



# GREWIN CUTTING INSERT

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ZHUZHOU GREWIN TUNGSTEN CARBIDE TOOLS CO.,LTD

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[www.gwcarbide.com](http://www.gwcarbide.com)

# COMPANY PROFILE

Zhuzhou Grewin Tungsten Carbide Tools Co., Ltd is a rapid grow company expertise and professional in carbide materials and carbide cutting tools over 50 years of experience, integrated with new technology, high-end machinery and collaborate with cutting tool maker to make good quality tools for customers. Over the decade, we have actively collaborated with researcher and university to enhance the cutting tool design and tool life, we have successfully helped our customer to reduce their cost and gain more market share with us.

The company has a wide range of inspection equipment' s to fulfil products quality inspection, using ERP system for ordering processing, tracking and delivery.

The company mission and vision are to help customer solve the business needs by providing One-Stop Procurement peace of mind solution with various tungsten carbide material and carbide cutting tools for metalworking and woodworking to all customers all over the world.

our main products:

Metal cutting tools: carbide cutting insert, carbide end mill carbide drill carbide taps carbide reamers carbide saw blade

Wood working tool: wood cutting insert carbide drill bit saw blade and planer reversible cutting insert carbide saw tips

Solid carbide rod for metal & wood

Advertising working tools

Tungsten carbide preform tools like strips plate block

The company has ISO 9001:2008 quality system, possesses advanced production equipment' s, complete testing instruments, strong R&D center, and QC team. Grewin branding products are trusted brand sold to more than 80 countries in the world end to end, business to business such as USA, South America, Europe, Middle East, South East Asia, etc.

Grewin is dedicated – WE GROW TOGETHER WE WIN. Grewin is growing up with the worlds carbide technology to meet the demand of our customer from all over the world. The company even aggressively work with WWO and other organization on contributing back by carrying more socially responsible, reducing air pollution from our industry, blood donation and donation to the orphanage. To make social direct benefit.





## HIGH QUALITY ASSURANCE

Grewin Owns a complete CNC insert production line, it including raw materials spraying treatment, mold making, deep processing, coating, etc. we are committed to research and development on Solutions of high-performance CNC cutting tools.

We are Equipped with some worlds top brand of precision high-end equipment, such as OSTERWALDER multi-axis electric press, CNC peripheral grinder, Balzer coating furnace.

Grewin adopts automatic numerical control equipment for raw material preparation, pressing, sintering, coating and products inspection.

We also have the advanced equipment' s like Mikron machining center and leading coating processing and world-class quality control system to ensure the good quality of our carbide insert.

We are aiming to provide the high-quality CNC cutting tools and improve the production efficiency to users and fully meet the strict requirements on insert quality.





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## GW CUTTING TOOLS TURNING INSERTS



Turning Inserts

A01-A103



Milling Inserts

B01-B37



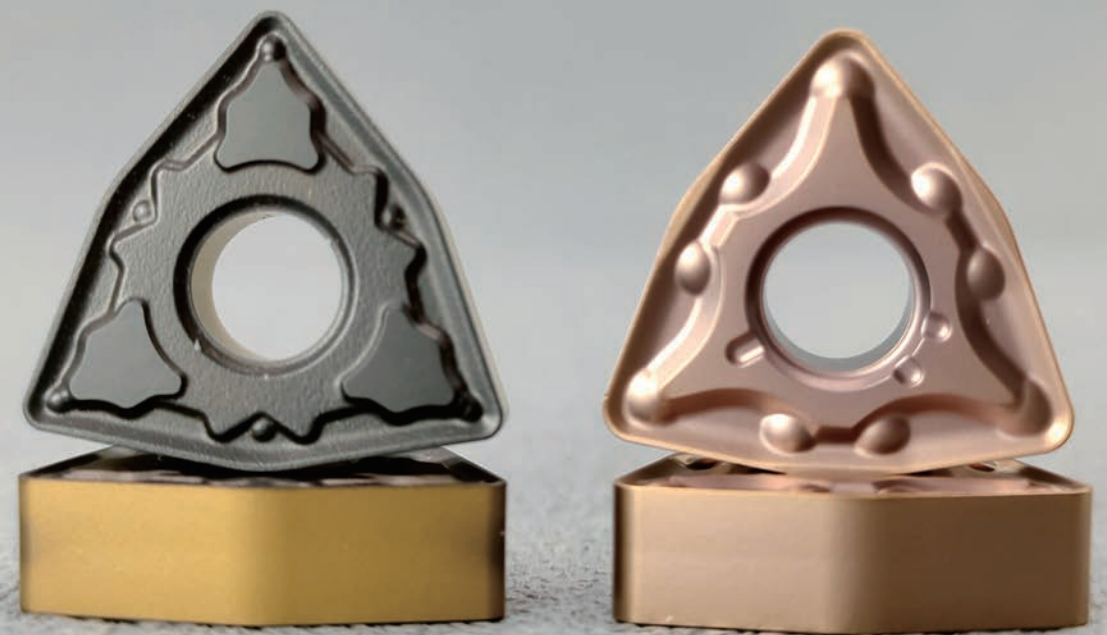
Drilling Inserts

C01-C05



Technical Information

D01-D17





## Recommended Turning Insert Grade

| ISO                             | Classification | CVD    |        |  |         | PVD    |        |  |
|---------------------------------|----------------|--------|--------|--|---------|--------|--------|--|
| P<br>Steel                      | 01             |        |        |  |         |        |        |  |
|                                 | 10             | GW2154 |        |  | GW3154  |        |        |  |
|                                 | 20             | GW2254 |        |  | GW3254  |        |        |  |
|                                 | 30             |        | GW2354 |  |         |        |        |  |
|                                 | 40             |        |        |  |         |        |        |  |
| M<br>Stainless<br>Steel         | 01             |        |        |  |         |        |        |  |
|                                 | 10             |        |        |  | GW8241  | GW5251 | GW8281 |  |
|                                 | 20             |        |        |  |         |        |        |  |
|                                 | 30             |        |        |  |         |        |        |  |
|                                 | 40             |        |        |  |         |        |        |  |
| K<br>Cast Iron                  | 01             |        |        |  |         |        |        |  |
|                                 | 10             | GW3153 |        |  | GW4153  |        |        |  |
|                                 | 20             |        |        |  |         |        |        |  |
|                                 | 30             |        |        |  |         |        |        |  |
|                                 | 40             |        |        |  |         |        |        |  |
| S<br>Heat<br>Resistant<br>Alloy | 01             |        |        |  |         |        |        |  |
|                                 | 10             |        |        |  | GW80101 |        |        |  |
|                                 | 20             |        |        |  |         | GW8241 | GW8251 |  |
|                                 | 30             |        |        |  |         |        |        |  |
|                                 | 40             |        |        |  |         |        |        |  |

## General Turning Insert

| Item No. | Application             | Chipbreaker                                                                           | Feature/Shape of insert                                                                                                                                                                        |
|----------|-------------------------|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | Steel<br>Finishing      | AF                                                                                    | P-type Material Finishing                                                                                                                                                                      |
|          |                         |    | M-level double-sided chipbreaker, two-stage bump effect for stable chip handling in a wide range of feeds.                                                                                     |
| 2        | Steel<br>Semi-finishing | AS                                                                                    | P-type Material Semi-finishing                                                                                                                                                                 |
|          |                         |    | M-level double-sided chipbreaker, negative chamfer design, high edge strength, suitable for semi-finishing occasions with unstable working conditions.                                         |
| 3        | Steel<br>Roughing       | AR                                                                                    | P-type Material Roughing                                                                                                                                                                       |
|          |                         |  | The preferred chip breaker for lightload roughing, wide margin design, good edge strength, high metal removal rate, good wear resistance and cutting life.                                     |
| 4        | Steel<br>Heavy-load     | AR<br>( Single Side )                                                                 | P-type Material Heavy-load                                                                                                                                                                     |
|          |                         |  | M-level single-sided chipbreaker, negative chamfer design, under the large cutting depth and large feed processing parameters, high edge strength and high metal removal rate can be obtained. |

## General Turning Insert

| Item No. | Application                           | Chipbreaker                                                                         | Feature/Shape of insert                                                                                                                                                                                                                                  |
|----------|---------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5        | Stainless steel finishing             | BF                                                                                  | M type material finishing                                                                                                                                                                                                                                |
|          |                                       |    | M-level double-sided chipbreaker, small edge width + double positive rake angle, sharp blade edge, low cutting resistance, special edge inclination design, can obtain high-quality machined surface.                                                    |
| 6        | Stainless steel semi-finishing        | BM                                                                                  | M type material semi-finishing                                                                                                                                                                                                                           |
|          |                                       |    | M-level double-sided chipbreaker, double positive rake angle, higher edge strength, widely application for the general processing of stainless steel.                                                                                                    |
| 7        | Stainless steel roughing              | BR                                                                                  | M type material roughing                                                                                                                                                                                                                                 |
|          |                                       |  | M-level double-sided chipbreaker, variable blade width + variable rake angle design, suitable for semi-finishing and roughing of stainless steel                                                                                                         |
| 8        | High temperature alloy semi-finishing | DM                                                                                  | S type material semi-finishing                                                                                                                                                                                                                           |
|          |                                       |  | M-level double-sided chipbreaker. Adopting the double positive rake angle combines the sharpness and strength of the insert; the cutting resistance is small, and the wider chipbreaker ensures enough space for chip deformation, reducing groove wear. |

