ASSAB PM 30 SUPERCLEAN

UDDEHOLM VANADIS 30 SUPERCLEAN

ASSAB	UDDEHOLM a voestalpine company	REFERENCE STANDARD		
		AISI	WNr.	JIS
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 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			

20220824

( ) - modified grade

Edition 20230725

ASSAB PM 30 SuperClean

ASSAB PM 30 SuperClean is a Co high alloyed powder metallurgy high speed steel corresponding to AISI M3:2 + Co. The high compressive strength, 67 HRC, and good abrasive wear resistance makes ASSAB PM 30 SuperClean suitable for demanding cold work applications and for cutting tools as an alternative to AISI M42 or other Co-alloyed HSS.

The PM process gives a good machinability and grindability as well as a good dimension stability during heat treatment.

APPLICATIONS

ASSAB PM 30 SuperClean is a cobalt alloyed high performance PM high speed steel. The cobalt addition of approx. 8.5% has a positive influence on the hot strength/hot hardness, temper resistance and modulus of elasticity. The presence of cobalt has little influence on wear resistance. As cobalt does not form carbides, the wear resistance of ASSAB PM 30 SuperClean is more or less the same as for steels with the same base analysis but without cobalt (e.g. ASSAB PM 23 SuperClean). On the other hand, its presence reduces the toughness and hardenability somewhat but increases compressive strength and high temperature properties.

FOR COLD WORK

- The combination of high wear resistance and unusually good compressive strength can be put to use in tooling for heavy forming operations.
- In some cold work operations, the active surface (e.g. cutting edge or forming surface) of a tool can reach temperatures in excess of 200°C. Such conditions can be found in tooling running on high speed presses. Also, development of high temperatures in the tooling can be expected in heavy forming operations.

GENERAL

ASSAB PM 30 SuperClean is a W-Mo-V-Co alloyed PM high speed steel characterised by:

- High wear resistance
- High compressive strength at high hardness
- Good through hardening properties
- Good toughness
- Good dimensional stability on heat treatment
- Good graindability and machinability
- Very good temper resistance

Typical analysis %	C 1.28	Cr 4.2	Mo 5.0	W 6.4	V 3.1	Co 8.5
Standard specification	W.-Nr. 1.3294 AISI (M3:2 +Co)					
Delivery condition	Soft annealed, max. 300 HB Drawn max. 320 HB					

PROPERTIES

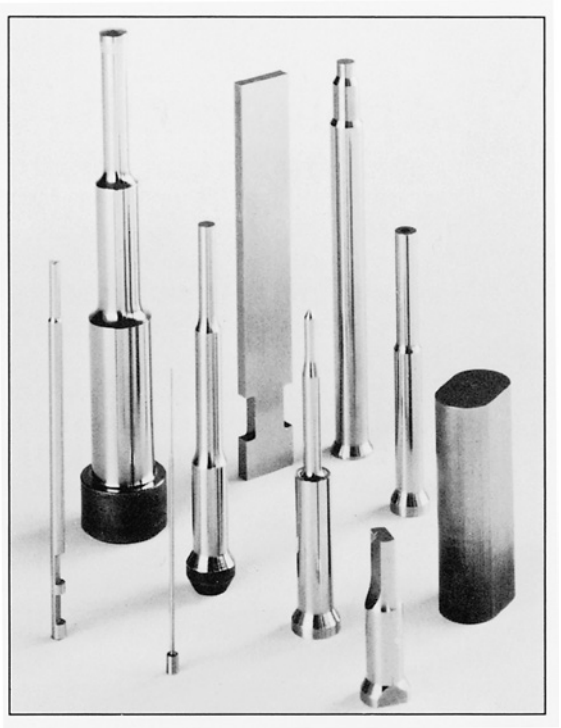
PHYSICAL DATA

Temperature	20°C	400°C	600°C
Density [1] kg/m³	8 040	7 935	7 880
Modulus of elasticity[2] MPa	240 000	214 000	192 000
Thermal conductivity[2] W/m°C	22	26	25
Specific heat[2] J/kg°C	420	510	600

[1] = for the soft annealed condition.
[2] = for the hardened and tempered condition.

