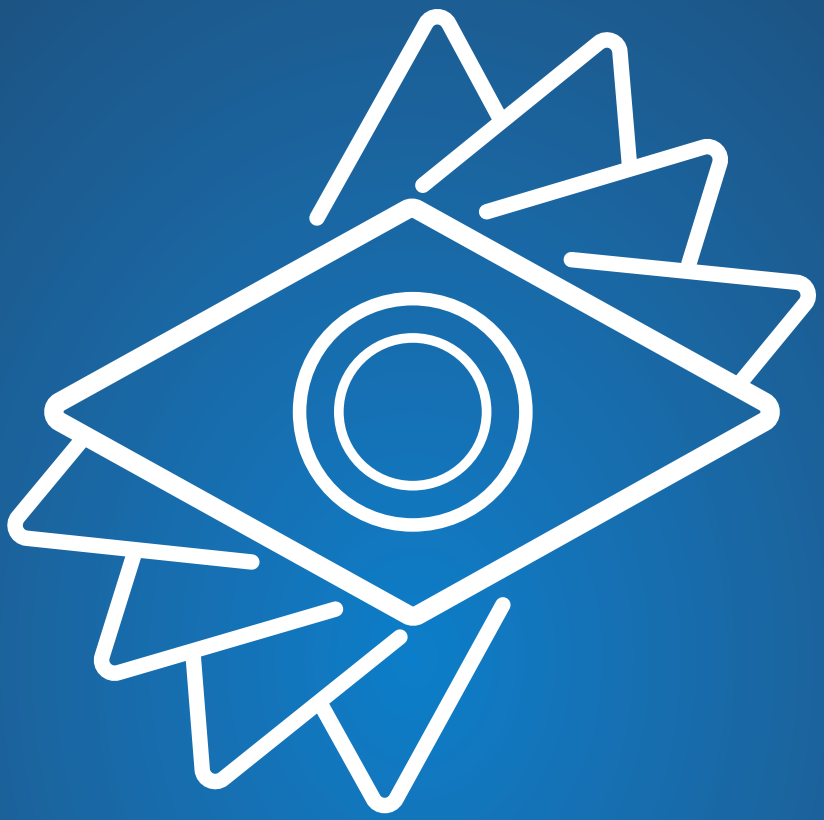
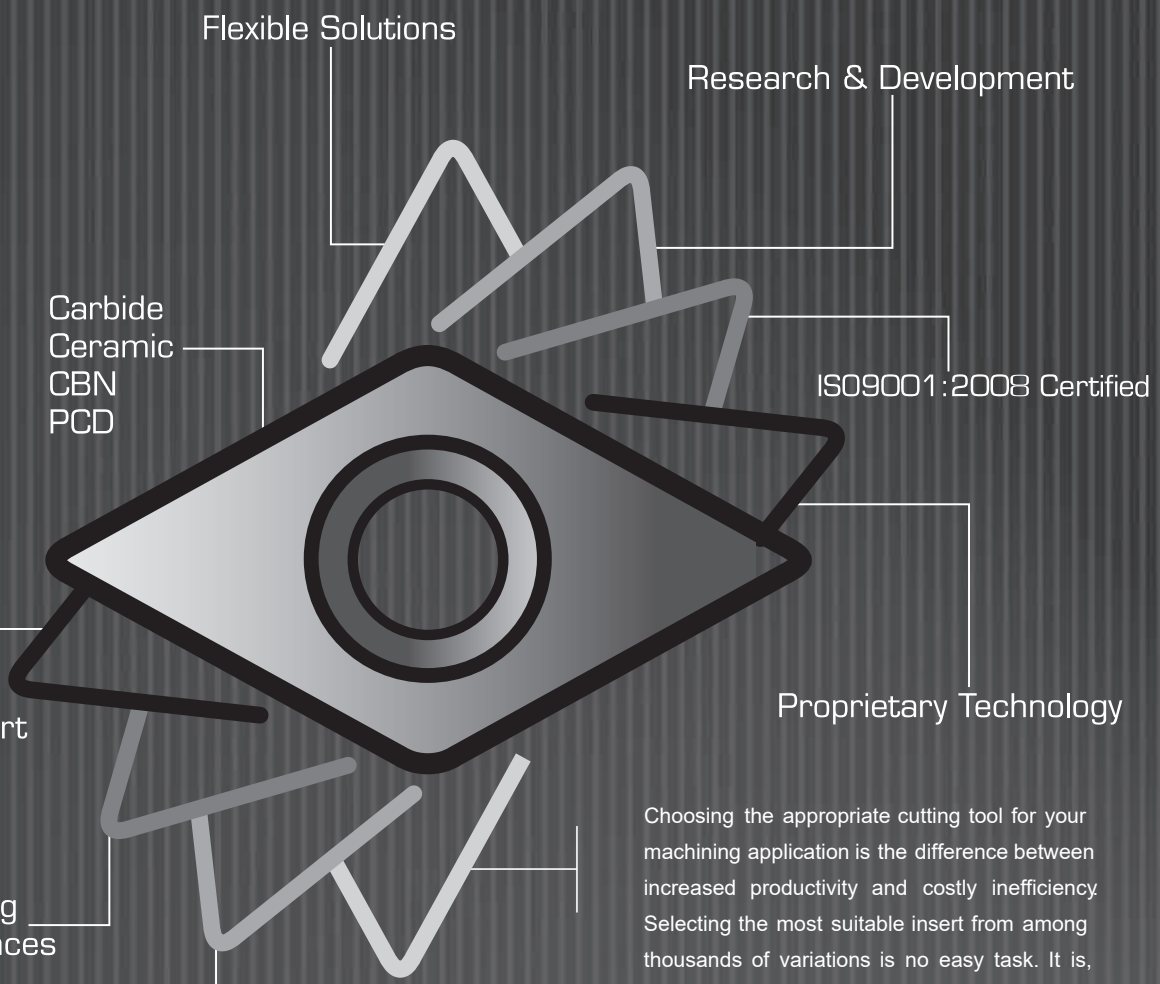
GWS TOOL GROUP

PCD/PCBN INSERTS



POLYCRYSTALLINE DIAMOND AND CUBIC BORON NITRIDE INSERTS



Choosing the appropriate cutting tool for your machining application is the difference between increased productivity and costly inefficiency. Selecting the most suitable insert from among thousands of variations is no easy task. It is, however, the key to prolonging tool life, avoiding catastrophic failure, ensuring work piece quality and minimizing downtime for tool changes.

