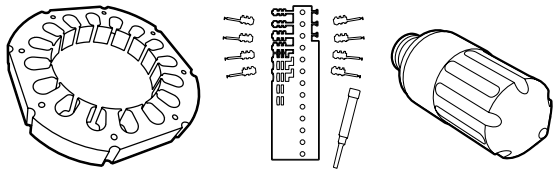
TOOLING ALLOYS
DATA SHEET CPM® 15V®/Z-15 PM®

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®/Z-15 PM®

CPM® 15V® is an ultra-high vanadium PM grade designed to maximize the wear performance of tooling components. It is an enhancement of the CPM 10V® (Z-10 PM) composition which offers a 50% increase in the volume of hard vanadium carbides found in the microstructure. Heat treatment and attainable hardness are similar to CPM 10V® (Z-10 PM).
This grade is intended for applications where resistance to abrasion and long tool life are desired. It can be considered as a suitable upgrade for CPM 10V® (Z-10 PM) when toughness is not an issue. It can also be considered as a potential alternative to sintered carbide tooling when fracture or fabrication difficulties are encountered.

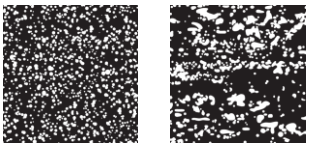
TYPICAL APPLICATIONS

_ 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

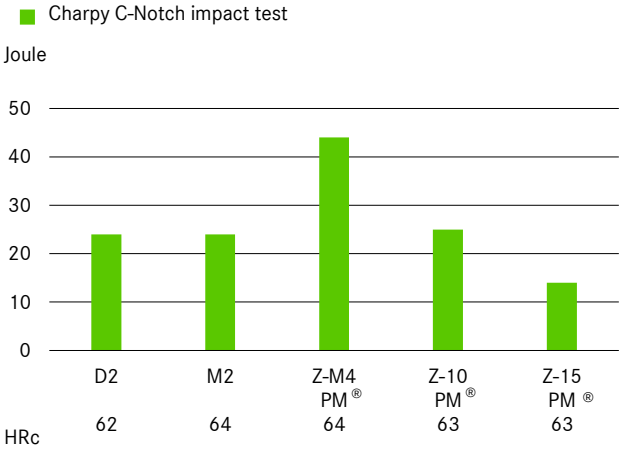
Modulus of elasticity E [psi x 10^{-6}]	32
Density [lb/in]	0.268
Coefficient of thermal expansion [in/in/°F] over temperature range of 100 - 1100°F	6.82 x 10^{-6}

POWDER METALLURGICAL AND CONVENTIONAL MICROSTRUCTURE



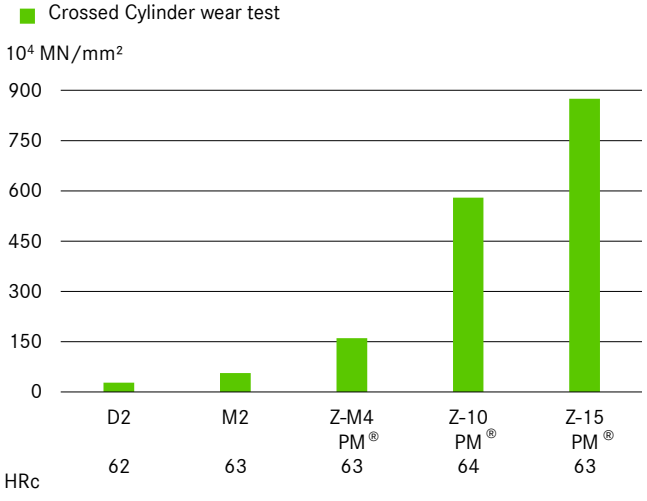
The uniform distribution of carbides in the powder-metallurgical structure compared to conventional tool steels with big carbides and carbide clusters.

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 1600 – 1650 °F (870 – 900 °C). Maintain the temperature for 2 hours and allow to cool slowly to 1000 °F (550 °C) in the furnace at a cooling rate of 50 °F (15 °C) per hour. Final cooling is carried out in still air. The typical hardness achieved by soft annealing is approx. HB 250 – 280.

STRESS RELIEVING

Stress relieving follows rough machining by heating to 1100 – 1400 °F (600 - 700 °C). After complete heat penetration, cooling is carried out in the furnace down to a temperature of approx. 1000 °F (500 °C). Further cooling is then achieved in still air.

HARDENING

Hardening of CPM® 15V® usually involves the use of 3 preheating stages (at approx. 1200 – 1300°F/ 1500 – 1600°F/ 1800 – 1900 °F).
The material is then heated rapidly from the preheating temperature to the austenitizing temperature in the range of 1950 – 2150 °F (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. 1050 °F (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).

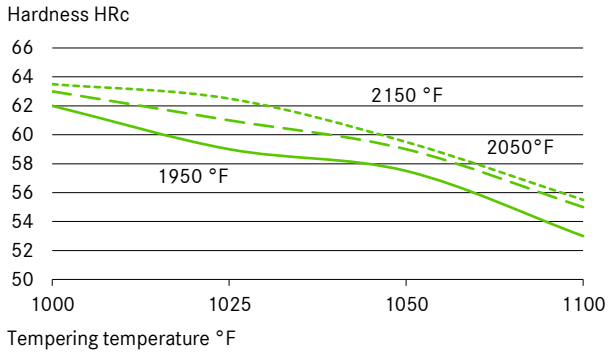
TEMPERING

Immediately temper after the material has cooled down below 100 °F (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 1000 – 1040 °F (540 – 550 °C). To ensure complete tempering, temperatures below 1000 °F (540 °C) should be avoided.

SURFACE TREATMENTS

CPM® 15V® can be nitrided or PVD/ CVD coated.

TEMPERING DIAGRAM



HEAT TREATMENT INSTRUCTIONS

1st preheating	1200-1300 °F
2nd preheating	1500-1600 °F
3rd preheating	1800-1900 °F
Hardening	as specified in table
Tempering	3 x each 2 hours as specified in table

Quenching after hardening in hot bath at approx. 1050°F or in vacuum at least at 5 bar overpressure.

Required hardness HRc ± 1	Austenitizing temperature °F	Holding time at austenitizing temperature minutes*	Tempering temperature[°F]
59	1950	40	1020
60	2050	30	1020
63	2150	15	1020

* 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-⌀ 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.

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