



# ROYALLOY

UDDEHOLM ROYALLOY

	 <small>a voestalpine company</small>	REFERENCE STANDARD		
		AISI	Wnr.	JIS
ASSAB DF-3	ARNE	O1	1.2510	SKS 3
ASSAB XW-10	RIGOR	A2	1.2363	SKD 12
ASSAB XW-42	SVERKER 21	D2	1.2379	(SKD 11)
CALMAX / CARMO	CALMAX / CARMO		1.2358	
VIKING	VIKING / CHIPPER		(1.2631)	
CALDIE	CALDIE			
ASSAB 88	SLEIPNER			
ASSAB PM 23 SUPERCLEAN	VANADIS 23 SUPERCLEAN	(M3:2)	1.3395	(SKH 53)
ASSAB PM 30 SUPERCLEAN	VANADIS 30 SUPERCLEAN	(M3:2 + Co)	1.3294	SKH 40
ASSAB PM 60 SUPERCLEAN	VANADIS 60 SUPERCLEAN		(1.3292)	
VANADIS 4 EXTRA SUPERCLEAN	VANADIS 4 EXTRA SUPERCLEAN			
VANADIS 8 SUPERCLEAN	VANADIS 8 SUPERCLEAN			
VANCRON SUPERCLEAN	VANCRON SUPERCLEAN			
ELMAX SUPERCLEAN	ELMAX SUPERCLEAN			
VANAX SUPERCLEAN	VANAX SUPERCLEAN			
ASSAB 518		P20	1.2311	
ASSAB 618 T		(P20)	(1.2738)	
ASSAB 618 / 618 HH		(P20)	1.2738	
ASSAB 718 SUPREME / 718 HH	IMPAX SUPREME / IMPAX HH	(P20)	1.2738	
NIMAX / NIMAX ESR	NIMAX / NIMAX ESR			
VIDAR 1 ESR	VIDAR 1 ESR	H11	1.2343	SKD 6
UNIMAX	UNIMAX			
CORRAX	CORRAX			
ASSAB 2083		420	1.2083	SUS 420J2
STAVAX ESR	STAVAX ESR	(420)	(1.2083)	(SUS 420J2)
MIRRAX ESR	MIRRAX ESR	(420)		
MIRRAX 40	MIRRAX 40	(420)		
TYRAX ESR	TYRAX ESR			
POLMAX	POLMAX	(420)	(1.2083)	(SUS 420J2)
ROYALLOY	ROYALLOY	(420 F)		
COOLMOULD	COOLMOULD			
ASSAB 2714			1.2714	SKT 4
ASSAB 2344		H13	1.2344	SKD 61
ASSAB 8407 2M	ORVAR 2M	H13	1.2344	SKD 61
ASSAB 8407 SUPREME	ORVAR SUPREME	H13 Premium	1.2344	SKD 61
DIEVAR	DIEVAR			
QRO 90 SUPREME	QRO 90 SUPREME			
FORMVAR	FORMVAR			

( ) - modified grade

“ASSAB” and the logo are trademark registered. The information contained herein is based on our present state of knowledge and is intended to provide general notes on our products and their uses. Therefore, it should not be construed as a warranty of specific properties of the products described or a warranty for fitness for a particular purpose. Each user of ASSAB products is responsible for making its own determination as to the suitability of ASSAB products and services.

Edition 20210913

## GENERAL

RoyAlloy is a patented free machining stainless holder steel, which is supplied in the prehardened condition. RoyAlloy is characterised by:

- Excellent machinability
- Good dimensional stability
- Excellent weldability
- Good corrosion resistance
- Good ductility
- Uniform hardness in all dimensions
- Smooth as rolled surfaces
- Good indentation resistance

Note : RoyAlloy is ultrasonic tested.

Typical analysis %	C 0.05	Si 0.4	Mn 1.2	Cr 12.6	S 0.12	Cu +	N +
Standard specification	None (patented)						
Delivery condition	Hardened and tempered to ~ 310 HB.						

