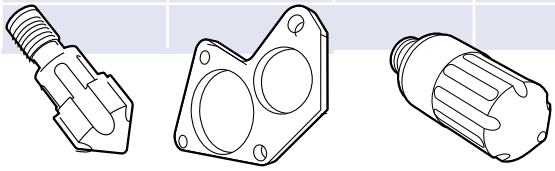
CPM 9V

Chemical Composition

C	1.8%	Cr	5.3%
Mo	1.3%	V	9.0%



CPM 9V

CPM® 9V is a wear resistant cold work steel with high toughness of the CPM® tool steel family. It combines a high density with a tough matrix, resulting in a high wear and creep resistant tool steel with a high toughness and a good compressive strength. CPM® 9V is often selected as an alternative to 1.2343 for tools and machine components where, in the higher hardness range, enhanced wear resistance, cutting edge stability and toughness at elevated temperatures are required.

READYMILLED.COM

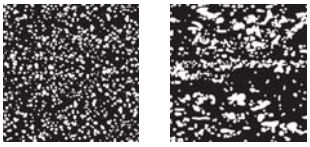
Rectangular sections from 25mm³ up to 430 x 430 x 150mm can be delivered fine milled on all six faces to - 0+0.1mm and with squareness guaranteed to 0.1mm/m.

Typical Applications

- Blanking and punching, even for thicker sheet metals
- Fine blanking for sheets thicker than 8mm
- Dies for cold and semi cold extrusion
- Embossing dies
- High speed metal-cutting tools
- Sinter pressing tools
- Shearing and deburring tools
- Plastic forming tools

zapp

POWDER METALLURGICAL AND CONVENTIONAL MICROSTRUCTURE



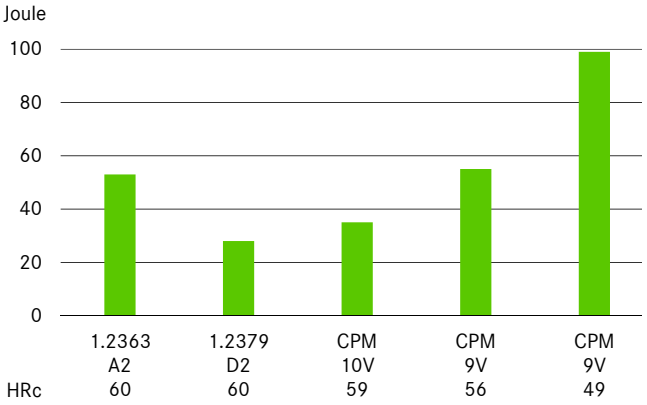
The uniform distribution of carbides in the powder- metallurgical structure compared to conventional tool steels with big carbides and carbide clusters.

PHYSICAL PROPERTIES

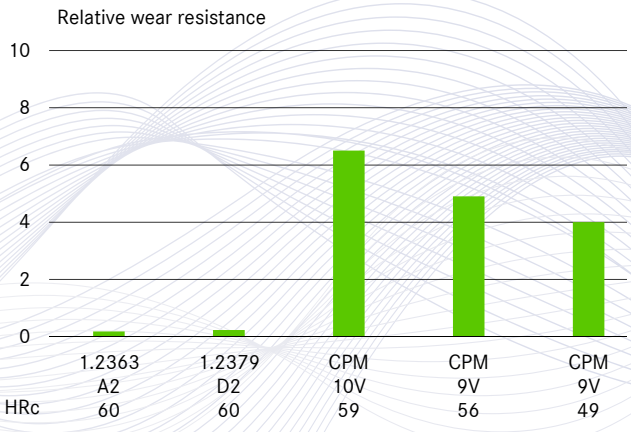
Modulus of elasticity E [GPa]	221
Density [kg/dm³]	7.5
Coefficient of thermal expansion [mm/mm /K] over temperature range of	
20 – 90 °C	11.1 x 10^{-6}
20 – 200 °C	11.2 x 10^{-6}
20 – 430 °C	11.6 x 10^{-6}
20 – 650 °C	11.9 x 10^{-6}
Thermal conductivity [W/(m*K)] at	
20 °C	20.5
100 °C	21.6
200 °C	23.1
300 °C	25.3
500 °C	25.8
540 °C	26.0

TOUGHNESS

Charpy C-Notch impact test



WEAR RESISTANCE



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HEAT TREATMENT

Soft Annealing

The material is heated uniformly to a temperature of 900° C and then maintained at this temperature for 2 hours. Then, the material is cooled to 550°C in a furnace at a cooling rate of maximum 15°C per hour. It is then further cooled in still air down to room temperature. The typical hardness achieved by soft annealing is approx. 220-260 HB.

