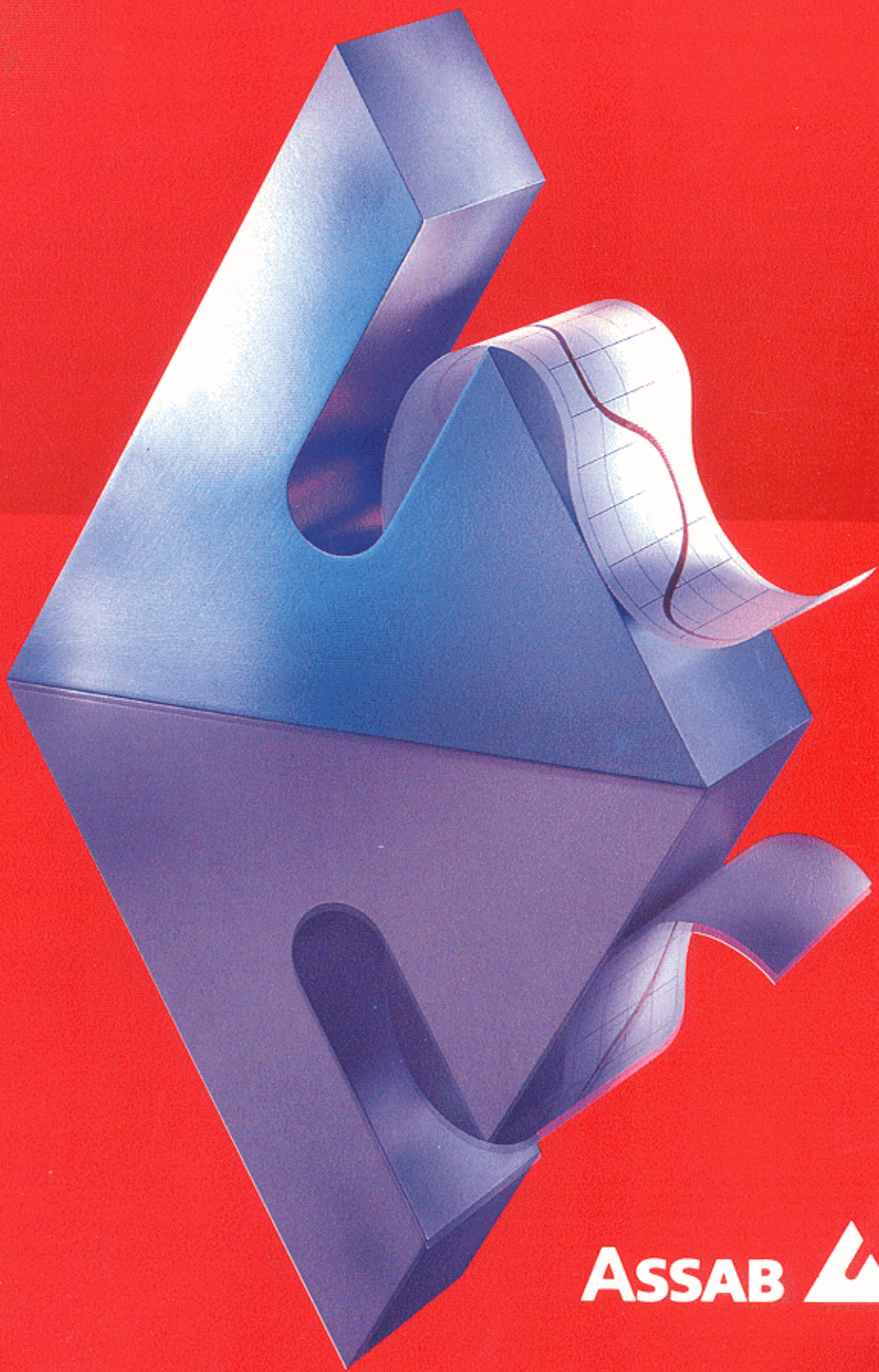
ASSAB 709 M
A new concept in machinery steels



ASSAB

ASSAB 709M

M-STEELS... A new concept in machinery steels

ASSAB M-steels are machinery steels with unique machinability. They are made by a special melting technique which makes it possible to increase the cutting speed by up to 30% or extend the tool life up to four times.
More information about the M-steels can be found in our brochure ASSAB M-STEELS.

NEAREST STANDARDS

AISI/SAE	DIN	W.nr.	BS	AFNOR	JIS	SS
4140	42CrMo4	1.7225	708M42	42CD4	SCM4	2244

CHEMICAL COMPOSITION

C %	Si %	Mn %	Cr %	Mo %
0.42	0.25	0.75	1.05	0.20

PROPERTIES AND APPLICATIONS

ASSAB 709M is an alloyed machinery steel with high strength in small and medium sizes.

