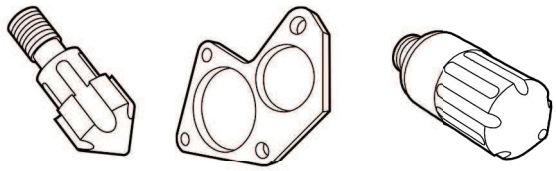
TOOL ALLOYS
DATA SHEET CPM® 9 V

CERTIFIED TO ISO 9001



CHEMICAL COMPOSITION

Carbon	1.90 %
Chromium	5.25 %
Vanadium	9.00 %
Molybdenum	1.30 %
Manganese	0.50 %
Silicon	0.90 %

CPM® 9 V

is a new type of tool steel produced in a special Crucible Particle Metallurgy process. The base alloy corresponds to that of steel for hot work applications with the addition of concentrated carbon and vanadium to achieve higher wear resistance in conjunction with higher toughness and thermal fatigue strength. These excellently matched combinations of properties make it possible to use CPM® 9 V for any applications wherever high-alloyed high speed steel fail prematurely due to inadequate toughness or where steels for hot work applications offer only inadequate resistance to wear.

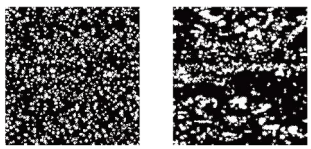
TYPICAL APPLICATIONS

_ cold and hot roll forming
_ wire rolling, rolling mill rolls
_ high speed metal-cutting tools
_ dies for cold and semi cold extrusion
_ embossing dies
_ sinter pressing tools
_ shearing and deburring tools

PHYSICAL PROPERTIES

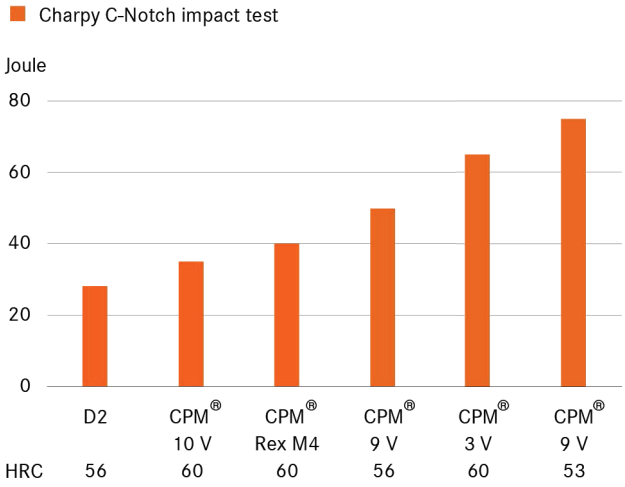
Modulus of elasticity E [kN/mm²]	221
Specific weight [kg/dm³]	7.4
Coefficient of thermal expansion over temperature range of [mm/mm k]	
21 - 200°C	11.18×10^{-6}
21 - 450°C	11.61×10^{-6}
21 - 650°C	11.86×10^{-6}

POWDER METALLURGICAL AND CONVENTIONAL MICROSTRUCTURE



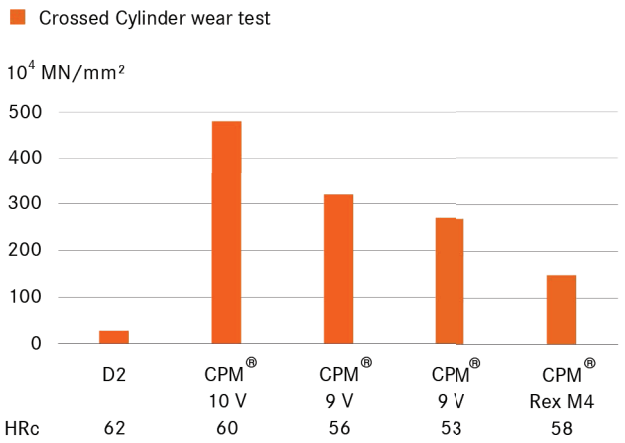
The uniform distribution of carbides in the powder-metallurgical structure compared to corventional tool steels with big carbides and carbide clusters.

TOUGHNESS



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

WEAR RESISTANCE



Reciprocal of wear rate in wear test with non lubricated crossed cylinder in contact with a rotation tungsten carbide cylinder.

RS Alloys
Steel & Copper

HEAT TREATMENT ANNEALING

SOFT ANNEALING

The material is heated uniformly to a temperature of 880 - 900 °C; maintain temperature for 2 hours and allow to cool to 550 °C in the furnace at a cooling rate of 20 °C per hour. This is followed by cooling in still air. Hardening after annealing: approx. HB 223/ 255.

