

DIA EDGE

# BC8200 SERIES

EXCELLENT COATED CBN GRADE FOR NEXT GENERATION TURNING OF HARDENED STEELS

# ABOUT OUR BRAND

## Your manufacturing success is our success.

It's simple. We want to provide high-quality cutting tool products that help deliver unparalleled performance and control for you to manufacture precisely perfect products every day.

Our long heritage of building partnerships through cutting tool solutions to metal working manufacturers, like yours, has given Mitsubishi Materials USA a solid reputation as an industry leader. We understand the importance of getting it right the first time by delivering high-quality cutting tool product brands to help overcome machining challenges to improve machining processes.

Your success is our success and is the driving force behind our innovative products. Our product brands, DIAEDGE and MOLDINO, are trusted globally in the metal manufacturing and die & mold industries for delivering expertly-designed manufactured tools of the trade for highly specialized industries like yours.

With the acquisition of Hitachi Tool Engineering, LTD, our traditional Mitsubishi Materials USA cutting tool product line is now sold under the DIAEDGE product brand name.

**Brands you can trust:**

MITSUBISHI MATERIALS U.S.A.

TRUSTED PRODUCT BRANDS

DIAEDGE MOLDINO

## CBN Grade for Turning Hardened Steel

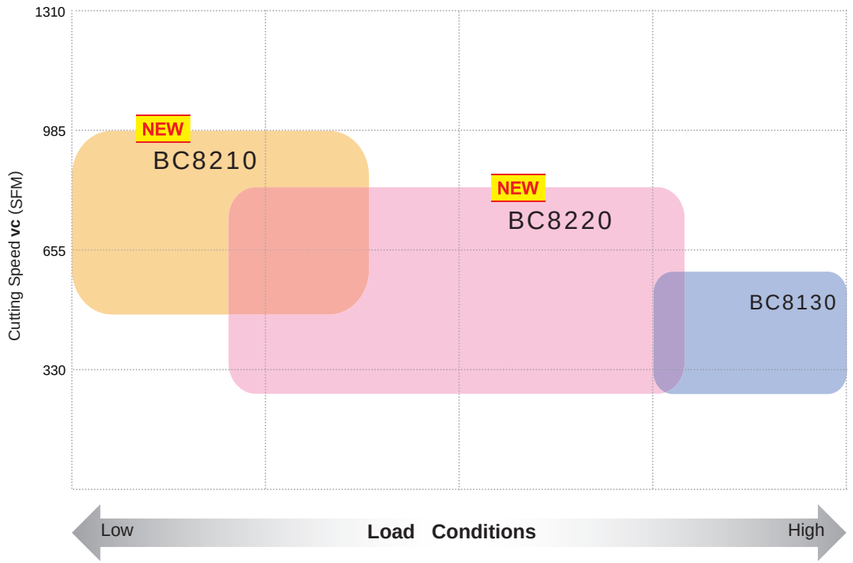
# BC8200 Series

NEW

## BC8210 For Continuous and Light Interrupted Cutting

### Outstanding Tool Life with High-speed Machining

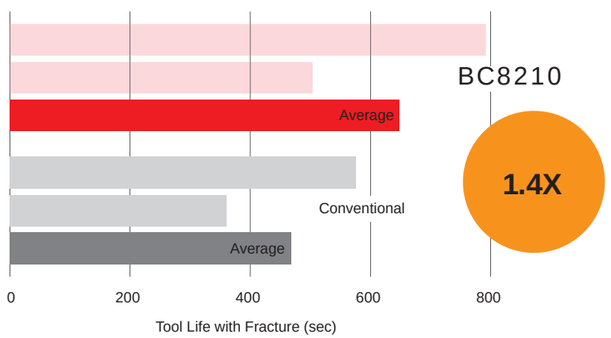
Suitable for continuous cutting and Light interrupted cutting. BC8210 exhibits excellent chipping, flank and crater wear resistance, thereby providing a stable machining process at high speed cutting conditions.





### Comparison of Wear Resistance During Continuous Cutting

Defects due to crater wear are suppressed and tool life is improved when compared to conventional products.



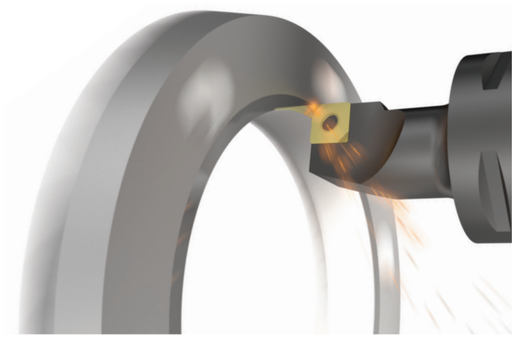

<Cutting Conditions>
Workpieces Material : AISI 5120 (60 HRC)
Inserts : NP-CNGA432-GS2
Cutting Speed : vc=655 SFM
Feed per Rev. : f=.004 IPR
Depth of Cut : ap=.008 inch
Cutting Mode : Dry Cutting

NEW

## BC8220 General Applications

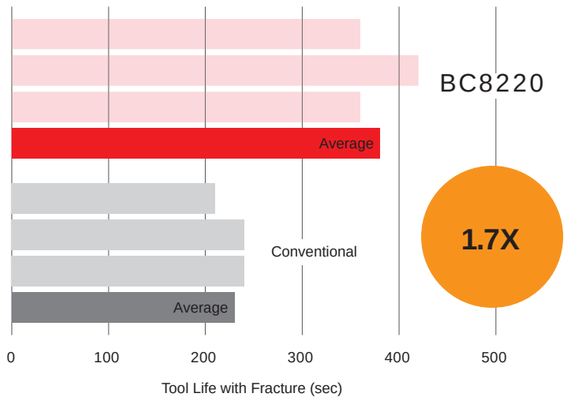
### Achieves Impressive Tool Life Over a Wide Range of Cutting Conditions.

Highly suited to a wide application area from continuous through to heavy interrupted cutting. It also has excellent crater wear and fracture resistance due to the new CBN base material combined with a new coating to dramatically extend tool life.



### Comparison of Fracture Resistance During Medium Interrupted Cutting

Excelling in suppression of chipping and cracks, it also improves fracture resistance after crater wear providing stable cutting action that improves tool life.



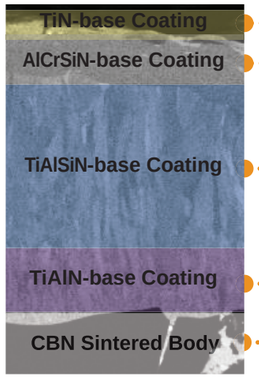

<Cutting Conditions>
Workpieces Material : AISI 5120 (60 HRC)
Inserts : NP-CNGA432-VA2
Cutting Speed : vc=820 SFM
Feed per Rev. : f=.006 IPR
Depth of Cut : ap=.004 inch
Cutting Mode : Dry Cutting

## Features

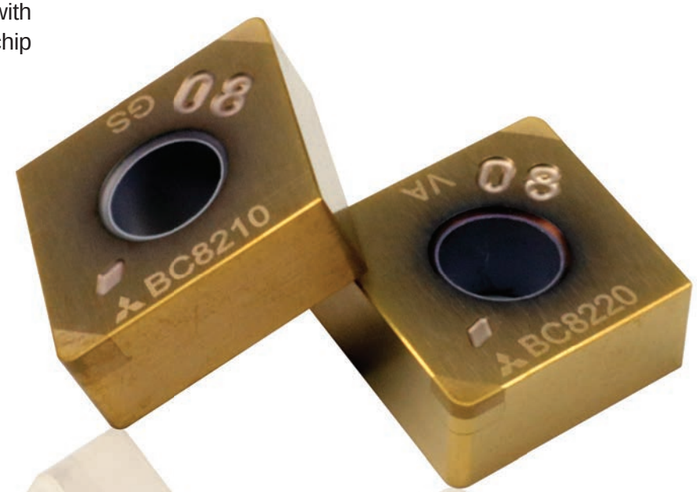
# BC8210

The newly developed, impact absorbing, AlCrSiN-base coating combined with the excellent wear-resistant, TiAlSiN-base coating, provides stable wear and chip resistance from continuous through to low interrupted cutting.

NEW




- Gold color aids easy identification of edge use.
- Excellent chipping resistance
  Absorbs impact forces
- Excellent wear resistance
  Abrasion resistant layer
- Improved strength of adhesion to the CBN substrate prevents peeling
  High adhesion layer for BC8210
- Excellent crater wear and chipping resistance
  Exclusive BC8210 sintered body




# BC8220

TiAlN-base coating, which has excellent wear resistance and a fine multi-layered structure suppresses the growth of cracks in the coating and thereby reduces edge chipping. This allows for stable cutting in a wide variety of applications.

NEW


- Gold color aids easy identification of edge use.
- High wear and chipping resistance
  Super Multi-layer
- Improved strength of adhesion to the CBN substrate prevents peeling
  High adhesion layer for BC8220
- Excellent crater wear and chipping resistance
  Exclusive BC8220 Sintered body

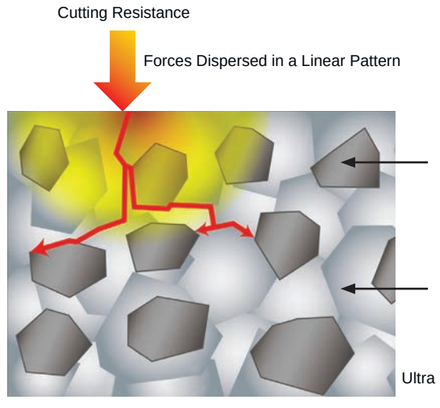
## Ultra Micro-particle/ Heat Resistant Binder Technology

The new CBN substrate contains a new ultra micro-particle and heat resistant binder. This suppresses both chipping and crater wear that promote longer tool life.

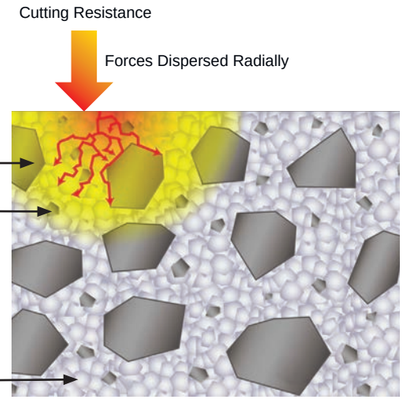
### Optimized Substrate Technology with Ultra Micro-particle Binder

The ultra micro-particle binder prevents linear crack development to avoid sudden fracturing.

