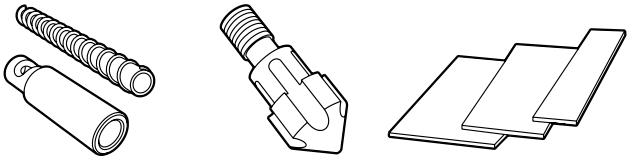
TOOLING ALLOYS
DATA SHEET CPM® S30V

ZAPP IS CERTIFIED TO ISO 9001



CHEMICAL COMPOSITION

Carbon	1.5 %
Chromium	14.0 %
Vanadium	4.0 %
Molybdenum	2.0 %
Silicon	0.5 %
Manganese	0.5 %

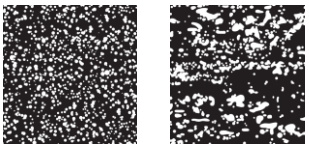
CPM® S30V
is a newly developed highly corrosion resistant tool steel produced by the special Crucible Particle Metallurgy Process. CPM® S30V is a martensitic stainless steel, which contains a large constituent volume of extremely small and finely dispersed particles of highly wear-resistant vanadium carbide. CPM® S30V 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

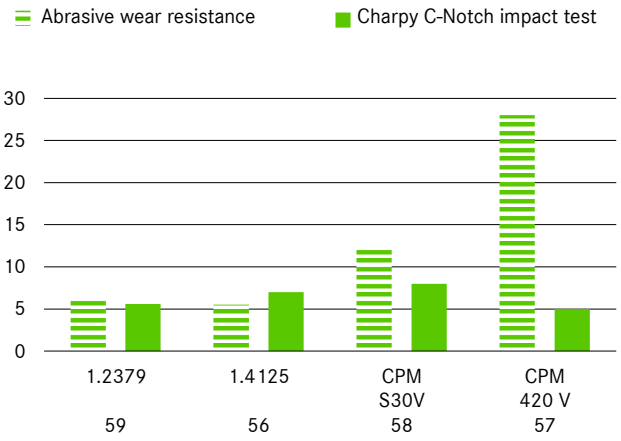
Modulus of elasticity E [GPa]	221
Density [kg/dm³]	7.47
Thermal conductivity [W/(m*K)] at 65 °C	17.3
Coefficient of thermal expansion [mm/mm/K] over temperature range of	
20 - 200 °C	11.0 x 10^{-6}
20 - 300 °C	11.5 x 10^{-6}

POWDER METALLURGICAL AND CONVENTIONAL MICROSTRUCTURE



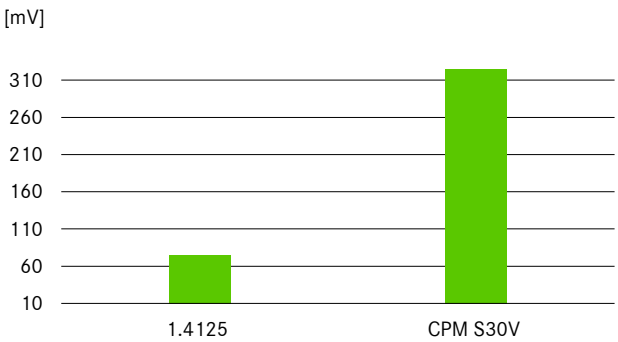
The uniform distribution of carbides in the powder-metallurgical structure compared to conventional tool steels with big carbides and carbide clusters.

ABRASIVE WEAR RESISTANCE / TOUGHNESS



CORROSION RESISTANCE

The diagram shows qualitatively the potential for pitting formation (formation of corrosion products at 5% NaCl at a temperature of 25°C).



HEAT TREATMENT ANNEALING

SOFT ANNEALING

CPM® S30V 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 approximately 250-270 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® S30V 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. 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. 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® S30V we recommend hardening to be carried out in a vacuum or a protective gas.

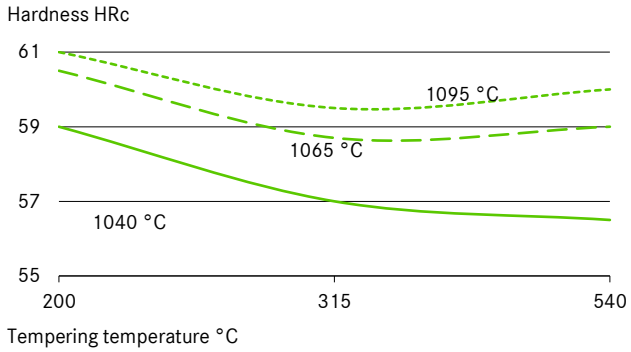
QUENCHING

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.

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. It is important to ensure that the tools are cooled down to room temperature between the individual tempering stages.
If required, cooling to sub-zero temperatures can be carried out between the first and the second tempering cycle to fully destroy any re-austenitic formation. The first tempering process should always be concluded prior to any sub-zero cooling process.

TEMPERING DIAGRAM



HEAT TREATMENT INSTRUCTIONS

1st preheating	450–500 °C
2nd preheating	800–850 °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.

Required hardness HRc ± 1	Austenitizing temperature °C	Holding time at austenitizing temperature minutes*	Tempering temperature [°C]
57	1040	30	200
58	1065	20	200
60	1095	15	200
58	1040	30	315
59	1065	20	315
59	1095	15	315
57	1040	30	540
60	1065	20	540
59	1095	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.

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.

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