## APPLICATIONS

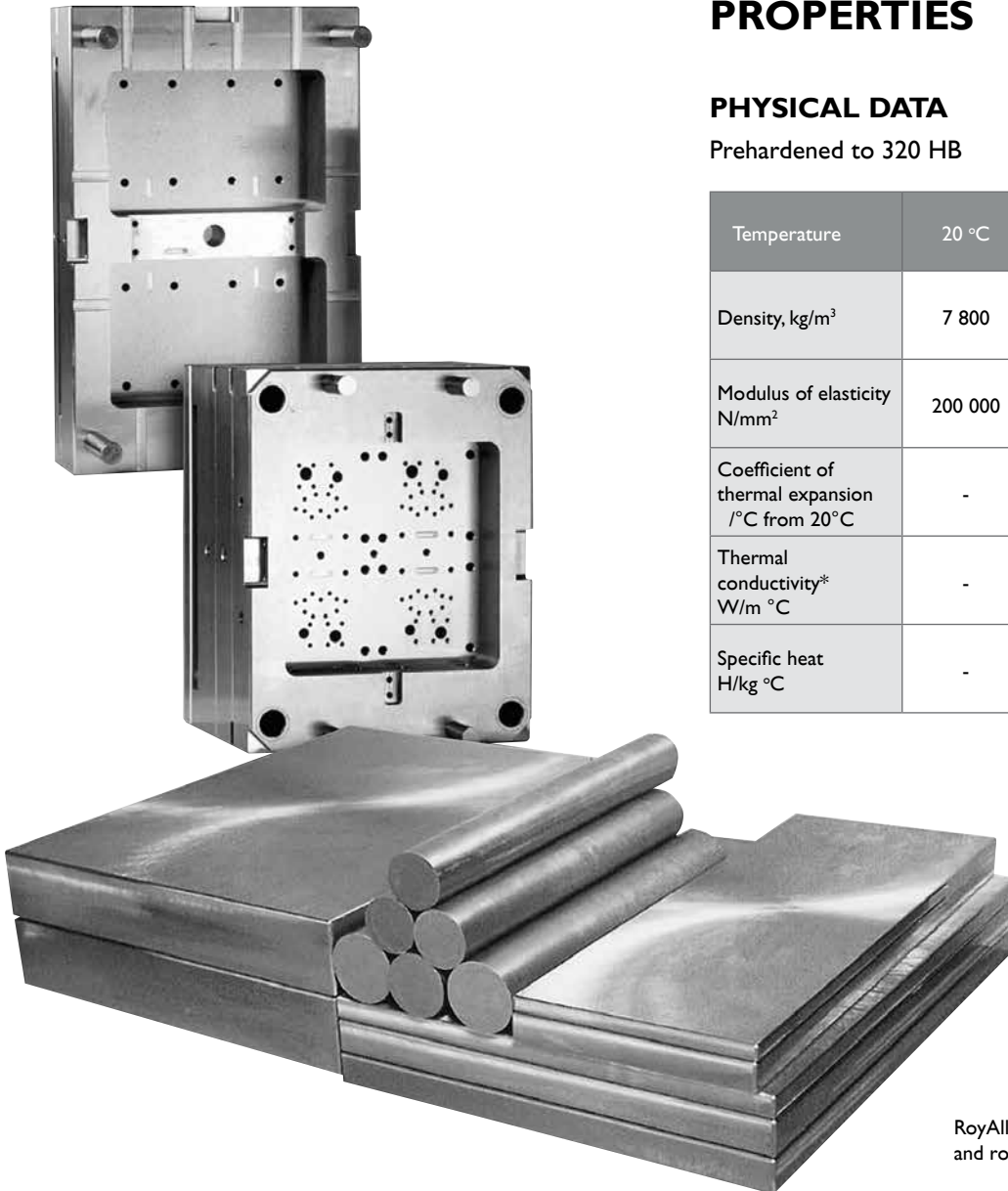
- Mould bases (holders/bolsters, cavity plates, support/backing plates, ejector plates)
- Plastic and rubber moulds with low demands on surface finish
- Dies for plastic extrusion
- Constructional parts

