	0.05 - 0.15
5 - 10	18 - 20	0.15 - 0.25
10 - 15	18 - 20	0.25 - 0.30
15 - 20	18 - 20	0.30 - 0.35

\* For coated HSS, uncoated HSS drill is not recommended

## Carbide drill

Cutting data parameters	Type of drill		
	Indexable insert	Solid carbide	Brazed carbide <sup>1</sup>
Cutting speed ( $v_c$ ) m/min	150 - 170	120 - 150	60 - 90
Feed (f) mm/r	0.03 - 0.12 <sup>2</sup>	0.05 - 0.20 <sup>2</sup>	0.10 - 0.20 <sup>2</sup>

<sup>1</sup> Drill with internal cooling channels and brazed carbide tip

<sup>2</sup> 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	100 - 140	140 - 170
Feed ( $f_z$ ) mm/tooth	0.2 - 0.4	0.1 - 0.2
Depth of cut ( $a_p$ ) mm	2 - 4	≤ 2
Carbide designation ISO	P20 - P40 Coated carbide	P10 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	60 - 100	60 - 100	25 - 30 <sup>1</sup>
Feed ( $f_z$ ) mm/tooth	0.006 - 0.20 <sup>2</sup>	0.06 - 0.20 <sup>2</sup>	0.02 - 0.35 <sup>2</sup>
Carbide designation ISO	K10, P40	P20 - P30	-

<sup>1</sup> For coated HSS end mill,  $v_c \sim 45-50$  m/min

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

## GRINDING

**Wheel recommendation**

Type of grinding	Grinding wheel designation
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

## Heat treatment

718 Hi Hard is intended for use in the hardened and tempered condition, i.e., the delivery condition. When, however, the steel is to be heat treated to a higher hardness or case hardened, the following instructions may be helpful.

### SOFT ANNEALING

Protect the steel and heat through to 700°C. Then cool in the furnace at 10°C per hour to 600°C, then freely in air.

### STRESS RELIEVING

After rough machining, the tool should be heated through to 550°C, holding time 2 hours. Cool slowly to room temperature.

### HARDENING

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

*Preheating temperature:* 500–600°C

*Austenitising temperature:* 850°C

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

*Protect the tool against decarburisation and oxidation during the hardening process.*

### QUENCHING MEDIA

- Oil (60–80°C)
- Martempering bath at 300°C, max. 4 minutes, then cool in air

*Note:* Temper the tool as soon as its temperature reaches 50–70°C.

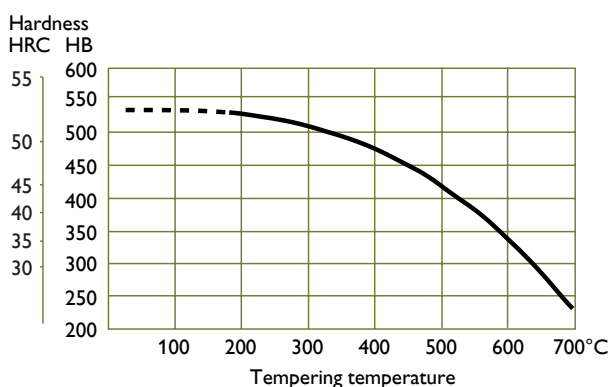
### TEMPERING

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 180°C for small inserts, but preferred minimum is 250°C. The minimum holding time at temperature is 2 hours.

### Tempering graph

The diagram is valid for small samples 15 x 15 x 40 mm austenitised 30 minutes at 850°C, quenched in air and tempered 2 + 2 hours.



## Surface treatment

### NITRIDING AND NITROCARBURISING

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

For best results, the following steps should be followed:

1. Rough machining
2. Stress tempering at 550°C
3. Grinding
4. Nitriding

The following surface hardness and nitriding depths will be achieved after nitriding:

Process	Time h	Surface hardness HV <sub>1</sub>	Depth mm
Gas nitriding at 525°C	20	650	0.30
	30	650	0.35
Plasma nitriding at 480°C	24	700	0.30
	48	700	0.40
Gas nitrocarburising at 570°C	2	700	0.10

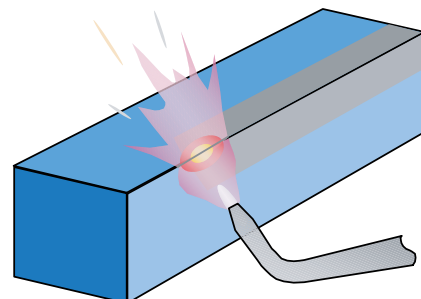
### HARD CHROME PLATING

After plating, the tool should be tempered at 180°C for 4 hours, within 4 hours of plating, to avoid the risk of hydrogen embrittlement

### FLAME AND INDUCTION HARDENING

718 Hi Hard can be flame or induction hardened to a hardness of approx. 50 HRC.

Flame hardening may cause a certain amount of distortion, depending on the design of the mould. If possible, flame hardening should be carried out directly after rough machining. Grinding will then be performed after flame hardening.