STRESS RELIEVING

Stress relieving follows rough machining by heating to 600 – 700 °C, holding time 2 hours. The material is subsequently allowed to cool in the furnace to approximately 500 °C, followed by cooling in air.

HARDENING

Hardening of CPM® 9 V usually involves the use of 2 preheating stages (450 – 500 °C/ 850 – 870 °C). The material is then heated to the required austenitizing temperature in the range from 1070 °C to 1180 °C. A temperature of 1070 °C should normally be used to achieve optimum toughness values; a temperature of 1150 °C is recommended for applications, in which properties such as elevated temperature and wear resistance are required. The maximum permissible austenitizing temperature is 1180 °C. To achieve a corresponding degree of dissolution of the alloy elements as well as an appropriate hardening and tempering level , a minimum holding time after complete heat penetration of 60 min. is recommended for hardening at 1070 °C, 30 min. for hardening at 1120 °C and 20 min. for hardening at 1150 °C. These temperature equalisation times should be correspondingly adapted for large and very thin-walled material cross-sections.

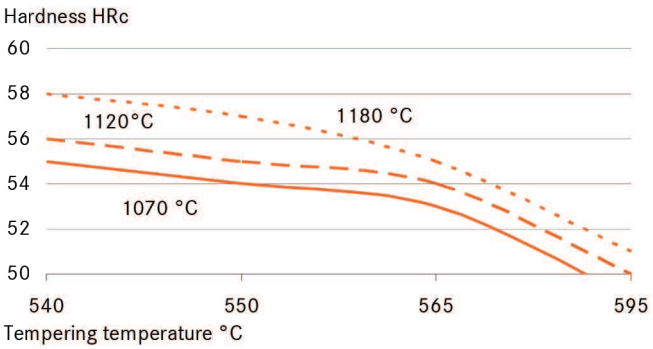
QUENCHING

Air, hot bath or interrupted oil quenching can be used. We recommend hot bath quenching at approx. 550 °C. Particular care must be taken in the case of protective gas or vacuum heat treatment to ensure that an appropriate quenching rate is achieved in order to obtain the required hardening and tempering level at the recommended tempering temperature.

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 bare 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.

TEMPERING DIAGRAM



HEAT TREATMENT INSTRUCTIONS

1st preheating	450–500 °C
2nd preheating	850–900 °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	1070	60	540
53	1070	60	560
49**	1070	60	590
43	1070	60	620
56	1120	30	540
54***	1120	30	560
50	1120	30	590
45	1120	30	620
57	1150	20	540
58 ****	1180	15	540

* 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

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-⌀ 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.

TOOL ALLOYS
STOCK LIST CPM® 9 V

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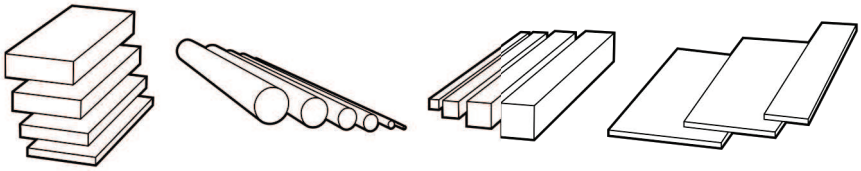

The sizes indicated below are usually available in a machined execution and can be considered as finished sizes.

ROUND BAR DIMENSIONS
4.5 mm
13.0 mm
16.2 mm
18.4 mm
19.4 mm
25.7 mm
32.1 mm
38.4 mm
45.2 mm
47.0 mm
51.5 mm
55.7 mm
57.0 mm
64.2 mm
65.0 mm
66.0 mm
67.5 mm
77.7 mm
80.0 mm
84.1 mm
92.0 mm
103.1 mm
105.0 mm
115.8 mm
122.2 mm
128.5 mm
135.0 mm
153.9 mm
206.3 mm
232.0 mm
303.0 mm

FLAT BAR DIMENSIONS
in thicknesses
20.7 mm
40.0 mm
65.0 mm
101.6 mm

Further dimensions are available within 3-4 weeks after request.

ZAPP MATERIALS ENGINEERING
TOOL ALLOYS
Robert Zapp Werkstofftechnik GmbH
Zapp-Platz 1
40880 Ratingen
P.O. Box 10 18 62
40838 Ratingen
Germany
Phone +49 2102 710-591
Fax +49 2102 710-596
toolalloys@zapp.com

SERVICE CENTER
Hochstraße 32
59425 Unna
Germany
Phone +49 2304 79-511
Fax +49 2304 79-7652