## PROPERTIES

### PHYSICAL DATA

Prehardened to 320 HB

Temperature	20 °C	100 °C	200 °C
Density, kg/m <sup>3</sup>	7 800	-	7 750
Modulus of elasticity N/mm <sup>2</sup>	200 000	-	190 000
Coefficient of thermal expansion /°C from 20°C	-	-	11.0 x 10 <sup>-6</sup>
Thermal conductivity* W/m °C	-	27.5	28
Specific heat H/kg °C	-	500	540



RoyAlloy is available in both flats and rounds.

## MECHANICAL PROPERTIES

### IMPACT STRENGTH

The energy absorption at impact testing depends on the test material (bar size and delivered hardness), test temperature and specimen (type, location, and orientation in the bar).

Charpy-V-notch impact toughness at room temperature tested in the LT-direction.

Plate thickness 76 mm.

Hardness	320 HB
Impact energy, J	22

### COMPRESSIVE STRENGTH

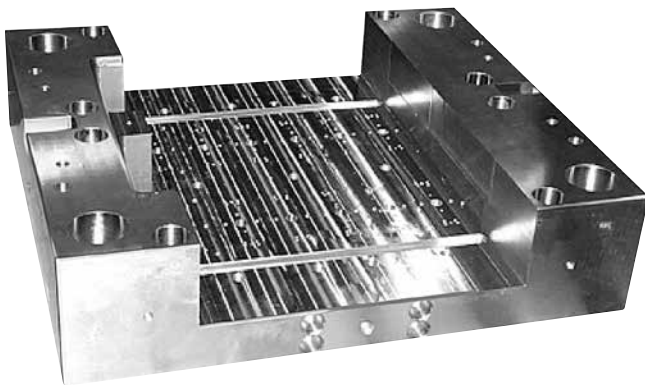
Approximate values

Hardness	320 HB
Compressive strength, Rc0.2 MPa	760

### TENSILE STRENGTH

Approximate values. Longitudinal specimens tested at room temperature.

Hardness	320 HB
Yield strength, Rp0.2 MPa	890
Tensile strength, Rm MPa	1 070
Elongation, A5 %	12
Reduction of area, Z %	34



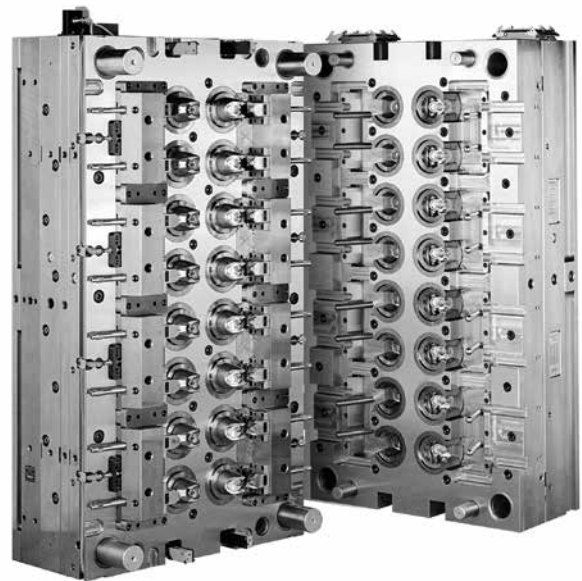
## CORROSION RESISTANCE

RoyAlloy was developed with a chemical composition adjusted to sufficiently provide good corrosion resistance during tool operation and storage. Tools made from RoyAlloy will have good resistance to corrosion caused by humid working and storage condition, and when moulding corrosive plastics under normal production conditions.

## HEAT TREATMENT

RoyAlloy is supplied in the prehardened condition with through-hardness of 290 – 330 HB. Each plate is carefully hardness tested to ensure consistency.