## General Inner Hole Turning Insert

| Item No. | Application               | Chipbreaker                                                                         | Feature/Shape of insert                                                                                                     |
|----------|---------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 9        | General semi-finishing    | GM                                                                                  | General chipbreaker                                                                                                         |
|          |                           |  | M-level single-sided chipbreaker, suitable for semi-finishing of inner holes and outer circles of P, M and K type materials |
| 10       | Stainless steel finishing | GF                                                                                  | M type material finishing                                                                                                   |
|          |                           |  | M-level single-sided chipbreaker, suitable for innerhole and outer circle finishing of stainless steel.                     |

## Special Turning Insert

| Item No. | Application               | Chipbreaker                                                                           | Feature/Shape of insert                                                                                           |
|----------|---------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| 11       | Train wheel hub machining | 175.32 series                                                                         | Chipbreaker for finishing of P type material                                                                      |
|          |                           |  | M-level double-sided chipbreaker, vertical cutting inserts, especially suitable for the trimming of train wheels. |
| 12       |                           | RCMX series                                                                           | Chipbreaker for heavy-load machining of P type material                                                           |
|          |                           |  | M-level single-sided chipbreaker, negative chamfer design, high edge strength, first choice for profiling.        |



## Product and Chip Breaker

|                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |
|----------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Finishing      |    |    |    |    |    |    |
|                | CNMG-AF                                                                             | DNMG-AF                                                                             | SNMG-AF                                                                             | TNMG-AF                                                                             | VNMG-AF                                                                              | WNMG-AF                                                                               |
| Length         | 09、12                                                                               | 15                                                                                  | 12                                                                                  | 16                                                                                  | 16                                                                                   | 08                                                                                    |
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| Finishing      |    |    |    |    |    |    |
|                | CNMG-BF                                                                             | DNMG-BF                                                                             | SNMG-BF                                                                             | TNMG-BF                                                                             | VNMG-BF                                                                              | WNMG-BF                                                                               |
| Length         | 09、12                                                                               | 15                                                                                  | 12                                                                                  | 16                                                                                  | 16                                                                                   | 06、08                                                                                 |
| Page           | A-16                                                                                | A-24                                                                                | A-33                                                                                | A-41                                                                                | A-48                                                                                 | A-52                                                                                  |
| Semi-finishing |   |   |   |   |   |   |
|                | CNMG-AS                                                                             | CNMG-BM                                                                             | CNMG-CM                                                                             | CNMG-DM                                                                             | DNMG-AS                                                                              | DNMG-BM                                                                               |
| Length         | 12、16、19                                                                            | 12、16                                                                               | 12、16、19                                                                            | 12                                                                                  | 15                                                                                   | 15                                                                                    |
| Page           | A-13                                                                                | A-17                                                                                | A-18                                                                                | A-20                                                                                | A-22                                                                                 | A-25                                                                                  |
| Semi-finishing |  |  |  |  |  |  |
|                | DNMG-CM                                                                             | DNMG-DM                                                                             | SNMG-AS                                                                             | SNMG-BM                                                                             | SNMG-CM                                                                              | SNMG-DM                                                                               |
| Length         | 15                                                                                  | 15                                                                                  | 12、15                                                                               | 12、15                                                                               | 12                                                                                   | 12、15                                                                                 |
| Page           | A-27                                                                                | A-28                                                                                | A-30                                                                                | A-34                                                                                | A-36                                                                                 | A-37                                                                                  |
| Semi-finishing |  |  |  |  |  |  |
|                | TNMG-AS                                                                             | TNMG-BM                                                                             | TNMG-CM                                                                             | VNMG-AS                                                                             | VNMG-CM                                                                              | WNMG-AS                                                                               |
| Length         | 16、22                                                                               | 16、22                                                                               | 16、22                                                                               | 11、16                                                                               | 16                                                                                   | 08                                                                                    |
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## Product and Chip Breaker

|                |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |                                                                                     |
|----------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Semi-finishing |    |    |    |                                                                                       |                                                                                     |                                                                                     |
|                | WNMG-BM                                                                               | WNMG-CM                                                                               | WNMG-DM                                                                               |                                                                                       |                                                                                     |                                                                                     |
| Length         | 06、08                                                                                 | 08                                                                                    | 08                                                                                    |                                                                                       |                                                                                     |                                                                                     |
| Page           | A-53                                                                                  | A-55                                                                                  | A-56                                                                                  |                                                                                       |                                                                                     |                                                                                     |
| Roughing       |    |    |    |    |  |  |
|                | CNMG-AR                                                                               | CNMG-BR                                                                               | DNMG-AR                                                                               | DNMG-BR                                                                               | SNMG-AR                                                                             | SNMG-BR                                                                             |
| Length         | 12、16、19                                                                              | 12、16                                                                                 | 15                                                                                    | 15                                                                                    | 12、15、19                                                                            | 12、15                                                                               |
| Page           | A-14                                                                                  | A-19                                                                                  | A-23                                                                                  | A-26                                                                                  | A-31                                                                                | A-35                                                                                |
| Roughing       |   |   |   |   |                                                                                     |                                                                                     |
|                | TNMG-AR                                                                               | TNMG-BR                                                                               | WNMG-AR                                                                               | WNMG-BR                                                                               |                                                                                     |                                                                                     |
| Length         | 16、22                                                                                 | 16、22                                                                                 | 06、08                                                                                 | 06、08                                                                                 |                                                                                     |                                                                                     |
| Page           | A-40                                                                                  | A-44                                                                                  | A-51                                                                                  | A-54                                                                                  |                                                                                     |                                                                                     |
| Heavy-load     |  |  |                                                                                       |                                                                                       |                                                                                     |                                                                                     |
|                | CNMM-AR                                                                               | SNMM-AR                                                                               |                                                                                       |                                                                                       |                                                                                     |                                                                                     |
| Length         | 19、25                                                                                 | 19、25                                                                                 |                                                                                       |                                                                                       |                                                                                     |                                                                                     |
| Page           | A-15                                                                                  | A-32                                                                                  |                                                                                       |                                                                                       |                                                                                     |                                                                                     |
| Semi-finishing |  |  |  |  |                                                                                     |                                                                                     |
|                | CCMT-GM                                                                               | DCMT-GM                                                                               | SCMT-GM                                                                               | TCMT-GM                                                                               |                                                                                     |                                                                                     |
| Length         | 06、09、12                                                                              | 07、11                                                                                 | 09、12                                                                                 | 09、11、16                                                                              |                                                                                     |                                                                                     |
| Page           | A-57                                                                                  | A-59                                                                                  | A-61                                                                                  | A-63                                                                                  |                                                                                     |                                                                                     |

# Product and Chip Breaker

|                                        |                                                                                     |                                                                                     |                                                                                     |                                                                                    |                                                                                    |  |
|----------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|--|
| M<br>Finishing                         |    |    |    |   |                                                                                    |  |
|                                        | CCMT-GF                                                                             | DCMT-GF                                                                             | SCMT-GF                                                                             | TCMT-GF                                                                            |                                                                                    |  |
| Length                                 | 06、09                                                                               | 07、11                                                                               | 09                                                                                  | 09、11、16                                                                           |                                                                                    |  |
| Page                                   | A-58                                                                                | A-60                                                                                | A-62                                                                                | A-64                                                                               |                                                                                    |  |
| Small<br>Parts<br>Machining            |    |    |    |   |  |  |
|                                        | TNGG-FS                                                                             | VNGG-FS                                                                             | DCGT-FS                                                                             | VBGT-FS                                                                            | VCGT-FS                                                                            |  |
| Length                                 | 16                                                                                  | 16                                                                                  | 11                                                                                  | 11                                                                                 | 11                                                                                 |  |
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| GRINDED<br>Small<br>Parts<br>Machining |   |   |   |  |                                                                                    |  |
|                                        | CCGT-UF                                                                             | DCGT-UF                                                                             | TCGT-UF                                                                             | VCGT-UF                                                                            |                                                                                    |  |
| Length                                 | 09                                                                                  | 07、11                                                                               | 11                                                                                  | 08、11                                                                              |                                                                                    |  |
| Page                                   | A-71                                                                                | A-72                                                                                | A-73                                                                                | A-74                                                                               |                                                                                    |  |
| GRINDED<br>Small<br>Parts<br>Machining |  |  |  |                                                                                    |                                                                                    |  |
|                                        | TNGG-F                                                                              | TNGG-M                                                                              | TPGH                                                                                |                                                                                    |                                                                                    |  |
| Length                                 | 16                                                                                  | 16                                                                                  | 08、09、11                                                                            |                                                                                    |                                                                                    |  |
| Page                                   | A-75                                                                                | A-76                                                                                | A-77                                                                                |                                                                                    |                                                                                    |  |

