



# **NIMAX ESR**

**Uddeholm Nimax ESR**

	 <small>a voestalpine company</small>	REFERENCE STANDARD		
		AISI	Wnr.	JIS
ASSAB DF-3	ARNE	O1	1.2510	SKS 3
ASSAB XW-5	SVERKER 3	D6 (D3)	(1.2436)	(SKD 2)
ASSAB XW-10	RIGOR	A2	1.2363	SKD 12
ASSAB XW-42	SVERKER 21	D2	1.2379	SKD 11
CARMO	CARMO		1.2358	
CALMAX	CALMAX		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 6 SUPERCLEAN	VANADIS 6 SUPERCLEAN			
VANADIS 8 SUPERCLEAN	VANADIS 8 SUPERCLEAN			
VANADIS 10 SUPERCLEAN	VANADIS 10 SUPERCLEAN			
VANCRON 40 SUPERCLEAN	VANCRON 40 SUPERCLEAN			
ELMAX SUPERCLEAN	ELMAX SUPERCLEAN			
ASSAB 518		P20	1.2311	
ASSAB 618		(P20)	1.2738	
ASSAB 618 HH		(P20)	1.2738	
ASSAB 618 T		(P20)	(1.2738)	
ASSAB 718 SUPREME	IMPAX SUPREME	(P20)	1.2738	
ASSAB 718 HH	IMPAX HH	(P20)	1.2738	
NIMAX	NIMAX			
NIMAX ESR	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)		
POLMAX	POLMAX	(420)	(1.2083)	(SUS 420J2)
RAMAX HH	RAMAX HH	(420 F)		
ROYALLOY	ROYALLOY	(420 F)		
COOLMOULD	COOLMOULD			
ALVAR 14	ALVAR 14		1.2714	SKT 4
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			
HOTVAR	HOTVAR			
QRO 90 SUPREME	QRO 90 SUPREME			
FORMVAR	FORMVAR			

( ) - modified grade

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## GENERAL

Nimax ESR is a low carbon plastic mould steel delivered at a hardness of ~40 HRC. Nimax ESR is an ESR remelted version of Nimax, keeping the features of Nimax, but with improved cleanliness and homogeneity as a result of the ESR process.

Nimax ESR is characterised by the following:

- Excellent polishing and texturing properties
- High impact and fracture toughness
- Very good welding properties
- Good resistance against indentations
- Consistent properties through large sections
- Excellent machinability

## WHAT DOES ESR GIVE?

### CLEANLINESS AND HOMOGENEITY

Low amount of inclusions and less segregations

- Improved polishing results
- Improved toughness/ductility
- Improved texturing results

The excellent machinability and easy weldability, no preheating or post treatment necessary, reduce the manufacturing time and make the maintenance much easier. The high hardness in combination with a high toughness results in a mould with good resistance to indentations and a minimum risk for unexpected failures, leading to a safer mould and a prolonged tool life.

Typical analysis %	C	Si	Mn	Cr	Mo	Ni
	0.1	0.3	2.5	3.0	0.3	1.0
Delivery condition	360 - 400 HB					
Colour code	Blue					

## APPLICATIONS

The material is specifically developed for big and middle sized injection moulds with high demands on surface finish.

Main applications are transparent, high gloss polished or textured moulds for use mainly within automotive, white goods, packaging and electronic industry.

Examples of applications where ESR material is often needed can be found within:

- Automotive : Head and rear lights  
Large interior parts
- White goods : Control panels
- Electronic : LED TV frames

## PROPERTIES

### PHYSICAL DATA

Temperature	20 °C	200 °C
Density kg/m <sup>3</sup>	7 900	-
Modulus of elasticity MPa	205 000	-
Coefficient of thermal expansion /°C from 20 °C	-	12.4 x 10 <sup>-6</sup>
Thermal conductivity W/m°C	-	28
Specific heat J/kg°C	460	-

## MECHANICAL PROPERTIES

The properties are representative of samples taken from the centre of bars with dimension 596 x 296 mm unless otherwise is indicated. Values of different mechanical properties depend on dimension of original material, position and direction of samples as well as hardness and test temperature.



A highly polished mould for production of car headlights.

