Catalogue ViRiAL®

Indexable faceted cubic boron nitride (cBN) inserts

www.virial.ru/en

St. Petersburg 2012

VIRIAL®

cBN inserts

VIRIAL Ltd. jointly with RUSNANO manufactures ceramic and cermet cutting tools for metal and composite machining, featuring high hardness, excellent strength and thermal stability.

Our company manufactures and supplies cutting tools with cubic boron nitride (cBN)-based composite inserts widely used in various industries, e.g.:

Heavy engineering

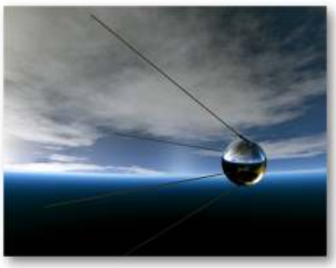
Machining of housings, gear wheels, shafts, cylinders, hydraulic parts made of hardened steel and cast iron grades.

Automotive industry

Machining of housings, brake discs, power
train parts, bearings.

Oil and gas production

Machining of pump parts, pressure and stop valve components.



Aerospace

Machining of Ti alloy parts.

Insert designation (as per ISO)

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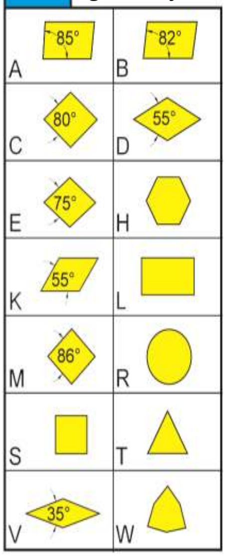
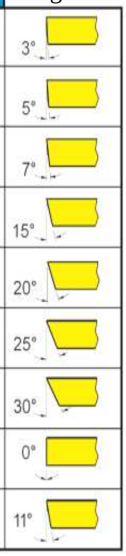
C	N	M	G		12	04	08		-	-
1	2	3	4		5	6	7		8	9

1 Insert geometry



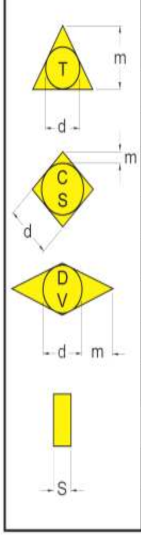
A	85°	B	82°
C	80°	D	55°
E	75°	H	
K	55°	L	
M	86°	R	
S		T	
V	35°	W	

2 Clearance angle



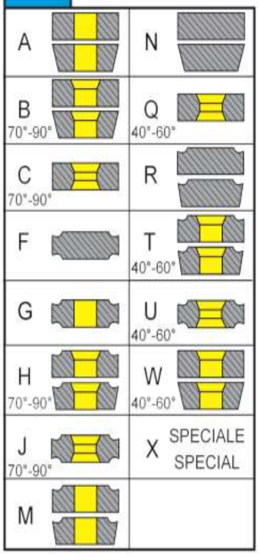
A	3°
B	5°
C	7°
D	15°
E	20°
F	25°
G	30°
N	0°
P	11°

3 Tolerances



	m	s	d
A	+/-0,005	+/-0,025	+/-0,025
C	+/-0,013	+/-0,025	+/-0,025
E	+/-0,025	+/-0,025	+/-0,025
F	+/-0,005	+/-0,025	+/-0,013
G	+/-0,025	+/-0,05 +/-0,13	+/-0,025
H	+/-0,013	+/-0,025	+/-0,013
J	+/-0,005	+/-0,025	+/-0,05 +/-0,13
K	+/-0,013	+/-0,025	+/-0,05 +/-0,13
L	+/-0,05	+/-0,013	+/-0,025
M	+/-0,08 +/-0,18	+/-0,13	+/-0,05 +/-0,18
N	+/-0,08 +/-0,18	+/-0,025	+/-0,05 +/-0,13
U	+/-0,13 +/-0,38	+/-0,05 +/-0,13	+/-0,08 +/-0,32

