VIDAR 1 ESR

UDDEHOLM VIDAR 1 ESR

ASSAB	UDDEHOLM a voestalpine company	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

Edition 20210913

GENERAL

Vidar 1 ESR is a chromium-molybdenum-vanadium-alloyed steel which is characterised by:

- Good high-temperature strength
- Good toughness and ductility
- Good machinability and polishability
- Good through-hardening properties
- Good size stability during hardening

Typical analysis %	C 0.38	Si 1.0	Mn 0.4	Cr 5.0	Mo 1.3	V 0.4
Standard specification	AISI H11, B H11, W.-Nr. 1.2343, EN X37 CrMoV 5-1					
Delivery condition	Soft annealed to approx.185 HB					

APPLICATIONS

General hot work and plastic mould applications, specially large plastic moulds with requirements on high toughness in combination with very good polishability and texturing properties.

PROPERTIES

PHYSICAL DATA

Specimens hardened and tempered to 44 – 46 HRC.

Temperature	20 °C	400 °C	600 °C
Density, kg/m³	7 800	7 700	7 600
Modulus of elasticity MPa	210 000	180 000	140 000
Coefficient of thermal expansion /°C from 20°C	-	12.6 x 10^{-6}	13.2x 10^{-6}
Thermal conductivity* W/m °C	25	29	30

MECHANICAL DATA

Tensile strength at room temperature.

Hardness, HRC	44	48
Tensile strength, Rm MPa	1 400	1 620
Yield point, Rp0.2 MPa	1 150	1 380

HIGH TEMPERATURE STRENGTH AT ELEVATED TEMPERATURES

Hardness 48 HRC.

Testing temperature	Rm, MPa	Rp0.2, MPa
200 °C	1 490	1 250
400 °C	1 370	1 120
500 °C	1 190	910
550 °C	1 170	790
600 °C	880	600

HEAT TREATMENT

SOFT ANNEALING

Protect the steel and heat through to 850 °C. Then cool in furnace at 10 °C per hour to 650°C, then freely in air.

STRESS RELIEVING

After rough machining the tool should be heated through to 650 °C, holding time 2 hours. Cool slowly to 500 °C, then freely in air.

HARDENING

Preheating temperature: 600 – 850 °C (normally two preheating steps).
Austenitising temperature: 990 – 1010 °C, normally 990 – 1000 °C.
Soaking time: 30 – 45 minutes.
Soaking time = time at austenitising temperature after the tool is fully heated through.
Protect the tool against decarburisation and oxidation during austenitising.

QUENCHING MEDIA

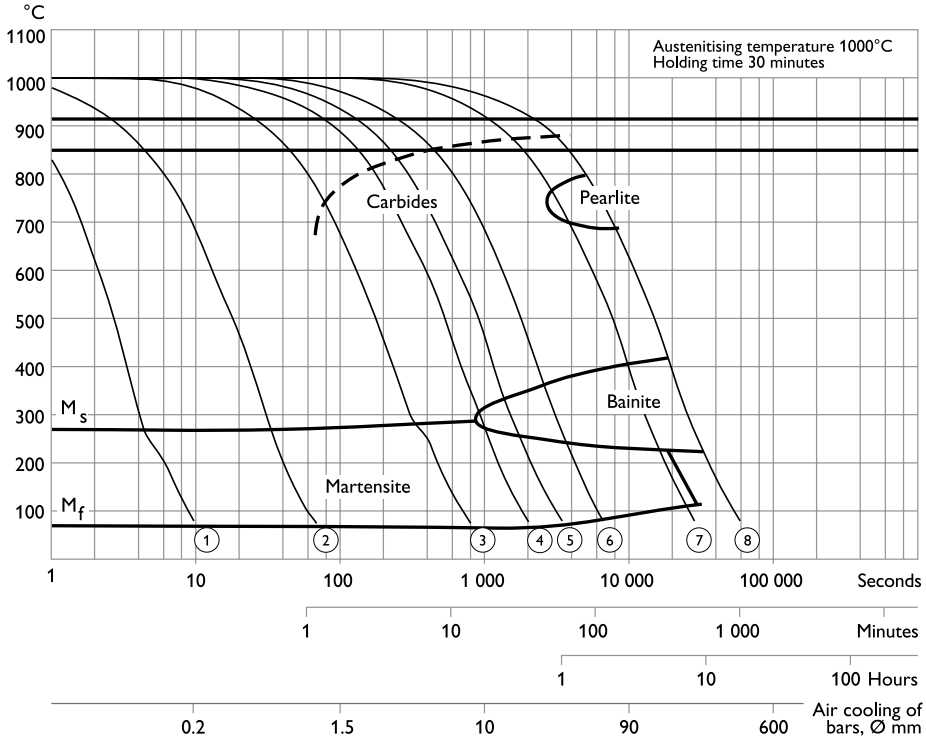
- High speed gas/circulating atmosphere
- Vacuum (high speed gas with sufficient positive pressure)
- Martempering bath (salt or fluidised bed) at 500 – 550 °C
- Martempering bath (salt or fluidised bed) at 180 – 220°C
- Warm oil