**Conventional**




**BC8200, BC8100 Series**

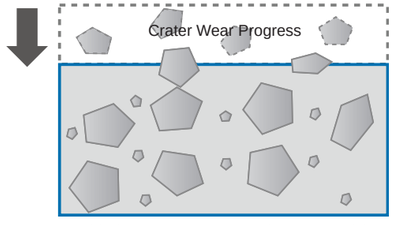



NEW

### Positive Effect of the Newly Developed Heat Resistant Binder

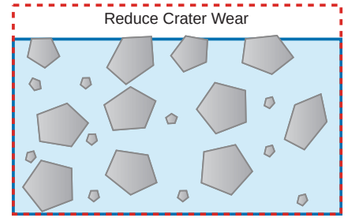
The progress of crater wear is greatly reduced due to the use of a heat resistant binder.
This suppresses chipping, crater wear and fracturing.

**Conventional**

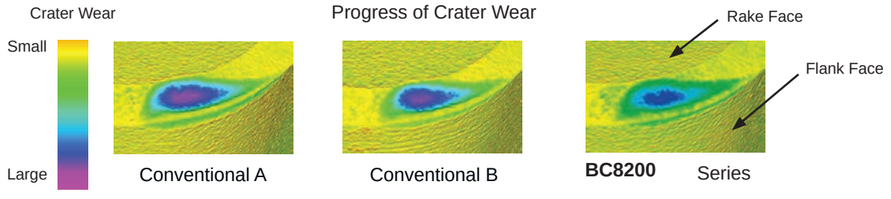



As binder wear progresses, the cBN particles are exposed and lost.

**BC8200 Series**



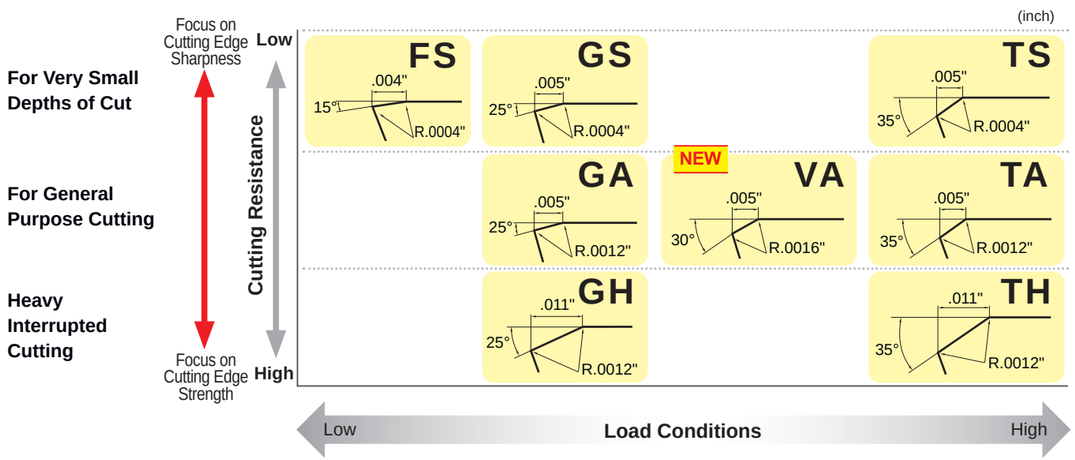

Suppresses the binder wear caused by cutting heat.



# Features of the Insert

## Edge Preparation (Honing)

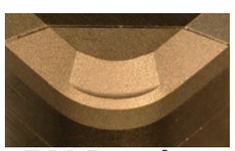
New VA honing type with improved fracture resistance for high speeds and feed.
In addition, a range of different honing types that can be used for various applications is available.



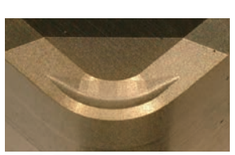

| | Continuous Cutting | General Purpose | | For Fracture Resistance | Interrupted Cutting | |
|---|---|---|---|---|---|---|
| | General Cutting | General Cutting | High Feed and Depth | High Speeds and Feed | General Cutting | High Feed and Depth |
| BC8210 | **FS** | **GS** | **GH** | | **TS** | |
| BC8220 | | **GA** | **GH** | **VA** | **TA** | **TH** |

## Chip Breaker

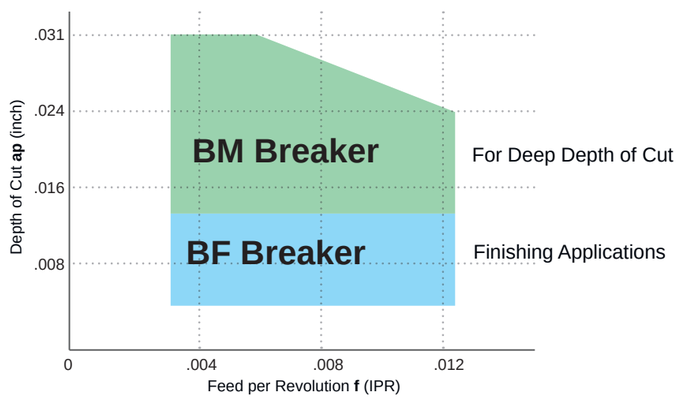
Chip breaker system for excellent chip control when finishing, removing carburised layers and for high load machining.



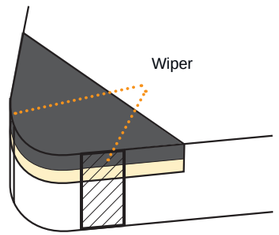
**BM Breaker**



**BF Breaker**




# Wiper Insert




### Improving Surface Finish

Under the same machining conditions as conventional chip breakers, but with the feed rate increased, the surface finish of the workpiece can be improved.

### Improving Efficiency

High feed rates not only shorten machining times but also make it possible to combine roughing and finishing operations.

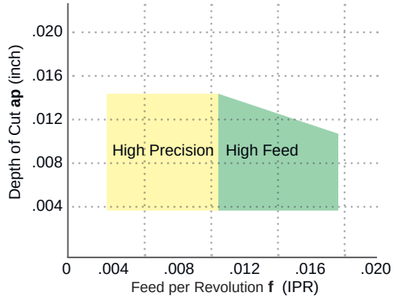
### Increased Tool Life

When using at high feed conditions, the time required to cut one component is decreased, thus more parts can be machined with each insert. In addition, the high feed rate prevents rubbing, therefore, delaying the progression of wear and increasing tool life.

### Improving Chip Control

Under high feed conditions, the chips generated become thicker and are more easily broken, thus, chip control is improved.

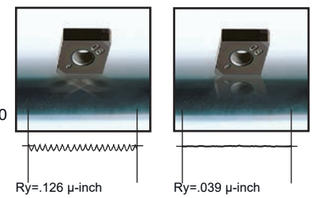
## Recommended Cutting Conditions and Performance




**High Precision Finishing**

Cutting Speed: vc=330 SFM  Feed per Rev.: f=.004 IPR
Depth of Cut: ap=.004 inch  Cutting Mode: Dry Cutting

Without Wiper | **With Wiper**

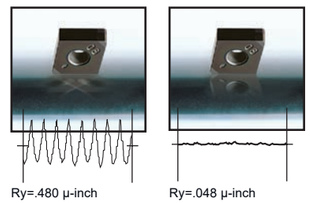


Ry=.126 µ-inch  Ry=.039 µ-inch

**High Feed Machining**

Cutting Speed: vc=330 SFM  Feed per Rev.: f=.012 IPR
Depth of Cut: ap=.004 IPR  Cutting Mode: Dry Cutting

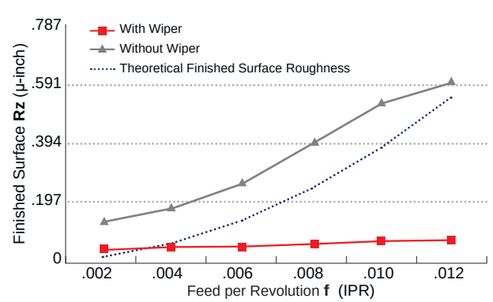
Without Wiper | **With Wiper**



Ry=.480 µ-inch  Ry=.048 µ-inch

### Cutting Performance

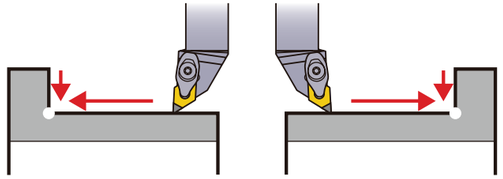
| | |
|---|---|
| Insert | NP-CNGA432 |
| Workpiece Material | Hardened Steel (60 HRC) |
| Machining Methods | Continuous |
| Cutting Speed **vc** (SFM) | 395 |
| Depth of Cut **ap** (inch) | .004 |
| Cutting Mode | Dry Cutting |



# Combination of BF Breaker and WS Wiper Insert

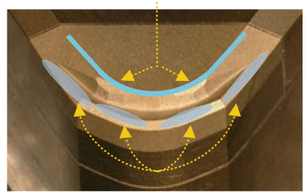
CNGM and DNGM types are now available with new inserts that combine a BF chip breaker with a WS wiper Insert. ( BC8210 : BF-◯NGM◯◯◯TSWS2, BC8220 : BF-◯NGM◯◯◯TAWS2 )
It is effective for chip control and improvement of finished surface roughness without worrying about the hand of the tool even in continuous external turning or internal turning and facing.

### Effect of Chip Breaker and Wiper Insert



Demonstrates the effects of breaker and wiper Insert in both right handed and left handed cutting.

**BF Chip Breaker**



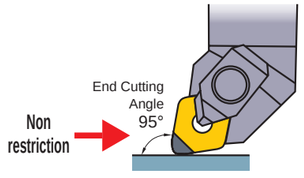
WS Wiper Insert (Neutral)

## ■ Notes for Use

### In the case of using CNGM type

**No Restriction for Holders**

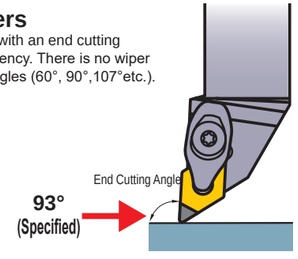
A standard holder can be used.
(☆A double clamp, high rigidity tool is recommended.)