4 Insert geometry (side view)

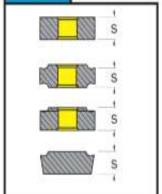


A		N	
B	70°-90°	Q	40°-60°
C	70°-90°	R	
F		T	40°-60°
G		U	40°-60°
H	70°-90°	W	40°-60°
J	70°-90°	X	SPECIALE SPECIAL
M			

5 Cutting edge dimensions

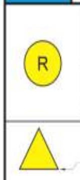
Ød CERCHIO INSCRITTO INSCRIBED CIRCLE	A	C	D	E	K	L	M	R	S	T	V	W
3,97												02
4,76										08		02-03
5,56		05								09		
6,00												03
6,35		06	07	06			06		06	11	11	04
6,70	10											
7,94									07			
8,00				08								05
9,45	16											
9,52	15-16	09	11	09	16	15	09		09	16	16	06
10,00								10				06
11,00									11			
11,50						12						
12,00								12				07
12,62						18						
12,70		12	15	12		15-20			12	22		08
15,87		16							15			
19,05		19							19			

6 Insert thickness



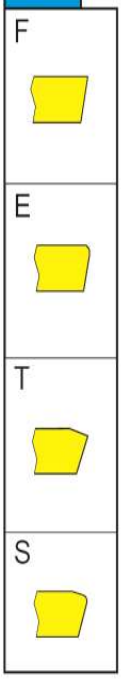
S	mm
01	1,59
T1	1,97
02	2,38
T2	2,78
03	3,18
T3	3,97
04	4,76
05	5,56
06	6,35
07	7,94
09	9,52

7 Radius

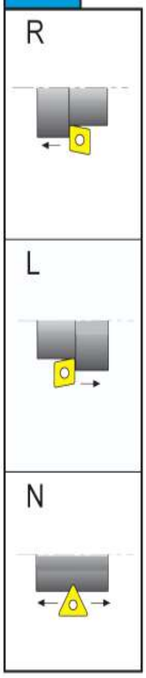


	00 (")
	MO (mm)
	r (mm)
02	r=0,2
04	r=0,4
05	r=0,5
06	r=0,6
08	r=0,8
10	r=1,0
12	r=1,2
16	r=1,6

8



9



What is cBN?

Cubic boron nitride-based composite cutting inserts as per ISO - 1832 and GOST 28762-90 standards.

Cutting tool quality is a crucial factor in achieving high-efficiency and cost-effective machining. The material of choice for today and to a great extent, tomorrow's cutting tools is the cubic boron nitride (cBN). It meets all the major demands placed on the cutting tools.

The main advantages of our cutting insets include:

-High hardness (~70000 MPa), machining capability for turning and milling of steel grades and alloys
with HRC 45-70

-High thermal stability (up to 1300 °C).

-High quality of as-machined surface (class 7 to 8)

-Threading capability for hardened steels

-Uneven surface machining capability (impact turning)

-Skin machining (stellite, sormite), weld joints

-Skin machining of cast parts

-Machining of chilled and high-strength cast irons

-Mn-steel machining

-Siliconized graphite machining

-Booth coolant-aided and coolant-free machining

All these advantages enable our customers to use VIRIAL cBN inserts:

-at increased depth of cutting

-at higher cutting speeds

-at larger feed rates

Hard turning as an alternative to grinding

Hard turning process physics is based on the specially engineered tool geometry and cutting regime leading to contact zone between the tool cutting edge and workpiece being heated nearly to melting point (contact temperature reaching up to 1500 °C), which results in workpiece tempering and consequent hardness reduction down to HRC 25. Upon chip cooling the material is rapidly cooled, so the overall hardness loss is limited to less than 2 units, the removed chip having a hardness around 45 units. The bulk of the part is left virtually unheated. The purpose of hard turning as a replacement for grinding is the reduction of the labor intensity of the part processing, and, consequently, boosted economic efficiency of processing.