|                                 |                                                                                     |                                                                                     |                                                                                     |                                                                                     |  |  |
|---------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--|--|
| Train<br>Wheel Hub<br>Machining |  |  |  |  |  |  |
|                                 | RCMX                                                                                | 175.32-22                                                                           | 175.32-24                                                                           | 175.32-28                                                                           |  |  |
| Length                          | 08-32                                                                               | 19                                                                                  | 19                                                                                  | 19                                                                                  |  |  |
| Page                            | A-78                                                                                | A-79                                                                                | A-80                                                                                | A-81                                                                                |  |  |

|                            |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                     |
|----------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Parting<br>and<br>Grooving |    |    |    |    |  |
|                            | EDMN-C                                                                                | EDMN-J                                                                                | ECMN-T                                                                                | ERMN-T                                                                                | MGGN-GL                                                                             |
| Length                     | 2.0-5.0                                                                               | 2.0-5.0                                                                               | 3.0-6.0                                                                               | 3.0-6.0                                                                               | 2.0-5.0                                                                             |
| Page                       | A-84                                                                                  | A-85                                                                                  | A-86                                                                                  | A-87                                                                                  | A-88                                                                                |
| Parting<br>and<br>Grooving |  |                                                                                       |                                                                                       |                                                                                       |                                                                                     |
|                            | ERMN-M                                                                                |                                                                                       |                                                                                       |                                                                                       |                                                                                     |
| Length                     | 2.0-8.0                                                                               |                                                                                       |                                                                                       |                                                                                       |                                                                                     |
| Page                       | A-89                                                                                  |                                                                                       |                                                                                       |                                                                                       |                                                                                     |
| GRINDED<br>Grooving        |  |  |  |  |                                                                                     |
|                            | ESG16R/L                                                                              | ESA22R/L                                                                              | ECF12R/L                                                                              | ECF16R/L                                                                              |                                                                                     |
| Length                     | 1.1-3.0                                                                               | 1.25-3.0                                                                              | 0.5-2.0                                                                               | 1.5-2.0                                                                               |                                                                                     |
| Page                       | A-91                                                                                  | A-92                                                                                  | A-94                                                                                  | A-94                                                                                  |                                                                                     |



## A Turning Insert

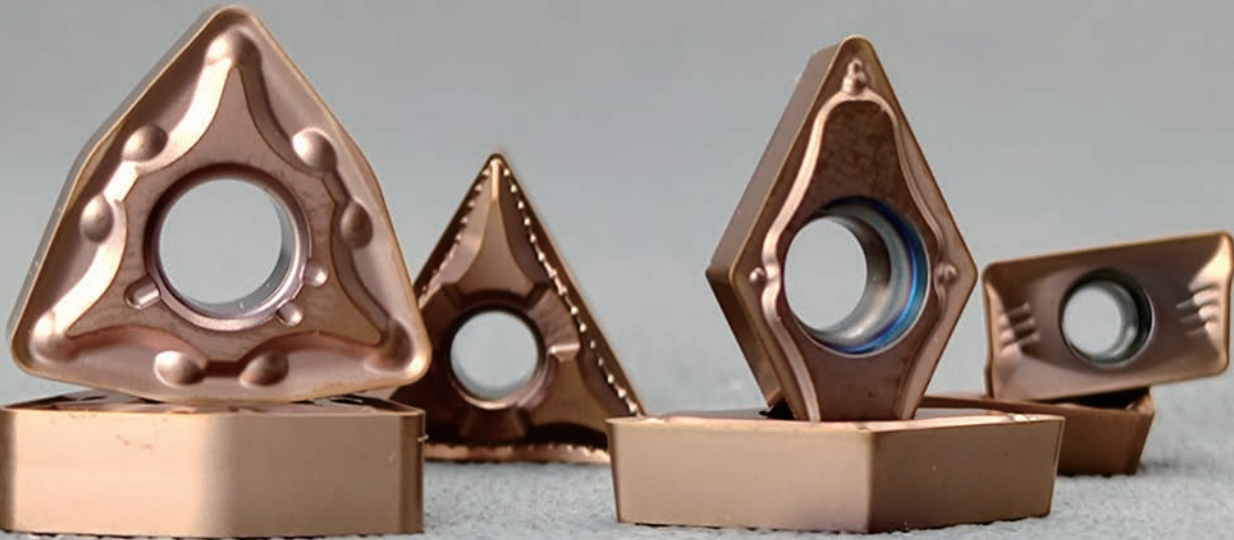
A diagram consisting of four square boxes arranged horizontally. Each box has an orange border and contains a black letter: 'C', 'N', 'M', and 'G' from left to right.

| 2. Clearance Angle |                                                                                     |              |                                                                                     | 3. Tolerance                                                                        |                                                                                     |                                                                                     |                                                                                     |             |             |       |       |     |  |  |  |
|--------------------|-------------------------------------------------------------------------------------|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------|-------------|-------|-------|-----|--|--|--|
| Code               | Clearance Angle                                                                     | Code         | Clearance Angle                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |             |             |       |       |     |  |  |  |
| A                  |  | B            |  |  |  |  |  |             |             |       |       |     |  |  |  |
| Code               | m (mm)                                                                              | d = I.C (mm) | S (mm)                                                                              |                                                                                     |                                                                                     |                                                                                     |                                                                                     |             |             |       |       |     |  |  |  |
| A                  | ±0.005                                                                              | ±0.025       | ±0.025                                                                              | Inscribed Circle                                                                    | Regular Triangle                                                                    | Square                                                                              | 80° Rhombus                                                                         | 55° Rhombus | 35° Rhombus |       |       |     |  |  |  |
| F                  | ±0.005                                                                              | ±0.013       | ±0.025                                                                              | 6.35                                                                                | ±0.08                                                                               | ±0.08                                                                               | ±0.08                                                                               | ±0.11       | ±0.16       | ---   |       |     |  |  |  |
| C                  | ±0.013                                                                              | ±0.025       | ±0.025                                                                              | 9.525                                                                               | ±0.08                                                                               | ±0.08                                                                               | ±0.08                                                                               | ±0.11       | ±0.16       | ---   |       |     |  |  |  |
| H                  | ±0.013                                                                              | ±0.013       | ±0.025                                                                              | 12.7                                                                                | ±0.13                                                                               | ±0.13                                                                               | ±0.13                                                                               | ±0.15       | ---         | ---   |       |     |  |  |  |
| E                  | ±0.013                                                                              | ±0.013       | ±0.025                                                                              | 15.875                                                                              | ±0.15                                                                               | ±0.15                                                                               | ±0.15                                                                               | ±0.18       | ---         | ---   |       |     |  |  |  |
| E                  | ±0.025                                                                              | ±0.025       | ±0.025                                                                              | 19.05                                                                               | ±0.15                                                                               | ±0.15                                                                               | ±0.15                                                                               | ±0.18       | ---         | ---   |       |     |  |  |  |
| G                  | ±0.025                                                                              | ±0.025       | ±0.13                                                                               | 25.4                                                                                | ---                                                                                 | ±0.18                                                                               | ---                                                                                 | ---         | ---         | ---   |       |     |  |  |  |
| J                  | ±0.005                                                                              | ±0.05±0.13   | ±0.025                                                                              | ♦ Tolerance of Inscribed Circle(mm)                                                 |                                                                                     |                                                                                     |                                                                                     |             |             |       |       |     |  |  |  |
| K                  | ±0.013                                                                              | ±0.05±0.13   | ±0.025                                                                              | Inscribed Circle                                                                    | Regular Triangle                                                                    | Square                                                                              | 80° Rhombus                                                                         | 55° Rhombus | 35° Rhombus |       |       |     |  |  |  |
| L                  | ±0.025                                                                              | ±0.05±0.13   | ±0.025                                                                              | 6.35                                                                                | ±0.05                                                                               | ±0.05                                                                               | ±0.05                                                                               | ±0.05       | ±0.05       | ±0.05 | ---   |     |  |  |  |
| M                  | ±0.08±0.18                                                                          | ±0.05±0.13   | ±0.13                                                                               | 9.525                                                                               | ±0.05                                                                               | ±0.05                                                                               | ±0.05                                                                               | ±0.05       | ±0.05       | ±0.05 | ±0.05 | --- |  |  |  |
| N                  | ±0.08±0.18                                                                          | ±0.05±0.13   | ±0.025                                                                              | 12.7                                                                                | ±0.08                                                                               | ±0.08                                                                               | ±0.08                                                                               | ±0.08       | ±0.08       | ---   | ±0.08 |     |  |  |  |
| U                  | ±0.13±0.38                                                                          | ±0.08±0.25   | ±0.13                                                                               | 15.875                                                                              | ±0.10                                                                               | ±0.10                                                                               | ±0.10                                                                               | ±0.10       | ±0.10       | ---   | ±0.10 |     |  |  |  |
|                    |                                                                                     |              |                                                                                     | 19.05                                                                               | ±0.10                                                                               | ±0.10                                                                               | ±0.10                                                                               | ±0.10       | ±0.10       | ---   | ±0.10 |     |  |  |  |
|                    |                                                                                     |              |                                                                                     | 25.4                                                                                | ---                                                                                 | ±0.13                                                                               | ---                                                                                 | ---         | ---         | ---   | ±0.13 |     |  |  |  |