### In the case of using DNGM type

**Restriction for Holders**

Use PDJN holder or DDJN holder with an end cutting angle 93° for improving wiper efficiency. There is no wiper efficiency with other end cutting angles (60°, 90°,107°etc.).




## Identification

**BF - C N G M 4 3 2 - TA WS 2 _ _**

| Insert Geometry | |
|---|---|
| BM | With Breaker |
| BF | With Breaker |
| NP | New Petit Cut |

| Edge Preparation | |
|---|---|
| Symbol | Application |
| FS | Continuous Cutting |
| GS<br>GA<br>GH | General Cutting |
| VA | For High Speed,<br>High Feed Cutting |
| TS<br>TA<br>TH | Interrupted Cutting |

| Wiper | |
|---|---|
| WS | For High Rigidity Workpiece Material |
| No Mark | Without Wiper |

| Cutting Direction | | |
|---|---|---|
| Symbol | Hand | Figure |
| JR | Right | |
| JL | Left | |
| No mark | Neutral | |

## Memo

# BC8200 **Series** NEW

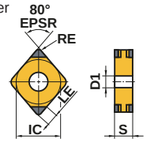
## Negative Inserts (With Hole)

G Class

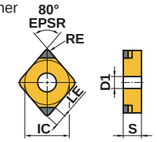
CNGA, CNGM

| NEW PETIT CUT | NEW PETIT CUT | NEW PETIT CUT | NEW PETIT CUT |
|---|---|---|---|
| **NP_○○4** | **NP_○○WS4** | **NP_○○2** | **NP_○○WS2** |
|  |  |  |  |
| | (With Wiper) | | (With Wiper) |
| **NEW PETIT CUT** | | | |
| **BF_, BM_** | | | |
|  | | | |
| (With Breaker) | | | |

4 corner




2 corner




(inch)

| Order Number | Coated CBN | | | | | | | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BC8210 | BC8220 | | | | | | | | | | | |
| **NP-CNGA431-GA4** | | ● | | | | | | 4 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-GA4** | | ● | | | | | | 4 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-GA4** | | ● | | | | | | 4 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-GS4** | ★ | | | | | | | 4 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-GS4** | ● | | | | | | | 4 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-GS4** | ★ | | | | | | | 4 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-GH4** | ★ | ★ | | | | | | 4 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-GH4** | ● | ● | | | | | | 4 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-GH4** | ★ | ★ | | | | | | 4 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-FS4** | ★ | | | | | | | 4 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-FS4** | ★ | | | | | | | 4 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-FS4** | ★ | | | | | | | 4 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-VA4** | | ★ | | | | | | 4 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-VA4** | | ● | | | | | | 4 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-VA4** | | ● | | | | | | 4 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-TA4** | | ★ | | | | | | 4 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-TA4** | | ★ | | | | | | 4 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-TA4** | | ★ | | | | | | 4 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-TS4** | ★ | | | | | | | 4 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-TS4** | ★ | | | | | | | 4 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-TS4** | ★ | | | | | | | 4 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA432-TH4** | | ★ | | | | | | 4 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-TH4** | | ★ | | | | | | 4 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-FSWS4** | ★ | | | | | | | 4 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-FSWS4** | ● | | | | | | | 4 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-FSWS4** | ★ | | | | | | | 4 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-GAWS4** | | ★ | | | | | | 4 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-GAWS4** | | ● | | | | | | 4 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-GAWS4** | | ★ | | | | | | 4 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-GSWS4** | ★ | | | | | | | 4 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-GSWS4** | ★ | | | | | | | 4 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-GSWS4** | ★ | | | | | | | 4 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA430.5-GA2** | | ● | | | | | | 2 | .500 | .187 | .008 | .203 | .067 |
| **NP-CNGA431-GA2** | | ● | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-GA2** | | ● | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-GA2** | | ● | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |

● : USA Stock ★ : Stocked in Japan
(1 insert in one case)

(inch)

| Order Number | Coated CBN | | | | | | | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BC8210 | BC8220 | | | | | | | | | | | |
| **NP-CNGA430.5-GS2** | ● | | | | | | | 2 | .500 | .187 | .008 | .203 | .067 |
| **NP-CNGA431-GS2** | ● | | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-GS2** | ● | | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-GS2** | ● | | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-GH2** | ★ | ★ | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-GH2** | ● | ● | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-GH2** | ★ | ★ | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA430.5-FS2** | ● | | | | | | | 2 | .500 | .187 | .008 | .203 | .067 |
| **NP-CNGA431-FS2** | ● | | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-FS2** | ● | | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-FS2** | ★ | | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-VA2** | | ● | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-VA2** | | ● | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-VA2** | | ● | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-TA2** | | ● | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-TA2** | | ● | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-TA2** | | ● | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-TS2** | ★ | | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-TS2** | ★ | | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-TS2** | ★ | | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA432-TH2** | | ★ | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-TH2** | | ● | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-FSWS2** | ★ | | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-FSWS2** | ★ | | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-FSWS2** | ★ | | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-GAWS2** | | ● | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-GAWS2** | | ● | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-GAWS2** | | ● | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |
| **NP-CNGA431-GSWS2** | ● | | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **NP-CNGA432-GSWS2** | ● | | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **NP-CNGA433-GSWS2** | ★ | | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |
| **BF-CNGM432-TAWS2** | | ● | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **BF-CNGM433-TAWS2** | | ● | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |
| **BF-CNGM431-TS2** | ★ | | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **BF-CNGM432-TS2** | ★ | | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **BF-CNGM433-TS2** | ★ | | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |
| **BF-CNGM432-TSWS2** | ★ | | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **BF-CNGA433-TSWS2** | ★ | | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |
| **BM-CNGM431-TA2** | | ★ | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **BM-CNGM432-TA2** | | ● | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **BM-CNGM433-TA2** | | ● | | | | | | 2 | .500 | .187 | .047 | .203 | .087 |

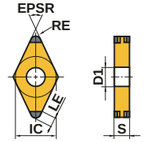
# BC8200 **Series** NEW

## Negative Inserts (With Hole)

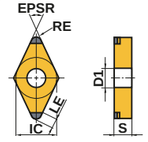
G Class

DNGA, DNGM

4 corner




2 corner




| NEW PETIT CUT | NEW PETIT CUT |
|---|---|
| NP_○○4 | NP_○○2 |
|  |  |
| NEW PETIT CUT | NEW PETIT CUT |
| NP_WS2JR/L | BF_, BM_ |
|  |  |
| (With Wiper) | (With Breaker) |

(inch)

| Order Number | Coated CBN BC8210 | Coated CBN BC8220 | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|
| NP-DNGA431-GA4 | | ● | 4 | .500 | .187 | .016 | .203 | .083 |
| NP-DNGA432-GA4 | | ● | 4 | .500 | .187 | .031 | .203 | .079 |
| NP-DNGA433-GA4 | | ★ | 4 | .500 | .187 | .047 | .203 | .071 |
| NP-DNGA441-GA4 | | ★ | 4 | .500 | .250 | .016 | .203 | .083 |
| NP-DNGA442-GA4 | | ★ | 4 | .500 | .250 | .031 | .203 | .079 |
| NP-DNGA443-GA4 | | ★ | 4 | .500 | .250 | .047 | .203 | .071 |
| NP-DNGA431-GS4 | ★ | | 4 | .500 | .187 | .016 | .203 | .083 |
| NP-DNGA432-GS4 | ★ | | 4 | .500 | .187 | .031 | .203 | .079 |
| NP-DNGA433-GS4 | ★ | | 4 | .500 | .187 | .047 | .203 | .071 |
| NP-DNGA441-GS4 | ★ | | 4 | .500 | .250 | .016 | .203 | .083 |
| NP-DNGA442-GS4 | ★ | | 4 | .500 | .250 | .031 | .203 | .079 |
| NP-DNGA443-GS4 | ★ | | 4 | .500 | .250 | .047 | .203 | .071 |
| NP-DNGA431-GH4 | ★ | ● | 4 | .500 | .187 | .016 | .203 | .083 |
| NP-DNGA432-GH4 | ★ | ★ | 4 | .500 | .187 | .031 | .203 | .079 |
| NP-DNGA433-GH4 | ★ | ★ | 4 | .500 | .187 | .047 | .203 | .071 |
| NP-DNGA441-GH4 | ★ | ★ | 4 | .500 | .250 | .016 | .203 | .083 |
| NP-DNGA442-GH4 | ★ | ★ | 4 | .500 | .250 | .031 | .203 | .079 |
| NP-DNGA443-GH4 | ★ | ★ | 4 | .500 | .250 | .047 | .203 | .071 |
| NP-DNGA431-FS4 | ★ | | 4 | .500 | .187 | .016 | .203 | .083 |
| NP-DNGA432-FS4 | ★ | | 4 | .500 | .187 | .031 | .203 | .079 |
| NP-DNGA433-FS4 | ★ | | 4 | .500 | .187 | .047 | .203 | .071 |
| NP-DNGA441-FS4 | ★ | | 4 | .500 | .250 | .016 | .203 | .083 |
| NP-DNGA442-FS4 | ★ | | 4 | .500 | .250 | .031 | .203 | .079 |
| NP-DNGA443-FS4 | ★ | | 4 | .500 | .250 | .047 | .203 | .071 |
| NP-DNGA431-VA4 | | ★ | 4 | .500 | .187 | .016 | .203 | .083 |
| NP-DNGA432-VA4 | | ● | 4 | .500 | .187 | .031 | .203 | .079 |
| NP-DNGA433-VA4 | | ★ | 4 | .500 | .187 | .047 | .203 | .071 |
| NP-DNGA441-VA4 | | ★ | 4 | .500 | .250 | .016 | .203 | .083 |
| NP-DNGA442-VA4 | | ★ | 4 | .500 | .250 | .031 | .203 | .079 |
| NP-DNGA443-VA4 | | ★ | 4 | .500 | .250 | .047 | .203 | .071 |
| NP-DNGA431-TA4 | | ★ | 4 | .500 | .187 | .016 | .203 | .083 |
| NP-DNGA432-TA4 | | ★ | 4 | .500 | .187 | .031 | .203 | .079 |
| NP-DNGA433-TA4 | | ● | 4 | .500 | .187 | .047 | .203 | .071 |
| NP-DNGA441-TA4 | | ★ | 4 | .500 | .250 | .016 | .203 | .083 |
| NP-DNGA442-TA4 | | ★ | 4 | .500 | .250 | .031 | .203 | .079 |
| NP-DNGA443-TA4 | | ★ | 4 | .500 | .250 | .047 | .203 | .071 |