Cost efficiency increase is based on the following factors:

Material removal during hard turning is roughly 1/3 that of during grinding

Machining precision is equal for both hard turning and grinding;

Processing time for hard turning is many times less, than the time required for grinding;

No coolant is necessary

Hard turning is much more flexible. Complicated parts may be easily machined, while in grinding similar parts the wheel exchange and machine tool adjustment are necessary;

Hard turning may be effected on the same machine tool used for regular turning of parts before hardening, which additionally contributes to the process flexibility and versatility;

Chip disposal/recycling after hard turning is cheaper than that after grinding.

The above demonstrates that hard turning is almost in any case is 30 to 50 % more cost-efficient than grinding.

High stability of insert facets is based on the high-intensity coalescence of the grains in microstructure. Chemical stability is provided by the strong nature of bonding between boron and nitrogen.

Chemical stability is best demonstrated in machining of ferrous metals, preventing the diffusion and oxidation processes that normally cause edge weare during machining.

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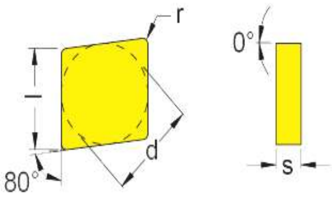
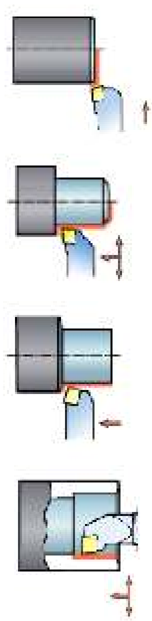
Selecting insert geometry

Solid inserts, fastened by clamping on top



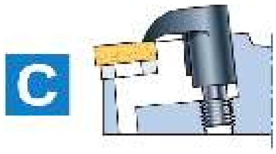
ISO marking	d	l	s	r	cBN grade
CNMN 05 03 04	5.56	6.0	3.18	0.4	
CNMN 05 03 08	5.56	6.0	3.18	0.8	
CNMN 05 03 12	5.56	6.0	3.18	1.2	
CNMN 09 03 04	9.525	9.7	3.18	0.4	
CNMN 09 03 08	9.525	9.7	3.18	0.8	
CNMN 09 03 12	9.525	9.7	3.18	1.2	
CNMN 12 03 04	12.7	12.9	3.18	0.4	K-07
CNMN 12 03 08	12.7	12.9	3.18	0.8	
CNMN 12 03 12	12.7	12.9	3.18	1.2	
CNMN 12 T3 08	12.7	12.9	3.97	0.8	
CNMN 12 T3 12	12.7	12.9	3.97	1.2	
CNMN 12 04 08	12.7	12.9	4.76	0.8	
CNMN 12 04 12	12.7	12.9	4.76	1.2	

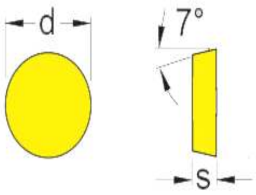
Inserts with clearance angle: 0°, 5°, 7°

Insert geometry	application	designation	feed rate (mm per revolution) f min|f max	depth of cut ap min|ap max
 solid		CNMN 05 03 04	00.5|0.10	00.5|1.0
		CNMN 05 03 08	00.5|0.15	00.5|1.0
		CNMN 05 03 12	00.5|0.20	00.5|1.0
		CNMN 09 03 04	00.5|0.25	0.10|3.60
		CNMN 09 03 08	00.5|0.26	0.10|3.60
		CNMN 09 03 12	00.5|0.27	0.10|3.60
		CNMN 12 03 04	00.5|0.25	0.10|3.80
		CNMN 12 03 08	00.5|0.26	0.10|4.0
		CNMN 12 03 12	00.5|0.27	0.10|3.60
		CNMN 12 T3 08	00.5|0.26	0.10|3.60
		CNMN 12 T3 12	00.5|0.27	0.10|3.80
		CNMN 12 04 08	00.5|0.26	0.10|4.0
		CNMN 12 04 12	00.5|0.27	0.10|4.0