COEFFICIENT OF THERMAL EXPANSION

Temperature range, °C	Coefficient, °C from 20
20 - 100	10.1×10^{-6}
20 - 200	10.3×10^{-6}
20 - 300	10.6×10^{-6}
20 - 400	11.0×10^{-6}
20 - 500	11.2×10^{-6}
20 - 550	11.3×10^{-6}



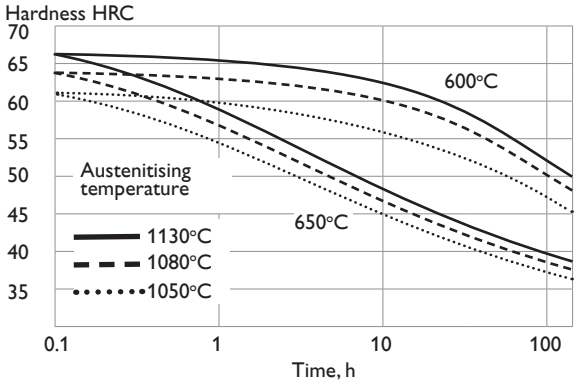
Punches for high performance. A suitable application for ASSAB PM 30 SuperClean.

HIGH TEMPERATURE PROPERTIES

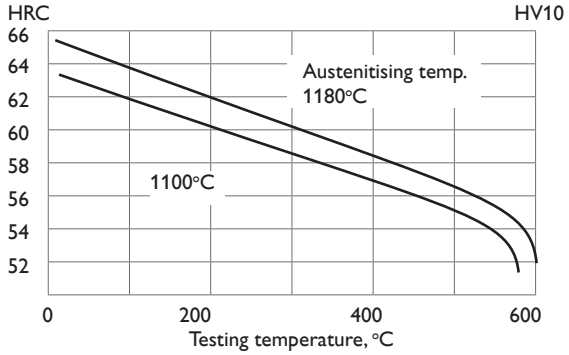
Austenitising temperature: 1050–1130°C.

Tempering: 3 x 1 h at 560°C.