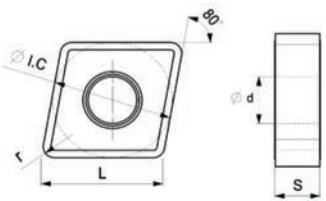
12 04 12 - MA (ISO)

## Turning Insert

GW  
CUTTING TOOLS  
TURNING INSERTS



80° CN□□ With Hole

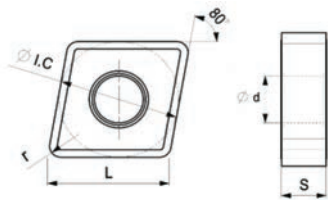


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 9      | 9.525    | 3.18 | 3.81 | 0.4–0.8 |
| 12     | 12.7     | 4.76 | 5.16 | 0.4–1.2 |

| Shape                                                                                                       | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |
|-------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|                                                                                                             |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |         |         |
|                                                                                                             |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8251 | GWR0101 | GWR5251 |
| <br><br>P<br>Finishing | CNMG090304-AF | 0.26-3.2   | 0.05-0.15      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |         |         |
|                                                                                                             | CNMG090308-AF | 0.52-3.2   | 0.1-0.30       | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |         |         |
|                                                                                                             | CNMG120404-AF | 0.26-3.2   | 0.05-0.15      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |         |         |
|                                                                                                             | CNMG120408-AF | 0.52-3.2   | 0.1-0.30       | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |         |         |
|                                                                                                             | CNMG120412-AF | 0.78-3.2   | 0.15-0.45      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |         |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock

**80° CN□□ With Hole**

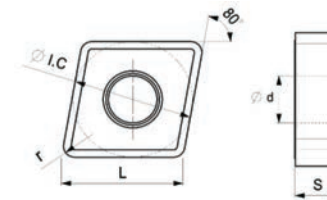


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 12     | 12.7     | 4.76 | 5.16 | 0.4-1.6 |
| 16     | 15.875   | 6.35 | 6.35 | 0.8-1.6 |
| 19     | 19.05    | 6.35 | 7.94 | 0.8-1.6 |

| Shape                                                                                                      | Type          | Ap (mm)   | Fn (mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |
|------------------------------------------------------------------------------------------------------------|---------------|-----------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                                            |               |           |             | CVD    |        |        |        |        |        | PVD    |        |        |        |        |         |
|                                                                                                            |               |           |             | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW80101 |
| <br>P<br>Semi-finishing | CNMG120404-AS | 0.60-6.40 | 0.10-0.30   | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                            | CNMG120408-AS | 1.20-6.40 | 0.20-0.60   | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                            | CNMG120412-AS | 1.80-6.40 | 0.30-0.90   | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                            | CNMG120416-AS | 2.40-6.40 | 0.12-0.40   | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                            | CNMG160608-AS | 1.20-8.10 | 0.10-0.30   | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                            | CNMG160612-AS | 1.80-8.10 | 0.20-0.60   | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                            | CNMG160616-AS | 2.40-8.10 | 0.30-0.90   | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                            | CNMG190608-AS | 1.20-9.70 | 0.20-0.60   | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                            | CNMG190612-AS | 1.80-9.70 | 0.30-0.90   | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                            | CNMG190616-AS | 2.40-9.70 | 0.40-1.20   | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |

Note: ◆ Recommended grade ready to stock

**80° CN□□ With Hole**



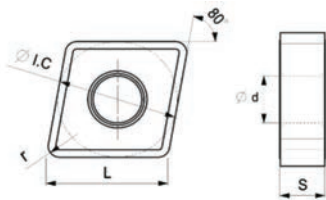
| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 12     | 12.7     | 4.76 | 5.16 | 0.8-1.6 |
| 16     | 15.875   | 6.35 | 6.35 | 0.8-1.6 |
| 19     | 19.05    | 6.35 | 7.94 | 0.8-2.4 |

| Shape                                                                                                  | Type          | Ap (mm)   | Fn (mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |
|--------------------------------------------------------------------------------------------------------|---------------|-----------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                                        |               |           |             | CVD    |        |        |        |        |        | PVD    |        |        |        |        |         |
|                                                                                                        |               |           |             | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW80101 |
| <br>P<br>Roughing | CNMG120408-AR | 1.45-5.20 | 0.15-0.32   |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                        | CNMG120412-AR | 2.15-5.20 | 0.25-0.50   |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                        | CNMG120416-AR | 2.90-5.20 | 0.30-0.65   |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                        | CNMG160608-AR | 1.45-6.40 | 0.15-0.35   |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                        | CNMG160612-AR | 2.15-6.40 | 0.24-0.50   |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                        | CNMG160616-AR | 2.90-6.40 | 0.30-0.65   |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                        | CNMG190608-AR | 1.45-7.70 | 0.15-0.35   |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                        | CNMG190612-AR | 2.15-7.70 | 0.25-0.50   |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                        | CNMG190616-AR | 2.90-7.70 | 0.30-0.65   |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                        | CNMG190624-AR | 4.30-7.70 | 0.45-0.95   |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |

Note: ◆ Recommended grade ready to stock



**80° CN□□ With Hole**

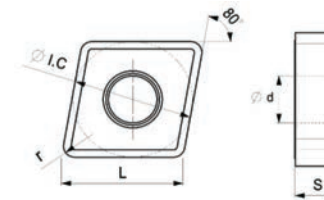


| Length | Size(mm) |           |      |         |
|--------|----------|-----------|------|---------|
|        | IC       | S         | d    | r       |
| 19     | 19.05    | 6.35      | 7.94 | 1.2-2.4 |
| 25     | 25.4     | 7.94-9.52 | 9.12 | 2.4-3.2 |

| Shape                                                                                                      | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |         |
|------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|                                                                                                            |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |         |         |
|                                                                                                            |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW80101 | GW80101 |
| <br>P<br>Heavy<br>-load | CNMM190612-AR | 2.40-9.70  | 0.25-0.60      |        |        | ◆      | ◇      | ◆      |        |        |        |        |        |        |         |         |
|                                                                                                            | CNMM190616-AR | 3.20-9.70  | 0.35-0.80      |        |        | ◆      | ◇      | ◆      |        |        |        |        |        |        |         |         |
|                                                                                                            | CNMM190624-AR | 4.80-9.70  | 0.50-1.20      |        |        | ◆      | ◇      | ◆      |        |        |        |        |        |        |         |         |
|                                                                                                            | CNMM250724-AR | 4.80-12.90 | 0.50-1.20      |        |        | ◆      | ◇      | ◆      |        |        |        |        |        |        |         |         |
|                                                                                                            | CNMM250924-AR | 4.80-12.90 | 0.50-1.20      |        |        | ◆      | ◇      | ◆      |        |        |        |        |        |        |         |         |
|                                                                                                            | CNMM250932-AR | 4.80-12.90 | 0.50-1.20      |        |        | ◆      | ◇      | ◆      |        |        |        |        |        |        |         |         |
|                                                                                                            |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock

**80° CN□□ With Hole**

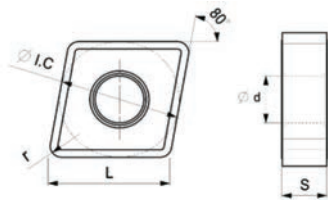


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 9      | 9.525    | 3.18 | 3.81 | 0.4-0.8 |
| 12     | 12.7     | 4.76 | 5.16 | 0.4-1.2 |

| Shape                                                                                                   | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |         |         |
|---------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                                         |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |         |         |         |         |
|                                                                                                         |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW80101 | GW80101 | GW80101 | GW80101 |
| <br>M<br>Finishing | CNMG090304-BF | 0.25-2.40  | 0.05-0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                         | CNMG090308-BF | 0.50-2.40  | 0.10-0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                         | CNMG120404-BF | 0.25-3.20  | 0.05-0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                         | CNMG120408-BF | 0.50-3.20  | 0.10-0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                         | CNMG120412-BF | 0.75-3.20  | 0.15-0.45      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock

**80° CN□□ With Hole**

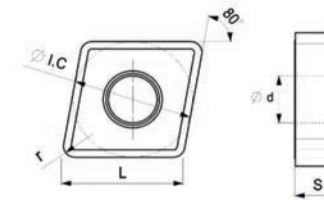


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 12     | 12.7     | 4.76 | 5.16 | 0.4-1.2 |
| 16     | 15.875   | 6.35 | 6.35 | 0.8-1.6 |

| Shape                                                                               | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |        |
|-------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                     |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |        |        |        |
|                                                                                     |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW8281 | GW8281 | GW8281 |
|  | CNMG120404-BM | 0.30-4.30  | 0.08-0.25      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇      |        | ◇      |
|                                                                                     | CNMG120408-BM | 0.65-4.30  | 0.15-0.45      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇      |        | ◇      |
|                                                                                     | CNMG120412-BM | 0.95-4.30  | 0.20-0.65      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇      |        | ◇      |
|                                                                                     | CNMG160608-BM | 0.65-5.30  | 0.15-0.45      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇      |        | ◇      |
|                                                                                     | CNMG160612-BM | 0.95-5.30  | 0.25-0.65      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇      |        | ◇      |
|                                                                                     | CNMG160616-BM | 1.30-5.30  | 0.30-0.90      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇      |        | ◇      |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
| M<br>Semi-finishing                                                                 |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