Selecting insert geometry

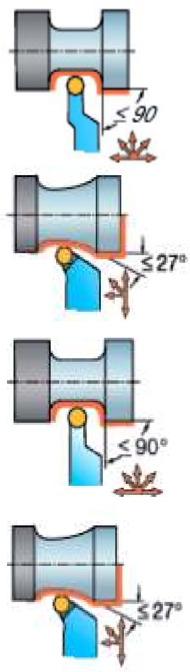
Solid inserts, fastened by clamping on top





ISO marking	d	l	s	r	cBN grade
RNMN 05 03 00	3.6		3.18		K-07
RNMN 05 03 00	5.56		3.18		
RNMN 05 T3 00	5.56		3.97		
RNMN 06 03 00	6.35		3.18		
RNMN 07 03 00	7.0		3.18		
RNMN 08 03 00	8.0		3.18		
RNMN 09 03 00	9.525		3.18		
RNMN09 T3 00	9.525		3.97		
RNMN 12 03 00	12.7		3.18		
RNMN 12 04 00	12.7		4.76		

Inserts with clearance angle: 0°, 5°, 7°

Insert geometry	application	designation	feed rate (mm per revolution) f min|f max	depth of cut ap min|ap max
 solid  Full-top		RNMN 05 03 00	0.10|0.30	0.10|0.30
		RNMN 05 03 00	0.10|0.50	0.15|1.0
		RNMN 05 T3 00	0.10|0.70	0.15|1.0
		RNMN 06 03 00	0.10|0.80	0.15|2.70
		RNMN 07 03 00	0.10|1.0	0.15|2.70
		RNMN 08 03 00	0.10|2.44	0.15|2.70
		RNMN 09 03 00	0.10|2.44	0.15|2.70
		RNMN09 T3 00	0.10|2.65	0.15|2.70
		RNMN 12 03 00	0.10|2.80	0.15|3.60
		RNMN 12 04 00	0.10|2.90	0.15|3.60

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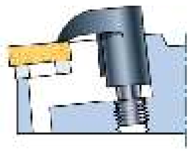
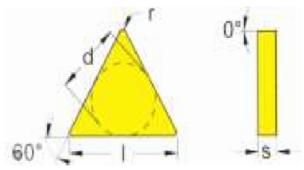
Selecting insert geometry

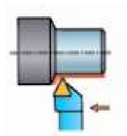
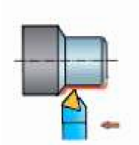
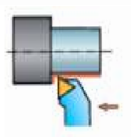
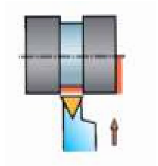


Solid inserts, fastened by clamping on top C



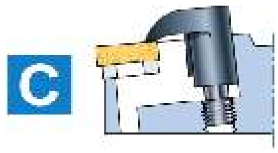
ISO marking	d	l	s	r	cBN grade
TNMN 09 03 08	5.56	9.0	3.18	0.8	K-07
TNMN 09 03 12	5.56	9.0	3.18	1.2	
TNMN 11 03 08	6.35	11.0	3.18	0.8	
TNMN 11 03 12	9.52	11.0	3.18	1.2	
TNMN 16 03 08	9.52	16.0	3.18	0.8	
TNMN 16 T3 08	9.52	16.0	3.97	0.8	
TNMN 16 04 08	9.52	16.0	4.76	0.8	

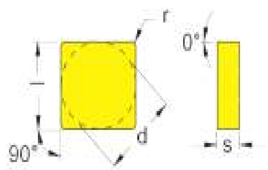
Inserts with clearance angle: 0°, 5°, 7°

Insert geometry	application	designation	feed rate (mm per revolution) f min|f max	depth of cut ap min|ap max
 solid		TNMN 09 03 08	0.02|0.1	0.05|1.0
 Brased-tip		TNMN 09 03 12	0.02|0.1	0.05|1.5
		TNMN 11 03 08	0.02|0.12	0.05|1.5
		TNMN 11 03 12	0.02|0.12	0.05|1.5
		TNMN 16 03 08	0.02|0.12	0.05|1.70
		TNMN 16 T3 08	0.02|0.14	0.05|1.70
		TNMN 16 04 08	0.02|0.14	0.05|1.70

