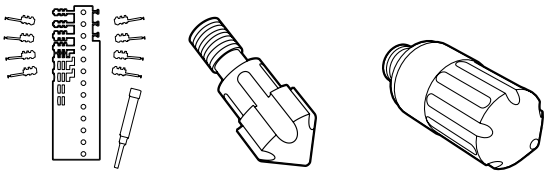
TOOLING ALLOYS
DATA SHEET CPM® 10V

ZAPP IS CERTIFIED TO ISO 9001



CHEMICAL COMPOSITION

Carbon	2.5 %
Chromium	5.3 %
Vanadium	9.8 %
Molybdenum	1.3 %
Manganese	0.5 %
Silicon	0.9 %

CPM® 10V

CPM® 10V is a wear resistant, high performance grade of the CPM® tool steel family. The high amount of Vanadium carbides in a tough matrix provides the optimal combination of wear resistance, cutting edge stability and a good toughness.
CPM 10V is particularly suitable as a high performance alternative to 1.2379 or 1.3344 when significant tool performance improvements are required or as an alternative to “tough” carbide grades for intricate and crack (fracture) sensitive tools.

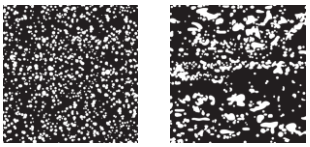
TYPICAL APPLICATIONS

_ punching dies and tools
_ fine blanking tools
_ knife blades for cutting, shearing and deburring
_ guillotine blades and industrial knives and rollers
_ paper and film cutters
_ cold forming tools
_ tool and tool inserts in the plastic processing industry
_ sinter pressing tools

PHYSICAL PROPERTIES

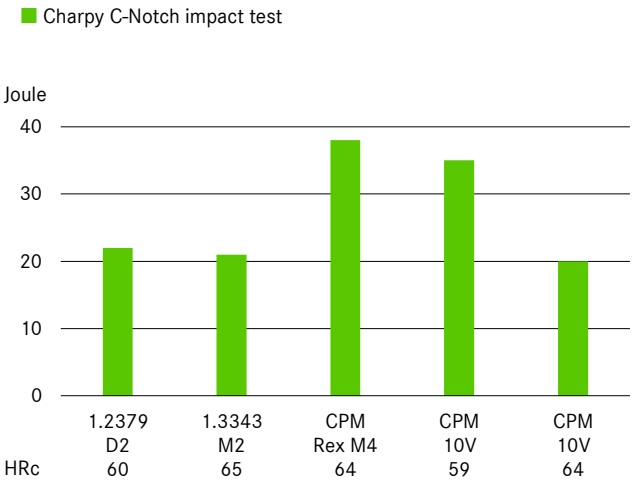
Modulus of elasticity E [GPa]	221
Density [kg/dm³]	7.41
Coefficient of thermal expansion [mm/mm/K] over temperature range of	
20 - 100 °C	10.7 x 10^{-6}
20 - 250 °C	11.1 x 10^{-6}
20 - 425 °C	11.8 x 10^{-6}
20 - 600 °C	12.3 x 10^{-6}
Thermal conductivity [W/(m*K)] at	
20 °C	20.4
100 °C	21.5
300 °C	24.9
500 °C	26.3

POWDER METALLURGICAL AND CONVENTIONAL MICROSTRUCTURE



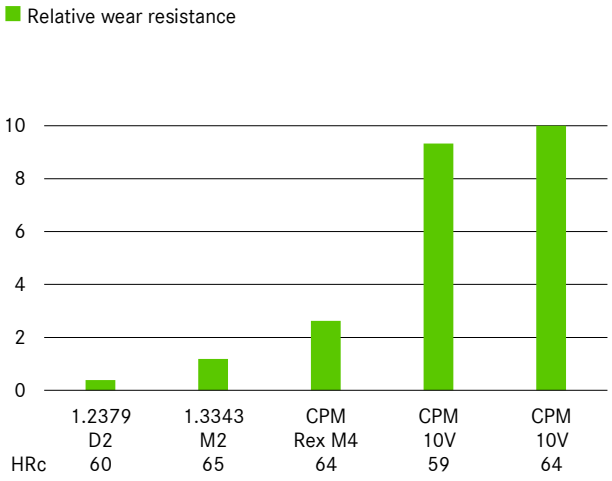
The uniform distribution of carbides in the powder- metallurgical structure compared to conventional tool steels with big carbides and carbide clusters.