● : USA Stock ★ : Stocked in Japan
(1 insert in one case)

(inch)

| Order Number | Coated CBN BC8210 | Coated CBN BC8220 | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|
| NP-DNGA431-TS4 | ★ | | 4 | .500 | .187 | .016 | .203 | .083 |
| NP-DNGA432-TS4 | ★ | | 4 | .500 | .187 | .031 | .203 | .079 |
| NP-DNGA433-TS4 | ★ | | 4 | .500 | .187 | .047 | .203 | .071 |
| NP-DNGA441-TS4 | ★ | | 4 | .500 | .250 | .016 | .203 | .083 |
| NP-DNGA442-TS4 | ★ | | 4 | .500 | .250 | .031 | .203 | .079 |
| NP-DNGA443-TS4 | ★ | | 4 | .500 | .250 | .047 | .203 | .071 |
| NP-DNGA432-TH4 | | ★ | 4 | .500 | .187 | .031 | .203 | .079 |
| NP-DNGA433-TH4 | | ★ | 4 | .500 | .187 | .047 | .203 | .071 |
| NP-DNGA442-TH4 | | ★ | 4 | .500 | .250 | .031 | .203 | .079 |
| NP-DNGA443-TH4 | | ★ | 4 | .500 | .250 | .047 | .203 | .071 |
| NP-DNGA332-GA2 | | ● | 2 | .375 | .187 | .031 | .150 | .079 |
| NP-DNGA430.5-GA2 | | ● | 2 | .500 | .187 | .008 | .203 | .087 |
| NP-DNGA431-GA2 | | ● | 2 | .500 | .187 | .016 | .203 | .083 |
| NP-DNGA432-GA2 | | ● | 2 | .500 | .187 | .031 | .203 | .079 |
| NP-DNGA433-GA2 | | ● | 2 | .500 | .187 | .047 | .203 | .071 |
| NP-DNGA441-GA2 | | ★ | 2 | .500 | .250 | .016 | .203 | .083 |
| NP-DNGA442-GA2 | | ★ | 2 | .500 | .250 | .031 | .203 | .079 |
| NP-DNGA443-GA2 | | ★ | 2 | .500 | .250 | .047 | .203 | .071 |
| NP-DNGA430.5-GS2 | ● | | 2 | .500 | .187 | .008 | .203 | .087 |
| NP-DNGA431-GS2 | ● | | 2 | .500 | .187 | .016 | .203 | .083 |
| NP-DNGA432-GS2 | ● | | 2 | .500 | .187 | .031 | .203 | .079 |
| NP-DNGA433-GS2 | ★ | | 2 | .500 | .187 | .047 | .203 | .071 |
| NP-DNGA441-GS2 | ★ | | 2 | .500 | .250 | .016 | .203 | .083 |
| NP-DNGA442-GS2 | ★ | | 2 | .500 | .250 | .031 | .203 | .079 |
| NP-DNGA443-GS2 | ★ | | 2 | .500 | .250 | .047 | .203 | .071 |
| NP-DNGA431-GH2 | ★ | ★ | 2 | .500 | .187 | .016 | .203 | .083 |
| NP-DNGA432-GH2 | ★ | ★ | 2 | .500 | .187 | .031 | .203 | .079 |
| NP-DNGA433-GH2 | ★ | ★ | 2 | .500 | .187 | .047 | .203 | .071 |
| NP-DNGA441-GH2 | ★ | ★ | 2 | .500 | .250 | .016 | .203 | .083 |
| NP-DNGA442-GH2 | ★ | ★ | 2 | .500 | .250 | .031 | .203 | .079 |
| NP-DNGA443-GH2 | ★ | ★ | 2 | .500 | .250 | .047 | .203 | .071 |
| NP-DNGA430.5-FS2 | ● | | 2 | .500 | .187 | .008 | .203 | .087 |
| NP-DNGA431-FS2 | ● | | 2 | .500 | .187 | .016 | .203 | .083 |
| NP-DNGA432-FS2 | ● | | 2 | .500 | .187 | .031 | .203 | .079 |
| NP-DNGA433-FS2 | ● | | 2 | .500 | .187 | .047 | .203 | .071 |
| NP-DNGA441-FS2 | ★ | | 2 | .500 | .250 | .016 | .203 | .083 |
| NP-DNGA442-FS2 | ★ | | 2 | .500 | .250 | .031 | .203 | .079 |
| NP-DNGA443-FS2 | ★ | | 2 | .500 | .250 | .047 | .203 | .071 |
| NP-DNGA431-VA2 | | ● | 2 | .500 | .187 | .016 | .203 | .083 |
| NP-DNGA432-VA2 | | ● | 2 | .500 | .187 | .031 | .203 | .079 |
| NP-DNGA433-VA2 | | ● | 2 | .500 | .187 | .047 | .203 | .071 |
| NP-DNGA441-VA2 | | ★ | 2 | .500 | .250 | .016 | .203 | .083 |
| NP-DNGA442-VA2 | | ★ | 2 | .500 | .250 | .031 | .203 | .079 |
| NP-DNGA443-VA2 | | ★ | 2 | .500 | .250 | .047 | .203 | .071 |

# BC8200 **Series** NEW

(inch)

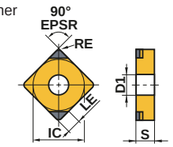
| Order Number | Coated CBN | | | | | | | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BC8210 | BC8220 | | | | | | | | | | | |
| **NP-DNGA431-TA2** | | ● | | | | | | 2 | .500 | .187 | .016 | .203 | .083 |
| **NP-DNGA432-TA2** | | ● | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **NP-DNGA433-TA2** | | ● | | | | | | 2 | .500 | .187 | .047 | .203 | .071 |
| **NP-DNGA441-TA2** | | ★ | | | | | | 2 | .500 | .250 | .016 | .203 | .083 |
| **NP-DNGA442-TA2** | | ★ | | | | | | 2 | .500 | .250 | .031 | .203 | .079 |
| **NP-DNGA443-TA2** | | ★ | | | | | | 2 | .500 | .250 | .047 | .203 | .071 |
| **NP-DNGA431-TS2** | ★ | | | | | | | 2 | .500 | .187 | .016 | .203 | .083 |
| **NP-DNGA432-TS2** | ★ | | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **NP-DNGA433-TS2** | ★ | | | | | | | 2 | .500 | .187 | .047 | .203 | .071 |
| **NP-DNGA441-TS2** | ★ | | | | | | | 2 | .500 | .250 | .016 | .203 | .083 |
| **NP-DNGA442-TS2** | ★ | | | | | | | 2 | .500 | .250 | .031 | .203 | .079 |
| **NP-DNGA443-TS2** | ★ | | | | | | | 2 | .500 | .250 | .047 | .203 | .071 |
| **NP-DNGA432-TH2** | | ★ | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **NP-DNGA433-TH2** | | ★ | | | | | | 2 | .500 | .187 | .047 | .203 | .071 |
| **NP-DNGA442-TH2** | | ★ | | | | | | 2 | .500 | .250 | .031 | .203 | .079 |
| **NP-DNGA443-TH2** | | ★ | | | | | | 2 | .500 | .250 | .047 | .203 | .071 |
| **NP-DNGA431-GAWS2JR** | | ★ | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **NP-DNGA431-GAWS2JL** | | ★ | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **NP-DNGA432-GAWS2JR** | | ● | | | | | | 2 | .500 | .187 | .031 | .203 | .067 |
| **NP-DNGA432-GAWS2JL** | | ● | | | | | | 2 | .500 | .187 | .031 | .203 | .067 |
| **NP-DNGA441-GAWS2JR** | | ★ | | | | | | 2 | .500 | .250 | .016 | .203 | .071 |
| **NP-DNGA441-GAWS2JL** | | ★ | | | | | | 2 | .500 | .250 | .016 | .203 | .071 |
| **NP-DNGA442-GAWS2JR** | | ★ | | | | | | 2 | .500 | .250 | .031 | .203 | .067 |
| **NP-DNGA442-GAWS2JL** | | ● | | | | | | 2 | .500 | .250 | .031 | .203 | .067 |
| **NP-DNGA431-GSWS2JR** | ★ | | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **NP-DNGA431-GSWS2JL** | ★ | | | | | | | 2 | .500 | .187 | .016 | .203 | .071 |
| **NP-DNGA432-GSWS2JR** | ★ | | | | | | | 2 | .500 | .187 | .031 | .203 | .067 |
| **NP-DNGA432-GSWS2JL** | ★ | | | | | | | 2 | .500 | .187 | .031 | .203 | .067 |
| **NP-DNGA441-GSWS2JR** | ★ | | | | | | | 2 | .500 | .250 | .016 | .203 | .071 |
| **NP-DNGA441-GSWS2JL** | ★ | | | | | | | 2 | .500 | .250 | .016 | .203 | .071 |
| **NP-DNGA442-GSWS2JR** | ★ | | | | | | | 2 | .500 | .250 | .031 | .203 | .067 |
| **NP-DNGA442-GSWS2JL** | ★ | | | | | | | 2 | .500 | .250 | .031 | .203 | .067 |
| **BF-DNGM432-TAWS2** | | ● | | | | | | 2 | .500 | .187 | .031 | .203 | .094 |
| **BF-DNGM433-TAWS2** | | ● | | | | | | 2 | .500 | .187 | .047 | .203 | .102 |
| **BF-DNGM431-TS2** | ★ | | | | | | | 2 | .500 | .187 | .016 | .203 | .083 |
| **BF-DNGM432-TS2** | ★ | | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **BF-DNGM433-TS2** | ● | | | | | | | 2 | .500 | .187 | .047 | .203 | .071 |
| **BF-DNGM432-TSWS2** | ★ | | | | | | | 2 | .500 | .187 | .031 | .203 | .094 |
| **BF-DNGM433-TSWS2** | ★ | | | | | | | 2 | .500 | .187 | .047 | .203 | .102 |
| **BM-DNGM431-TA2** | | ● | | | | | | 2 | .500 | .187 | .016 | .203 | .083 |
| **BM-DNGM432-TA2** | | ★ | | | | | | 2 | .500 | .187 | .031 | .203 | .079 |
| **BM-DNGM433-TA2** | | ● | | | | | | 2 | .500 | .187 | .047 | .203 | .071 |

