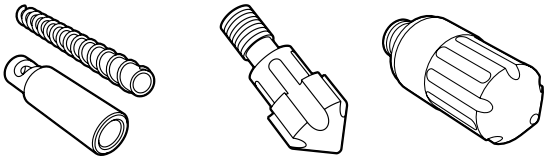
TOOL ALLOYS
DATA SHEET CPM® 420 V

CERTIFIED TO ISO 9001



CHEMICAL COMPOSITION

Carbon	2.30 %
Chromium	14.00 %
Vanadium	9.00 %
Molybdenum	1.30 %
Manganese	0.50 %
Silicon	0.50 %

CPM® 420 V

is a newly developed highly corrosion resistant tool steel produced by the special Crucible Particle Metallurgy Process. CPM® 420 V is a martensitic stainless steel, which contains a large constituent volume of extremely small and finely dispersed particles of highly wear-resistant vanadium carbide. CPM® 420 V combines the effectual properties of stainless steel with the high wear resistance of tool steels. The material is well suited for applications which demand corrosion resistance, whilst also affording a high level of wear resistance.

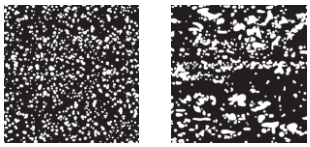
TYPICAL APPLICATIONS

_ use in the food and plastic industry
_ chemical processing industry
_ fields of pumping systems
_ rubber processing
_ palletizing tools
_ bearings, bearing shells
_ valves, shafts, rollers

PHYSICAL PROPERTIES

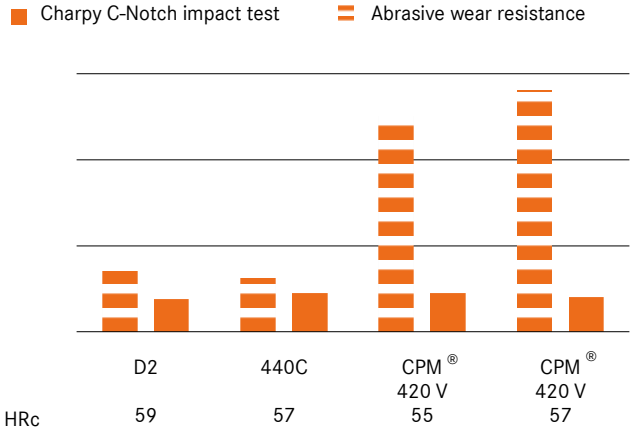
Modulus of elasticity E [kN/mm²]	215
Specific weight [kg/dm³]	7.4
Thermal conductivity at 65 °C [W/mk]	17.3
Coefficient of thermal expansion over temperature range of [mm/mm °C]	
20 - 200 °C	11.0 x 10^{-6}
20 - 315 °C	11.5 x 10^{-6}

POWDER METALLURGICAL AND CONVENTIONAL MICROSTRUCTURE



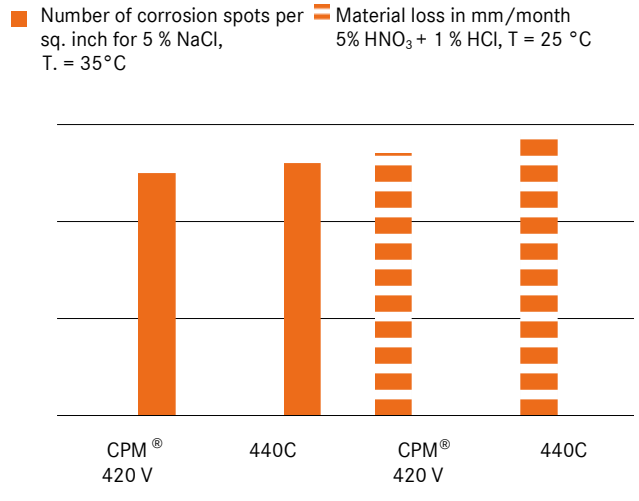
The uniform distribution of carbides in the powder-metallurgical structure compared to conventional tool steels with big carbides and carbide clusters.

TOUGHNESS / ABRASIVE WEAR RESISTANCE



Qualitative comparison

CORROSION RESISTANCE



Qualitative comparison

HEAT TREATMENT ANNEALING

SOFT ANNEALING

CPM® 420 V is heated uniformly at a temperature of 900 °C; maintain the temperature for 2 hours and allow to cool slowly to 600 °C in the furnace at a cooling rate of max. 15 °C per hour. It is then further cooled in still air. The hardness achieved by soft annealing is approx. HB 275.

STRESS RELIEVING

After machining it is recommended to subject the work piece to a stress relieving process at a temperature of 600 – 700 °C for a thermal holding period of 2 hours duration.

HARDENING

CPM® 420 V is to be preheated slowly and thoroughly to a temperature of 840 - 870 °C. Further heating in the furnace continues until an austenitizing temperature of 1150 – 1180 °C is reached. The holding time after complete penetration amounts to 10 – 30 minutes (lower temperatures require longer soaking times). The lower end of the austenitizing temperature range should be selected to attain maximum toughness, whilst the top end of the range produces maximum wear and corrosion resistance. For CPM® 420 V we recommend hardening to be carried out in a vacuum or a protective gas.

QUENCHING

CPM® 420 V can be cooled in air, in protective gas, in hot bath or in oil. To achieve maximum toughness salt bath quenching at a temperature of approx. 540 °C, followed by immediate residual quenching in still air down to less than 50 °C is recommended. In the case of heat treatment in a vacuum, quenching must be undertaken at a pressure of at least 5 bar down to below 40 °C.

TEMPERING

Immediately temper after the material has cooled down below 40 °C. CPM® 420 V is normally tempered through two tempering stages, each of 2 hours duration at 200 °C to 400 °C. If required, cooling to sub-zero temperatures can be carried out between the first and the second tempering cycle to fully destroy any reaustenitic formation. The first tempering process should always be concluded prior to any sub-zero cooling process.

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. A vacuum furnace is recommended.

Required hardness HRc ± 1	Austenitizing temperature °C	Holding time at austenitizing temperature minutes*	Tempering temperature[°C]
56	1150	30	320**
57	1150	30	260
58	1150	30	200
58	1180	20	260
59	1180	20	200

* 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.

**Tempering temperatures over 400°C are not allowed, because the corrosion resistance will be reduced.

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
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.