CHANGE IN HARDNESS VERSUS HOLDING TIME FOR DIFFERENT WORKING TEMPERATURES



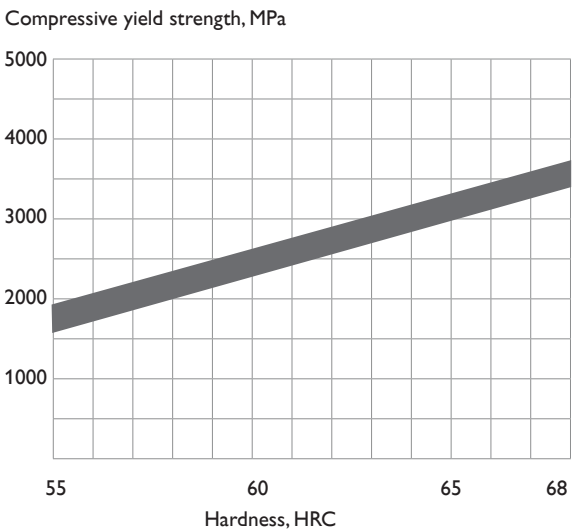
ASSAB PM 30 SUPERCLEAN HOT HARDNESS



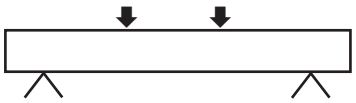
COMPRESSIVE YIELD STRENGTH

Specimen: Hourglass shaped with 10 mm Ø waist

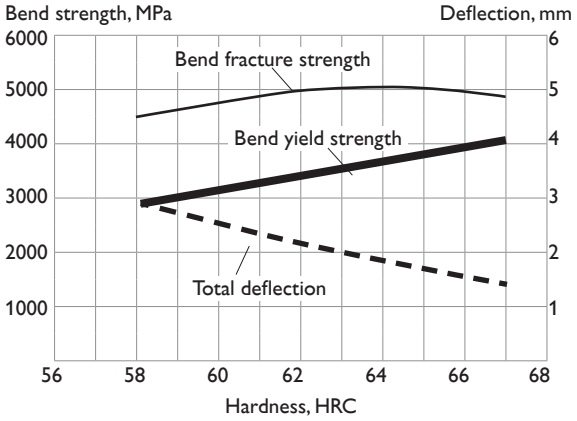
APPROXIMATE COMPRESSIVE YIELD STRENGTH VERSUS HARDNESS AT ROOM TEMPERATURE



BEND STRENGTH AND DEFLECTION



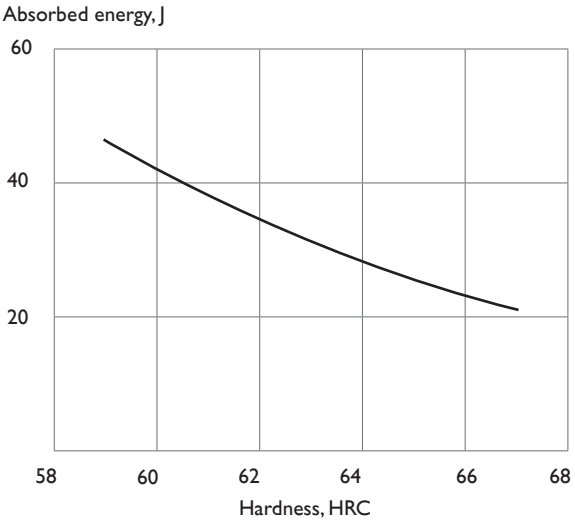
Four-point bend testing
Specimen size: 5 mm Ø
Loading rate: 5 mm/min
Austenitising temperature: 1050–1180°C
Tempering: 3 x 1 h at 560°C, air cooling to room temperature.



IMPACT STRENGTH

Specimen size: 7 x 10 x 55 mm
Specimen type: unnotched
Tempering: 3 x 1 h at 560°C

APPROXIMATE ROOM TEMPERATURE IMPACT STRENGTH AT DIFFERENT HARDNESS LEVELS



HEAT TREATMENT

SOFT ANNEALING

Protect the steel and heat through to 850–900°C. Then cool in the furnace at 10°C per hour to 700°C, then freely in air.

STRESS RELIEVING

After rough machining the tool should be heated through to 600–700°C, holding time 2 hours. Cool slowly to 500°C, then freely in air.

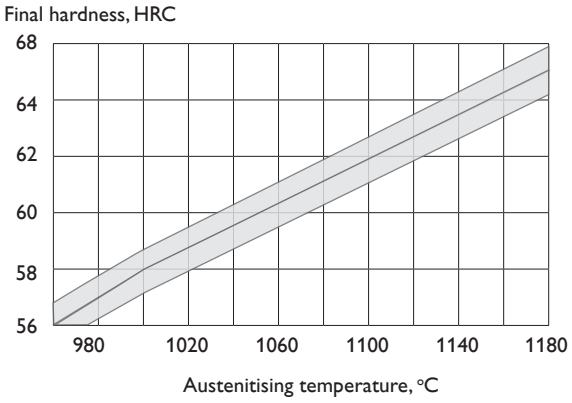
HARDENING

Pre-heating temperature: 450–500°C and 850–900°C

Austenitising temperature: 1050–1180°C, according to the desired final hardness.

The tool should be protected against decarburisation and oxidation during hardening.

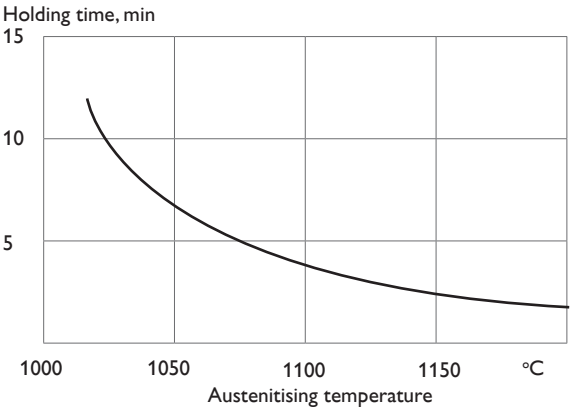
HARDNESS AFTER TEMPERING 3 TIMES FOR 1 HOUR AT 560°C



Hardness for different austenitising temperatures after tempering 3 times for one hour at 560°C