Stress Relieving

Rough machined material is stress relieved by heating to 600-700°C. Once complete heat penetration has been reached (minimum 2 hours), the material is allowed to cool in the furnace to approximately 500°C followed by cooling in air. Hardened material is stress relieved at 15-30°C for 2 hours below last tempering temperature followed by cooling in air.

Straightening

Straightening should be done in the temperature range of 200 to 430°C.

Hardening

Hardening of CPM® 9V usually involves the use of two preheating steps according to the table on the right. Depending on a furnace and charging, additional preheating steps can be implemented. Maximum toughness is attained by austenitizing at 1070°C, whilst maximum wear resistance is attained by austenitizing at 1180°C. In order to achieve a corresponding degree of dissolution of the alloying elements, as well as an appropriate hardening, minimum heat penetration times as given in the table are recommended. These holding times should be correspondingly adapted for thick or thin-walled material cross sections.

Quenching

Quenching can take place in hot bath at 540°C, oil or pressurised gas. Quenching in salt bath or oil leads to maximum hardness, whereas cooling in vacuum can lead to lower values of 1-2 HRc. By use of vacuum quenching a minimum pressure needs to be adjusted for complex tool shapes in order to minimise risk of cracking and tool distortion, For attaining ideal toughness properties, it is recommended to apply the hot bath quenching method. For attaining ideal toughness properties, it is recommended to apply the hot bath quenching method. For attaining ideal toughness properties, it is recommended to apply the hot bath quenching method. For attaining maximum hardness after quenching, the cooling rate between 1000°C and 590°C needs to be maximised.

Tempering

Tempering should be carried out immediately after the material has cooled down to below 40°C or when the tool can beheld with hands. Triple tempering with a holding time of 2 hours in each stage at the tempering temperature is necessary. It is important to ensure that the tools are cooled down to room temperature between the individual tempering stages. Temperatures below 540°C should be avoided in order to ensure satisfactory tempering results.

Surface Treatments

CPM 9V can be nitrided and/ or PVD/ CVD coated.

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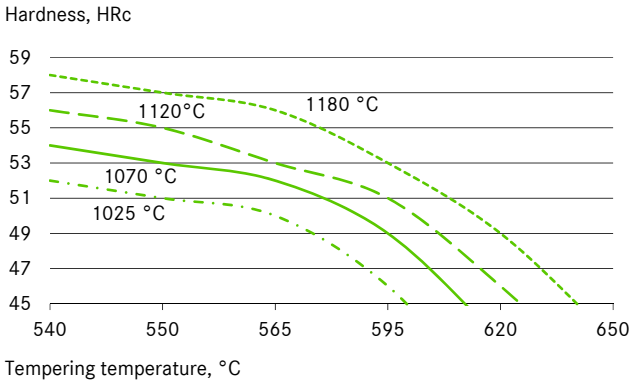
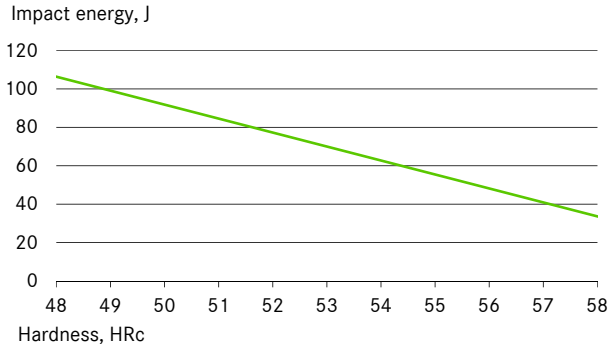
CPM 9V

TEMPERING DIAGRAM



TOUGHNESS VALUES



HEAT TREATMENT INSTRUCTIONS

1st preheating	450–500 °C
2nd preheating	850–900 °C
(3rd preheating)	1000-1050 °C
Hardening	As specified in table
Tempering	3 x each 2 hours as specified in table

Quenching after hardening in hot bath at approx. 550°C or in vacuum at least at 5 bar overpressure.