**80° CN□□ With Hole**

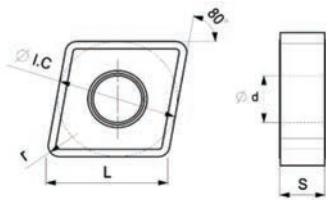


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 12     | 12.7     | 4.76 | 5.16 | 0.4-1.6 |
| 16     | 15.875   | 6.35 | 6.35 | 0.8-1.6 |
| 19     | 19.05    | 6.35 | 7.94 | 0.8-1.6 |

| Shape                                                                                 | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |  |  |  |  |  |  |  |  |
|---------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--|--|--|--|--|--|--|--|
|                                                                                       |               |            |                | CVD    |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                       |               |            |                | GW0203 | GW0403 | GW3153 | GW4153 |  |  |  |  |  |  |  |  |
|  | CNMG120404-CM | 0.40-4.30  | 0.08-0.25      |        |        | ◆      |        |  |  |  |  |  |  |  |  |
|                                                                                       | CNMG120408-CM | 0.80-4.30  | 0.15-0.45      |        |        | ◆      |        |  |  |  |  |  |  |  |  |
|                                                                                       | CNMG120412-CM | 1.20-4.30  | 0.20-0.65      |        |        | ◆      |        |  |  |  |  |  |  |  |  |
|                                                                                       | CNMG160612-CM | 1.20-5.30  | 0.25-0.65      |        |        | ◆      |        |  |  |  |  |  |  |  |  |
|                                                                                       | CNMG160616-CM | 1.60-5.30  | 0.30-0.90      |        |        | ◆      |        |  |  |  |  |  |  |  |  |
|                                                                                       | CNMG190612-CM | 1.20-6.40  | 0.25-0.65      |        |        | ◆      |        |  |  |  |  |  |  |  |  |
|                                                                                       |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
| K<br>Semi-finishing                                                                   |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                       |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                       |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                       |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |

Note: ◆ Recommended grade ready to stock

80° CN□□ With Hole

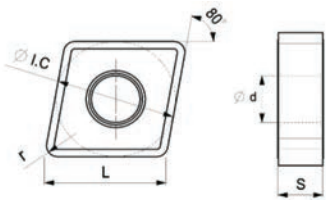


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 12     | 12.7     | 4.76 | 5.16 | 0.4-1.2 |
| 16     | 15.875   | 6.35 | 6.35 | 0.8-1.6 |

| Shape                                                                                                | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |  |
|------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
|                                                                                                      |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |        |        |  |
|                                                                                                      |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8281 | GW0101 | GW5251 | GW5281 |  |
| <br>M<br>Roughing | CNMG120404-BR | 0.30-4.30  | 0.08-0.25      |        |        |        |        | ◆      | ◆      | ◆      | ◆      |        | ◆      |        |  |
|                                                                                                      | CNMG120408-BR | 0.65-4.30  | 0.15-0.45      |        |        |        |        | ◆      | ◆      | ◆      | ◆      |        | ◆      |        |  |
|                                                                                                      | CNMG120412-BR | 0.95-4.30  | 0.25-0.65      |        |        |        |        | ◆      | ◆      | ◆      | ◆      |        | ◆      |        |  |
|                                                                                                      | CNMG160608-BR | 0.65-5.30  | 0.15-0.45      |        |        |        |        | ◆      | ◆      | ◆      | ◆      |        | ◆      |        |  |
|                                                                                                      | CNMG160612-BR | 0.95-5.30  | 0.25-0.65      |        |        |        |        | ◆      | ◆      | ◆      | ◆      |        | ◆      |        |  |
|                                                                                                      | CNMG160616-BR | 1.25-5.30  | 0.30-0.90      |        |        |        |        | ◆      | ◆      | ◆      | ◆      |        | ◆      |        |  |
|                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |  |

Note: ◆ Recommended grade ready to stock

80° CN□□ With Hole



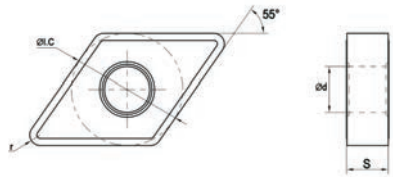
| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 12     | 12.7     | 4.76 | 5.16 | 0.4-1.6 |
|        |          |      |      |         |

| Shape                                                                                                        | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |        |
|--------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                                              |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |        |        |        |
|                                                                                                              |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8251 | GW8281 | GW0101 | GW5201 | GW5251 | GW0301 |
| <br>S<br>Semi-finishing | CNMG120404-DM | 0.40-4.30  | 0.08-0.25      |        |        |        |        | ◆      |        |        | ◆      | ◆      |        | ◆      |        |
|                                                                                                              | CNMG120408-DM | 0.80-4.30  | 0.15-0.45      |        |        |        |        | ◆      |        |        | ◆      | ◆      |        | ◆      |        |
|                                                                                                              | CNMG120412-DM | 1.20-4.30  | 0.25-0.65      |        |        |        |        | ◆      |        |        | ◆      | ◆      |        | ◆      |        |
|                                                                                                              | CNMG120416-DM | 1.60-4.30  | 0.30-0.90      |        |        |        |        | ◆      |        |        | ◆      | ◆      |        | ◆      |        |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock



**55° DN□□ With Hole**

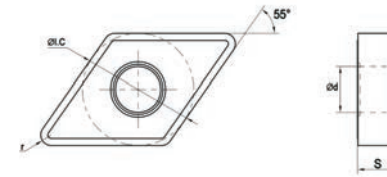


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 15     | 12.7     | 4.76 | 5.16 | 0.8-1.2 |
| 15     | 12.7     | 6.35 | 5.16 | 0.4-1.2 |

| Shape                                                                                                 | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |        |
|-------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                                       |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |        |
|                                                                                                       |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8251 | GW0101 | GW5251 | GW8251 |
| <br>P<br>Finishing | DNMG150404-AF | 0.26-3.1   | 0.05-0.15      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                       | DNMG150408-AF | 0.52-3.1   | 0.10-0.30      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                       | DNMG150412-AF | 0.78-3.1   | 0.15-0.45      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                       | DNMG150604-AF | 0.26-3.1   | 0.05-0.15      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                       | DNMG150608-AF | 0.52-3.1   | 0.10-0.30      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                       | DNMG150612-AF | 0.78-3.1   | 0.15-0.45      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

**55° DN□□ With Hole**

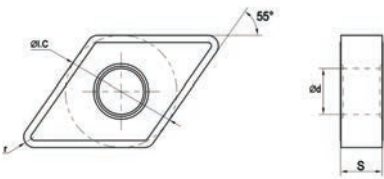


| Length | Size(mm) |           |      |         |
|--------|----------|-----------|------|---------|
|        | IC       | S         | d    | r       |
| 15     | 12.7     | 4.76-6.35 | 5.16 | 0.4-1.2 |
|        |          |           |      |         |

| Shape                                                                                                        | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |        |
|--------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                                              |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |        |
|                                                                                                              |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW0101 |
| <br>P<br>Semi-finishing | DNMG150404-AS | 0.60-5.40  | 0.10-0.30      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                              | DNMG150408-AS | 1.20-5.40  | 0.20-0.60      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                              | DNMG150412-AS | 1.80-5.40  | 0.30-0.90      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                              | DNMG150604-AS | 0.60-5.40  | 0.10-0.30      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                              | DNMG150608-AS | 1.20-5.40  | 0.20-0.60      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                              | DNMG150612-AS | 1.80-5.40  | 0.30-0.90      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

55° DN□□ With Hole

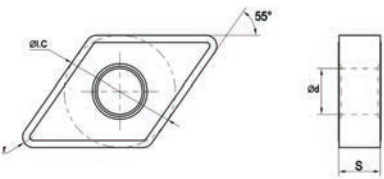


| Length | Size(mm) |           |      |         |
|--------|----------|-----------|------|---------|
|        | IC       | S         | d    | r       |
| 15     | 12.7     | 4.76–6.35 | 5.16 | 0.8–1.2 |

| Shape                                                                                                | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |  |
|------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|--|
|                                                                                                      |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |         |         |  |
|                                                                                                      |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8251 | GWR0101 | GWR5251 |  |
| <br>P<br>Roughing | DNMG150408-AR | 0.80-4.0   | 0.15-0.50      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |         |         |  |
|                                                                                                      | DNMG150412-AR | 1.20-4.0   | 0.15-0.65      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |         |         |  |
|                                                                                                      | DNMG150608-AR | 0.80-4.0   | 0.15-0.50      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |         |         |  |
|                                                                                                      | DNMG150612-AR | 1.20-4.0   | 0.15-0.65      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |         |         |  |
|                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |         |         |  |
|                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |         |         |  |
|                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |         |         |  |
|                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |         |         |  |
|                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |         |         |  |
|                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |         |         |  |

