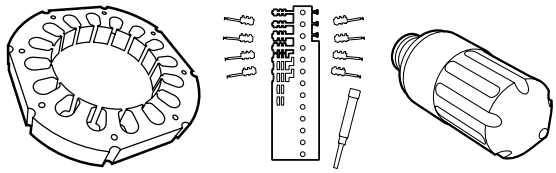
TOOLING ALLOYS
DATA SHEET CPM® 15 V

ZAPP IS CERTIFIED TO ISO 9001



CHEMICAL COMPOSITION

Carbon	3.40 %
Chromium	5.25 %
Vanadium	14.50 %
Molybdenum	1.30 %
Manganese	0.50 %
Silicon	0.90 %

CPM® 15 V
is a newly developed tool steel produced by the special Crucible Particle Metallurgy Process. The material contains approximately 50% more ultra wear resistant vanadium carbide than is contained in CPM® 10 V. As a result, the degree of wear resistance has been dramatically increased. The advantage in comparison to conventional steel manufacture is that an absolutely homogeneous microstructure in the powder metallurgical production process is achieved, producing significantly better mechanical properties. CPM® 15 V has been developed for applications where the highest demands for wear resistance are imposed, and where tungsten carbides cannot be effectively utilized due to their lower toughness characteristics.

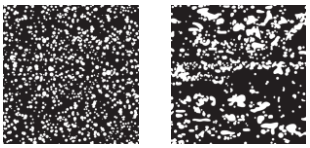
TYPICAL APPLICATIONS

_ blanking and punching tools (thin sheets)
_ tools for the powder pressing industry
_ extrusion dies and hole punching tools
_ knives for electric sheet steel
_ knives for cutting foil, film and paper
_ rotary cutters
_ general items subject to wear

PHYSICAL PROPERTIES

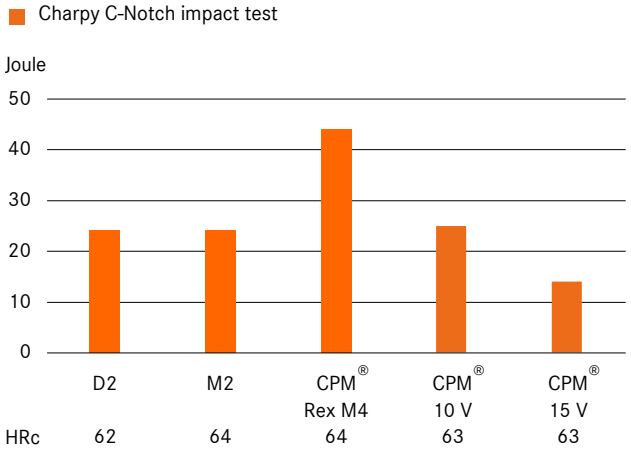
Modulus of elasticity E [kN/mm²]	235
Specific weight [kg/dm³]	7.25
Coefficient of thermal expansion over temperature range of [mm/mm k]	
21 - 200°C	11.00 x 10^{-6}
21 - 450°C	11.70 x 10^{-6}
21 - 600°C	12.10 x 10^{-6}

POWDER METALLURGICAL AND CONVENTIONAL MICROSTRUCTURE



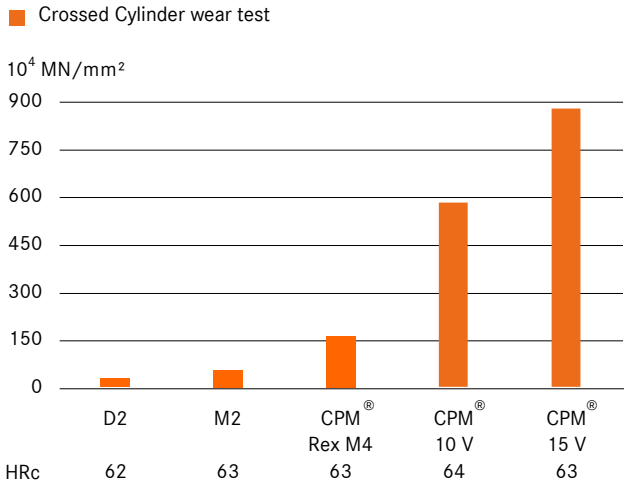
The uniform distribution of carbides in the powder-metallurgical structure compared to conventional tool steels with big carbides and carbide clusters.

