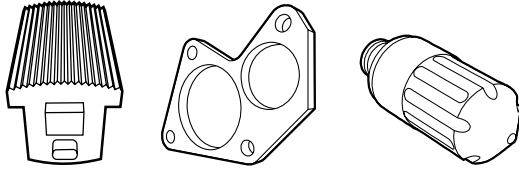


TOOL ALLOYS

DATA SHEET CPM® 3 V



CERTIFIED TO ISO 9001



CHEMICAL COMPOSITION

| | |
|------------|--------|
| Carbon | 0.80 % |
| Chromium | 7.50 % |
| Vanadium | 2.75 % |
| Molybdenum | 1.30 % |

CPM® 3 V

is a newly developed ultra-tough powder-metallurgical high performance steel produced by the special Crucible Particle Metallurgy Process. CPM® 3 V provides a high resistance against tool breakage and chipping, but at the same time gives good wear resistance. It offers a better impact toughness value than, for example, the materials D2 or A2, and closely attains the level afforded by a hot working steel. Because of the good thermodynamic stability, coatings can be applied at time by using the PVD method of coating. CPM® 3 V has been developed for applications where robustness is an important factor. With effective hardness values of approx. 58 – 60 HRC, CPM® 3 V offers a high degree of safety against fracturing occurring, whilst providing good properties of wear resistance.

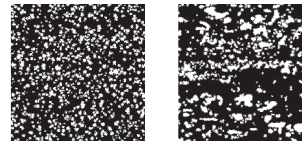
TYPICAL APPLICATIONS

- _ blanking and punching, even for thicker sheet metals
- _ fine blanking
- _ dies and forging tools
- _ thread rolling tools
- _ hole punches
- _ guillotine blades and industrial knives and rollers
- _ tool and tool inserts in the plastic processing industry

PHYSICAL PROPERTIES

| | |
|---|-------------------------|
| Modulus of elasticity E [kN/mm ²] | 215 |
| Specific weight [kg/dm ³] | 7.7 |
| Thermal conductivity at 65 °C [W/mk] | 24.2 |
| Coefficient of thermal expansion over temperature range of 20 - 400 °C [mm/mm °C] | 10.6 x 10 ⁻⁶ |

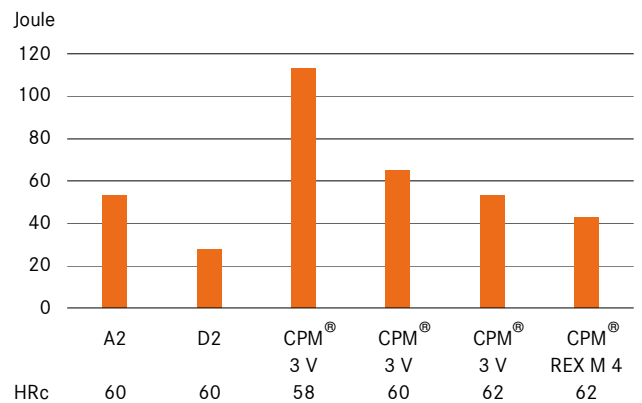
POWDER METALLURGICAL AND CONVENTIONAL MICROSTRUCTURE



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

TOUGHNESS

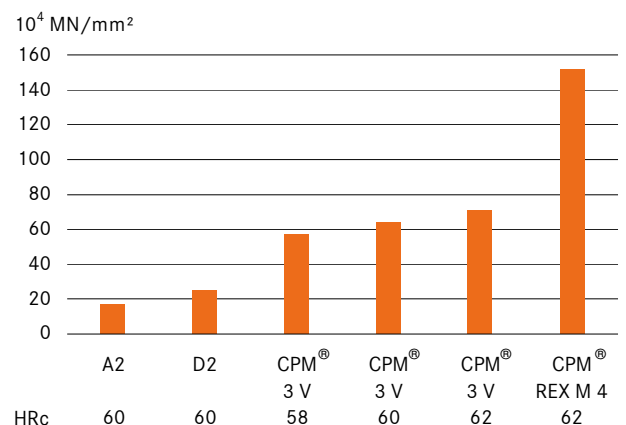
Charpy C-Notch impact test



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

WEAR RESISTANCE

Crossed Cylinder wear test



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

CPM® 3 V is heated slowly and uniformly to a temperature of 900 °C; maintain the temperature for 2 hours and allow to cool to 590 °C in a furnace at a cooling rate of 15 °C per hour. It is then further cooled in still air down to room temperature. The typical hardness achieved by soft annealing is approx. HB 240.

STRESS RELIEVING

Stress relieving follows rough machining by heating to 600 – 700 °C. Once complete heat penetration has been reached, the material is allowed to cool in the furnace to approx. 500 °C followed by cooling in air.