As standard ASSAB 709M is supplied tough hardened requiring no further heat treatment. It can be oil hardened to higher mechanical properties.

ASSAB 709M is suitable for flame and induction hardening. It can also be nitrided or tufftrided to a surface hardness of 600—650 Vickers.

ASSAB 709M is not suitable for welding but can with certain precautions be repair welded.

Typical applications include shafts and other power transmission components as well as high strength bolts.

SIZE RANGE

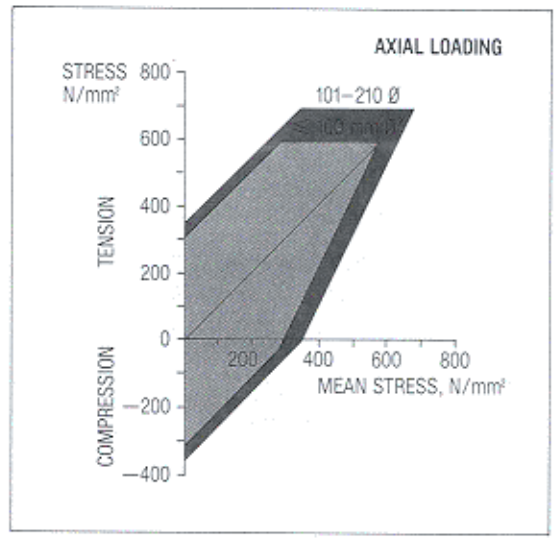
ASSAB 709M is available as standard in sizes 16—210 mm diameter, un-machined.

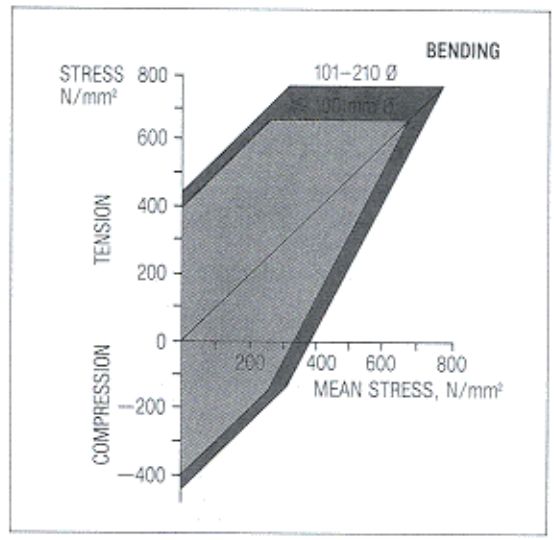
MECHANICAL PROPERTIES AS SUPPLIED

	⩽100 mm	101—210 mm
Yield strength, Re	min. 690 N/mm²	min. 600 N/mm²
Tensile strength, Rm	900—1050 N/mm²	800—950 N/mm²
Elongation, A5	min. 12%	min. 14%
Reduction of area, Z	min. 50%	min. 55%
Impact strength, KU	min. 25 J	min. 25 J
Hardness	275—320 Brinell	245—290 Brinell

The mechanical properties are guaranteed for sizes up to and including 210 mm diameter.

Fatigue strength diagram according to Goodman (Smith)





CUTTING DATA

Turning with coated carbide tools P15

ROUGH TURNING

Tool life T = 15 min

Feed s mm/r	Cutting depth a, mm <2	2—5	>5	Power requirement per cutting depth, kW/mm
	Cutting speed v, m/min			
0.25	290	260	230	3.7
0.32	250	230	205	4.0
0.40	220	205	185	4.2
0.50	200	185	170	4.4
0.65	175	160	140	4.8
0.80	150	140	120	5.2

FINE TURNING

The feed is determined on the basis of reference radius (nose radius) and desired surface finish

Tool life T = 30 min

Surface roughness R_a µm	Reference radius r, mm 0.4	0.8	1.2	1.6
	Feed s, mm/r			
0.8	0.08	0.10	0.12	0.16
1.6	0.12	0.16	0.20	0.25
3.2	0.16	0.20	0.25	0.32
6.3	0.25	0.32	0.40	0.50

Recommended cutting speed	
Feed s, mm/r	Cutting speed v, m/min
0.12	290
0.16	265
0.20	240
0.25	215
0.32	200
0.40	180