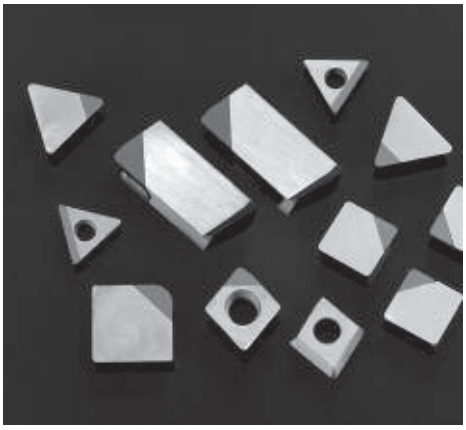
GWS Tool Group makes the choice easier. GWS has been dedicated to meeting the cutting tool needs of customers in industries as diverse as automotive, aerospace, electronic and heavy equipment manufacturing. Through our broad range of products, technical expertise, R & D capabilities and commitment to customer service. GWS Tool Group provides cost-effective, flexible solutions to any cutting challenge.

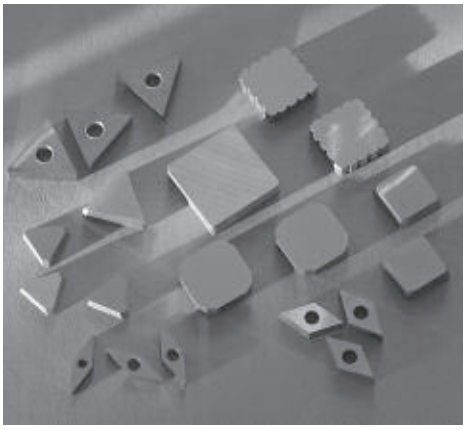
By utilizing advanced, proprietary technology, we manufacture precision ground inserts that provide consistent, increased productivity. An ISO9001:2008 registered company, GWS Tool Group is driven by an emphasis on quality in everything we do.

GWS Tool Group offers a broad range of cutting tool materials to meet your machining needs. Whether your production systems involve hard turning or milling, require heavy roughing or high speed finishing, machine high silica aluminum or tough superalloys, we have the product.

Our carbide inserts offer a cost-effective solution for general purpose machining as well as a number of special applications. With a wide variety of grades, chipbreakers and coatings, you'll find the tool best suited to your application.

The GWS Tool Group line of **CBN** tooling (cubic boron nitride) offers great hardness and abrasion resistance, coupled with extreme chemical stability when in contact with ferrous alloys at high temperatures. It has the ability to machine both steels and cast irons at high speeds for long operating cycles.





GWS Tool Group's family of five **PCD** (polycrystalline diamond) grades can satisfy all of your nonferrous and non-metallic machining needs, from the roughest and most conditions and materials to the tightest tolerance and smoothest surface finish requirements. Our PCD inserts deliver maximum productivity.

Made from the finest powders in the world, using proprietary technology, **GWS** manufactures one of the strongest, wear resistant **ceramics**. A patented microwave sintering process produces a very fine-grained micro-structure with enhanced hardness, toughness and high temperature strength. Called **MicroWear**, this family of ceramics can machine a broad range of materials from the hardest cast irons to the toughest high-temperature alloys.

Engineered and manufactured using state-of-the-art technology, all of our inserts are of exceptional detail and exacting precision. So when you're looking for quality and increased productivity, look no further than **GWS Tool Group**.

TABLE OF CONTENTS

PCD/PCBN

RELAP/RESIZE/RETIPPING OF PCD/PCBN INSERTS AND CARTRIDGES

RELAPPING

This is accomplished by using CNC grinding technology to obtain the correct cutting edge quality desired. Insert or cartridge is reduced in size, and, if more than .015"(.381MM) needs to be ground, the tool will be rejected. It may be reconditioned using another of Indexable's PCD/PCBN reconditioning processes if applicable. This is by far the most economical process available.

RESIZING

Resizing the insert or cartridge is accomplished by removing the segment, preparing the pocket, and inserting a shim between the body and segment. This allows the tool to be returned to its original size, through CNC grinding technology. If more than .020"(.508MM) has to be removed, the tip is not acceptable, and must be retipped. If resizing is a viable option, it allows for an economical way to return the tooling to like-new standards.

RETIPPING

Once the tool can't be relapped or resized, retipping the tool becomes an option. Retipping allows the body of the insert to be retained, and a new PCD/PCBN tip is applied, CNC ground and returned to new tool quality and standards. Retipping is also an option when the segment has suffered severe fracture, but the tool body is not damaged.

PCD/PCBN

POLYCRYSTALLINE DIAMOND (PCD)	POLYCRYSTALLINE CUBIC BORON NITRIDE (PCBN)
⇩	⇩
NON-FERROUS APPLICATIONS	**FERROUS APPLICATIONS**
ALUMINUM ALLOYS PISTONS WHEELS GEARBOXES BRAKE CYLINDERS	**HARD CAST IRON** PUMPS IMPELLER SHAFTS
COPPER ALLOYS COPPER ENGINE BEARINGS BUSHINGS PUMP SEATS	**SOFT CAST IRON** ENGINE BLOCKS BRAKE ROTORS BRAKE DRUMS CLUTCH PLATES
HIGHLY ABRASIVE MATERIALS INDUSTRIAL CERAMICS SINTERED CERAMICS ALUMINUM OXIDE SPARK PLUG INSULATORS	**SINTERED IRON** VALVE SEATS CAM SHAFTS GEARS
FIBRE PRODUCTS CARBON FIBRE FIBREGLASS REENFORCED GRAPHITE ACRYLIC PLASTICS PHENOLIC PLASTICS	**HARDENED STEELS** PINION GEARS SIDE GEARS TRANSMISSION SHAFTS BEARINGS
WOOD AND STONE FIBREBOARD PLYWOOD MELANIMIC PANELS GRANITE SANDSTONE	**SUPERALLOYS** TURBINE DISK TURBINE BLADE TURBINE SHROUDS ENGINE SHAFTS TURBINE VANES

FOR APPLICATION OF PCD/PCBN GRADES SEE PAGES 5-6, FOR COMPARISON TO OTHER MANUFACTURERS GRADES, SEE PAGE 7.