RoyAlloy is intended for use in prehardened condition (i.e. delivery condition), no further heat treatment is generally required.



RoyAlloy is the preferred steel of choice of many mould makers and end users. The steel provides enhanced machinability, improved dimensional stability and superior surface finishes compared with AISI 420F/VV.-Nr. 1.2085 type of steel.

RoyAlloy remains dimensionally stable even after extensive machining of 152 x 711 x 813 mm. 0.15 mm distortion, corner to corner.

# MACHINING RECOMMENDATIONS

The cutting data below should be considered as guidelines only and may require adjustments based on equipment, selection of cutting tools, etc.

Condition: prehardened approx. 320 HB

## TURNING

Cutting data parameters	Turning with carbide		Turning with High speed steel Fine turning
	Rough turning	Fine turning	
Cutting speed ( $v_c$ ), m/min	130 – 190	190 – 250	25 - 28
Feed (f) mm/rev	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 - 3
Carbide designation ISO	P20 - P30 Coated carbide	P10 - P20 Coated carbide or cermet	-

## MILLING

### FACE AND SQUARE SHOULDER MILLING

Cutting data parameters	Milling with carbide	
	Rough milling	Fine milling
Cutting speed ( $v_c$ ) m/min	130 – 190	190 – 250
Feed ( $f_z$ ) mm/tooth	0.2 – 0.4	0.1 – 0.2
Depth of cut ( $a_p$ ) mm	2 – 5	≤ 2
Carbide designation ISO	P20 – P40 Coated carbide	P10 - P20 Coated carbide or cermet

### END MILLING

Cutting data parameters	Type of end mill		
	Solid carbide	Carbide indexable insert	High speed steel
Cutting speed ( $v_c$ ), m/min	80 – 120	120 – 170	35 – 40 <sup>1)</sup>
Feed ( $f_z$ ) mm/tooth	0.006 – 0.20 <sup>2)</sup>	0.06 – 0.20 <sup>2)</sup>	0.01 – 0.35 <sup>2)</sup>
Carbide designation ISO	-	P15 – P40	-

<sup>1)</sup> For coated HSS end mill,  $v_c = 60 - 66$  m/min

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

## DRILLING

### HIGH SPEED STEEL TWIST DRILL

Drill diameter mm	Cutting speed ( $v_c$ ) m/min	Feed (f) mm/r
≤ 5	17 – 19 *	0.05 – 0.10
5 – 10	17 – 19 *	0.10 – 0.20
10 – 15	17 – 19 *	0.20 – 0.25
15 – 20	17 – 19 *	0.25 – 0.30

\* For coated HSS drill  $v_c = 29 - 31$  m/min.

### CARBIDE DRILL

Cutting data parameters	Type of drill		
	Indexable insert	Solid carbide	Carbide tip <sup>1)</sup>
Cutting speed ( $v_c$ ), m/min	215 – 240	110 – 130	70 – 110
Feed (f) mm/r	0.05 – 0.15 <sup>2)</sup>	0.10 – 0.25 <sup>3)</sup>	0.15 – 0.25 <sup>4)</sup>

<sup>1)</sup> Drill with replaceable or brazed carbide tip

<sup>2)</sup> Feed rate for drill diameter 20 – 40 mm

<sup>3)</sup> Feed rate for drill diameter 5 – 20 mm

<sup>4)</sup> Feed rate for drill diameter 10 – 20 mm

## GRINDING

A general grinding wheel recommendation is given below. More information can be found in the publication "Grinding of tool steel".

Type of grinding	Delivery condition
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

## WELDING

RoyAlloy is readily weldable with RoyAlloy filler metal or several standard stainless filler metals, using TIG (GTAW) and MMA (SMAW) processes.

For best results, use RoyAlloy welding electrodes. To provide an optimal match with the base metal in terms of chemical composition and mechanical properties, RoyAlloy filler material is recommended.