● : USA Stock ★ : Stocked in Japan
(1 insert in one case)

## Negative Inserts (With Hole)
G Class
SNGA

NEW PETIT CUT
NP_○○2

2 corner



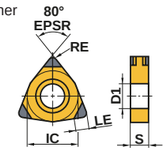

(inch)

| Order Number | Coated CBN | | | | | | | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BC8210 | BC8220 | | | | | | | | | | | |
| **NP-SNGA432-GA2** | | ★ | | | | | | 2 | .500 | .187 | .031 | .203 | .087 |
| **NP-SNGA433-GA2** | | ★ | | | | | | 2 | .500 | .187 | .047 | .203 | .098 |

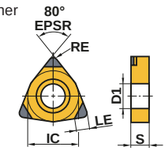
## Negative Inserts (With Hole)
G Class
WNGA

| NEW PETIT CUT | NEW PETIT CUT | NEW PETIT CUT |
|---|---|---|
| NP_○○6 | NP_○○3 | NP_○○WS3 |
|  |  |  |
| | | (With Wiper) |

6 corner




3 corner




(inch)

| Order Number | Coated CBN | | | | | | | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BC8210 | BC8220 | | | | | | | | | | | |
| **NP-WNGA432-GS6** | ★ | | | | | | | 6 | .500 | .187 | .031 | .203 | .079 |
| **NP-WNGA432-FS6** | ★ | | | | | | | 6 | .500 | .187 | .031 | .203 | .079 |
| **NP-WNGA432-TS6** | ★ | | | | | | | 6 | .500 | .187 | .031 | .203 | .079 |
| **NP-WNGA432-GA3** | | ● | | | | | | 3 | .500 | .187 | .031 | .203 | .079 |
| **NP-WNGA432-GS3** | ● | | | | | | | 3 | .500 | .187 | .031 | .203 | .079 |
| **NP-WNGA432-FS3** | ★ | | | | | | | 3 | .500 | .187 | .031 | .203 | .079 |
| **NP-WNGA432-TA3** | | ★ | | | | | | 3 | .500 | .187 | .031 | .203 | .079 |
| **NP-WNGA432-TS3** | ★ | | | | | | | 3 | .500 | .187 | .031 | .203 | .079 |
| **NP-WNGA432-GSWS3** | ★ | | | | | | | 3 | .500 | .187 | .031 | .203 | .079 |

# BC8200 **Series** NEW

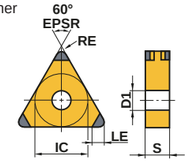
## Negative Inserts (With Hole)

G Class

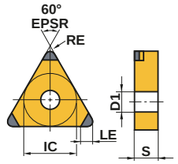
TNGA

| NEW PETIT CUT | NEW PETIT CUT |
|---|---|
| NP_○○6 | NP_○○3 |
|  |  |

6 corner




3 corner




(inch)

| Order Number | Coated CBN | | | | | | | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BC8210 | BC8220 | | | | | | | | | | | |
| **NP-TNGA331-GA6** | | ★ | | | | | | 6 | .375 | .187 | .016 | .150 | .063 |
| **NP-TNGA332-GA6** | | ★ | | | | | | 6 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-GA6** | | ★ | | | | | | 6 | .375 | .187 | .047 | .150 | .075 |
| **NP-TNGA331-GS6** | ● | | | | | | | 6 | .375 | .187 | .016 | .150 | .063 |
| **NP-TNGA332-GS6** | ★ | | | | | | | 6 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-GS6** | ★ | | | | | | | 6 | .375 | .187 | .047 | .150 | .075 |
| **NP-TNGA331-GH6** | | ★ | | | | | | 6 | .375 | .187 | .016 | .150 | .063 |
| **NP-TNGA332-GH6** | | ★ | | | | | | 6 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-GH6** | | ★ | | | | | | 6 | .375 | .187 | .047 | .150 | .075 |
| **NP-TNGA331-FS6** | ★ | | | | | | | 6 | .375 | .187 | .016 | .150 | .063 |
| **NP-TNGA332-FS6** | ★ | | | | | | | 6 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-FS6** | ★ | | | | | | | 6 | .375 | .187 | .047 | .150 | .075 |
| **NP-TNGA331-VA6** | | ★ | | | | | | 6 | .375 | .187 | .016 | .150 | .063 |
| **NP-TNGA332-VA6** | | ★ | | | | | | 6 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-VA6** | | ★ | | | | | | 6 | .375 | .187 | .047 | .150 | .075 |
| **NP-TNGA331-TA6** | | ★ | | | | | | 6 | .375 | .187 | .016 | .150 | .063 |
| **NP-TNGA332-TA6** | | ★ | | | | | | 6 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-TA6** | | ★ | | | | | | 6 | .375 | .187 | .047 | .150 | .075 |
| **NP-TNGA331-TS6** | ★ | | | | | | | 6 | .375 | .187 | .016 | .150 | .063 |
| **NP-TNGA332-TS6** | ★ | | | | | | | 6 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-TS6** | ★ | | | | | | | 6 | .375 | .187 | .047 | .150 | .075 |
| **NP-TNGA332-TH6** | | ★ | | | | | | 6 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-TH6** | | ★ | | | | | | 6 | .375 | .187 | .047 | .150 | .075 |
| **NP-TNGA330.5-GA3** | | ★ | | | | | | 3 | .375 | .187 | .008 | .150 | .059 |
| **NP-TNGA331-GA3** | | ● | | | | | | 3 | .375 | .187 | .016 | .150 | .063 |
| **NP-TNGA332-GA3** | | ● | | | | | | 3 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-GA3** | | ● | | | | | | 3 | .375 | .187 | .047 | .150 | .075 |
| **NP-TNGA330.5-GS3** | ★ | | | | | | | 3 | .375 | .187 | .008 | .150 | .059 |
| **NP-TNGA331-GS3** | ★ | | | | | | | 3 | .375 | .187 | .016 | .150 | .063 |
| **NP-TNGA332-GS3** | ★ | | | | | | | 3 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-GS3** | ★ | | | | | | | 3 | .375 | .187 | .047 | .150 | .075 |
| **NP-TNGA331-GH3** | | ● | | | | | | 3 | .375 | .187 | .016 | .150 | .063 |
| **NP-TNGA332-GH3** | | ★ | | | | | | 3 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-GH3** | | ★ | | | | | | 3 | .375 | .187 | .047 | .150 | .075 |

● : USA Stock ★ : Stocked in Japan
(1 insert in one case)

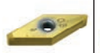
(inch)

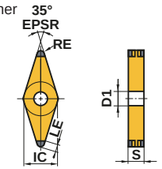
| Order Number | Coated CBN | | | | | | | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BC8210 | BC8220 | | | | | | | | | | | |
| **NP-TNGA330.5-FS3** | ★ | | | | | | | 3 | .375 | .187 | .008 | .150 | .059 |
| **NP-TNGA331-FS3** | ★ | | | | | | | 3 | .375 | .187 | .016 | .150 | .063 |
| **NP-TNGA332-FS3** | ★ | | | | | | | 3 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-FS3** | ★ | | | | | | | 3 | .375 | .187 | .047 | .150 | .075 |
| **NP-TNGA331-VA3** | | ● | | | | | | 3 | .375 | .187 | .016 | .150 | .063 |
| **NP-TNGA332-VA3** | | ● | | | | | | 3 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-VA3** | | ● | | | | | | 3 | .375 | .187 | .047 | .150 | .075 |
| **NP-TNGA331-TA3** | | ★ | | | | | | 3 | .375 | .187 | .016 | .150 | .063 |
| **NP-TNGA332-TA3** | | ★ | | | | | | 3 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-TA3** | | ★ | | | | | | 3 | .375 | .187 | .047 | .150 | .075 |
| **NP-TNGA331-TS3** | ★ | | | | | | | 3 | .375 | .187 | .016 | .150 | .063 |
| **NP-TNGA332-TS3** | ★ | | | | | | | 3 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-TS3** | ★ | | | | | | | 3 | .375 | .187 | .047 | .150 | .075 |
| **NP-TNGA332-TH3** | | ★ | | | | | | 3 | .375 | .187 | .031 | .150 | .067 |
| **NP-TNGA333-TH3** | | ★ | | | | | | 3 | .375 | .187 | .047 | .150 | .075 |

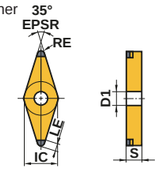
# BC8200 **Series** NEW

## Negative Inserts (With Hole)

G Class
VNGA

| NEW PETIT CUT | NEW PETIT CUT |
|---|---|
| NP_○○4 | NP_○○2 |
|  |  |

4 corner



2 corner



(inch)

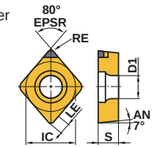
| Order Number | Coated CBN BC8210 | Coated CBN BC8220 | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|
| NP-VNGA331-GA4 | | ★ | 4 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-GA4 | | ★ | 4 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA333-GA4 | | ★ | 4 | .375 | .187 | .047 | .150 | .059 |
| NP-VNGA331-GS4 | ★ | | 4 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-GS4 | ★ | | 4 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA333-GS4 | ★ | | 4 | .375 | .187 | .047 | .150 | .059 |
| NP-VNGA331-GH4 | | ★ | 4 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-GH4 | | ★ | 4 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA331-FS4 | ★ | | 4 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-FS4 | ★ | | 4 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA331-VA4 | | ★ | 4 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-VA4 | | ★ | 4 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA333-VA4 | | ★ | 4 | .375 | .187 | .047 | .150 | .059 |
| NP-VNGA331-TA4 | | ★ | 4 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-TA4 | | ★ | 4 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA331-TS4 | ★ | | 4 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-TS4 | ★ | | 4 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA331-TH4 | | ★ | 4 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-TH4 | | ★ | 4 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA330.5-GA2 | | ● | 2 | .375 | .187 | .008 | .150 | .098 |
| NP-VNGA331-GA2 | | ● | 2 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-GA2 | | ● | 2 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA333-GA2 | | ● | 2 | .375 | .187 | .047 | .150 | .059 |
| NP-VNGA330.5-GS2 | ● | | 2 | .375 | .187 | .008 | .150 | .098 |
| NP-VNGA331-GS2 | ● | | 2 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-GS2 | ● | | 2 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA333-GS2 | ★ | | 2 | .375 | .187 | .047 | .150 | .059 |
| NP-VNGA331-GH2 | | ★ | 2 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-GH2 | | ★ | 2 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA330.5-FS2 | ★ | | 2 | .375 | .187 | .008 | .150 | .098 |
| NP-VNGA331-FS2 | ● | | 2 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-FS2 | ● | | 2 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA331-VA2 | | ● | 2 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-VA2 | | ★ | 2 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA333-VA2 | | ★ | 2 | .375 | .187 | .047 | .150 | .059 |
| NP-VNGA331-TA2 | | ★ | 2 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-TA2 | | ★ | 2 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA331-TS2 | ★ | | 2 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-TS2 | ★ | | 2 | .375 | .187 | .031 | .150 | .079 |
| NP-VNGA331-TH2 | | ★ | 2 | .375 | .187 | .016 | .150 | .098 |
| NP-VNGA332-TH2 | | ★ | 2 | .375 | .187 | .031 | .150 | .079 |