PCD/PCBN

PCD CUTTING RECOMMENDATIONS			
MATERIAL	**SPEED (SF/M)**	**DOC**	**FEED**
ALUMINUM <12%	1000-6000	.002-.125	.004-.015
ALUMINUM <18%	500-2500	.002-.125	.002-.010
COPPER	1200-3500	.005-.100	.005-.020
BRASS	1200-3500	.005-.125	.005-.020
SINTERED CARBIDE	40-90	.005-.125	.004-.020
UNSINTERED CARBIDE	400-1200	.005-.100	.004-.025
PRESSED CERAMICS	200-800	.001-.005	.001-.005
FIBREGLASS	300-9000	.005-.020	.001-.010
NYLONS AND ACRYLICS	550-10000	.002-.100	.005-.020
HARD RUBBER	550-2500	.005-.125	.004-.020
PCBN CUTTING RECOMMENDATIONS			
CARBON STEEL	200-500	.008	.020
BEARING MATERIAL	200-500	.008	.020
ALLOY STEELS	200-500	.008	.020
TOOL/DIE STEEL	160-350	.008	.020
HIGH TENSILE CAST IRONS	200-500	.060	.020
CHILLED CAST IRON	130-260	.032	.020
GREY CAST IRON	2000-4000	.020	.020
POWERED METAL	500-650	.016	.020
INCONEL	500-650	.006	.020
RENE42	500-650	.006	.020
RENE 77	450-550	.006	.020
INCOLOY	750-900	.006	.020
MONEL	550-650	.006	.020

FOR APPLICATION OF PCD/PCBN GRADES SEE PAGES 5-6, FOR COMPARISON TO OTHER MANUFACTURERS GRADES, SEE PAGE 7.

PCBN

GRADE INFORMATION AND APPLICATIONS

Grade	TYPE	CBN (VOL.%)	GRAIN SIZE	MAJOR BINDER	APPLICATION
CBN 45	CARBIDE BACKED	45	<1	TITANIUM NITRIDE	-Low thermal conductivity -Strong edge due to low edge compressiveness
CBN 50	CARBIDE BACKED	50	2	TITANIUM CARBIDE	-Good thermal stability and crater resistance -High-speed continuous machining of hardened steel
CBN 60	CARBIDE BACKED	60	2	TITANIUM NITRIDE	-Combination of wear resistance and impact strength -General usage in continuous and interrupted cutting of hardened steel
CBN 70	CARBIDE BACKED	70	2	TITANIUM CARBONITRIDE	-High degree of toughness due to fine microstructure of CBN and ceramic binder -Rough and interrupted machining of hardened steel
CBN 80	CARBIDE BACKED	80	3	TITANIUM NITRIDE	-Combination of wear resistance and thermal properties -Superior to other grades in machining superalloy
CBN 90	CARBIDE BACKED	90	3	TITANIUM NITRIDE	-Higher toughness and heat resistance as an alternitive to CBN 95 -Machining non-homogenous cast iron and power metal alloys
CBN 95	CARBIDE BACKED	95	3	TITANIUM ALLOY	-Extreme wear resistance due to high content CBN and metal binder -Excellent at machining various cast irons
CBN 100	SOLID FORM	93	10	ALUMINUM NITRIDE	-Extreme wear resistance due to coarser CBN and high content -Rough machining of cast iron and power metal alloys

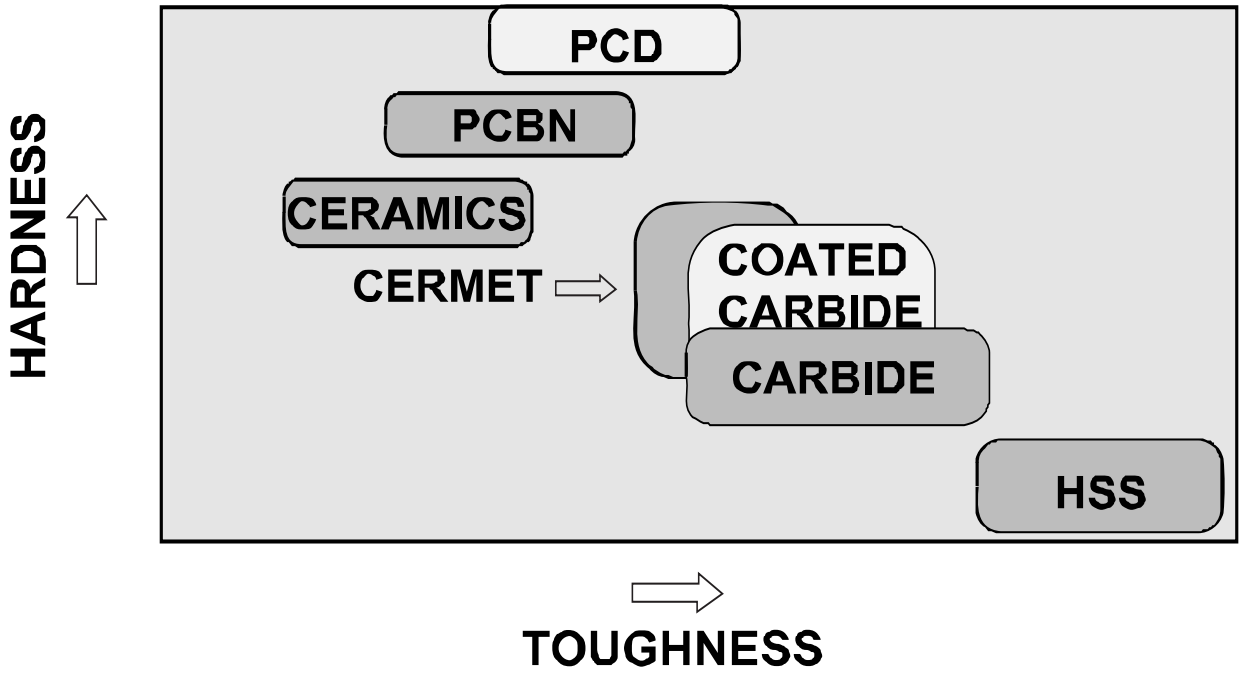
FOR COMPARISON TO OTHER MANUFACTURERS GRADES, SEE PAGE 7.