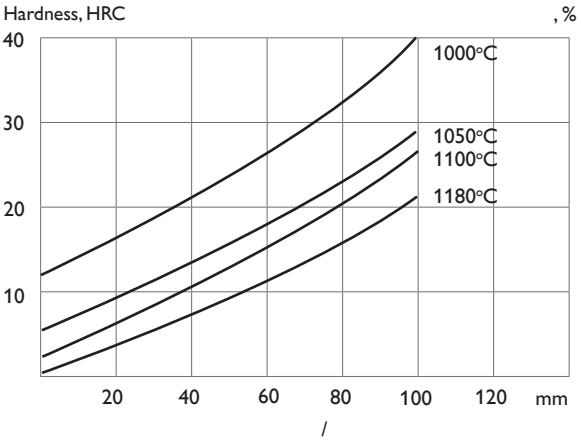
Hardness, HRC	Austenitising temperature °C
60	1000
62	1050
64	1100
66	1150
67	1180

RECOMMENDED HOLDING TIME, FLUIDISED BED, VACUUM OR ATMOSPHERE FURNACE



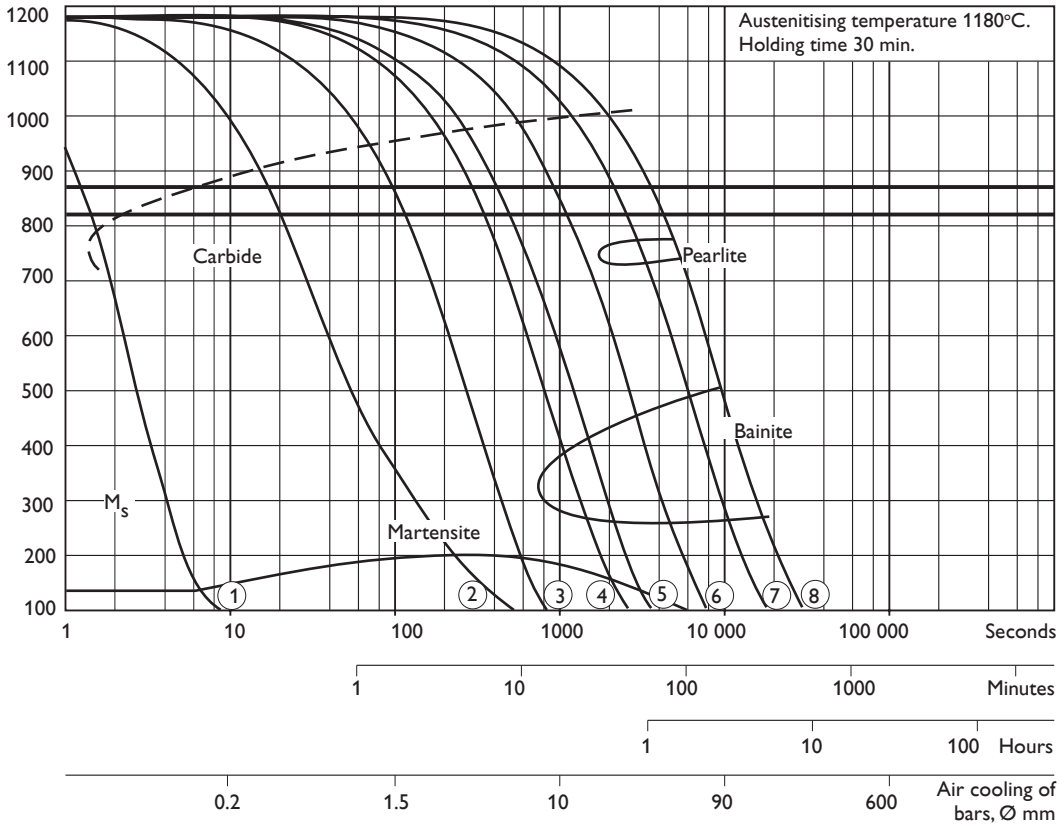
Note: Holding time = time at austenitising temperature after the tool is fully heated through.

