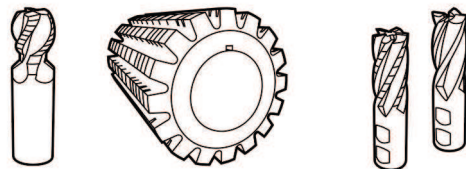


TOOLING ALLOYS

DATA SHEET CPM® REX T15

ZAPP IS CERTIFIED TO ISO 9001

ZAPP



CHEMICAL COMPOSITION

Carbon	1.60 %
Chromium	4.00 %
Vanadium	5.00 %
Molybdenum	max. 1.00 %
Tungsten	12.25 %
Cobalt	5.00 %
Manganese	0.30 %
Silicon	0.30 %

CPM® REX T15

is a tungsten-based alloyed high speed steel with high carbon, vanadium and cobalt content to ensure a high degree of hardness, outstanding wear resistance and good elevated temperature hardness. Due to the special Crucible Particle Metallurgy process, CPM® Rex T 15 additionally offers substantially higher toughness and grindability properties than the conventional high speed steel S12-1-4-5 (1.3202). CPM® Rex T15 is mainly used wherever demanding requirements must be met for materials which are difficult to machine.

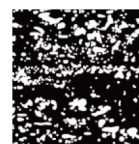
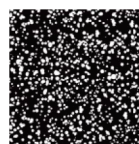
TYPICAL APPLICATIONS

- _ milling tools such as cylindrical milling cutters
- _ end milling cutters
- _ parallel milling cutters
- _ broaches
- _ reamers
- _ thread taps
- _ twist drills
- _ single-edge tools e. g. profile turning tools

PHYSICAL PROPERTIES

Modulus of elasticity E [kN/mm²]	218
Specific weight [kg/dm³]	8.19
Thermal conductivity [W/mK]	24.2
Coefficient of thermal expansion over temperature range of 40 - 540 °C [mm/mm °C]	11.95 x 10 ⁻⁶

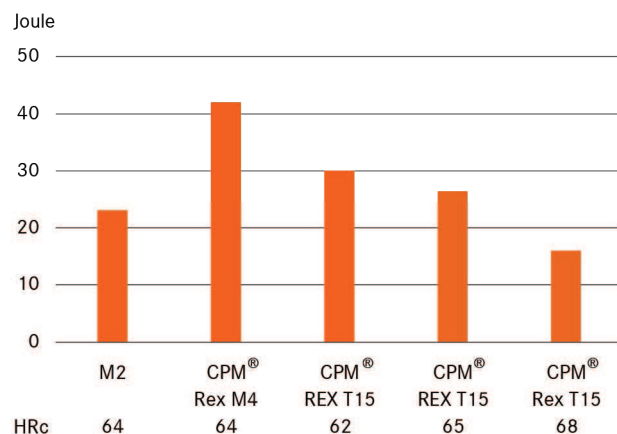
POWDER METALLURGICAL AND CONVENTIONAL MICROSTRUCTURE



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

TOUGHNESS

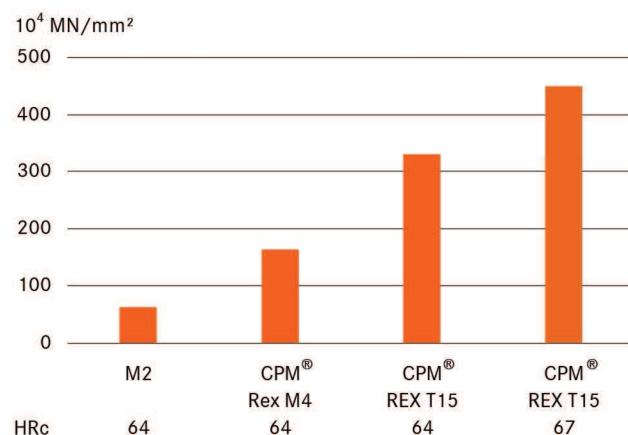
Charpy C-Notch impact test



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

The material is heated uniformly to a temperature of 860 - 870 °C; held at this temperature for 2 hours and allowed to cool to 550 °C in the furnace at a cooling rate of 10 °C per hour. This is followed by cooling in still air. The strength values achieved by soft annealing are HB 245/ 275.

STRESS RELIEVING

Stress relieving follows rough machining by heating to 600 – 700 °C, holding time 2 hours. The material is subsequently allowed to cool in the furnace to approximately 500 °C followed by cooling in air.

HARDENING

Hardening of CPM® Rex T15 usually involves the use of 2-3 preheating stages (450 – 500 °C / 850 – 900 °C / 1000°C). The material is then rapidly heated from the preheating temperature to the austenitizing temperature of 1180 °C to 1230 °C. High austenitizing temperature results in high service and elevated temperature hardness while a low austenitizing temperature provides improved toughness. We recommend hardening in salt bath. The austenitizing temperature bath should not be overloaded as cold batches can cause a large temperature drop in the bath. CPM® Rex T15 does not require special holding times. Standard guidelines for conventional high speed steels can be applied.

