ASSAB M2

GENERAL

ASSAB M2 is a molybdenum-tungsten high speed steel with excellent properties of toughness, wear resistance and machinability. The unique range of properties, determined by the alloy design, leads ASSAB M2 to be the most versatile high speed steel used in several distinct applications.

Typical analysis %	C 0.9	Cr 4.1	Mo 5.0	W 6.2	V 1.8
Reference standard	AISI M2, DIN 1.3343, JIS SKH51, BS BM2, AFNOR Z90WDCV06-05-04-02, UNI HS6-5-2				
Delivery condition	Hot-rolled, hardness ≤280 HB Cold-rolled, hardness ≤290 HB				

APPLICATIONS

ASSAB M2 is particularly suitable for cutting tools such as taps, twist drills, reamers, broaching tools, metal saws, milling tools of all types.

ASSAB M2 is also suitable as cold work steel for applciations such as punching, forming and embossing moulds. Its combination of excellent wear resistance and toughness is better than other high-alloy cold work steel.

PROPERTIES

PHYSICAL DATA

Temperature	20°C
Density kg/m^3	8100
Modulus of elasticity KN/mm^2	219
Thermal conductivity W/m°C	22
Specific heat J/kg°C	433

Temperature	100°C	200°C	400°C	600°C
Coefficient of thermal expansion /°C from 20°C	11.5 x 10^{-6}	11.7 x 10^{-6}	12.4 x 10^{-6}	13.0 x 10^{-6}

HEAT TREATMENT

ANNEALING

At 770-840°C, controlled slow cooling in furnace (10 to 20°C/h) to approximately 600°C, air cooling. Hardness after annealing: maximum 280 Brinell.

STRESS RELIEVING

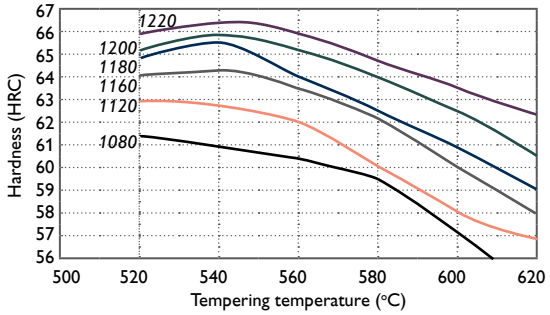
At 600-650°C, slow cooling in furnace. After through heating, hold in neutral atmosphere for 1 to 2 hours.

HARDENING AND TEMPERING

For improved tool performance, the hardening temperature should be chosen depending on the hardness level required, considering a given tempering temperature around 560°C (refer to the graph below). The indicated hardening temperatures are:

Application	Hardening	Tempering
Cutting tools	1180-1220°C	560°C
Cold work dies	1080-1160°C	

The hardening procedure must involve pre-heating at 400-500°C followed by other at 860-880°C. For large tools, it is also recommended to do another pre-heating at 1050°C. After pre-heating, hardening at the suitable austenitising temperature may be conducted, followed by quenching down to room temperature. A protective atmosphere is absolutely necessary. Double tempering treatments, of at least 2 hr, are required and followed by cooling of each tool to room temperature.



Tempering Curve : The austenitising temperatures relative to each curve are indidcated in italics.

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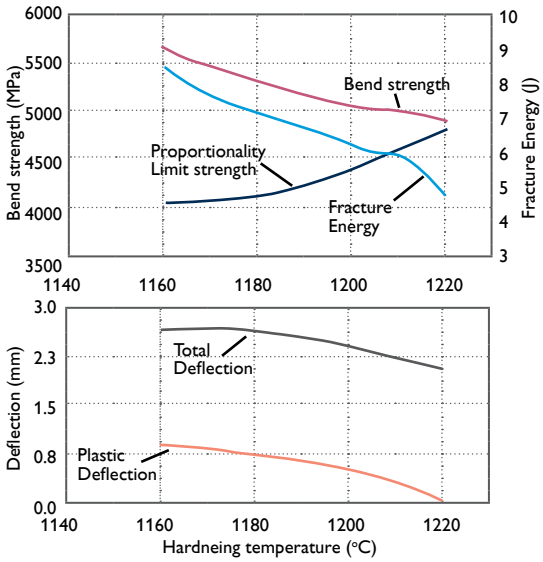
TOUGHNESS

Bend test results show that increase in hardening temperature results in decrease in bend strength, fracture energy and deflections. This indicates that toughness is higher if low hardening temperatures are used. Hardening temperatures between 1080 and 1160°C are necessary for cold work tooling where high toughness is required. For cutting tools, hardening should be in the range of 1180 to 1220°C to improve hardness and wear resistance. Avoid temperatures higher than 1220°C as it can cause a considerable loss in toughness.