CORRECTION COEFFICIENTS

		Coefficient for cutting speed
Tool (coated)	P15	1.00
	P25	0.95
	P35	0.85
Cutting conditions	Forged or rolled surface	0.7—0.9
	Non-continuous machining or large variations in cutting depth	0.8—0.9
	Internal turning	0.8
	Work piece difficult to machine or poor condition of the machine	0.7—0.9

Drilling with high speed steel drills

Cutting lubrication, emulsion

Cutting speed v = 20 m/min

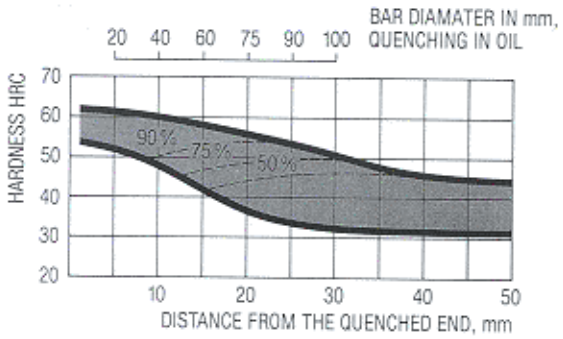
Diam. of drill	Feed	Revolutions	Feeding speed	Power consumption	Drilling depth to 1st chip removal	Drilling depth to next chip removal
d mm	s mm/r	n r/min	n × s mm/min	P kW	mm	mm
3	0.06	1805	108	0.2	12	6
4	0.08	1355	108	0.2	15	8
5	0.09	1080	97	0.3	20	8
6	0.11	900	99	0.4	25	10
8	0.14	675	95	0.6	30	12
10	0.17	540	92	0.8	35	14
12	0.19	450	86	1.0	40	16
16	0.23	340	78	1.4	50	20
18	0.25	300	75	1.6	50	20
20	0.27	270	73	1.9	55	22
25	0.28	215	61	2.3	65	24
30	0.29	180	52	2.7	70	26
40	0.31	135	42	3.5	90	26
50	0.34	110	37	4.3	110	26

CORRECTION COEFFICIENTS

		Coefficient for cutting speed	Coefficient for feed
Drilling depth l	l = ≤4 × d	1.00	1.00
	l = 4 × d—8 × d	0.80	0.80
Machining condition	Through hole	0.85	
	Poor condition or lack of stability of the machine	0.80	0.80
	Especially favourable machining conditions	1.20	

The values in the above tables are applicable for ASSAB 709M, in sizes up to 100 mm dia. Tough hardened to 275—320 HB. Values for heavier sizes (tough hardened to 245—290 HB) can be taken from the tables in our brochure, M-STEELS, machining.

Hardenability diagram



Soft annealing at 680—720°C
Soak at temperature for 2 hours. Cool with furnace at a maximum rate of 15°C per hour down to 600°C, and then freely in air.

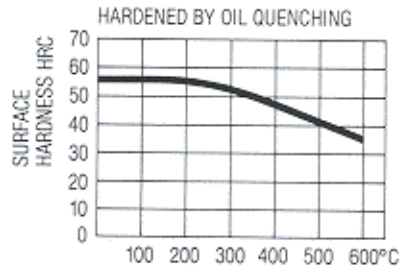
Stress relieving at 450—650°C
Tough hardened steel should be heated to approx. 50°C below the temperature at which tempering was carried out (as standard ASSAB 709M is supplied tempered at 600°C and should, thus, be stress relieved at 550°C). Soak for 1/2—2 hours after the material has reached full temperature. Cool with furnace down to 450°C, and then freely in air.

Hardening at 830—850°C with quenching in oil. Soaking time in minutes when the surface has attained full temperature, is 0.7 × thickness in mm. Interrupt the quenching at 125°C and temper immediately afterwards.

Flame or induction hardening at 880—900°C
After heating the surface, quench immediately in water or oil. Quenching in water for parts of simple design. Oil quenching for more complicated design. The hardness, approx. 58—62 HRC, is dependent on factors such as workpiece size and quenching procedure. After hardening, tempering to required surface hardness.

Tempering at 500—700°C
Soaking time should be 1—2 hours after the workpiece has attained full temperature throughout.

Tempering diagram



Effect of tempering temperature on the mechanical properties

R_e YIELD STRENGTH OR 0.2% PROOF STRESS, N/mm²
R_m TENSILE STRENGTH, N/mm²
HB BRINELL HARDNESS
A_5 ELONGATION AFTER FRACTURE, MEASURING LENGTH 5XD, %
Z REDUCTION OF AREA, %

TESTPIECE HARDENED BY OIL QUENCHING FROM 850°C.