Note 1: Temper the tool as soon as its temperature reaches 50 – 70 °C.

Note 2: In order to obtain the optimum properties for the tool, the cooling rate should be fast, but not at a level that gives excessive distortion or cracks.

CCT GRAPH

Austenitising temperature 1000°C. Holding time 30 minutes.

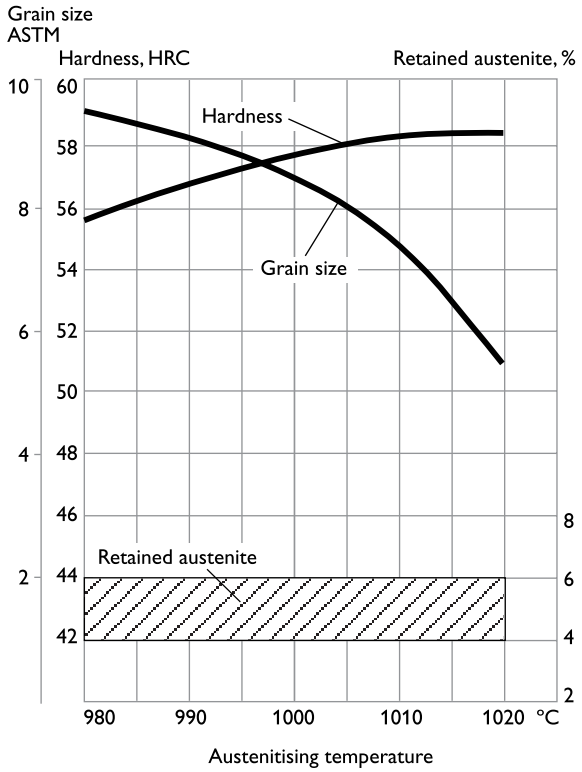


A_{C3} = 915 °C

A_{C1} = 850 °C

Cooling Curve No.	Hardness HV 10	$T_{800-500}$ sec
1	715	2
2	715	13
3	695	125
4	654	374
5	642	623
6	642	1 248
7	559	5 200
8	459	10 400

HARDNESS, GRAIN SIZE AND RETAINED AUSTENITE AS A FUNCTION OF AUSTENITISING TEMPERATURE



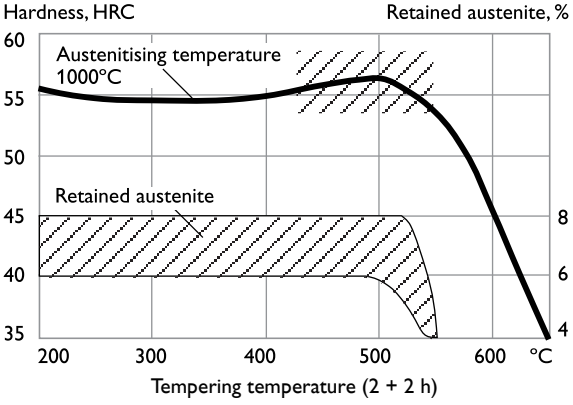
TEMPERING

Choose the tempering temperature according to the hardness required by reference to the tempering graph below. Temper twice with intermediate cooling to room temperature. Lowest tempering temperature 180 °C. Holding time at temperature minimum 2 hours.