PCD

GRADE INFORMATION AND APPLICATIONS

Grade	TYPE	PCD (VOL.%)	GRAIN SIZE	MAJOR BINDER	APPLICATION
PCD	CARBIDE BACKED	92	10	CO	-GENERAL PURPOSE GRADE -GOOD SURFACE FINISH -GOOD WEAR RESISTANCE
PCD3	CARBIDE BACKED	94	30	CO	-SUPERIOR WEAR RESISTANCE -STRONG DIAMOND BOND
PCD-F	CARBIDE BACKED	90	4	CO	-GOOD SURFACE FINISHING
PCD-UF	CARBIDE BACKED	90	2	CO	-EXCELLENT SURFACE FINISH
PCD-XUF	CARBIDE BACKED	90	0.5	CO	-EXCELLENT SURFACE FINISH -GOOD WEAR RESISTANCE -SUITED FOR WOODWORKING APPLICATIONS

CUTTING TOOL MATERIALS



FOR COMPARISON TO OTHER MANUFACTURERS GRADES, SEE PAGE 7.

NOMENCLATURE

SHAPE

A - Parallelogram 85°
B - Parallelogram 82°
C - Diamond 80°
H - Hexagon
L - Rectangle
M - Diamond 86°
N - Diamond 87°
O - Octagon
P - Pentagon
R - Round
S - Square
T - Triangle

TOLERANCE

ANSI

	Cutting point	Thickness
A	± .0002	±.001
B	± .0002	±.005
C	± .0005	±.001
D	± .0005	±.005
E	± .001	±.001
G	± .001	±.005
M	± .002 to ± .005*	
U	± .005 to ± .012*	±.005

*Exact tolerances determined by size of insert

ISO

Triangular insert with secondary cutting edge

SYM.	m	d	s
A	±.005	±.025	±.025
F	±.005	±.013	±.025
C	±.013	±.025	±.025
H	±.013	±.013	±.025
E	±.025	±.025	±.025
G	±.025	±.025	±.13
J	±.005	±.05–±.13	±.025
K*	±.013	±.05–±.13	±.025
L*	±.025	±.05–±.13	±.025
M*	±.08–±.18	±.05–±.13	±.13
N*	±.08–±.18	±.05–±.13	±.025
U*	±.13–±.38	±.08–±.25	±.13

*Exact tolerances determined by size of insert. FOR CLASS M INSERTS SEE TABLE TO RIGHT

I.C.					
6.35	±.08	-	-	-	-
9.525	±.08	±.08	±.08	±.11	±.13
12.70	±.13	±.13	±.13	±.15	-
15.875	±.15	±.15	±.15	±.18	-
19.05	±.15	±.15	±.15	±.18	-
25.40	-	±.18	-	-	-
31.75	-	±.25	-	-	-

TOLERANCE ON THE CIRCUMSCRIBED CIRCLE

I.C.						
6.35	±.05	-	-	-	-	-
9.525	±.05	±.05	±.05	±.05	±.05	±.05
12.70	±.08	±.08	±.08	±.08	-	±.08
15.875	±.10	±.10	±.10	±.10	-	±.10
19.05	±.10	±.10	±.10	-	-	±.10
25.40	-	±.13	-	-	-	±.10
31.75	-	±.20	-	-	-	±.12

T	N	G	N
SHAPE	CLEARANCE	TOLERANCE	TYPE

CLEARANCE

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

TYPE(ANSI)

A With hole
B With hole and one countersink
C With hole and two countersinks
D Smaller than 1/4" I.C. with hole
E Smaller than 1/4" I.C.
F Chip grooves on top rake surfaces, without hole
G Chip grooves on top rake surfaces, with hole
H With hole, one countersink and chip grooves on one top rake surface
J With hole, two countersinks and chip grooves on top rake surfaces
M With hole and chip grooves on one top rake surface
P With hole and 10° positive chip-breaker both sides
S With hole and 20° chip-breaker one side
X Dimple Lock (interchangeable with competitors notch lock style inserts)
X V-Bottom

TYPE(ISO)

A With hole
B With hole and one 70°-90° countersink
C With hole and two 70°-90° countersinks
F Chipbreaker both sides
G With hole, chipbreaker on both sides
H With hole, one 70°-90° countersink and chipbreaker on one side
J With hole, two 70°-90° countersinks and chipbreaker on both sides
M With hole and chipbreaker on one side
N No hole, no chipbreaker
Q With hole, one 40°-60° countersink
R Chipbreaker one side
T With hole, one 40°-60° countersink,chipbreaker one side
W With hole, one 40°-60° countersink
X Dimple Lock (interchangeable with competitors notch lock style inserts)
X V-Bottom

SIZE									
R	V	D	C	S	T	M	I.C. (MM)	I.C. (INCH)	ANSI SYMBOL
03		04	S4	03	06	03	3,97	0.156	1.25
04	08	05	04	04	08	04	4,76	0.188	1.5
05	09	06	05	05	09	05	5,56	0.219	1.8
06	11*	06					6,00		
06*	11	07	06	06	11	06	6,35	0.250	2
07	13	09	08	07	13	07	7,94	0.313	2.5
08*							8,00		
09	16	11	09	09	16	09	9,525	0.375	3
10*							10,00		
12*							12,00		
12	22	15	12	12	22	12	12,70	0.500	4
15		19	16	15	27	15	15,875	0.625	5
16							16,00		
19	33	23	19	19	33	19	19,05	0.750	6
20*							20,00		
	38	27	22	22	38	22	22,225		
25*							25,00		
25	44	31	25	25	44	25	25,40	1.000	8
31		38	32	31	53	31	31,75	1.250	10
32							32,00		

THICKNESS			
ISO	MM	ANSI	INCH
01	1,59	1	0.062
T1	1,98	1.2	0.078
02	2,38	1.5	0.094
03	3,18	2	0.125
T3	3,97	2.5	0.156
04	4,76	3	0.188
05	5,56	3.5	0.219
06	6,35	4	0.250
07	7,94	5	0.313
09	9,52	6	0.375
12	12,7	8	0.500

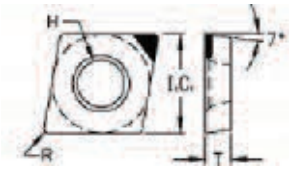
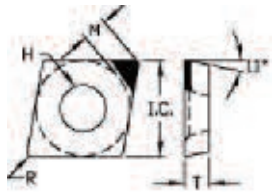
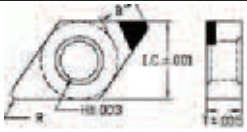
Rectangles and parallelograms use a 2 digits to size:
1st digit-Number of 1/8ths inch in width
2nd digit-Number of 1/4 inches in length