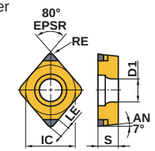
● : USA Stock ★ : Stocked in Japan
(1 insert in one case)

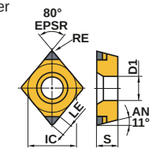
## Positive Inserts (With Hole)

G Class
CCGW 7°, CCGT 7°,
CPGB 11°

| NEW PETIT CUT | NEW PETIT CUT | NEW PETIT CUT | NEW PETIT CUT |
|---|---|---|---|
| NP_○○2 | NP_○○W○2 | BF_, BM_ | NP |
|  |  |  |  |
| | (With Wiper) | (With Breaker) | (Non-ISO) |

1 corner



2 corner



2 corner



(inch)

| Order Number | Coated CBN BC8210 | Coated CBN BC8220 | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|
| NP-CCGW21.50.5-GA2 | | ● | 2 | .250 | .094 | .008 | .110 | .067 |
| NP-CCGW21.51-GA2 | | ● | 2 | .250 | .094 | .016 | .110 | .071 |
| NP-CCGW21.52-GA2 | | ● | 2 | .250 | .094 | .031 | .110 | .079 |
| NP-CCGW32.50.5-GA2 | | ● | 2 | .375 | .156 | .008 | .173 | .067 |
| NP-CCGW32.51-GA2 | | ● | 2 | .375 | .156 | .016 | .173 | .071 |
| NP-CCGW32.52-GA2 | | ● | 2 | .375 | .156 | .031 | .173 | .079 |
| NP-CCGW21.50.5-GS2 | ● | | 2 | .250 | .094 | .008 | .110 | .067 |
| NP-CCGW21.51-GS2 | ● | | 2 | .250 | .094 | .016 | .110 | .071 |
| NP-CCGW21.52-GS2 | ● | | 2 | .250 | .094 | .031 | .110 | .079 |
| NP-CCGW32.50.5-GS2 | ● | | 2 | .375 | .156 | .008 | .173 | .067 |
| NP-CCGW32.51-GS2 | ● | | 2 | .375 | .156 | .016 | .173 | .071 |
| NP-CCGW32.52-GS2 | ● | | 2 | .375 | .156 | .031 | .173 | .079 |
| NP-CCGW21.50.5-FS2 | ● | | 2 | .250 | .094 | .008 | .110 | .067 |
| NP-CCGW21.51-FS2 | ● | | 2 | .250 | .094 | .016 | .110 | .071 |
| NP-CCGW21.52-FS2 | ★ | | 2 | .250 | .094 | .031 | .110 | .079 |
| NP-CCGW32.50.5-FS2 | ● | | 2 | .375 | .156 | .008 | .173 | .067 |
| NP-CCGW32.51-FS2 | ● | | 2 | .375 | .156 | .016 | .173 | .071 |
| NP-CCGW32.52-FS2 | ● | | 2 | .375 | .156 | .031 | .173 | .079 |
| NP-CCGW32.51-VA2 | | ● | 2 | .375 | .156 | .016 | .173 | .071 |
| NP-CCGW32.52-VA2 | | ● | 2 | .375 | .156 | .031 | .173 | .079 |
| NP-CCGW32.51-TA2 | | ★ | 2 | .375 | .156 | .016 | .173 | .071 |
| NP-CCGW32.52-TA2 | | ★ | 2 | .375 | .156 | .031 | .173 | .079 |
| NP-CCGW32.51-FSWS2 | ★ | | 2 | .375 | .156 | .016 | .173 | .071 |
| NP-CCGW32.52-FSWS2 | ★ | | 2 | .375 | .156 | .031 | .173 | .079 |
| NP-CCGW32.51-GAWS2 | | ● | 2 | .375 | .156 | .016 | .173 | .071 |
| NP-CCGW32.52-GAWS2 | | ● | 2 | .375 | .156 | .031 | .173 | .079 |
| NP-CCGW32.51-GSWS2 | ● | | 2 | .375 | .156 | .016 | .173 | .071 |
| NP-CCGW32.52-GSWS2 | ★ | | 2 | .375 | .156 | .031 | .173 | .079 |
| BF-CCGT32.51-TS2 | ★ | | 2 | .375 | .156 | .016 | .173 | .071 |
| BF-CCGT32.52-TS2 | ● | | 2 | .375 | .156 | .031 | .173 | .079 |
| BM-CCGT32.51-TA2 | | ★ | 2 | .375 | .156 | .016 | .173 | .071 |
| BM-CCGT32.52-TA2 | | ★ | 2 | .375 | .156 | .031 | .173 | .079 |
| NP-CCGW03S102FS | ● | | 1 | .141* | .055 | .008 | .079 | .043 |
| NP-CCGW03S104FS | ● | | 1 | .141* | .055 | .016 | .079 | .039 |
| NP-CCGW04T002FS | ● | | 1 | .172* | .070 | .008 | .094 | .059 |
| NP-CCGW04T004FS | ● | | 1 | .172* | .070 | .016 | .094 | .055 |

* Diameter of inscribed circle is non-ISO standard. (For SCLC type)

# BC8200 **Series** NEW

(inch)

| Order Number | Coated CBN BC8210 | Coated CBN BC8220 | | | | | | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NP-CPGB2.51.51-GA2** | | ★ | | | | | | 2 | .313 | .094 | .016 | .138 | .071 |
| **NP-CPGB2.51.52-GA2** | | ★ | | | | | | 2 | .313 | .094 | .031 | .138 | .079 |
| **NP-CPGB2.51.53-GA2** | | ★ | | | | | | 2 | .313 | .094 | .047 | .138 | .087 |
| **NP-CPGB320.5-GA2** | | ★ | | | | | | 2 | .375 | .125 | .008 | .177 | .067 |
| **NP-CPGB321-GA2** | | ★ | | | | | | 2 | .375 | .125 | .016 | .177 | .071 |
| **NP-CPGB322-GA2** | | ★ | | | | | | 2 | .375 | .125 | .031 | .177 | .079 |
| **NP-CPGB323-GA2** | | ● | | | | | | 2 | .375 | .125 | .047 | .177 | .087 |
| **NP-CPGB2.51.51-GS2** | ● | | | | | | | 2 | .313 | .094 | .016 | .138 | .071 |
| **NP-CPGB2.51.52-GS2** | ★ | | | | | | | 2 | .313 | .094 | .031 | .138 | .079 |
| **NP-CPGB320.5-GS2** | ★ | | | | | | | 2 | .375 | .125 | .008 | .177 | .067 |
| **NP-CPGB321-GS2** | ★ | | | | | | | 2 | .375 | .125 | .016 | .177 | .071 |
| **NP-CPGB322-GS2** | ★ | | | | | | | 2 | .375 | .125 | .031 | .177 | .079 |
| **NP-CPGB321-VA2** | | ★ | | | | | | 2 | .375 | .125 | .016 | .177 | .071 |
| **NP-CPGB322-VA2** | | ★ | | | | | | 2 | .375 | .125 | .031 | .177 | .079 |
| **NP-CPGB323-VA2** | | ★ | | | | | | 2 | .375 | .125 | .047 | .177 | .087 |
| **NP-CPGB321-TA2** | | ★ | | | | | | 2 | .375 | .125 | .016 | .177 | .071 |
| **NP-CPGB322-TA2** | | ★ | | | | | | 2 | .375 | .125 | .031 | .177 | .079 |
| **NP-CPGB323-TA2** | | ★ | | | | | | 2 | .375 | .125 | .047 | .177 | .087 |

● : USA Stock ★ : Stocked in Japan
(1 insert in one case)

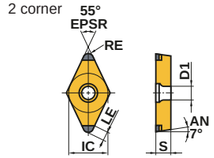
## Positive Inserts (With Hole)

G Class

DCGW 7°, DCGT 7°

| NEW PETIT CUT | NEW PETIT CUT |
|---|---|
| NP_○○2 | BF_, BM_ |
|  |  |
| | (With Breaker) |