HARDENING

Hardening of CPM® 3 V usually involves the use of 2 preheating stages (450 – 500 °C/ 850 – 900 °C). Immediately following this it is heated to the required austenitizing temperature of 1030 – 1130 °C. Maximum toughness is attained at a temperature of 1030 °C, whilst maximum wear resistance is attained at a temperature of 1130 °C. In order to achieve a corresponding degree of dissolution of the alloy elements, a minimum heat penetration time of 40 minutes for hardening at 1030 °C is recommended, or 30 minutes for hardening at 1130 °C. These holding times should be correspondingly adapted for thick or thin-walled material cross-sections.

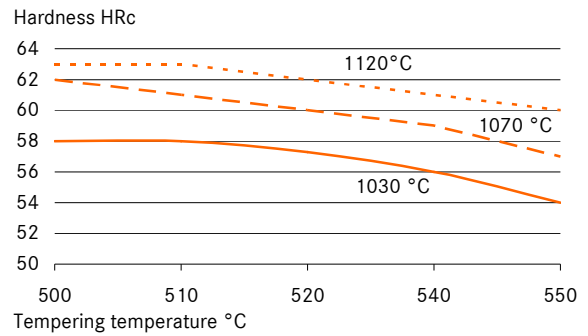
QUENCHING

Air, hot bath or interrupted oil quenching can be used. In the case of vacuum heat treatment, due regards is to be given to applying an appropriate rate (at least at 5 bar pressure). For attaining ideal toughness properties it is recommended to apply the hot bath quenching method.

TEMPERING

Immediately temper after the material has cooled down below 40 °C. Triple tempering with a holding time of 2 hours in each stage at the tempering temperature is necessary. Normally CPM® 3 V is tempered with a temperature range of 520 – 560 °C.

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 | 1030 | 40 | 550 |
| 56 | 1030 | 40 | 540 |
| 57 | 1070 | 35 | 550 |
| 59 | 1070 | 35 | 540 |
| 60 | 1120 | 30 | 550 |
| 61 | 1120 | 30 | 540 |
| 63 | 1130 | 30 | 520 |

* 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 1130 °C must not be exceeded.

MACHINING DATA

TURNING

| Cutting parameter | Turning with cemented carbide | | HSS |
|--|-------------------------------|----------------|----------|
| | medium turning | finish turning | |
| Cutting speed (V _c) m/min. | 100-150 | 150-200 | 12-15 |
| 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 | | HSS |
|--|-------------------------------|----------------|-----|
| | medium turning | finish turning | |
| Cutting speed (V _c) m/min. | 90-120 | 120-150 | 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. | 45-55 | 90-110 | 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- ϕ 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. | 80-110 | 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 | B 126 R75 B3* 3SG 60 KVS** A 60 IV |
| Internal grinding | A 46 JV | B 126 R75 B3* 3SG 80 KVS** A 60 HV |
| Profile grinding | A 100 LV | B 126 R100 B6* 5SG 80 KVS** A 120 JV |

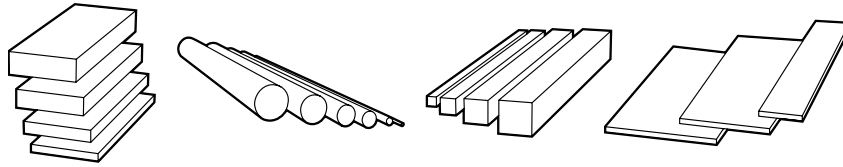
* for these applications we recommend CBN-wheels

** grinding wheel from the company Norton Co.

TOOL ALLOYS STOCK LIST CPM® 3 V



CERTIFIED TO ISO 9001



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

ROUND BAR DIMENSIONS

| | |
|---------|----------|
| | 153.9 mm |
| 13.0 mm | 181.0 mm |
| 19.4 mm | 206.3 mm |
| 25.7 mm | 231.0 mm |
| 32.1 mm | 281.0 mm |
| 38.4 mm | 321.0 mm |

| |
|----------|
| 45.0 mm |
| 47.0 mm |
| 51.5 mm |
| 55.0 mm |
| 58.5 mm |
| 66.0 mm |
| 70.6 mm |
| 77.7 mm |
| 80.0 mm |
| 90,4 mm |
| 103.1 mm |
| 115.8 mm |
| 128.5 mm |
| 133.0 mm |
| 143.0 mm |

FLAT BAR DIMENSIONS

in thicknesses

| |
|----------|
| 25.4 mm |
| 31.7 mm |
| 38.1 mm |
| 44.4 mm |
| 50.8 mm |
| 76.2 mm |
| 101.6 mm |
| 155.0 mm |

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

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