22	04	08	E
SIZE	THICKNESS	RADIUS	OTHER CONDITIONS
4	3	2	E

RADIUS			
ISO	MM	ANSI	INCH
00	SHARP EDGE	0	SHARP EDGE
02	0.2	0.5	0.008
04	0.4	1	0.016
08	0.8	2	0.031
12	1.2	3	0.047
16	1.6	4	0.062
20	2	5	0.078
24	2.4	6	0.094
28	2.78	7	0.109
32	3.18	8	0.125
00	ROUND INSERT	0	ROUND INSERT

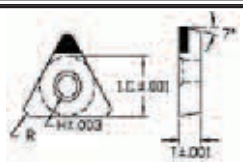
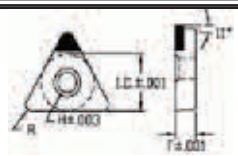
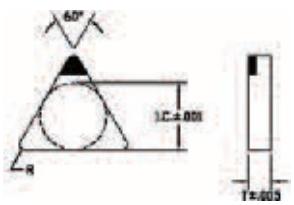
OTHER CONDITIONS
A -Light hone
B -Medium hone
C -Heavy hone
D -Ground top and bottom only- Heavy hone
E -Unground insert honed
F -Unground insert not honed
J -Polished(rake face only)
T - T-Land
FA -Finishing application
SA -Standard application

SINGLE TIPPED INSERTS

CCMW	INSERT NUMBER	DIMENSIONS				ISO CODE NUMBERS
		I.C.	T	H	R	
	CCMW 21.51	0.250	0.094	0.110	0.016	CCMW 06 02 04
	CCMW 21.52				0.032	CCMW 06 02 08
	CCMW 32.51	0.375	0.156	0.173	0.016	CCMW 09 T3 04
	CCMW 32.52				0.032	CCMW 09 T3 08
	CCMW 431	0.500	0.188	0.216	0.016	CCMW 12 04 04
	CCMW 432				0.032	CCMW 12 04 08
CPMW		**I.C.**	**T**	**H**	**R**	
	CPMW 21.51	0.250	0.094	0.110	0.016	CPMW 06 02 04
	CPMW 21.52				0.032	CPMW 06 02 08
	CPMW 32.51	0.375	0.156	0.173	0.016	CPMW 09 T3 04
	CPMW 32.52				0.032	CPMW 09 T3 08
	CPMW 431	0.50	0.188	0.216	0.016	CPMW 12 04 04
	CPMW 432				0.032	CPMW 12 04 08
CNGA		**I.C.**	**T**	**H**	**R**	
	CNGA 431	0.500	0.188	0.203	0.016	CNGA 12 04 04
	CNGA 432				0.032	CNGA 12 04 08
	CNGA 433				0.047	CNGA 12 04 12
DCMW		**I.C.**	**T**	**H**	**R**	
	DCMW 21.51	0.250	0.094	0.110	0.016	DCMW 07 02 04
	DCMW 21.52				0.032	DCMW 07 02 08
	DCMW 32.51	0.375	0.156	0.173	0.016	DCMW 11 T3 04
	DCMW 32.52				0.032	DCMW 11 T3 08
DPMW		**I.C.**	**T**	**H**	**R**	
	DPMW 21.51	0.250	0.094	0.110	0.016	DPMW 07 02 04
	DPMW 21.52				0.032	DPMW 07 02 08
	DPMW 32.51	0.375	0.156	0.173	0.016	DPMW 11 T3 04
	DPMW 32.52				0.032	DPMW 11 T3 08
DNGA (DNMA)		**I.C.**	**T**	**H**	**R**	
	DNGA 431	0.500	0.188	0.203	0.016	DNGA 15 04 04
	DNGA 432				0.032	DNGA 15 04 08

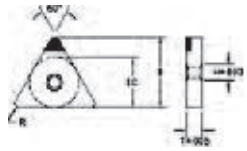
AVAILABLE GRADES(For grade characteristics and applications see pages 2-7)												
PCD					PCBN							
PCD	PCD 3	PCD-F	PCD-UF	PCD-XUF	CBN100	CBN95	CBN90	CBN80	CBN80D	CBN70	CBN60	CBN50	CBN45
NOTE: Segment size varies based on depth of cut and/ or customers' request												

SINGLE TIPPED INSERTS

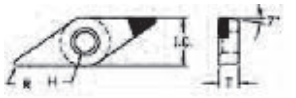
SNGA (SNMA)	INSERT NUMBER	DIMENSIONS I.C.	T	H	R	ISO CODE NUMBERS
	SNGA 431	0.500	0.188	0.203	0.016	SNGA 12 04 04
	SNGA 432				0.032	SNGA 12 04 08
	SNGA 433				0.047	SNGA 12 04 12
SNGN		**I.C.**	**T**		**R**	
	SNGN 431	0.500	0.188		0.016	SNGN 12 04 04
	SNGN 432				0.032	SNGN 12 04 08
	SNGN 433				0.047	SNGN 12 04 12
SPGN		**I.C.**	**T**		**R**	
	SPGN 431	0.500	0.188		0.016	SPGN 12 04 04
	SPGN 432				0.032	SPGN 12 04 08
	SPGN 433				0.047	SPGN 12 04 12
TCGW (TCMW)		**I.C.**	**T**	**H**	**R**	
	TCGW 1.81.51	0.219	0.094	0.118	0.016	TCGW 09 02 04
	TCGW 21.51	0.250	0.094	0.110	0.016	TCGW 11 02 04
	TCGW 21.52				0.032	TCGW 11 02 08
	TCGW 32.51	0.375	0.156	0.173	0.016	TCGW 16 T3 04
	TCGW 32.52				0.032	TCGW 16 T3 08
TPGW (TPMW)		**I.C.**	**T**	**H**	**R**	
	TPGW 1.81.51	0.219	0.094	0.118	0.016	TPGW 09 02 04
	TPGW 21.51	0.250	0.094	0.110	0.016	TPGW 11 02 04
	TPGW 21.52				0.032	TPGW 11 02 08
	TPGW 32.51	0.375	0.156	0.173	0.016	TPGW 16 T3 04
	TPGW 32.52				0.032	TPGW 16 T3 08
TNG		**I.C.**	**T**		**R**	
	TNG 221	0.250	0.125		0.016	TNGN 11 03 04
	TNG 222				0.032	TNGN 11 03 08
	TNG 321	0.375	0.125		0.016	TNGN 16 03 04
	TNG 322				0.032	TNGN 16 03 08
	TNG 331		0.188		0.016	TNGN 16 04 04
	TNG 332				0.032	TNGN 16 04 08
	TNG 431	0.500	0.188		0.016	TNGN 22 04 04
	TNG 432				0.032	TNGN 22 04 08
	TNG 433				0.047	TNGN 22 04 12