2 corner




(inch)

| Order Number | Coated CBN BC8210 | Coated CBN BC8220 | | | | | | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NP-DCGW21.50.5-GA2** | | ★ | | | | | | 2 | .250 | .094 | .008 | .110 | .087 |
| **NP-DCGW21.51-GA2** | | ★ | | | | | | 2 | .250 | .094 | .016 | .110 | .083 |
| **NP-DCGW21.52-GA2** | | ★ | | | | | | 2 | .250 | .094 | .031 | .110 | .079 |
| **NP-DCGW32.50.5-GA2** | | ★ | | | | | | 2 | .375 | .156 | .008 | .173 | .087 |
| **NP-DCGW32.51-GA2** | | ● | | | | | | 2 | .375 | .156 | .016 | .173 | .083 |
| **NP-DCGW32.52-GA2** | | ● | | | | | | 2 | .375 | .156 | .031 | .173 | .079 |
| **NP-DCGW21.50.5-GS2** | ★ | | | | | | | 2 | .250 | .094 | .008 | .110 | .087 |
| **NP-DCGW21.51-GS2** | ● | | | | | | | 2 | .250 | .094 | .016 | .110 | .083 |
| **NP-DCGW21.52-GS2** | ★ | | | | | | | 2 | .250 | .094 | .031 | .110 | .079 |
| **NP-DCGW32.50.5-GS2** | ★ | | | | | | | 2 | .375 | .156 | .008 | .173 | .087 |
| **NP-DCGW32.51-GS2** | ★ | | | | | | | 2 | .375 | .156 | .016 | .173 | .083 |
| **NP-DCGW32.52-GS2** | ● | | | | | | | 2 | .375 | .156 | .031 | .173 | .079 |
| **NP-DCGW21.50.5-FS2** | ★ | | | | | | | 2 | .250 | .094 | .008 | .110 | .087 |
| **NP-DCGW21.51-FS2** | ● | | | | | | | 2 | .250 | .094 | .016 | .110 | .083 |
| **NP-DCGW21.52-FS2** | ★ | | | | | | | 2 | .250 | .094 | .031 | .110 | .079 |
| **NP-DCGW32.50.5-FS2** | ★ | | | | | | | 2 | .375 | .156 | .008 | .173 | .087 |
| **NP-DCGW32.51-FS2** | ● | | | | | | | 2 | .375 | .156 | .016 | .173 | .083 |
| **NP-DCGW32.52-FS2** | ● | | | | | | | 2 | .375 | .156 | .031 | .173 | .079 |
| **NP-DCGW32.51-VA2** | | ★ | | | | | | 2 | .375 | .156 | .016 | .173 | .083 |
| **NP-DCGW32.52-VA2** | | ● | | | | | | 2 | .375 | .156 | .031 | .173 | .079 |
| **NP-DCGW32.51-TA2** | | ★ | | | | | | 2 | .375 | .156 | .016 | .173 | .083 |
| **NP-DCGW32.52-TA2** | | ★ | | | | | | 2 | .375 | .156 | .031 | .173 | .079 |
| **BF-DCGT32.51-TS2** | ★ | | | | | | | 2 | .375 | .156 | .016 | .173 | .083 |
| **BF-DCGT32.52-TS2** | ★ | | | | | | | 2 | .375 | .156 | .031 | .173 | .079 |
| **BM-DCGT32.51-TA2** | | ● | | | | | | 2 | .375 | .156 | .016 | .173 | .083 |
| **BM-DCGT32.52-TA2** | | ● | | | | | | 2 | .375 | .156 | .031 | .173 | .079 |

# BC8200 **Series** NEW

## Positive Inserts (With Hole)

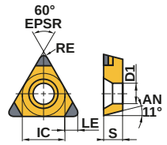
G Class

TPGB 11°

NEW PETIT CUT

NP_○○3

3 corner




(inch)

| Order Number | Coated CBN BC8210 | Coated CBN BC8220 | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|
| **NP-TPGB1.81.51-GA3** | | ★ | 3 | .219 | .094 | .016 | .114 | .063 |
| **NP-TPGB1.81.52-GA3** | | ★ | 3 | .219 | .094 | .031 | .114 | .067 |
| **NP-TPGB220.5-GA3** | | ★ | 3 | .250 | .125 | .008 | .134 | .059 |
| **NP-TPGB221-GA3** | | ● | 3 | .250 | .125 | .016 | .134 | .063 |
| **NP-TPGB222-GA3** | | ● | 3 | .250 | .125 | .031 | .134 | .067 |
| **NP-TPGB321-GA3** | | ● | 3 | .375 | .125 | .016 | .173 | .063 |
| **NP-TPGB322-GA3** | | ★ | 3 | .375 | .125 | .031 | .173 | .067 |
| **NP-TPGB1.51.51-GS3** | ★ | | 3 | .187 | .094 | .016 | .094 | .063 |
| **NP-TPGB1.51.52-GS3** | ★ | | 3 | .187 | .094 | .031 | .094 | .067 |
| **NP-TPGB1.81.51-GS3** | ● | | 3 | .219 | .094 | .016 | .114 | .063 |
| **NP-TPGB1.81.52-GS3** | ★ | | 3 | .219 | .094 | .031 | .114 | .067 |
| **NP-TPGB220.5-GS3** | ● | | 3 | .250 | .125 | .008 | .134 | .059 |
| **NP-TPGB221-GS3** | ★ | | 3 | .250 | .125 | .016 | .134 | .063 |
| **NP-TPGB222-GS3** | ★ | | 3 | .250 | .125 | .031 | .134 | .067 |
| **NP-TPGB321-GS3** | ● | | 3 | .375 | .125 | .016 | .173 | .063 |
| **NP-TPGB322-GS3** | ★ | | 3 | .375 | .125 | .031 | .173 | .067 |
| **NP-TPGB220.5-FS3** | ★ | | 3 | .250 | .125 | .008 | .134 | .059 |
| **NP-TPGB221-FS3** | ★ | | 3 | .250 | .125 | .016 | .134 | .063 |
| **NP-TPGB222-FS3** | ★ | | 3 | .250 | .125 | .031 | .134 | .067 |
| **NP-TPGB221-VA3** | | ★ | 3 | .250 | .125 | .016 | .134 | .063 |
| **NP-TPGB222-VA3** | | ● | 3 | .250 | .125 | .031 | .134 | .067 |
| **NP-TPGB221-TA3** | | ★ | 3 | .250 | .125 | .016 | .134 | .063 |
| **NP-TPGB222-TA3** | | ● | 3 | .250 | .125 | .031 | .134 | .067 |

● : USA Stock ★ : Stocked in Japan
(1 insert in one case)

## Positive Inserts (With Hole)

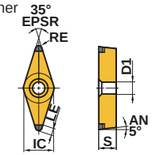
G Class

VBGW 5°, VCGW 7°

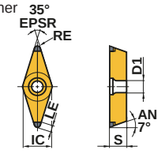
NEW PETIT CUT

NP_○○2

2 corner




2 corner




(inch)

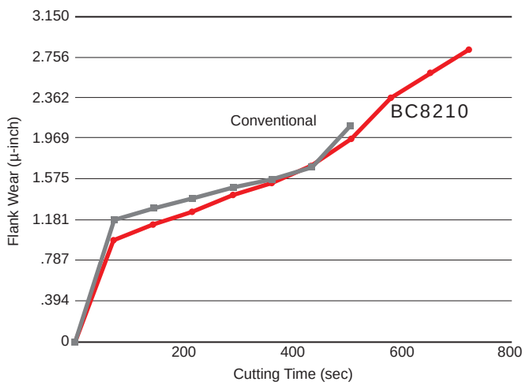
| Order Number | Coated CBN BC8210 | Coated CBN BC8220 | Cutting Edges | IC | S | RE | D1 | LE |
|---|---|---|---|---|---|---|---|---|
| **NP-VBGW220.5-GA2** | | ★ | 2 | .250 | .125 | .008 | .112 | .098 |
| **NP-VBGW221-GA2** | | ● | 2 | .250 | .125 | .016 | .112 | .098 |
| **NP-VBGW222-GA2** | | ● | 2 | .250 | .125 | .031 | .112 | .079 |
| **NP-VBGW330.5-GA2** | | ★ | 2 | .375 | .187 | .008 | .174 | .098 |
| **NP-VBGW331-GA2** | | ● | 2 | .375 | .187 | .016 | .174 | .098 |
| **NP-VBGW332-GA2** | | ★ | 2 | .375 | .187 | .031 | .174 | .079 |
| **NP-VBGW220.5-GS2** | ● | | 2 | .250 | .125 | .008 | .112 | .098 |
| **NP-VBGW221-GS2** | ★ | | 2 | .250 | .125 | .016 | .112 | .098 |
| **NP-VBGW222-GS2** | ★ | | 2 | .250 | .125 | .031 | .112 | .079 |
| **NP-VBGW330.5-GS2** | ● | | 2 | .375 | .187 | .008 | .174 | .098 |
| **NP-VBGW331-GS2** | ● | | 2 | .375 | .187 | .016 | .174 | .098 |
| **NP-VBGW332-GS2** | ● | | 2 | .375 | .187 | .031 | .174 | .079 |
| **NP-VBGW220.5-FS2** | ★ | | 2 | .250 | .125 | .008 | .112 | .098 |
| **NP-VBGW221-FS2** | ● | | 2 | .250 | .125 | .016 | .112 | .098 |
| **NP-VBGW222-FS2** | ★ | | 2 | .250 | .125 | .031 | .112 | .079 |
| **NP-VBGW330.5-FS2** | ● | | 2 | .375 | .187 | .008 | .174 | .098 |
| **NP-VBGW331-VA2** | | ★ | 2 | .375 | .187 | .016 | .174 | .098 |
| **NP-VBGW332-VA2** | | ★ | 2 | .375 | .187 | .031 | .174 | .079 |
| **NP-VBGW331-TA2** | | ★ | 2 | .375 | .187 | .016 | .174 | .098 |
| **NP-VBGW332-TA2** | | ★ | 2 | .375 | .187 | .031 | .174 | .079 |
| **NP-VCGW331-GA2** | | ● | 2 | .375 | .187 | .016 | .173 | .098 |
| **NP-VCGW332-GA2** | | ★ | 2 | .375 | .187 | .031 | .173 | .079 |
| **NP-VCGW331-GS2** | ● | | 2 | .375 | .187 | .016 | .173 | .098 |
| **NP-VCGW332-GS2** | ● | | 2 | .375 | .187 | .031 | .173 | .079 |
| **NP-VCGW331-VA2** | | ★ | 2 | .375 | .187 | .016 | .173 | .098 |
| **NP-VCGW332-VA2** | | ★ | 2 | .375 | .187 | .031 | .173 | .079 |
| **NP-VCGW331-TA2** | | ★ | 2 | .375 | .187 | .016 | .173 | .098 |
| **NP-VCGW332-TA2** | | ★ | 2 | .375 | .187 | .031 | .173 | .079 |

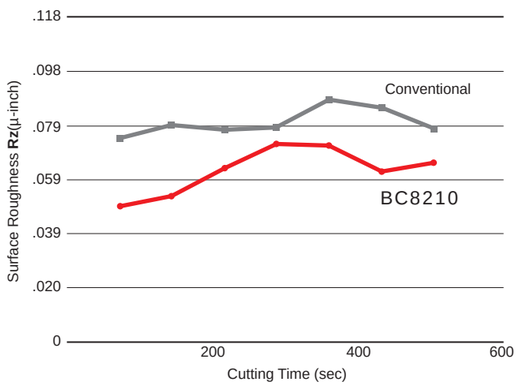
CBN Grade for Turning Hardened Steel

# BC8210 For Continuous and Light Interrupted Cutting

## Machining 5120(60 HRC):Comparison of Continuous Cutting

BC8210 reduces flank wear and maintains a good surface finish.