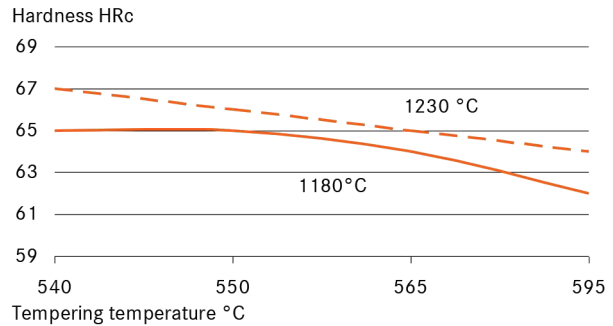
QUENCHING

Quenching can take place in oil, air or pressurized gas. Hot bath quenching at approx. 550°C is recommended. This provides flaw-free surfaces and avoids the risk of abnormal deformation. Material diameters up to max. 20 mm can be quenched with compressed gas (in vacuum furnace, depending on type of furnace). This quenching method is too slow for larger cross-sections and results in the hardness values being too low. Quenching in oil ensures the correct hardness level even for large cross-sections however, there is a risk of excessive distortion. Quenching large-volume tools in the hot bath generally results in slightly lower hardness than oil quenching. Irrespective of which quenching method is used, in all cases, the tools should be quenched to a temperature below 50 °C or to such an extent that they can be grasped with bare hands without any difficulties. The material must be tempered immediately after hardening.

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 two hands. Triple tempering with a holding time of 2 hours in each stage at the tempering temperature is necessary. It is important to ensure that the tools are cooled down to room temperature between the individual tempering stages. Temperatures below 540 °C should be avoided in order to ensure satisfactory tempering results.

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 sec.*	Tempering temperature[°C]
62	1160	20	590
64	1160	20	560
65	1160	20	540
65	1180**	20	550
64	1180**	20	565
62	1180	20	590
66	1200	15	540
65	1200	15	565
67	1230***	10	540
66	1230	10	560
64	1230	10	590

* 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 1240 °C must not be exceeded.

Holding time in sec./mm thickness.

** Best toughness

*** Best combination wear resistance/ toughness/ hot hardness

MACHINING DATA

TURNING

Cutting parameter	Turning with cemented carbide		HSS
	medium turning	finish turning	
Cutting speed (V _c) m/min.	60-90	90-110	6-10
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 EDMILLING

Cutting parameter	Milling with cemented carbide		HSS
	medium turning	finish turning	
Cutting speed (V _c) m/min.	40-60	60-80	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 a 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	50-70	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-Ø mm	Cutting speed (V _c) m/min.	Feed (f) mm/U
0 - 5	10-14*	0.05-0.15
5 - 10	10-14*	0.15-0.25
10 - 15	10-14*	0.25-0.35
15 - 20	10-14*	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	40-60	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

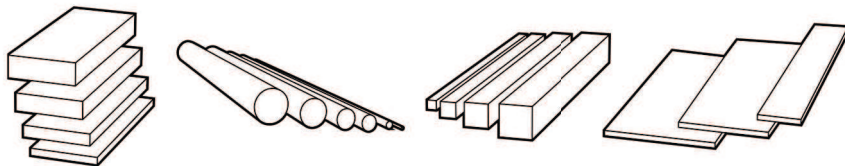
** grinding wheel from the company Norton Co.

TOOLING ALLOYS

STOCK LIST CPM[®] REX T15

ZAPP IS CERTIFIED TO ISO 9001

ZAPP



ROUND BAR DIMENSIONS, peeled or turned

3.7 mm
4.7 mm
6.3 mm
9.9 mm
10.4 mm
12.3 mm
13.0 mm
16.2 mm
19.4 mm
22.6 mm
32.1 mm
38.4 mm
44.8 mm
51.5 mm
64.2 mm
71.0 mm
82.0 mm

FLAT BAR DIMENSIONS, prefinished

in thicknesses
12.7 mm
19.5 mm
22.5 mm
25.4 mm
31.7 mm
38.1 mm
44.5 mm
50.8 mm
70.0 mm
80.0 mm
90.0 mm

SQUARE DIMENSIONS

125 mm square size

Further dimensions are available on request.

RS Acciai Srl

Firenze
Italy
Phone +39 055 7318818
Fax +39 055 7311083
rsacciai@rsacciai.it
www.rsacciai.it

ZAPP MATERIALS ENGINEERING
TOOLING ALLOYS
Robert Zapp Werkstofftechnik GmbH
Zapp-Platz 1
40880 Ratingen
P.O. Box 10 18 62
40838 Ratingen
Germany
Phone +49 2102 710-591
Fax +49 2102 710-596
toolingalloys@zapp.com

SERVICE CENTER
Hochstraße 32
59425 Unna
Germany
Phone +49 2304 79-511
Fax +49 2304 79-7652

Further information regarding our products and locations are available in our image brochure and under www.zapp.com

The illustrations, drawings, dimensional and weight data and other information included in these data sheets are intended only for the purposes of describing our products and represent non-binding average values. They do not constitute quality data, nor can they be used as the basis for any guarantee of quality or durability. The applications presented serve only as illustrations and can be construed neither as quality data nor as a guarantee in relation to the suitability of the material. This cannot substitute for comprehensive consultation on the selection of our products and on their use in a specific application. The brochure is not subject to change control.
Last revision: August 2012