The surface to be hardened is heated continuously by means of a gas flame to approx. 850°C (pale-red colour), followed by cooling in air. The gas flame may be an ordinary oxyacetylene flame. The size of the blowpipe and the temperature of the gas are adapted so that the heating is accomplished in a few seconds.

The flame hardened tool does not need to be tempered as this would cause a drop in hardness.

## Electrical discharge machining

If spark-erosion, EDM, is performed in the as-delivered condition, the tool should then be given an additional temper at approx. 550°C. If the steel has been rehardened, the additional tempering temperature should be 25°C lower than the last tempering temperature used.

Further information can be obtained from the ASSAB brochure "EDM of Tool Steel".

## 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 the tool is to be polished or photo-etched, it is necessary to work with an electrode type of matching composition.

For more detailed information, refer to ASSAB brochure "Welding of Tool Steel".

Welding method	TIG	MMA
Preheating temperature	200 - 250°C	200 - 250°C
Filler material	718 TIG-WELD	718 WELD
Maximum interpass temperature	375°C	375°C
Post weld cooling	20°C - 40°C/h for the first two hours and then freely in air	
Hardness after welding	300 - 330 HB	300 - 330 HB
<b>Heat treatment after welding</b>		
Tool that need to be polished	Temper at 520°C for 2 h	
Tool that need to be photo-etched	Temper at 550°C for 2 h	

## Polishing

718 Hi Hard has excellent polishability in its delivery condition. After grinding, polishing can be carried out using aluminium oxide or diamond paste.

### TYPICAL PROCEDURE

1. Grind to 0.05 mm from the finished size.
2. Polish with diamond paste grade 45 to obtain a dull and even surface.
3. Polish with diamond paste grade 15.
4. Polish with diamond paste grade 3, or grade 1 for particularly high demands on surface finish size.

*Note:* Each steel grade has an optimum polishing time, which largely depends on hardness and polishing technique. Overpolishing can lead to a poor surface finish (e.g., an "orange peel" effect).

## Photo-etching

718 Hi Hard is particularly suitable for texturing by the photo-etching method. Its very low sulphur content ensures accurate and consistent pattern reproduction.



Cap for shampoo bottle. Excellent polishability of 718 Hi Hard makes it a suitable mould for making product with high gloss surface finish.

## Further information

For further information, i.e., steel selection, heat treatment, application and availability, please contact our ASSAB office\* nearest to you.

\*See back cover page

## Relative comparison of ASSAB plastic mould steels

### RESISTANCE TO FAILURE MECHANISMS AND CRITICAL MOULD STEEL PROPERTIES

ASSAB grade	Plastic deformation	Cracking	Wear	Corrosion	Polishability	Thermal conductivity	Machinability
618	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
ROYALLOY	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
718 HH	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
NIMAX	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
CORRAX	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
POLMAX	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
MIRRAX ESR	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
STAVAX ESR	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
8407 SUPREME	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
UNIMAX	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
ELMAX	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
XW-10	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>

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value added services

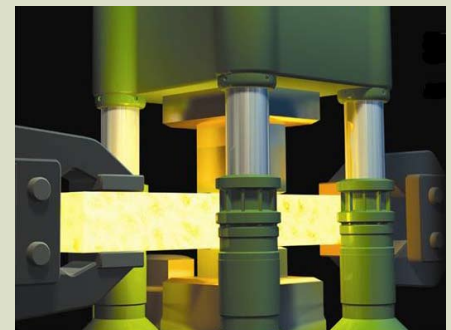
† Sales office only

ASSAB TOOL STEELS have been in Asia since 1945. Our customers associate ASSAB brand with tooling materials that are high in quality and consistency.

The ASSAB sales companies and distributors offer you well assorted stocks in a number of places covering the Asia Pacific region. To further shorten the lead time, ASSAB will mill, grind, drill and even wire-cut the tool steel to meet your requirements. ASSAB also provides state-of-the-art vacuum heat treatment services to enhance the steel properties.

Our engineers and metallurgists are always ready to assist you in your choice of the optimum steel grade and the best treatment for each application. We always carry out material examinations at our local mini laboratories and at the central laboratory in Sweden.

Our steel mill in Sweden, Uddeholm Tooling, is one of the few steelworks in the world that is dedicated to the manufacture of tool steels only. Uddeholm Tooling is certified to ISO 9001 and ISO 14001.



Our forging press is one of the most modern of its kind in the world.

Besides tool steels, the ASSAB services for tool makers include:

- Welding electrodes for repair welding of tools
- High strength aluminium for tooling purposes
- Copper alloys (e.g., beryllium copper) for inserts in moulds
- Alloy machinery steels
- Cold rolled strip steels for saws, compressor valves, coater blades, etc.
- High Performance Steels (HPS)
- Granshot