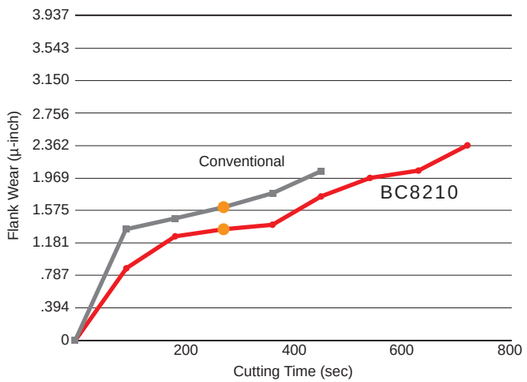


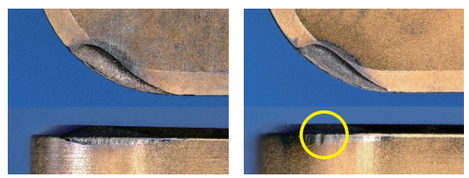

<Cutting Conditions>
Workpiece Material : AISI 5120 (60 HRC)
Inserts : NP-CNGA432-GS2
Cutting Speed : vc=655 SFM
Feed per Rev. : f=.004 IPR
Depth of Cut : ap=.008 inch
Cutting Mode : Dry Cutting

## Machining 5120(60 HRC):Comparison of Light Interrupted Cutting

BC8210 provides excellent chipping resistance.




After machining 360 seconds



BC8210 Conventional Product is Chipping

<Cutting Conditions>
Workpiece Material : AISI 5120 (60 HRC)
Inserts : NP-CNGA432-GS2
Cutting Speed : vc=525 SFM
Feed per Rev. : f=.004 IPR
Depth of Cut : ap=.008 inch
Cutting Mode : Dry Cutting

### Recommended Cutting Conditions

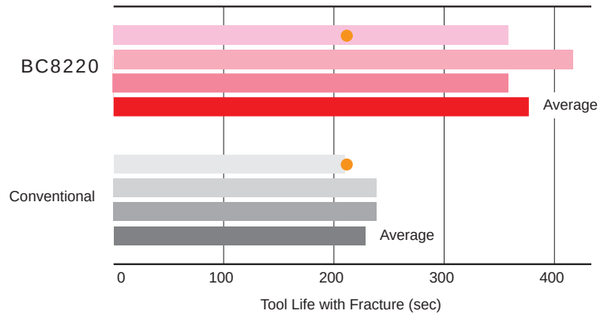
| Grade | Workpiece Material | Machining Methods | Cutting Speed vc (SFM) 330 490 655 820 985 | Feed per Rev. f (IPR) | Depth of Cut ap (inch) | Cutting Mode |
|---|---|---|---|---|---|---|
| BC8210 | Hardened Steels | Continuous Cutting | | ≤.008 | ≤.014 | Dry, Wet |
| | | Light Interrupted Cutting | | ≤.008 | ≤.014 | Dry, Wet |



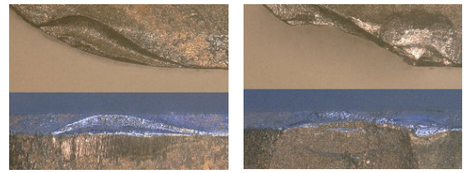
# BC8220 General Applications

## Machining 5120(60HRC): Comparison of Fracture Resistance During Medium Interrupted Cutting

Stable cutting is achieved with excellent fracture resistance in medium interrupted cutting.




After machining 210 seconds

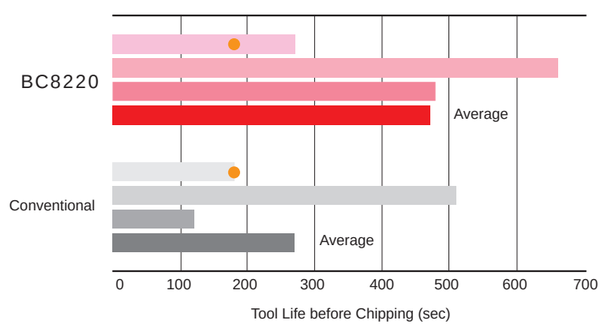


BC8220 Conventional

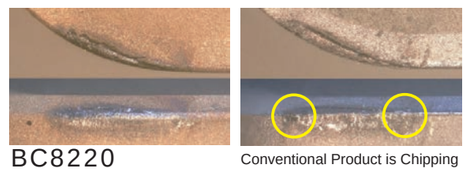
<Cutting Conditions>
Workpiece Material : AISI 5120 (60 HRC)
Inserts : NP-CNGA432-VA2
Cutting Speed : vc=820 SFM
Feed per Rev. : f=.006 IPR
Depth of Cut : ap=.004 inch
Cutting Mode : Dry Cutting

## Machining 5120(60HRC): Comparison of Fracture Resistance During Heavy Interrupted Cutting

Achieves excellent chipping resistance during heavy interrupted cutting.




After machining 180 seconds



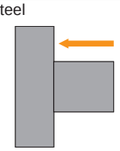
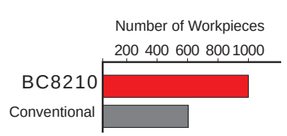
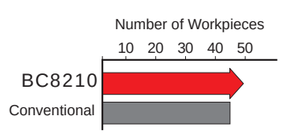
BC8220 Conventional Product is Chipping

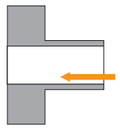
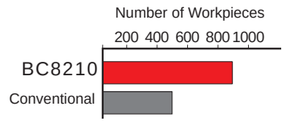
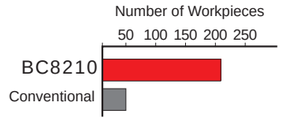
<Cutting Conditions>
Workpiece Material : AISI 5120 (60 HRC)
Inserts : NP-CNGA432-VA2
Cutting Speed : vc=655 SFM
Feed per Rev. : f=.002 IPR
Depth of Cut : ap=.004 inch
Cutting Mode : Wet Cutting

### Recommended Cutting Conditions

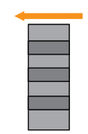
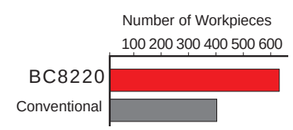
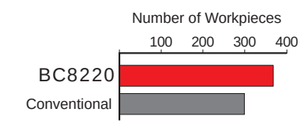
| Grade | Workpiece Material | Machining Methods | Cutting Speed vc (SFM) 330 490 655 820 985 | Feed per Rev. f (IPR) | Depth of Cut ap (inch) | Cutting Mode |
|---|---|---|---|---|---|---|
| BC8220 | Hardened Steels | Continuous Cutting | | ≤.008 | ≤.020 | Dry, Wet |
| | | Light to Medium Interrupted Cutting | | ≤.008 | ≤.012 | Dry, Wet |

## Examples of Usage

| Insert | | NP-CNGA433-GSWS2 | NP-DCGW32.51-GS2 |
|---|---|---|---|
| Workpiece Material | | Non-microalloyed Steel  | 16MnCr5  |
| Component | | Automobile Parts | Automobile Parts |
| Application | | External Continuous Cutting | Internal Continuous Cutting |
| Cutting Conditions | Cutting Speed vc (SFM) | 850 | 785 |
| | Feed per Rev. f (IPR) | .008 | .003 |
| | Depth of Cut ap (inch) | .006 | .008 |
| Cutting Mode | | Dry Cutting | Dry Cutting |
| Results | |   In continuous cutting, it was possible to maintain good surface roughness and to achieve a tool life extension of 1.6 X or more compared to conventional products. |   The same tool life as continuous cutting was achieved. Good surface roughness compared to conventional products was maintained. |

| Insert | | NP-CCGW32.52-GS2 | NP-CCGW32.51-FS2 |
|---|---|---|---|
| Workpiece Material | | 16MnCr5  | Alloy Steel  |
| Component | | Automobile Parts | Automobile Parts |
| Application | | Internal Continuous Cutting | Internal Continuous Cutting |
| Cutting Conditions | Cutting Speed vc (SFM) | 460 | 920 |
| | Feed per Rev. f (IPR) | .003 | .003 |
| | Depth of Cut ap (inch) | .004 | .004 |
| Cutting Mode | | Dry Cutting | Dry Cutting |
| Results | |   By significantly suppressing the deterioration of the surface of the insert, tool life was extended 1.8 X longer than that of conventional products in continuous cutting. |   Tool life is 4 X longer than that of conventional products during continuous cutting in high speeds. |

The application examples are from customers workpieces and can therefore differ from the recommended cutting conditions.

| Insert | | NP-TNGA333-TA3 | NP-TNGA33 (RE2.0)-TA3 |
|---|---|---|---|
| Workpiece Material | | 16MnCr5  | 16MnCr5  |
| Component | | Automobile Parts | Automobile Parts |
| Application | | Heavy Interrupted Boring | Heavy Interrupted Turning |
| Cutting Conditions | Cutting Speed vc (SFM) | 395 | 425 |
| | Feed per Rev. f (IPR) | .007 | .005 |
| | Depth of Cut ap (inch) | .006-.010 | .010 |
| Cutting Mode | | Dry Cutting | Dry Cutting |
| Results | |   BC8220, which has excellent fracture resistance, has a tool life 1.5 times longer than that of conventional products. |   BC8220, which has excellent fracture resistance, has a tool life 1.25 times longer than that of conventional products. |

The application examples are from customers workpieces and can therefore differ from the recommended cutting conditions.

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**For Your Safety**

- Don't handle inserts and chips without gloves.
- Please machine within the recommended application range and exchange expired tools with new ones in advance of breakage.
- Please use safety covers and wear safety glasses.
- When using compounded cutting oils, please take fire precautions.
- When attaching inserts or spare parts, please use only the correct wrench or driver.
- When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

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B249A-US-2021.10