* Results for round samples of a Ø5.5 mm bar. Fixed tempering at 560°C

SURFACE TREATMENT

ASSAB M2 is an adequate substrate for PVD coatings, which normally lead to considerable improvements in tool life.

If nitriding is applied, the treatment temperature should be lower than the tempering temperature, to avoid decrease of core hardness.

It is important that, before all surface treatments, tools have clean surface (without oil or grease) and are free from grinding overheating.

MOULD MAKING PROCESSES

MACHINING

ASSAB M2 may be processed through grinding, turning or milling.

ASSAB M2 presents a good grinding behaviour. However, special care in grinding procedure and wheel choice is crucial so as to avoid local heating of the material. Intense local heating causes tool cracking and poor service performance.

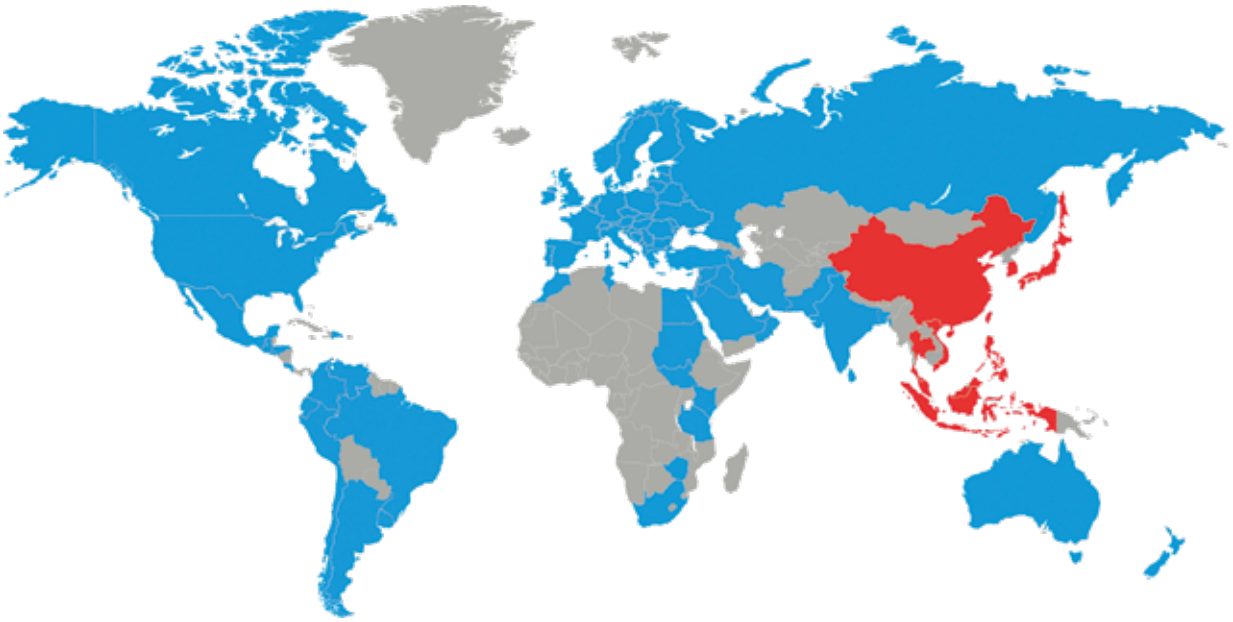
EDM–ELECTRICAL DISCHARGE MACHINING

If EDM is performed in the hardened and tempered condition, the EDM'd surface is covered with a resolidified layer (white layer) and a rehardened and untempered layer, both of which are very brittle and hence detrimental to the tool performance.

When a profile is produced by EDM, it is recommended to finish with "fine-sparking", i.e. low current, high frequency. For optimal performance, the EDM'd surface should be ground/polished to remove the white layer completely. The tool should then be retempered at approx. 25°C below the highest previous tempering temperature.

WELDING

Only indicated if a special procedure of pre-heating is applied and if the filler material is from the same grade.



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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