## TENSILE STRENGTH

Hardness ~370 HB

Yield strength, $R_{p0.2}$ MPa	785
Tensile strength, $R_m$ MPa	1 265
Elongation, %	11
Area contraction, %	47

## COMPRESSIVE STRENGTH

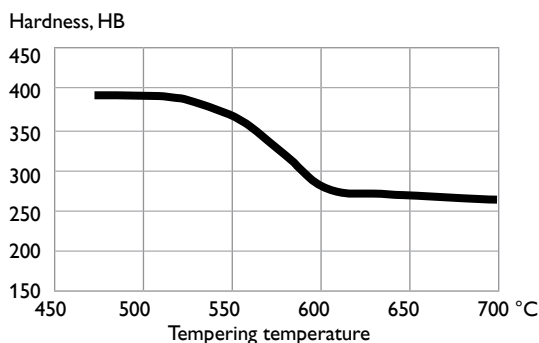
Hardness ~370 HB

Compressive strength, $R_{c0.2}$ MPa	1 000
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## HEAT TREATMENT

Nimax ESR is intended to be used in the delivery condition. The hardness cannot be increased by heat treatment, but can be decreased by tempering. **However, tempering is not recommended because it significantly decreases toughness even though that the hardness is reduced.**

The following hardness reduction can be expected after 2 hours at full temperature.



If the steel has been exposed to high temperature thus reducing toughness and hardness, the following procedure can be performed in order to restore the original condition:

Heat to 850 °C, holding time 30 min. Cool in circulating air.

## SURFACE TREATMENT

### FLAME AND INDUCTION HARDENING

The surface hardness of Nimax ESR cannot be increased by induction hardening or flame hardening.

### NITRIDING

Nitriding increases the surface hardness and wear resistance. For best result the following steps should be followed:

1. Rough machining
2. Temper at a temperature between 480 - 525°C thus reducing the amount of stresses and retained austenite content. This will minimise later dimensional changes during the nitriding operation. Heat the mould up until it is heated through and let it cool down to room temperature
3. Finish machining/grinding
4. Nitriding

The following approximate nitriding depths and surface hardnesses can be expected:

	Surface hardness MHV (200g)	Depth after nitriding		
		10 h mm	30 h mm	60 h mm
Gas nitriding at 510 °C	950	0.16 <sup>1)</sup>	0.28 <sup>1)</sup>	0.39 <sup>1)</sup>
Plasma nitriding at 480 °C	1 000	0.13 <sup>2)</sup>	0.25 <sup>1)</sup>	0.33 <sup>1)</sup>

<sup>1)</sup> **Not recommended**

<sup>2)</sup> **Recommended**

Nitriding at temperatures above 500 °C and longer than 10 hours is not recommended as it will reduce toughness and hardness significantly.

For more detailed information about nitriding contact your local ASSAB office.

# MACHINING RECOMMENDATIONS

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

## TURNING

Cutting data parameter	Turning with carbide		Turning with high speed steel
	Rough turning	Fine turning	Fine turning
Cutting speed ( $V_c$ ) m/min	110 – 150	150 – 200	10 – 15
Feed (f) mm/rev	0.2 – 0.4	≤ 0.3	≤ 0.3
Depth of cut ( $a_p$ ) mm	2 – 4	≤ 2	≤ 2
Carbide designation ISO	P20 – P30 Coated carbide	P10 Coated carbide	-

## DRILLING

### HIGH SPEED STEEL TWIST DRILL

Drill diameter mm	Cutting speed ( $V_c$ ) m/min	Feed (f) mm/rev
≤ 5	12 – 14 *	0.05 – 0.10
5–10	12 – 14 *	0.10 – 0.20
10–15	12 – 14 *	0.20 – 0.25
15–20	12 – 14 *	0.25 – 0.30

\* For coated HSS drill  $v_c = 18 – 20$  m/min.

### CARBIDE DRILL

Cutting data parameter	Type of drill		
	Indexable insert	Solid carbide	Carbide tipped <sup>1)</sup>
Cutting speed ( $V_c$ ) m/min	150 – 170	100 – 130	90 – 110
Feed. (f) mm/rev	0.05 – 0.25 <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

## MILLING

### FACE AND SQUARE SHOULDER MILLING

Cutting data parameter	Milling with carbide	
	Rough milling	Fine milling
Cutting speed ( $V_c$ ) m/min	80 – 150	150 – 180
Feed (f) mm/tooth	0.2 – 0.4	0.1 – 0.2
Depth of cut ( $a_p$ ) mm	2 – 5	≤ 2
Carbide designation ISO	P20 Coated carbide	P10 - P20 Coated carbide or cermet

### END MILLING

Cutting data parameter	Type of milling		
	Solid carbide	Carbide indexable insert	High speed steel
Cutting speed ( $V_c$ ) m/min	70 – 110	80 – 120	10 – 15 <sup>1)</sup>
Feed. (f) mm/tooth	0.03 – 0.20 <sup>2)</sup>	0.08 – 0.20 <sup>2)</sup>	0.05 – 0.35 <sup>2)</sup>
Carbide designation ISO	-	P20 – P30	-

<sup>1)</sup> For coated HSS end mill  $v_c = 25 – 30$  m/min.