TOUGHNESS



Standard size of the Charpy-test-piece with a 12.7 mm notch radius.

WEAR RESISTANCE



HEAT TREATMENT ANNEALING

SOFT ANNEALING

The material is heated uniformly to a temperature of 870 °C and then maintained at this temperature for 2 hours. Then, the material is cooled to 540 °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 approximately 250-280 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® 10V usually involves the use of two preheating steps according to the table on the right. Depending on 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, a minimum heat penetration time of 30 minutes for hardening at 1070 °C or 10 minutes for hardening at 1180 °C is 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 pressurized 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 of 6 bar is recommended. The appropriate pressure needs to be adjusted for complex tool shapes in order to minimize risk of cracking and tool distortion. 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 700°C needs to be maximized.

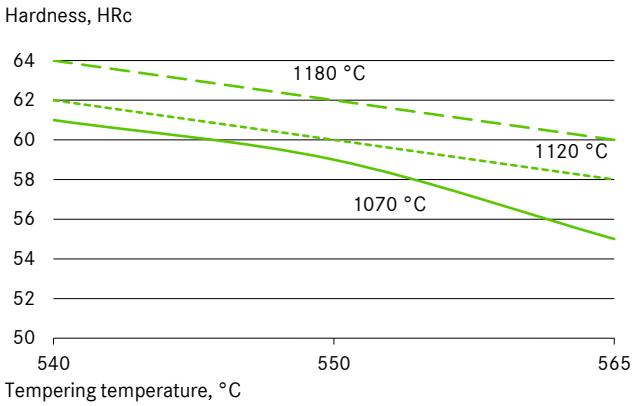
TEMPERING

Tempering should be carried out immediately after the material has cooled down to below 40 °C or when the tool can be held with hands. Two-stage tempering is obligatory while triple tempering is recommended particularly when hardening takes place at temperatures above 1150 °C. It is important to ensure that the tools are cooled down to room temperature between the individual tempering stages. The standard tempering temperature is 540 °C. With exception to the stress relieving procedure, temperatures below 540 °C should be avoided in order to ensure effective tempering treatment.

SURFACE TREATMENTS

CPM® 10V can be nitrided and/or PVD/CVD coated.

TEMPERING DIAGRAM



HEAT TREATMENT INSTRUCTIONS

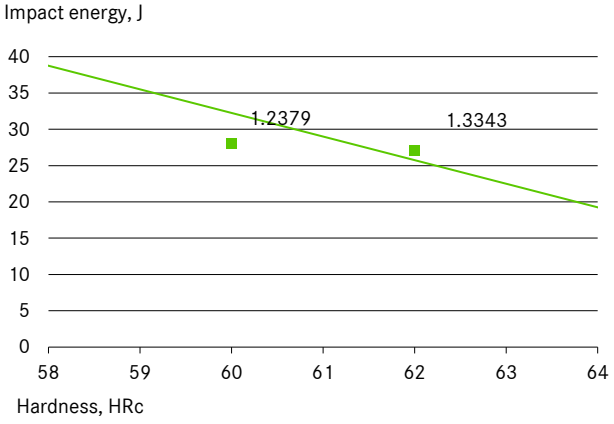
1st preheating	450–500 °C
2nd preheating	850–900 °C
3rd preheating	1000-1050 °C
Hardening	as specified in table
Tempering	3 x each 2 hours as specified in table

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**
58	1060	30–40	540
60	1070	30–40	540
61	1100	25–35	540
62	1120	20–30	540
63	1150	15–20	540
64	1180	10–15	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 1180 °C must not be exceeded.

TOUGHNESS VALUES



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.	20–35	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-⌀ mm	Cutting speed (V_C) m/min.	Feed (f) mm/U
–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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