Tempering in the range of 425 – 550 °C for the intended final hardness will result in a lower toughness.

TEMPERING GRAPH

Air cooling of specimen 15 x 15 x 40 mm



The tempering curves are obtained after heat treatment of samples with a size of 15 x 15 x 40 mm, cooling in forced air. Lower hardness can be expected after heat treatment of tools and dies due to factors like actual tool size and heat treatment parameters.

NITRIDING AND NITROCARBURISING

Nitriding and nitrocarburising result in a hard surface layer which is very resistant to wear and galling.

The surface hardness after nitriding is approximately 900 – 1100 $HV_{0.2}$. The thickness of the layer should be chosen to suit the application in question.

DEPTH OF NITRIDING

Process	Time	Depth*
		mm
Gas nitriding at 510 °C	10 h 30 h	0.12 0.20
Plasma nitriding at 480 °C	10 h 30 h	0.14 0.19
Nitrocarburising - in gas at 580 °C - salt bath at 580°C	 2.5 h 1 h	 0.12 0.07

* Depth of case = distance from surface where hardness is 50 $HV_{0.2}$ over base hardness

MACHINING RECOMMENDATIONS

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
	Rough turning	Fine turning	Fine turning
Cutting speed (v_C), m/min	200 – 250	250 – 300	25 – 30
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 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	180 – 260	260 – 300
Feed (f_z) mm/tooth	0.2 – 0.4	0.1 – 0.2
Depth of cut (a_p) mm	2 – 4	0.5 - 2
Carbide designation ISO	P20 - P40 Coated carbide	P10 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	160 – 200	170 – 230	35 – 40 [1]
Feed (f_z) mm/tooth	0.01 – 0.20 [2]	0.06 – 0.20 [2]	0.01 – 0.30 [2]
Carbide designation ISO	–	P20 – P30	–

[1] For coated HSS end mill v_c = 55 – 60 m/min.
[2] 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	16 – 18 *	0.05 – 0.15
5 – 10	16 – 18 *	0.15 – 0.20
10 – 15	16 – 18 *	0.20 – 0.25
15 – 20	16 – 18 *	0.25 – 0.35

* For coated HSS drill v_c = 28 – 30 m/min.

CARBIDE DRILL

Cutting data parameters	Type of drill		
	Indexable insert	Solid carbide	Carbide tip [1]
Cutting speed (vc), m/min	220 – 240	130 – 160	80 – 110
Feed (f) mm/r	0.03 – 0.12 [2]	0.08 – 0.20 [3]	0.15 – 0.25 [4]

[1] Drill with replaceable or brazed carbide tip
[2] Feed rate for drill diameter 20 – 40 mm
[3] Feed rate for drill diameter 5 – 20 mm
[4] 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	Soft annealed condition	Hardened condition
Face grinding straight wheel	A 46 HV	A 46 HV
Face grinding segments	A 24 GV	A 36 GV
Cylindrical grinding	A 46 LV	A 60 KV
Internal grinding	A 46 JV	A 60 JV
Profile grinding	A 100 KV	A 120 JV

PHOTO-ETCHING

Vidar 1 ESR is particularly suitable for texturing by the photo-etching method. Its high level of homogeneity and low sulphur content ensures accurate and consistent pattern reproduction.

POLISHING

Vidar 1 ESR has good polishability in the hardened and tempered condition. After grinding, polishing is undertaken with aluminium oxide or diamond paste.

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).