The weld metal hardness after welding will become 34 – 38 HRC. The welding consumable, as TIG filler rod, is available in  $\varnothing$  0.9 mm and  $\varnothing$  1.8 mm.

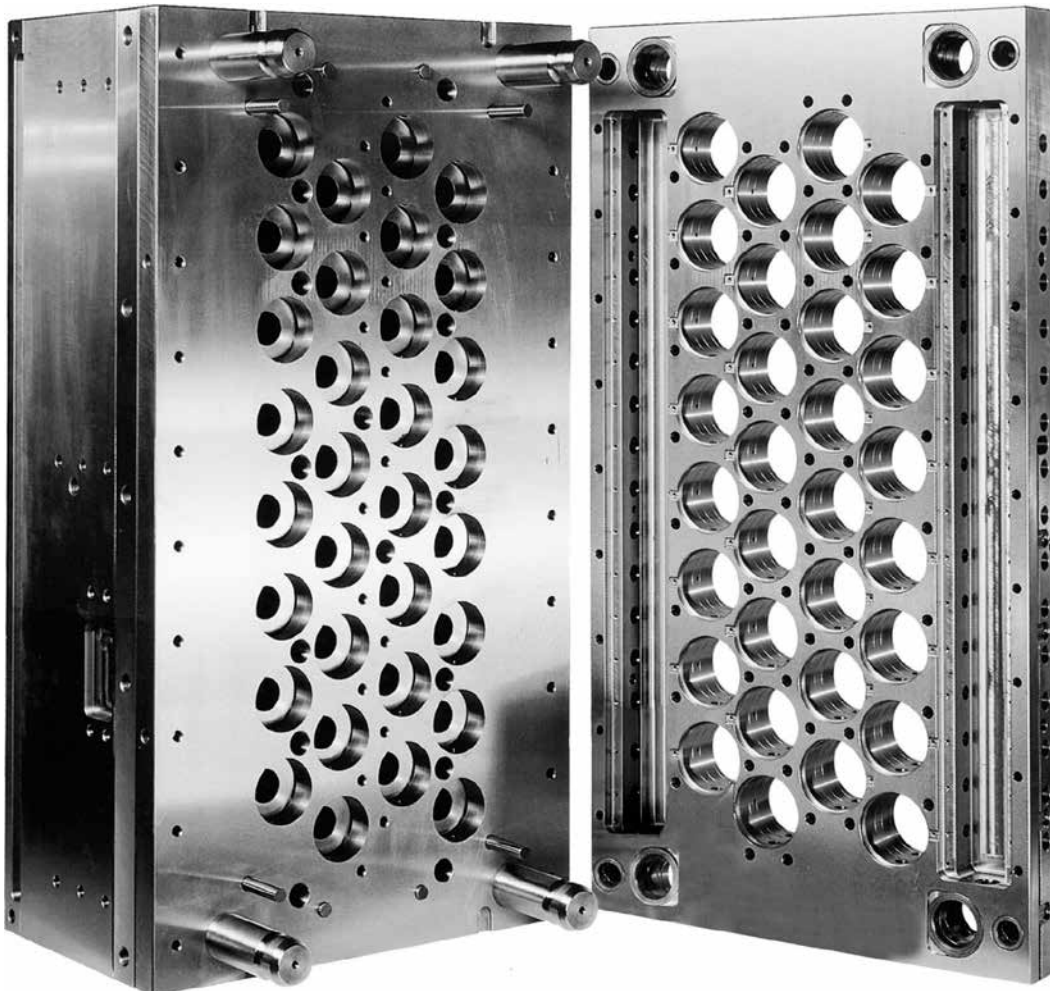
Neither pre-heating nor post-heating is necessary. RoyAlloy does not develop an over-hardened heat-affected zone (HAZ) around the weld deposit. This eliminates the concern of weld-induced cracking during repair or, subsequently, during service.

Stress relieving is recommended for large weld repairs to reduce residual stresses.