TOTAL SOAKING TIME IN A SALT BATH AFTER PRE-HEATING IN TWO STAGES AT 450°C AND 850°C



CCT-GRAPH (CONTINUOUS COOLING)

Austenitising temperature 1180°C.



A_{c1_f} = 870°C

A_{c1_s} = 820°C

Cooling Curve No.	Hardness HV10	$T_{800-500}$ (sec)
1	824	1
2	882	36
3	933	140
4	673	450
5	649	630
6	572	1390
7	566	3205
8	530	5215

QUENCHING MEDIA

- Vacuum furnace with high speed gas at sufficient overpressure, (≥ 2 bar)
- Martempering bath at approx. 540°C

Note 1 : Quenching should be continued until the temperature of the tool reaches approx. 50°C. The tool should then be tempered immediately.

Note 2 : In order to obtain a high toughness, the cooling speed in the core should be at least 10°C/sec. This is valid for cooling from the austenitising temperature down to approx. 540°C. After temperature equalisation between the surface and core, the cooling rate of approx. 5°C/sec. can be used. The above cooling cycle results in less distortion and residual stresses.

TEMPERING

Tempering should always be carried out at 560°C irrespective of the austenitising temperature. Temper three times for one hour at full temperature. The tool should be cooled to room temperature between the tempers.

The retained austenite content will be less than 1% after this tempering cycle.

DIMENSIONAL CHANGES

Dimensional changes after hardening and tempering.

Heat treatment : Austenitising between 1050 – 1130°C and tempering 3 x 1 h at 560°C.

Specimen size: 80 x 80 x 80 mm and 100 x 100 x 25 mm.

Dimensional changes: growth in length, width and thickness +0.03% – +0.13%.

SURFACE TREATMENT

Some tools are given a surface treatment in order to reduce friction and increase tool wear resistance.

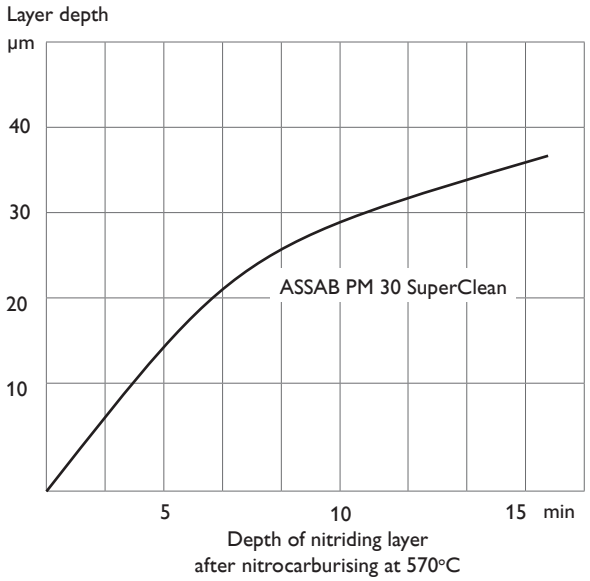
The most commonly used treatments are nitriding and surface coating with wear resistant layers of titanium carbide and titanium nitride (CVD, PVD).

ASSAB PM 30 SuperClean has been found to be particularly suitable for titanium carbide and titanium nitride coatings. The uniform carbide distribution in ASSAB PM 30 SuperClean facilitates bonding of the coating and reduces the spread of dimensional changes resulting from hardening. This, together with its high strength and toughness, makes ASSAB PM 30 SuperClean an ideal substrate for high wear surface coatings.

NITRIDING

A brief immersion in a special salt bath to produce a nitrided diffusion zone of 2–20 µm is recommended.

This reduces the friction on the envelope surface of punches and has various other advantages.



Depth of nitriding layer
after nitrocarburising at 570°C

PVD

Physical vapour deposition, PVD, is a method of applying a wear-resistant coating at temperatures between 200–500°C.

As ASSAB PM 30 SuperClean is high temperature tempered at 560°C there is no danger of dimensional changes during PVD coating.

CVD

Chemical vapour deposition, CVD, is used for applying wear resistant surface coatings at a temperature of around 1000°C.