TOUGHNESS



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

WEAR RESISTANCE



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

HEAT TREATMENT ANNEALING

SOFT ANNEALING

The material is heated slowly and uniformly to a temperature of 870 - 900 °C; maintain the temperature for 2 hours and allow to cool slowly to 550 °C in the furnace at a cooling rate of 15 °C per hour. Final cooling is carried out in still air. The typical hardness achieved by soft annealing is approx. HB 250.

STRESS RELIEVING

Stress relieving follows rough machining by heating to 600 - 700 °C. After complete heat penetration, cooling is carried out in the furnace down to a temperature of approx. 500 °C. Further cooling is than achieved in still air.

HARDENING

Hardening of CPM® 15 V usually involves the use of 3 preheating stages (at approx. 450 - 500°C/ 850 - 900 °C). The material is then heated rapidly from the preheating temperature to the austenitizing temperature in the rage of 1070 - 1180 °C in order to attain a corresponding degree of dissolution of the alloy elements. A holding time following complete heat penetration of at least 30 minutes is recommended.

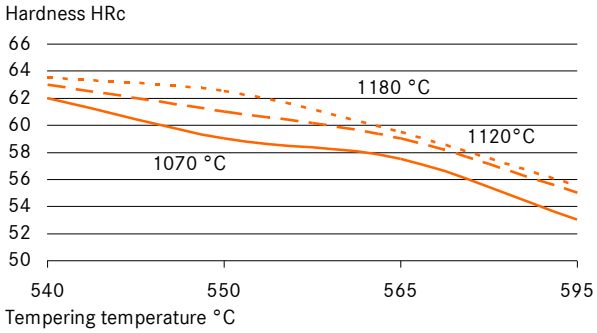
QUENCHING

Air, hot bath or oil quenching can be used. We recommend hot bath quenching at a temperature of approx. 550 °C. If protective gas is used or vacuum heat treatment is carried out, due regard must be paid to ensuring that the reasonable quenching rate is achieved (at least at 5 bar pressure).

TEMPERING

Immediately temper after the material has cooled down below 40 °C. Triple tempering is recommended. It is important to allow the tools to cool to room temperature between the tempering processes. The standard tempering temperature is 540 – 550 °C. To ensure complete tempering, temperatures below 540 °C should be avoided.

TEMPERING DIAGRAM



HEAT TREATMENT INSTRUTIONS

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]
59	1070	40	550
60	1120	30	550
63	1180	15	550

* 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.

MACHINING DATA

TURNING

Cutting parameter	Turning with cemented carbide medium turning	finish turning	HSS
Cutting speed (V_C) m/min.	80-110	110-150	15-20
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 20*	-

* 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.	80-130	130-160	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

	Solid carbide	Milling cutter w. indexable tips	Coated HSS
Cutting speed (V_C) m/min.	45-50	90-110	5-8
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
-5	10-12*	0.05-0.15
5-10	10-12*	0.15-0.25
10-15	10-12*	0.25-0.35
15-20	10-12*	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.	120-150	60-80	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 60 JV	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.

TOOLING ALLOYS
STOCK LIST CPM® 15 V

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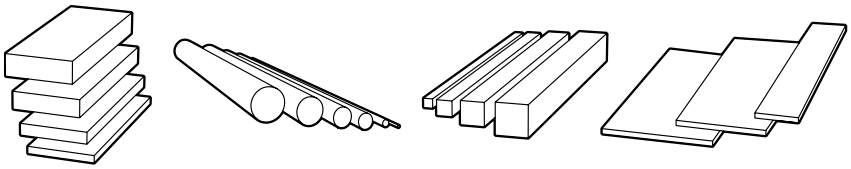

ROUND BAR DIMENSIONS, peeled or turned
16.2 mm
22.6 mm
25.8 mm
32.1 mm
38.4 mm
51.5 mm
66.0 mm
84.1 mm
90.4 mm
96.8 mm
103.1 mm
115.8 mm
128.5 mm
153.9 mm
181.0 mm
206.3 mm

FLAT BAR DIMENSIONS, prefinished in thicknesses
76.9 mm
101.6 mm

Further dimensions are available on request.

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