AVAILABLE GRADES(For grade characteristics and applications see pages 2-7)												
PCD					PCBN							
PCD	PCD 3	PCD-F	PCD-UF	PCD-XUF	CBN100	CBN95	CBN90	CBN80	CBN80D	CBN70	CBN60	CBN50	CBN45
NOTE: Segment size varies based on depth of cut and/ or customers' request												

SINGLE TIPPED INSERTS

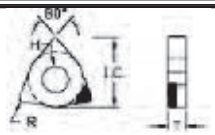
TNMA	INSERT NUMBER	DIMENSIONS I.C.	T	H	R	ISO CODE NUMBERS
	TNMA 331	0.375	0.188	0.125	0.016	TNMA 16 04 04
	TNMA 332				0.032	TNMA 16 04 08
	TNMA 431	0.500	0.188	0.203	0.016	TNMA 22 04 04
	TNMA 432				0.032	TNMA 22 04 08
	TNMA 433				0.047	TNMA 22 04 12

VBMW		I.C.	T	R	
	VBMW 21.51	0.250	0.094	0.016	VBMW 11 02 04
	VBMW 331	0.375	0.188	0.016	VBMW 16 04 04
	VBMW 332	0.375	0.188	0.032	VBMW 16 04 08

VCMW		I.C.	T	R	
	VCMW 21.51	0.250	0.094	0.016	VCMW 11 02 04
	VCMW 331	0.375	0.188	0.016	VCMW 16 04 04
	VCMW 332	0.375	0.188	0.032	VCMW 16 04 08

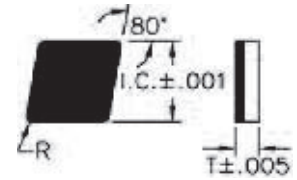
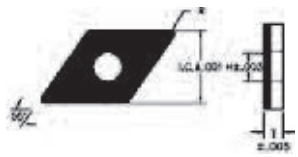
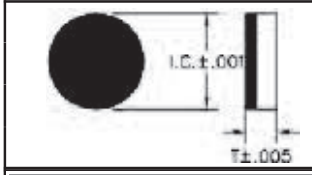
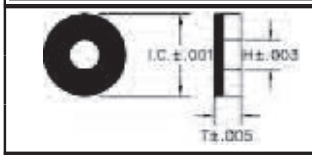
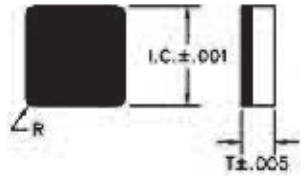
VPMW		I.C.	T	R	
	VPMW 21.51	0.250	0.094	0.016	VPMW 11 02 04
	VPMW 331	0.375	0.188	0.016	VPMW 16 04 04
	VPMW 332	0.375	0.188	0.032	VPMW 16 04 08

VNMA		I.C.	T	H	R	
	VNMA 331	0.375	0.188	0.150	0.016	VNMA 16 04 04
	VNMA 332				0.032	VNMA 16 04 08

WNMA		I.C.	T	H	R	
	WNMA 431	0.500	0.188	0.203	0.016	WNMA 08 04 04
	WNMA 432				0.032	WNMA 08 04 08

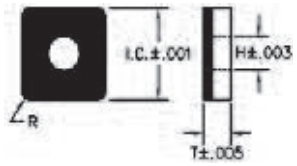
AVAILABLE GRADES(For grade characteristics and applications see pages 2-7)													
PCD					PCBN								
PCD	PCD 3	PCD-F	PCD-UF	PCD-XUF	CBN100	CBN95	CBN90	CBN80	CBN80D	CBN70	CBN60	CBN50	CBN45
NOTE: Segment size varies based on depth of cut and/ or customers' request													

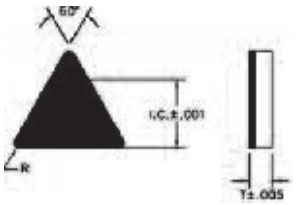
FULL TOP PCBN INSERTS

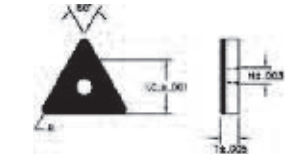
CNGA	INSERT NUMBER	DIMENSIONS I.C.	T	H		ISO CODE NUMBERS
	CNGA 431	0.500	0.188	0.203	0.016	CNGA 12 04 04
	CNGA 432				0.032	CNGA 12 04 08
	CNGA 433				0.047	CNGA 12 04 12
	CNGA 434				0.062	CNGA 12 04 16
CNGN		**I.C.**	**T**		**R**	
	CNGN 321	0.375	0.125		0.016	CNGN 09 03 04
	CNGN 322				0.032	CNGN 09 03 08
	CNGN 431	0.500	0.188		0.016	CNGN 12 04 04
	CNGN 432				0.032	CNGN 12 04 08
	CNGN 433				0.047	CNGN 12 04 12
DNGA		**I.C.**	**T**		**R**	
	DNGA 431	0.500	0.188		0.016	DNGA 12 04 04
	DNGA 432				0.032	DNGA 12 04 08
	DNGA 433				0.047	DNGA 12 04 12
	DNGA 434				0.062	DNGA 12 04 16
RNG		**I.C.**	**T**		**R**	
	RNG 22	0.250	0.125		-	RNGN 06 03 00
	RNG 32	0.375	0.125		-	RNGN 09 03 00
	RNG 42	0.500	0.125		-	RNGN 12 03 00
	RNG 43		0.188		-	RNGN 12 04 00
RNGA		**I.C.**	**T**		**H**	
	RNGA 43	0.500	0.188		0.203	RNGA 12 04 00
	RNGA 53	0.625	0.188		0.25	RNGA 15 04 00
	RNGA 83	1.000	0.188		0.359	RNGA 25 04 00
SNG		**I.C.**	**T**		**R**	
	SNG 321	0.375	0.125		0.016	SNGN 09 03 04
	SNG 322				0.032	SNGN 09 03 08
	SNG 431	0.500	0.188		0.016	SNGN 12 04 04
	SNG 432				0.032	SNGN 12 04 08
	SNG 433				0.047	SNGN 12 04 12
	SNG 434				0.062	SNGN 12 04 16