It is recommended that the tools should be separately hardened and tempered in a vacuum furnace after surface treatment.

CUTTING DATA RECOMMENDATIONS

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

Condition: soft annealed to ~300 HB.

TURNING

Cutting data parameter	Turning with carbide		Turning with high speed steel
	Rough turning	Fine turning	Fine turning
Cutting speed (V_c) m/min	80 – 110	110 – 140	10 – 15
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	K20, P10 – P20 Coated carbide* or cermet*	K15, P10 Coated carbide* or cermet*	-

* Use a wear resistant CVD coated carbide grade

DRILLING

HIGH SPEED STEEL TWIST DRILL

Drill diameter mm	Cutting speed (Vc) m/min	Feed (f) mm/rev
≤ 5	8 – 10*	0.05 – 0.15
5–10	8 – 10*	0.15 – 0.20
10–15	8 – 10*	0.20 – 0.25
15–20	8 – 10*	0.25 – 0.35

* For TiCN coated HSS drill v_c = 14–16 m/min.

CARBIDE DRILL

Cutting data parameter	Type of drill		
	Indexable insert	Solid carbide	Carbide tip [1]
Cutting speed (V_c) m/min	100 – 130	50 – 70	25 – 35
Feed. (f) mm/rev	0.05 – 0.15 [2]	0.10 – 0.25 [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

MILLING

FACE AND SQUARE SHOULDER MILLING

Cutting data parameter	Turning with carbide	
	Rough milling	Fine milling
Cutting speed (V_c) m/min	40 – 80	80 – 110
Feed (f) mm/tooth	0.2 – 0.4	0.1 – 0.2
Depth of cut (a_p) mm	2 – 4	≤ 2
Carbide designation ISO	K20–P20 Coated carbide*	K15–P15 Coated carbide* or cermet*

* Use a wear resistant CVD coated carbide grade

END MILLING

Cutting data parameter	Type of end mill		
	Solid carbide	Carbide indexable insert	High speed steel [1]
Cutting speed (V_c) m/min	35 – 45	70 – 90	12 – 16
Feed. (f) mm/tooth	0.01 – 0.2 [2]	0.06 – 0.20 [2]	0.01 – 0.3 [2]
Carbide designation ISO	–	K15 P10–P20 Coated carbide [3] or cermet [3]	–

[1] A coated high speed steel end mill
[2] Depending on radial depth of cut and cutter diameter
[3] Use a wear resistant CVD coated carbide grade

GRINDING

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

Type of grinding	Annealed condition	Hardened condition
Face grinding straight wheel	A 46 HV	B151 R50 B3 [1] A 46 HV [2]
Face grinding segments	A 36 GV	A 46 GV
Cylindrical grinding	A 60 KV	B151 R50 B3 [1] A 60 KV [2]
Internal grinding	A 60 JV	R151 R75 B3 [1] A 60 IV
Profile grinding	A 100 JV	B126 R100 B6 [1] A 120 JV

[1] If possible, use CBN-wheels for this application
[2] Preferably a wheel type containing sintered Al_2O_3 (seeded gel)

ELECTRICAL DISCHARGE MACHINING — EDM

If EDM is performed in the hardened and tempered condition, finish with "fine-sparking", i.e. low current, high frequency. For optimal performance the EDM'd surface should then be ground/polished and the tool retempered at approx. 535°C.