Required hardness HRc ± 1	Austenitizing temperature °C	Holding time at austenitizing temperature minutes*	Tempering temperature °C
54	107	60	540
53	107	60	560
49**	1	60	590
43	107	60	620
56	112	30	540
53***		30	560
50	112	30	590
45	112	30	620
57 ****	1180	15	540

* In case of previous preheating at 870 °C. The data referred to 13 mm round bar samples. The holding times at austenitizing temperature should be correspondingly adapted for large and very thin profile dimensions. The maximum permissible austenitizing temperature of 1080 °C must not be exceeded.

** Best toughness

*** Best combination wear resistance/ toughness

**** Best wear resistance

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MACHINING DATA

TURNING

Cutting parameter	Turning with cemented carbide medium turning	finish turning	HSS
Cutting speed (V_c) m/min.	70-100	100-120	8-10
Feed (f) mm/U	0.2–0.4	0.05–0.2	0.05–0.3
Cutting depth (a_p) mm	2–4	0.05–2	0.5–3
Tools according ISO	P 10–P 20*	P 10*	–

* Use wear resistant coated cemented carbide, e.g. Coromant 4015 or Seco TP 100.

MILLING

FACE- AND EDGEMILLING

Cutting parameter	Milling with cemented carbide medium turning	finish turning	HSS
Cutting speed (V_c) m/min.	50-70	70-100	15
Feed (f) mm/U	0.2–0.3	0.1–0.2	0.1
Cutting depth (a_p) mm	2–4	1–2	1–2
Tools according ISO	K 15*	K 15*	–

* Use wear resistant coated cemented carbide, e.g. Coromant 4015 or Seco TP 100.

END MILLING

Cutting parameter	Solid carbide	Milling cutter w. indexable tips	Coated HSS
Cutting speed (V_c) m/min.	25-35	60-80	12*
Feed (f) mm/U	0.01–0.20**	0.06–0.20**	0.01–0.30**
Tools according ISO	K 20	P 25***	–

* for TiCN-coated end mills made of HSS V_c ~ 25-30 m/min.
** depends on radial depth of cut and on milling cutter - diameter
*** Use wear resistant coated cemented carbide, e.g. Coromant 3015 or SECO T15M.

DRILLING

SPIRAL DRILL MADE OF HSS

Driller-ø mm	Cutting speed (V_c) m/min.	Feed (f) mm/U
0 – 5	5 - 8*	0.05–0.15
5 –10	5 - 8*	0.15–0.25
10 –15	5 - 8*	0.25–0.35
15 –20	8 – 8*	0.35–0.40

* for TiCN-coated end mills made of HSS V_c ~ 25-30 m/min.

CARBIDE METAL DRILLER

Cutting parameter	Drill type Insert drill	Solid carbide tip	Coolant bore driller with carbide tip*
Cutting speed (V_c) m/min.	70-90	40	35
Feed (f) mm/U	0.08–0.14**	0.10–0.15**	0.10–0.20**

* driller with coolant bores and a soldered on carbide tip
** depends on driller-diameter

GRINDING

Grinding method	soft annealed	hardened
Surface grinding, straight grinding wheels	A 13 HV	B 107 R75 B3* 3SG 46 GVS** A 46 GV
Surface grinding	A 24 GV	3SG 36 HVS**
Cylindrical grinding	A 60JV	B126 R75 B3* 3SG 60 KVS** A 60 IV
Internal grinding	A 46 JV	B126 R75 B3* 3SG 80 KVS** A 60 HV
Profile grinding	A 100 LV	B126 R100 B6* 5SG 80 KVS** A 120 JV

* for these applications we recommend CBN-wheels
** grinding wheel from the company Norton Co.

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