AVAILABLE GRADES(For grade characteristics and applications see pages 2-7)													
PCD					PCBN								
PCD	PCD 3	PCD-F	PCD-UF	PCD-XUF	CBN100	CBN95	CBN90	CBN80	CBN80D	CBN70	CBN60	CBN50	CBN45
NOTE: Segment size varies based on depth of cut and/ or customers' request													

FULL TOP PCBN INSERTS

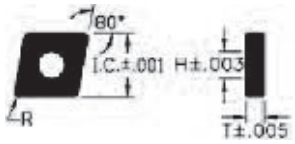
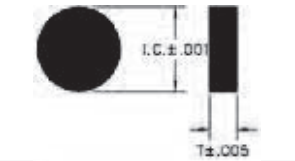
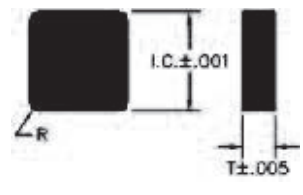
SNGA	INSERT NUMBER	DIMENSIONS				ISO CODE NUMBERS
		I.C.	T	H	R	
	SNGA 431	0.500	0.188	0.203	0.016	SNGA 12 04 04
	SNGA 432				0.032	SNGA 12 04 08
	SNGA 433				0.047	SNGA 12 04 12
	SNGA 434				0.062	SNGA 12 04 16
	SNGA 832	1.000	0.188	0.359	0.032	SNGA 25 04 08
	SNGA 833				0.047	SNGA 25 04 12
	SNGA 834				0.062	SNGA 25 04 16

TNG		I.C.	T	R	
	TNG 221	0.250	0.125	0.016	TNGN 11 03 04
	TNG 222			0.032	TNGN 11 03 08
	TNG 321	0.375	0.125	0.016	TNGN 16 03 04
	TNG 322			0.032	TNGN 16 03 08
	TNG 331		0.188	0.016	TNGN 16 04 04
	TNG 332			0.032	TNGN 16 04 08
	TNG 432	0.500	0.188	0.032	TNGN 22 04 08
	TNG 433			0.047	TNGN 22 04 12

TNGA		I.C.	T	R	
	TNGA 331	0.375	0.188	0.016	TNGA 16 04 04
	TNGA 332			0.032	TNGA 16 04 08
	TNGA 333			0.047	TNGA 16 04 12

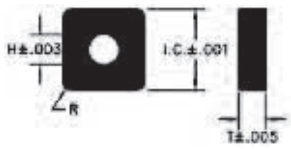
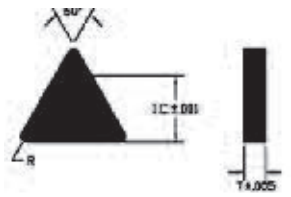
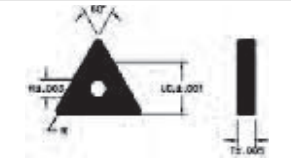
AVAILABLE GRADES(For grade characteristics and applications see pages 2-7)													
PCD					PCBN								
PCD	PCD 3	PCD-F	PCD-UF	PCD-XUF	CBN100	CBN95	CBN90	CBN80	CBN80D	CBN70	CBN60	CBN50	CBN45
NOTE: Segment size varies based on depth of cut and/ or customers' request													

SOLID PCBN INSERTS

CNGA	INSERT NUMBER	DIMENSIONS				ISO CODE NUMBERS
		I.C.	T	H	R	
	CNGA 431	0.500	0.188	0.203	0.016	CNGA 12 04 04
	CNGA 432				0.032	CNGA 12 04 08
	CNGA 433				0.047	CNGA 12 04 12
	CNGA 434				0.062	CNGA 12 04 16
CNGN		**I.C.**	**T**		**R**	
	CNGN 321	0.375	0.125		0.016	CNGN 09 03 04
	CNGN 322				0.032	CNGN 09 03 08
	CNGN 431	0.500	0.188		0.016	CNGN 12 04 04
	CNGN 432				0.032	CNGN 12 04 08
	CNGN 433				0.047	CNGN 12 04 12
DNGA		**I.C.**	**T**		**R**	
	DNGA 431	0.500	0.188		0.016	DNGA 12 04 04
	DNGA 432				0.032	DNGA 12 04 08
	DNGA 433				0.047	DNGA 12 04 12
	DNGA 434				0.062	DNGA 12 04 16
RNG		**I.C.**	**T**		**R**	
	RNG 22	0.250	0.125		-	RNGN 06 03 00
	RNG 32	0.375	0.125		-	RNGN 09 03 00
	RNG 42	0.500	0.125		-	RNGN 12 03 00
	RNG 43		0.188		-	RNGN 12 04 00
RNGA		**I.C.**	**T**	**H**		
	RNGA 43	0.500	0.188	0.203		RNGA 12 04 00
	RNGA 53	0.625	0.188	0.25		RNGA 15 04 00
	RNGA 83	1.000	0.188	0.359		RNGA 25 04 00
SNG		**I.C.**	**T**		**R**	
	SNG 321	0.375	0.125		0.016	SNGN 09 03 04
	SNG 322				0.032	SNGN 09 03 08
	SNG 431	0.500	0.188		0.016	SNGN 12 04 04
	SNG 432				0.032	SNGN 12 04 08
	SNG 433				0.047	SNGN 12 04 12
	SNG 434				0.062	SNGN 12 04 16

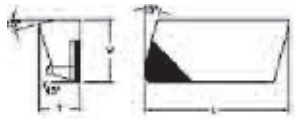
AVAILABLE GRADES(For grade characteristics and applications see pages 2-7)													
PCD					PCBN								
PCD	PCD 3	PCD-F	PCD-UF	PCD-XUF	CBN100	CBN95	CBN90	CBN80	CBN80D	CBN70	CBN60	CBN50	CBN45
NOTE: Segment size varies based on depth of cut and/ or customers' request													