FURTHER INFORMATION

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

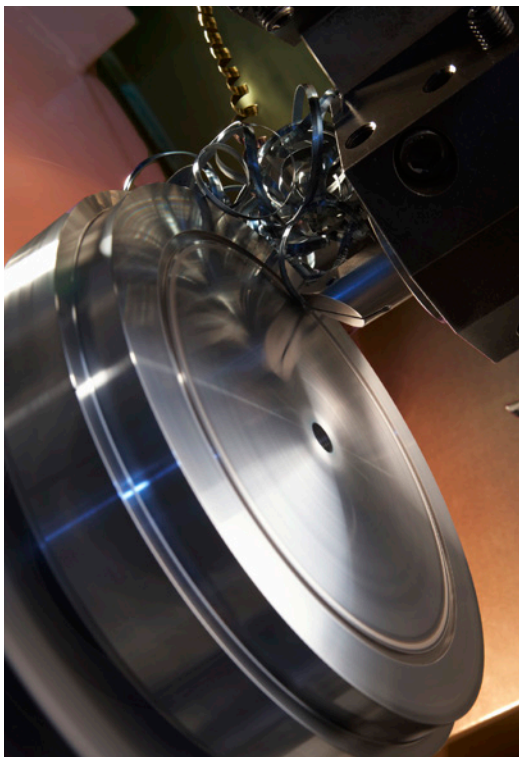
RELATIVE COMPARISON OF ASSAB COLD WORK TOOL STEEL

MATERIAL PROPERTIES AND RESISTANCE TO FAILURE MECHANISMS

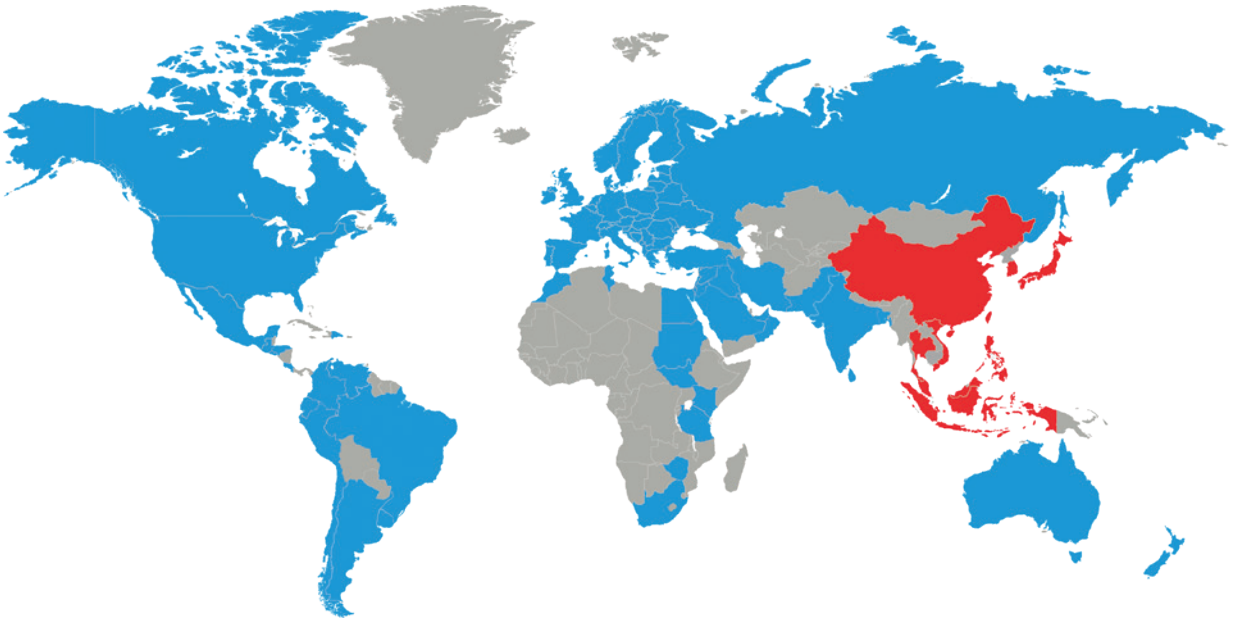
ASSAB Grade	Hardness/ Resistance to plastic deformation	Machinability	Grindability	Dimension stability	Resistance to		Fatigue cracking resistance	
					Abrasive wear	Adhesive wear/Galling	Ductility/ resistance to chipping	Toughness/ gross cracking
Conventional cold work tool steel								
Calmax								
Caldie (ESR)								
ASSAB 88								
ASSAB XW-42								
Powder metallurgical tool steel								
Vanadis 4 Extra*								
Vanadis 8*								
Vancron*								
Powder metallurgical high speed steel								
ASSAB PM 23*								
ASSAB PM 30*								
ASSAB PM 60*								
Conventional high speed steel								
ASSAB M2								

* ASSAB SuperClean PM 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

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