Max. stress relieving temperature 485 °C.

## FURTHER INFORMATION

Please contact your local ASSAB office for further information on the selection, heat treatment, application and availability of ASSAB tool steel.



# ASSAB

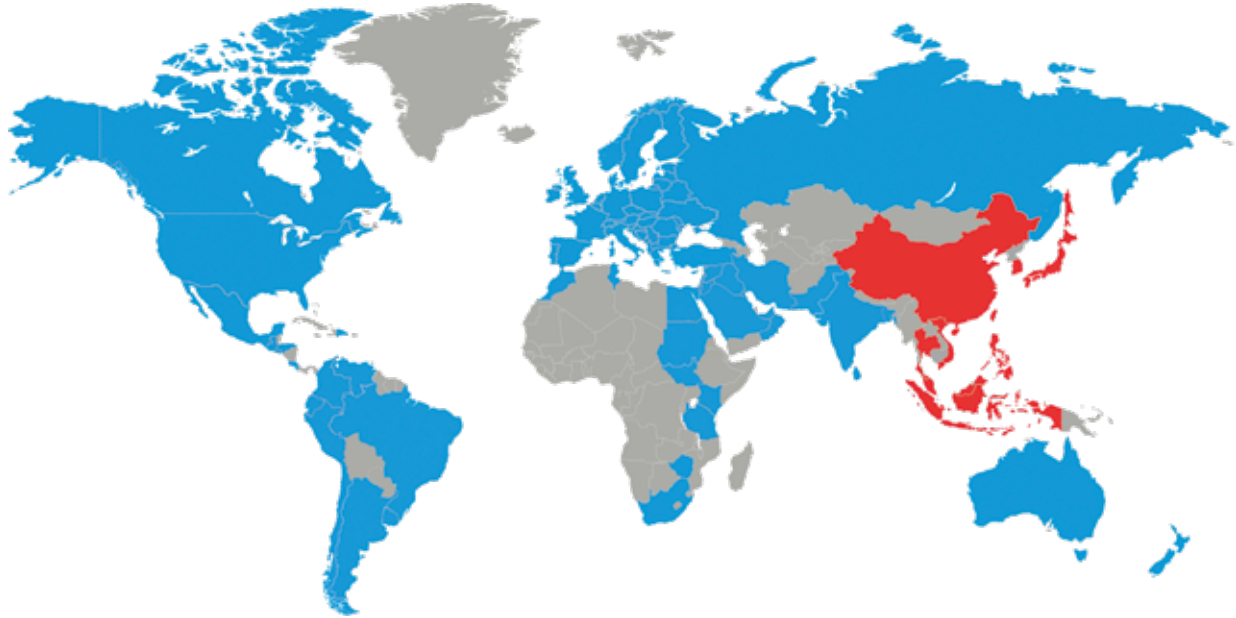
## SUPERIOR TOOLING SOLUTIONS

# A ONE-STOP SHOP



ASSAB is unmatched as a one-stop product and service provider that offers superior tooling solutions. In addition to the supply of tool steel and other special steel, our range of comprehensive value-added services, such as machining, heat treatment and coating services, span the entire supply chain to ensure convenience, accountability and optimal usage of steel for customers. We are committed to achieving solutions for our customers, with a constant eye on time-to-market and total tooling economy.





Choosing the right steel is of vital importance. ASSAB engineers and metallurgists are always ready to assist you in your choice of the optimum steel grade and the best treatment for each application. ASSAB not only supplies steel products with superior quality, we offer state-of-the-art machining, heat treatment and surface treatment services to enhance steel properties to meet your requirement in the shortest lead time. Using a holistic approach as a one-stop solution provider, we are more than just another tool steel supplier.

ASSAB and Uddeholm are present on every continent. This ensures you that high quality tool steel and local support are available wherever you are. Together we secure our position as the world's leading supplier of tooling materials.

For more information, please visit  
[www.assab.com](http://www.assab.com)