<sup>2)</sup> 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 “Grinding of tool steel” brochure.

### WHEEL RECOMMENDATION

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

## ELECTRICAL DISCHARGE MACHINING — EDM

Contrary to other steel grades, the heat affected surface layer achieved during EDM'ing will not be harder than the underlying steel. Consequently, the heat affected layer is more easily removed.

## WELDING

Preheating or post heat treatment is not necessary. However, if severe strain conditions could be expected, a stress relieving at 450 °C for 2 hours is recommended after welding.

Welding method	TIG	MMA
Preheating temperature	None	None
Filler material	ASSAB 718 TIG Weld Nimax TIG Weld	ASSAB 718 Weld
Max interpass temperature	300 °C	
Cooling rate	Freely in air	
Hardness as welded	ASSAB 718 TIG Weld 320 - 340 HB Nimax TIG Weld 360 - 400 HB	330 - 350 HB
Post heat treatment	None / 450°C 2 h	

## LASER WELDING

For laser welding Nimax laser weld rods are available, they are composed to be compatible with Nimax ESR.

## TEXTURING

Nimax ESR is very suitable for texturing. The very low sulphur content and homogeneous structure ensures an accurate and consistent pattern reproduction.

## POLISHING

Nimax ESR has an excellent polishability. The low amount of inclusions and the homogeneous structure ensures an excellent polishing result.

## FURTHER INFORMATION

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

# ASSAB

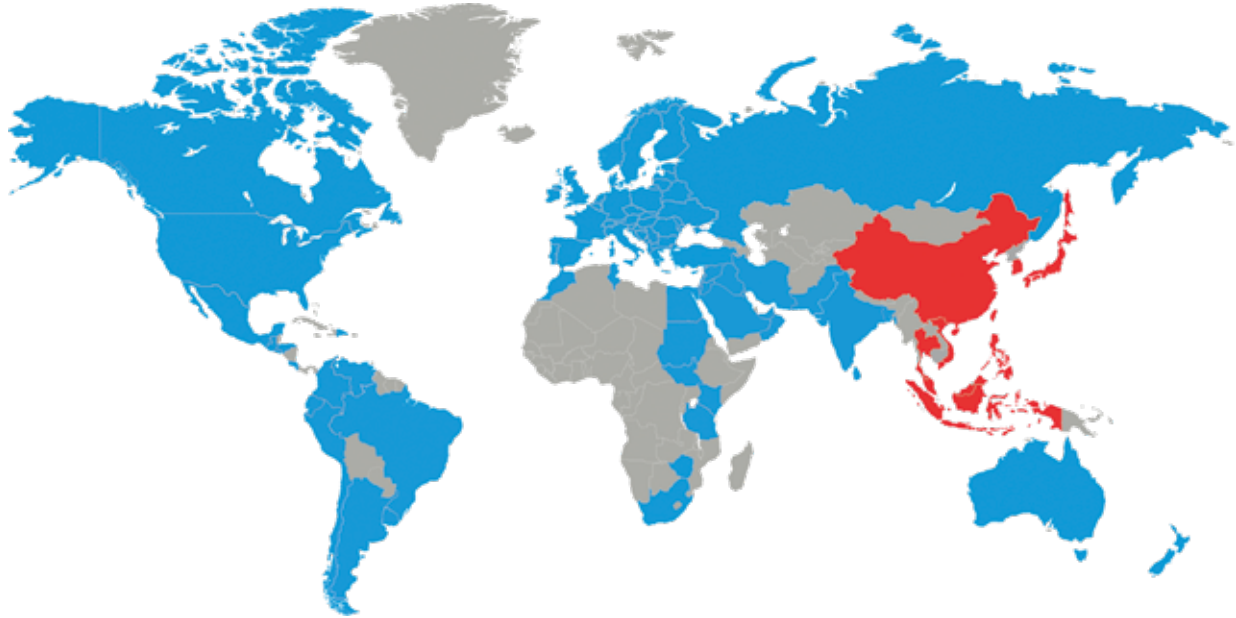
## SUPERIOR TOOLING SOLUTIONS

# 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)