Selecting insert geometry

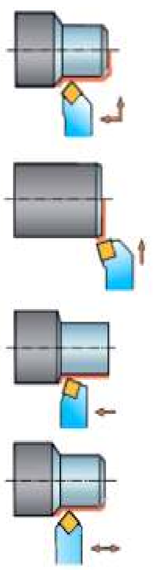
Solid inserts, fastened by clamping on top





ISO marking	d	l	s	r	cBN grade
SNMN 09 03 08	9.525		3.18	0.8	K-07
SNMN 09 03 12	9.525		3.18	1.2	
SNMN 09 03 16	9.525		3.18	1.6	
SNMN 05 T3 08	9.525		3.97	0.8	
SNMN 09 T3 12	9.525		3.97	1.2	
SNMN 09 T3 16	9.525		3.97	1.6	
SNMN 12 03 08	12.7		3.18	0.8	
SNMN 12 03 12	12.7		3.18	1.2	
SNMN 12 04 08	12.7		4.76	0.8	
SNMN 12 04 12	12.7		4.76	1.2	

Inserts with clearance angle: 0°, 5°, 7°

Insert geometry	application	designation	feed rate (mm per revolution) f min|f max	depth of cut ap min|ap max
 Brased-tip  solid		SNMN 09 03 08	0.10|0.26	0.10|5.0
		SNMN 09 03 12	0.10|0.26	0.10|5.0
		SNMN 09 03 16	0.10|0.36	0.10|5.0
		SNMN 05 T3 08	0.10|0.36	0.10|5.0
		SNMN 09 T3 12	0.10|0.46	0.10|5.0
		SNMN 09 T3 16	0.15|0.54	0.10|5.0
		SNMN 12 03 08	0.15|0.36	0.10|6.0
		SNMN 12 03 12	0.15|0.54	0.10|6.0
		SNMN 12 04 08	0.15|0.36	0.10|6.0
		SNMN 12 04 12	0.15|0.54	0.10|6.0

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Tool performance parameter

Material group		Machining parameters			
ISO group	Description and grade	Machining type	Cutting regimes		
			Vc, m/min	fz, mm Hooth	ap, mm
H	Structural and low-alloyed steels	roughing	150-300	0,1-0,2	2,0
		finishing	200-380	0,02-0,1	0,3
	Bearing steels and special steels	roughing	100-300	0,1-0,2	2,0
		finishing	250-350	0,03-0,1	0,3
	Structural steel and high alloy	roughing	60-250	0,07-0,15	1,5
		finishing	150-350	0,02-0,06	0,3
	Structural and spring steels	roughing	150-250	0,07-0,15	2,0
		finishing	200-300	0,02-0,06	0,3
	Carbon (tool) and alloyed steels	roughing	80-220	0,08-0,2	2,0
		finishing	150-300	0,02-0,1	0,3
	High-speed steels	roughing	80-220	0,06-0,15	2,0
		finishing	100-300	0,01-0,06	0,3
	Mn-steels and Hallfield steels	roughing	100-180	0,1-0,3	3,0
		finishing	120-300	0,02-0,1	0,5
	Brazing-reinforced steels by hard wire or powder	roughing	120-220	0,06-0,1	1,0
		finishing	180-350	0,02-0,06	0,3
K	Grey cast iron with hardness HB 140…290	roughing	600-800	0,1-1,0	6,0
		finishing	800-1700	0,05-0,4	1,0
	High-strength iron with hardness HB 260…420	roughing	200-600	0,1-1,0	6,0
		finishing	300-900	0,1-0,7	1,0
	Alloyed and chilled cast iron grades with hardness HB 280…420	roughing	30-200	0,1-0,4	4,0
		finishing	100-250	0,05-0,15	0,7
	Roll-foundry and wear-resistant cast iron grades with hardness HRC 48…68	roughing	80-200	0,07-0,15	3,0
		finishing	200-260	0,02-0,06	0,5

For notes:

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