ELECTRICAL DISCHARGE MACHINING — EDM

If spark-erosion, EDM, is performed in the hardened and tempered condition, the white re-cast layer should be removed mechanically e.g. by grinding or stoning. The tool should then be given an additional temper at approx. 25 °C below the previous tempering temperature.

WELDING

Welding of die components can be performed, with acceptable results, as long as the proper precautions are taken during the preparation of the joint, the filler material selection, the preheating of the die, the controlled cooling of the die and the post weld heat treatment processes. The following guidelines summarise the most important welding process parameters.

Welding method	TIG	MMA
Preheating temperature*	Min. 325°C	Min. 325°C
Filler metals	DIEVAR TIG-WELD QRO 90 TIG-WELD	UTP 673 QRO 90 WELD
Maximum interpass temperature	475°C	475°C
Post welding cooling	20 - 40 °C/h for the first 2 - 3 hours and then freely in air	
Hardness after welding	48 – 53 HRC	55 - 58 HRC (673) 48 - 53 HRC
Heat treatment after welding		
Hardened condition	Temper at 10 – 20 °C below the highest previous tempering temperature	
Soft annealed condition	Soft-anneal the material at 850 °C in protected atmosphere. Then cool in the furnace at 10 °C per hour to 650 °C then freely in air.	

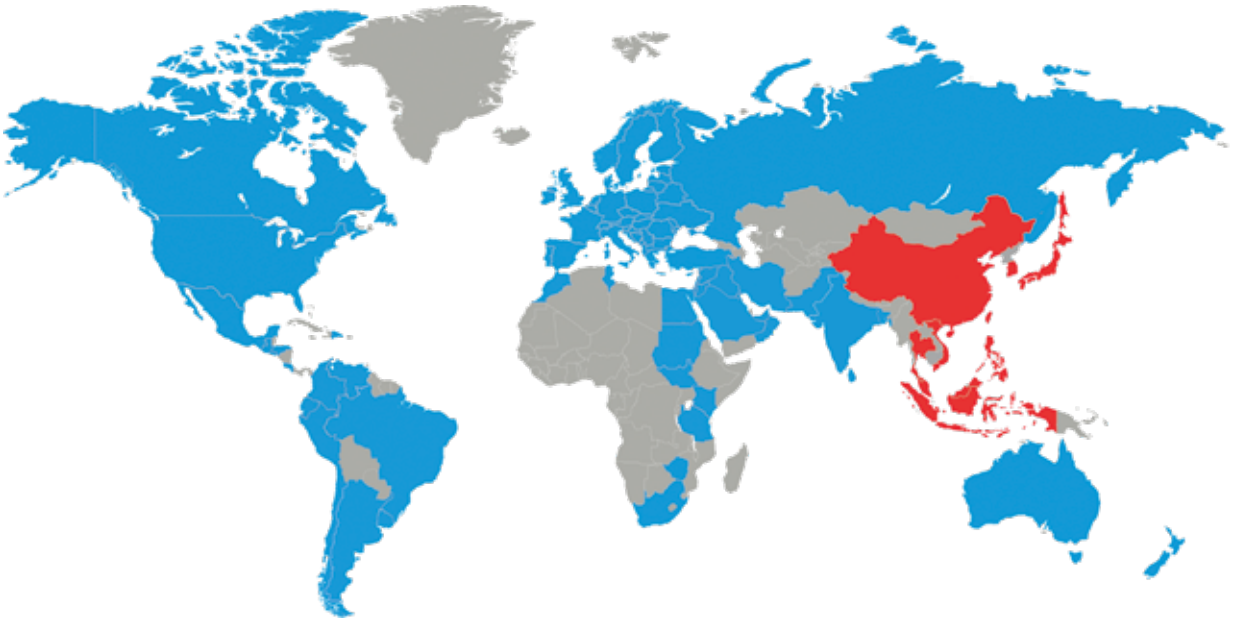
* Preheating temperature must be established throughout the die and must be maintained for the entirety of the welding process, to prevent weld cracking.

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

UDDEHOLM
a voestalpine company

ASSAB