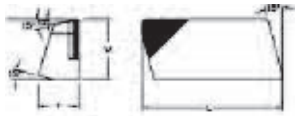
SOLID PCBN INSERTS

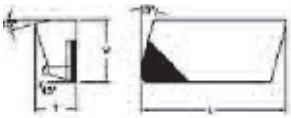
SNGA	INSERT NUMBER	DIMENSIONS				ISO CODE NUMBERS
		I.C.	T	H	R	
	SNGA 431	0.500	0.188	0.203	0.016	SNGA 12 04 04
	SNGA 432				0.032	SNGA 12 04 08
	SNGA 433				0.047	SNGA 12 04 12
	SNGA 434				0.062	SNGA 12 04 16
	SNGA 832	1.000	0.188	0.359	0.032	SNGA 25 04 08
	SNGA 833				0.047	SNGA 25 04 12
	SNGA 834				0.062	SNGA 25 04 16
TNG		**I.C.**	**T**		**R**	
	TNG 221	0.250	0.125		0.016	TNGN 11 03 04
	TNG 222				0.032	TNGN 11 03 08
	TNG 321	0.375	0.125		0.016	TNGN 16 03 04
	TNG 322				0.032	TNGN 16 03 08
	TNG 331		0.188		0.016	TNGN 16 04 04
	TNG 332				0.032	TNGN 16 04 08
	TNG 432	0.500	0.188		0.032	TNGN 22 04 08
	TNG 433				0.047	TNGN 22 04 12
TNGA		**I.C.**	**T**		**R**	
	TNGA 331	0.375	0.188		0.016	TNGA 16 04 04
	TNGA 332				0.032	TNGA 16 04 08
	TNGA 333				0.047	TNGA 16 04 12

AVAILABLE GRADES(For grade characteristics and applications see pages 2-7)												
PCD					PCBN							
PCD	PCD 3	PCD-F	PCD-UF	PCD-XUF	CBN100	CBN95	CBN90	CBN80	CBN80D	CBN70	CBN60	CBN50	CBN45
NOTE: Segment size varies based on depth of cut and/ or customers' request												

CARTRIDGE INSERTS

SDR-100	INSERT NUMBER	DIMENSIONS				
		L	T	W	R	EDGE LENGTH
	SDR-100-020-E1	0.875	0.250	0.375	0.020	0.250
	SDR-100-020-E3					0.500
	SDR-100-020-E5					0.750
	SDR-100-031-E1				0.031	0.250
	SDR-100-031-E3					0.500
	SDR-100-031-E5					0.750

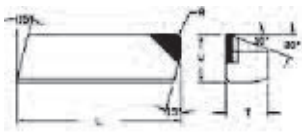
SDL-200		DIMENSIONS				
		L	T	W	R	EDGE LENGTH
	SDL-200-020-E1	0.875	0.25	0.375	0.020	0.250
	SDL-200-020-E3					0.500
	SDL-200-020-E5					0.750
	SDL-200-031-E1				0.031	0.250
	SDL-200-031-E3					0.500
	SDL-200-031-E5					0.750

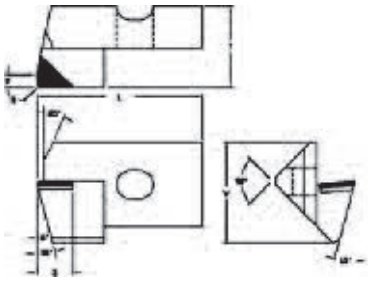
SDR-102		DIMENSIONS					
		L	T	W	R	WIPER	EDGE LENGTH
	SDR-102-020-E1W1	0.875	0.250	0.375	0.020	0.020	0.250
	SDR-102-020-E3W1						0.500
	SDR-102-020-E5W1						0.750
	SDR-102-031-E1W1				0.030	0.020	0.250
	SDR-102-031-E3W1						0.500
	SDR-102-031-E5W1						0.750
	SDR-102-020-E1W2	0.875	0.250	0.375	0.020	0.030	0.250
	SDR-102-020-E3W2						0.500
	SDR-102-020-E5W2						0.750
	SDR-102-031-E1W2				0.030	0.030	0.250
	SDR-102-031-E3W2						0.500
	SDR-102-031-E5W2						0.750

SDL-202		DIMENSIONS					
		L	T	W	R	WIPER	EDGE LENGTH
	SDL-202-020-E1W1	0.875	0.250	0.375	0.020	0.020	0.250
	SDL-202-020-E3W1						0.500
	SDL-202-020-E5W1						0.750
	SDL-202-031-E1W1				0.030	0.020	0.250
	SDL-202-031-E3W1						0.500
	SDL-202-031-E5W1						0.750
	SDL-202-020-E1W2	0.875	0.250	0.375	0.020	0.030	0.250
	SDL-202-020-E3W2						0.500
	SDL-202-020-E5W2						0.750
	SDL-202-031-E1W2				0.030	0.030	0.250
	SDL-202-031-E3W2						0.500
	SDL-202-031-E5W2						0.750

AVAILABLE GRADES(For grade characteristics and applications see pages 2-7)												
PCD					PCBN							
PCD	PCD 3	PCD-F	PCD-UF	PCD-XUF	CBN100	CBN95	CBN90	CBN80	CBN80D	CBN70	CBN60	CBN50	CBN45
NOTE: Segment size varies based on depth of cut and/ or customers' request												

CARTRIDGE INSERTS

EDR-10X	INSERT NUMBER	DIMENSIONS					
		L	T	W	R	WIPER	EDGE LENGTH
	EDR-100-031-E1	0.875	0.250	0.375	0.030	-	0.250
	EDR-100-031-E3						0.500
	EDR-100-031-E4						0.625
	EDR-100-031-E5						0.750
	EDR-102-031-E1W2					0.030	0.250
	EDR-102-031-E3W2						0.500
	EDR-102-031-E4W2						0.625
	EDR-102-031-E5W2						0.750

UCDR	DIMENSIONS					
	L	T	W	S	X	R
						
UCDR-11-00	1.236	0.600	0.750	0.265	0.060	0.010
UCDR-11-01					0.060	0.010
UCDR-20-00					0	0.030
UCDR-22-00					0.080	0.030

AVAILABLE GRADES(For grade characteristics and applications see pages 2-7)													
PCD					PCBN								
PCD	PCD 3	PCD-F	PCD-UF	PCD-XUF	CBN100	CBN95	CBN90	CBN80	CBN80D	CBN70	CBN60	CBN50	CBN45
NOTE: Segment size varies based on depth of cut and/ or customers' request													

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