Note: ◆ Recommended grade ready to stock

55° DN□□ With Hole

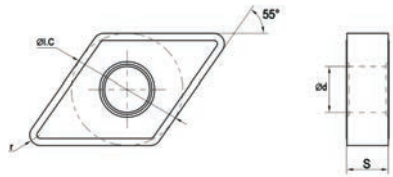


| Length | Size(mm) |           |      |         |
|--------|----------|-----------|------|---------|
|        | IC       | S         | d    | r       |
| 15     | 12.7     | 4.76–6.35 | 5.16 | 0.4–1.2 |

| Shape                                                                                                       | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |         |         |
|-------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                                             |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |         |         |         |         |
|                                                                                                             |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GWR0101 | GWR5201 | GWR5251 | GWR0281 |
| <br><br>M<br>Finishing | DNMG150404–BF | 0.25–2.90  | 0.05–0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |         |
|                                                                                                             | DNMG150408–BF | 0.50–2.90  | 0.10–0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |         |
|                                                                                                             | DNMG150412–BF | 0.75–2.90  | 0.15–0.45      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |         |
|                                                                                                             | DNMG150604–BF | 0.25–2.90  | 0.05–0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |         |
|                                                                                                             | DNMG150608–BF | 0.50–2.90  | 0.10–0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |         |
|                                                                                                             | DNMG150612–BF | 0.75–2.90  | 0.15–0.45      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock

**55° DN□□ With Hole**

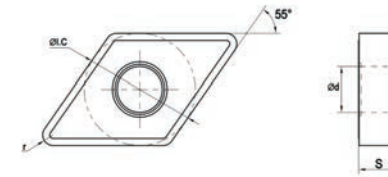


| Length | Size(mm) |           |      |         |
|--------|----------|-----------|------|---------|
|        | IC       | S         | d    | r       |
| 15     | 12.7     | 4.76-6.35 | 5.16 | 0.4-1.2 |

| Shape                                                                                                              | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |         |         |
|--------------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                                                    |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |         |         |         |         |
|                                                                                                                    |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GWR0101 | GWR5201 | GWR5251 | GWR0281 |
| <br><br>M<br>Semi-<br>finishing | DNMG150404-BM | 0.30-3.90  | 0.08-0.25      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |         |
|                                                                                                                    | DNMG150408-BM | 0.65-3.90  | 0.15-0.45      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |         |
|                                                                                                                    | DNMG150412-BM | 0.95-3.90  | 0.25-0.65      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |         |
|                                                                                                                    | DNMG150604-BM | 0.30-3.90  | 0.08-0.20      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |         |
|                                                                                                                    | DNMG150608-BM | 0.65-3.90  | 0.15-0.45      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |         |
|                                                                                                                    | DNMG150612-BM | 0.95-3.90  | 0.25-0.65      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock

**55° DN□□ With Hole**

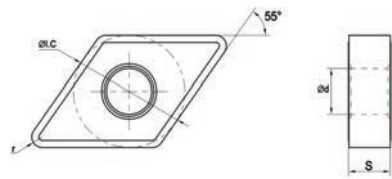


| Length | Size(mm) |           |      |         |
|--------|----------|-----------|------|---------|
|        | IC       | S         | d    | r       |
| 15     | 12.7     | 4.76-6.35 | 5.16 | 0.4-1.2 |

| Shape                                                                                                      | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |         |         |         |  |
|------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|--|
|                                                                                                            |               |            |                | CVD    |        |        |        | PVD    |        |        |        |         |         |         |  |
|                                                                                                            |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8281 | GWR0101 | GWR5251 | GWR5281 |  |
| <br><br>M<br>Roughing | DNMG150404-BR | 0.30-3.90  | 0.08-0.25      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |         | ◇       |         |  |
|                                                                                                            | DNMG150408-BR | 0.65-3.90  | 0.15-0.45      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |         | ◇       |         |  |
|                                                                                                            | DNMG150412-BR | 0.95-3.90  | 0.25-0.65      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |         | ◇       |         |  |
|                                                                                                            | DNMG150604-BR | 0.30-3.90  | 0.08-0.20      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |         | ◇       |         |  |
|                                                                                                            | DNMG150608-BR | 0.65-3.90  | 0.15-0.45      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |         | ◇       |         |  |
|                                                                                                            | DNMG150612-BR | 0.95-3.90  | 0.25-0.65      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |         | ◇       |         |  |
|                                                                                                            |               |            |                |        |        |        |        |        |        |        |        |         |         |         |  |
|                                                                                                            |               |            |                |        |        |        |        |        |        |        |        |         |         |         |  |
|                                                                                                            |               |            |                |        |        |        |        |        |        |        |        |         |         |         |  |

Note: ◆ Recommended grade ready to stock

**55° DN□□ With Hole**

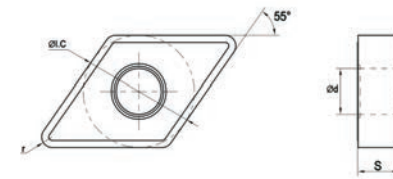


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 15     | 12.7     | 6.35 | 5.16 | 0.8–1.2 |

| Shape                                                                                                      | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |     |  |  |  |  |  |  |  |
|------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|-----|--|--|--|--|--|--|--|
|                                                                                                            |               |            |                | CVD    |        |        |        | PVD |  |  |  |  |  |  |  |
|                                                                                                            |               |            |                | GW0203 | GW0403 | GW3153 | GW4153 |     |  |  |  |  |  |  |  |
| <br>K<br>Semi-finishing | DNMG150404–CM | 0.40–3.90  | 0.08–0.25      |        |        | ◆      | ◇      |     |  |  |  |  |  |  |  |
|                                                                                                            | DNMG150408–CM | 0.80–3.90  | 0.15–0.45      |        |        | ◆      | ◇      |     |  |  |  |  |  |  |  |
|                                                                                                            | DNMG150412–CM | 1.20–3.90  | 0.25–0.65      |        |        | ◆      | ◇      |     |  |  |  |  |  |  |  |
|                                                                                                            | DNMG150604–CM | 0.40–3.90  | 0.08–0.20      |        |        | ◆      | ◇      |     |  |  |  |  |  |  |  |
|                                                                                                            | DNMG150608–CM | 0.80–3.90  | 0.15–0.45      |        |        | ◆      | ◇      |     |  |  |  |  |  |  |  |
|                                                                                                            | DNMG150612–CM | 1.20–3.90  | 0.25–0.65      |        |        | ◆      | ◇      |     |  |  |  |  |  |  |  |
|                                                                                                            |               |            |                |        |        |        |        |     |  |  |  |  |  |  |  |
|                                                                                                            |               |            |                |        |        |        |        |     |  |  |  |  |  |  |  |
|                                                                                                            |               |            |                |        |        |        |        |     |  |  |  |  |  |  |  |
|                                                                                                            |               |            |                |        |        |        |        |     |  |  |  |  |  |  |  |

Note: ◆ Recommended grade ready to stock

**55° DN□□ With Hole**



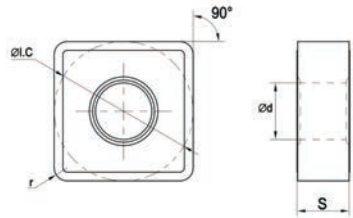
| Length | Size(mm) |           |      |         |
|--------|----------|-----------|------|---------|
|        | IC       | S         | d    | r       |
| 15     | 12.7     | 4.76–6.35 | 5.16 | 0.4–1.2 |

| Shape                                                                                                        | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |         |         |         |         |
|--------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                                              |               |            |                | CVD    |        |        |        | PVD    |        |        |        |         |         |         |         |
|                                                                                                              |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8251 | GW8281 | GWR0101 | GWR5201 | GWR5251 | GWR0301 |
| <br>S<br>Semi-finishing | DNMG150404–DM | 0.40–3.90  | 0.08–0.25      |        |        |        |        | ◇      |        |        | ◇      | ◇       |         | ◆       |         |
|                                                                                                              | DNMG150408–DM | 0.80–3.90  | 0.15–0.45      |        |        |        |        | ◇      |        |        | ◇      | ◇       |         | ◆       |         |
|                                                                                                              | DNMG150412–DM | 1.20–3.90  | 0.25–0.65      |        |        |        |        | ◇      |        |        | ◇      | ◇       |         | ◆       |         |
|                                                                                                              | DNMG150604–DM | 0.40–3.90  | 0.08–0.20      |        |        |        |        | ◇      |        |        | ◇      | ◇       |         | ◆       |         |
|                                                                                                              | DNMG150608–DM | 0.80–3.90  | 0.15–0.45      |        |        |        |        | ◇      |        |        | ◇      | ◇       |         | ◆       |         |
|                                                                                                              | DNMG150612–DM | 1.20–3.90  | 0.25–0.65      |        |        |        |        | ◇      |        |        | ◇      | ◇       |         | ◆       |         |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock



**90° SN□□ With Hole**

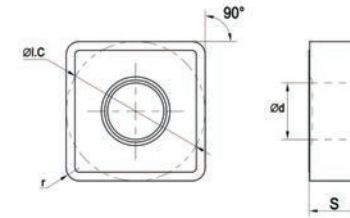


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 12     | 12.7     | 4.76 | 5.16 | 0.8-1.2 |
|        |          |      |      |         |

| Shape                                                                                                     | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |
|-----------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|                                                                                                           |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |         |         |
|                                                                                                           |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8251 | GWR0101 | GWR5251 |
| <br><br>P<br>Finishing | SNMG120404-AF | 0.26-3.2   | 0.05-0.15      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |         |         |
|                                                                                                           | SNMG120408-AF | 0.52-3.2   | 0.10-0.30      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |         |         |
|                                                                                                           | SNMG120412-AF | 0.78-3.2   | 0.15-0.45      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |         |         |
|                                                                                                           |               |            |                |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                           |               |            |                |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                           |               |            |                |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                           |               |            |                |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                           |               |            |                |        |        |        |        |        |        |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock  
◇

**90° SN□□ With Hole**

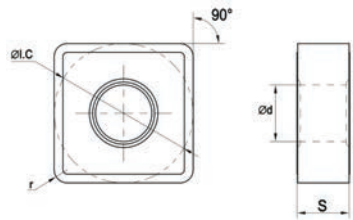


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 12     | 12.7     | 4.76 | 5.16 | 0.8-1.6 |
| 15     | 15.875   | 6.35 | 6.35 | 0.8-1.2 |

| Shape                                                                                                            | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |
|------------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                                                  |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |         |
|                                                                                                                  |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GWR0101 |
| <br><br>P<br>Semi-finishing | SNMG120404-AS | 1.00-5.00  | 0.12-0.40      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                                  | SNMG120408-AS | 1.20-5.00  | 0.15-0.55      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                                  | SNMG120412-AS | 1.50-5.00  | 0.20-0.55      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                                  | SNMG150612-AS | 2.00-7.00  | 0.30-0.65      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                                  |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                  |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                  |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                  |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                  |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                  |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |

Note: ◆ Recommended grade ready to stock  
◇

**90° SN□□ With Hole**

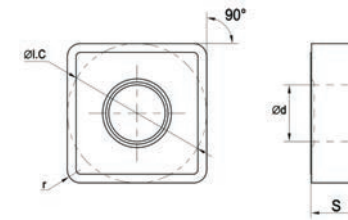


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 12     | 12.7     | 4.76 | 5.16 | 0.8–1.6 |
| 15     | 15.875   | 6.35 | 6.35 | 0.8–1.2 |
| 19     | 19.05    | 6.35 | 7.94 | 1.2–1.6 |

| Shape                                                                                                | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |
|------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                                      |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |         |
|                                                                                                      |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW80101 |
| <br>P<br>Roughing | SNMG120408-AR | 2.50–6.00  | 0.25–0.70      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                      | SNMG120412-AR | 2.50–6.00  | 0.30–0.70      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                      | SNMG120416-AR | 2.50–6.00  | 0.40–0.70      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                      | SNMG150612-AR | 2.15–6.40  | 0.25–0.50      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                      | SNMG190612-AR | 2.15–6.40  | 0.25–0.50      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                      | SNMG190616-AR | 2.85–7.60  | 0.30–0.65      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |

Note: ◆ Recommended grade ready to stock

**90° SN□□ With Hole**

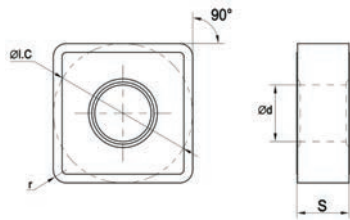


| Length | Size(mm) |           |      |         |
|--------|----------|-----------|------|---------|
|        | IC       | S         | d    | r       |
| 19     | 19.05    | 6.35      | 7.94 | 1.2–2.4 |
| 25     | 25.4     | 7.94–9.52 | 9.12 | 2.4–3.2 |

| Shape                                                                                                    | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |
|----------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                                          |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |         |
|                                                                                                          |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW80101 |
| <br>P<br>Heavy-load | SNMM190612-AR | 2.40–9.50  | 0.25–0.60      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                          | SNMM190616-AR | 3.20–9.50  | 0.35–0.80      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                          | SNMM190624-AR | 4.80–9.50  | 0.53–1.20      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                          | SNMM250724-AR | 4.80–12.70 | 0.53–1.20      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                          | SNMM250732-AR | 4.80–12.70 | 0.53–1.20      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                          | SNMM250924-AR | 4.35–12.70 | 0.53–1.20      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                          | SNMM250932-AR | 4.35–12.70 | 0.53–1.20      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                          |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |

Note: ◆ Recommended grade ready to stock

**90° SN□□ With Hole**

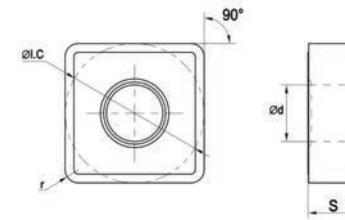


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 12     | 12.7     | 4.76 | 5.16 | 0.4-1.2 |
|        |          |      |      |         |

| Shape                                                                                                 | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |         |
|-------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|
|                                                                                                       |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |         |         |         |
|                                                                                                       |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GWR0101 | GWR5201 | GWR5251 |
| <br>M<br>Finishing | SNMG120404-BF | 0.25-3.20  | 0.05-0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |
|                                                                                                       | SNMG120408-BF | 0.50-3.20  | 0.10-0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |
|                                                                                                       | SNMG120412-BF | 0.75-3.20  | 0.15-0.45      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |

Note: ◆ Recommended grade ready to stock

**90° SN□□ With Hole**

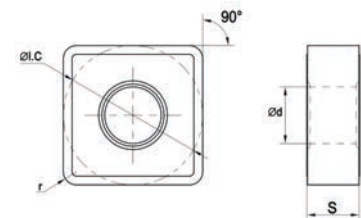


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 12     | 12.7     | 4.76 | 5.16 | 0.4-1.2 |
| 15     | 15.875   | 6.35 | 6.35 | 0.8-1.2 |

| Shape                                                                                                        | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |         |
|--------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|
|                                                                                                              |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |         |         |         |
|                                                                                                              |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GWR0101 | GWR5201 | GWR5251 |
| <br>M<br>Semi-finishing | SNMG120404-BM | 0.30-4.20  | 0.08-0.25      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |
|                                                                                                              | SNMG120408-BM | 0.65-4.20  | 0.15-0.45      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |
|                                                                                                              | SNMG120412-BM | 0.95-4.20  | 0.25-0.65      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |
|                                                                                                              | SNMG150608-BM | 0.65-5.20  | 0.15-0.45      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |
|                                                                                                              | SNMG150612-BM | 0.95-5.20  | 0.25-0.65      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |

Note: ◆ Recommended grade ready to stock

90° SN□□ With Hole

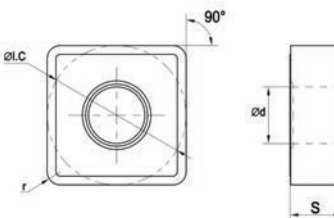


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 12     | 12.7     | 4.76 | 5.16 | 0.4-1.2 |
| 15     | 15.875   | 6.35 | 6.35 | 0.8-1.2 |

| Shape                                                                                                | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |         |         |
|------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|                                                                                                      |               |            |                | CVD    |        |        |        | PVD    |        |        |        |         |         |
|                                                                                                      |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8281 | GWR0101 | GWR5251 |
| <br>M<br>Roughing | SNMG120404-BR | 0.30-4.20  | 0.08-0.25      |        |        |        |        | ◆      | ◆      | ◆      | ◆      |         | ◆       |
|                                                                                                      | SNMG120408-BR | 0.65-4.20  | 0.15-0.45      |        |        |        |        | ◆      | ◆      | ◆      | ◆      |         | ◆       |
|                                                                                                      | SNMG120412-BR | 0.95-4.20  | 0.23-0.66      |        |        |        |        | ◆      | ◆      | ◆      | ◆      |         | ◆       |
|                                                                                                      | SNMG150608-BR | 0.65-5.20  | 0.15-0.44      |        |        |        |        | ◆      | ◆      | ◆      | ◆      |         | ◆       |
|                                                                                                      | SNMG150612-BR | 0.95-5.20  | 0.23-0.66      |        |        |        |        | ◆      | ◆      | ◆      | ◆      |         | ◆       |
|                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |         |         |
|                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |         |         |
|                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |         |         |
|                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |         |         |
|                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock

90° SN□□ With Hole



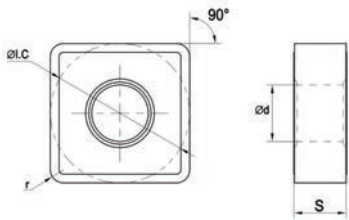
| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 12     | 12.7     | 4.76 | 5.16 | 0.4-1.6 |

| Shape                                                                                                        | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |     |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|-----|--|--|--|--|--|
|                                                                                                              |               |            |                | CVD    |        |        |        | PVD |  |  |  |  |  |
|                                                                                                              |               |            |                | GW0203 | GW0403 | GW3153 | GW4153 |     |  |  |  |  |  |
| <br>K<br>Semi-finishing | SNMG120404-CM | 0.40-4.20  | 0.08-0.25      |        |        | ◆      | ◆      |     |  |  |  |  |  |
|                                                                                                              | SNMG120408-CM | 0.80-4.20  | 0.15-0.45      |        |        | ◆      | ◆      |     |  |  |  |  |  |
|                                                                                                              | SNMG120412-CM | 1.20-4.20  | 0.25-0.65      |        |        | ◆      | ◆      |     |  |  |  |  |  |
|                                                                                                              |               |            |                |        |        |        |        |     |  |  |  |  |  |
|                                                                                                              |               |            |                |        |        |        |        |     |  |  |  |  |  |
|                                                                                                              |               |            |                |        |        |        |        |     |  |  |  |  |  |
|                                                                                                              |               |            |                |        |        |        |        |     |  |  |  |  |  |
|                                                                                                              |               |            |                |        |        |        |        |     |  |  |  |  |  |
|                                                                                                              |               |            |                |        |        |        |        |     |  |  |  |  |  |
|                                                                                                              |               |            |                |        |        |        |        |     |  |  |  |  |  |

Note: ◆ Recommended grade ready to stock



90° SN□□ With Hole

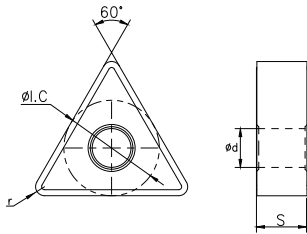


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 12     | 12.7     | 4.76 | 5.16 | 0.4-1.6 |
| 15     | 15.875   | 6.35 | 6.35 | 0.8-1.6 |

| Shape                                                                                                      | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |         |         |         |         |
|------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                                            |               |            |                | CVD    |        |        |        | PVD    |        |        |        |         |         |         |         |
|                                                                                                            |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8281 | GWR0101 | GWR5201 | GWR5251 | GWR0301 |
| <br>S<br>Semi-finishing | SNMG120404-DM | 0.40-3.90  | 0.08-0.25      |        |        |        |        | ◆      |        |        | ◆      | ◆       |         | ◆       |         |
|                                                                                                            | SNMG120408-DM | 0.80-3.90  | 0.15-0.45      |        |        |        |        | ◆      |        |        | ◆      | ◆       |         | ◆       |         |
|                                                                                                            | SNMG120412-DM | 1.20-3.90  | 0.25-0.65      |        |        |        |        | ◆      |        |        | ◆      | ◆       |         | ◆       |         |
|                                                                                                            | SNMG120416-DM | 1.80-3.90  | 0.30-0.90      |        |        |        |        | ◆      |        |        | ◆      | ◆       |         | ◆       |         |
|                                                                                                            | SNMG150608-DM | 0.80-3.90  | 0.15-0.45      |        |        |        |        | ◆      |        |        | ◆      | ◆       |         | ◆       |         |
|                                                                                                            | SNMG150612-DM | 1.20-3.90  | 0.25-0.65      |        |        |        |        | ◆      |        |        | ◆      | ◆       |         | ◆       |         |
|                                                                                                            | SNMG150616-DM | 1.80-3.90  | 0.30-0.90      |        |        |        |        | ◆      |        |        | ◆      | ◆       |         | ◆       |         |
|                                                                                                            |               |            |                |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock

60° TN□□ With Hole

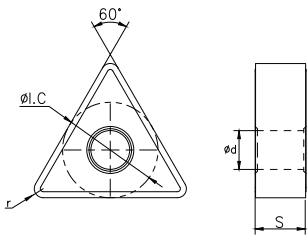


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 16     | 9.525    | 4.76 | 3.81 | 0.4-1.2 |

| Shape                                                                                                   | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |  |
|---------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|--|
|                                                                                                         |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |         |         |  |
|                                                                                                         |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8251 | GWR0101 | GWR5251 |  |
| <br>P<br>Finishing | TNMG160404-AF | 0.26-3.1   | 0.05-0.15      | ◆      | ◆      | ◆      |        | ◆      | ◆      |        |        |        |         |         |  |
|                                                                                                         | TNMG160408-AF | 0.52-3.1   | 0.10-0.30      | ◆      | ◆      | ◆      |        | ◆      | ◆      |        |        |        |         |         |  |
|                                                                                                         | TNMG160412-AF | 0.78-3.1   | 0.15-0.45      | ◆      | ◆      | ◆      |        | ◆      | ◆      |        |        |        |         |         |  |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |  |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |  |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |  |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |  |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |  |

Note: ◆ Recommended grade ready to stock

60° TN□□ With Hole

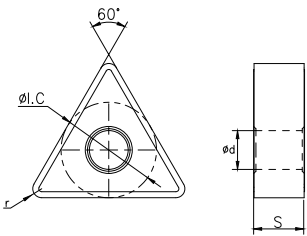


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 16     | 9.525    | 4.76 | 3.81 | 0.4-1.2 |
| 22     | 12.7     | 4.76 | 5.16 | 0.8-1.6 |

| Shape                                                                                                          | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |          |  |
|----------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|--|
|                                                                                                                |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |          |  |
|                                                                                                                |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW820101 |  |
| <br>P<br>Semi-<br>finishing | TNMG160404-AS | 0.60-5.80  | 0.10-0.30      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |          |  |
|                                                                                                                | TNMG160408-AS | 1.20-5.80  | 0.20-0.60      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |          |  |
|                                                                                                                | TNMG160412-AS | 1.80-5.80  | 0.30-0.90      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |          |  |
|                                                                                                                | TNMG220408-AS | 1.20-7.70  | 0.20-0.60      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |          |  |
|                                                                                                                | TNMG220412-AS | 1.80-7.70  | 0.30-0.90      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |          |  |
|                                                                                                                | TNMG220416-AS | 2.40-7.70  | 0.40-1.20      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |          |  |
|                                                                                                                |               |            |                |        |        |        |        |        |        |        |        |        |        |        |          |  |
|                                                                                                                |               |            |                |        |        |        |        |        |        |        |        |        |        |        |          |  |
|                                                                                                                |               |            |                |        |        |        |        |        |        |        |        |        |        |        |          |  |
|                                                                                                                |               |            |                |        |        |        |        |        |        |        |        |        |        |        |          |  |

Note:◆ Recommended grade ready to stock

60° TN□□ With Hole

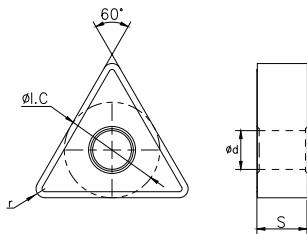


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 16     | 9.525    | 4.76 | 3.81 | 0.8-1.2 |
| 22     | 12.7     | 4.76 | 5.16 | 0.8-1.6 |

| Shape                                                                                                  | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |          |  |
|--------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|--|
|                                                                                                        |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |          |  |
|                                                                                                        |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW820101 |  |
| <br>P<br>Roughing | TNMG160408-AR | 2.00-5.00  | 0.25-0.65      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |          |  |
|                                                                                                        | TNMG220408-AR | 2.50-7.00  | 0.25-0.65      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |          |  |
|                                                                                                        | TNMG220412-AR | 2.50-7.00  | 0.25-0.65      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |          |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |        |        |        |          |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |        |        |        |          |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |        |        |        |          |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |        |        |        |          |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |        |        |        |          |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |        |        |        |          |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |        |        |        |          |  |

Note:◆ Recommended grade ready to stock

60° TN□□ With Hole

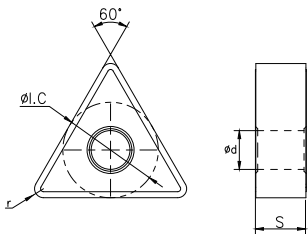


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 16     | 9.525    | 4.76 | 3.81 | 0.4-1.2 |
|        |          |      |      |         |

| Shape                                                                                                 | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |         |         |
|-------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                                       |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |         |         |         |         |
|                                                                                                       |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GWR0101 | GWR5201 | GWR5251 | GWR0281 |
| <br>M<br>Finishing | TNMG160404-BF | 0.25-3.10  | 0.05-0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |         |
|                                                                                                       | TNMG160408-BF | 0.50-3.10  | 0.10-0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |         |
|                                                                                                       | TNMG160412-BF | 0.75-3.10  | 0.10-0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |         |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock

60° TN□□ With Hole

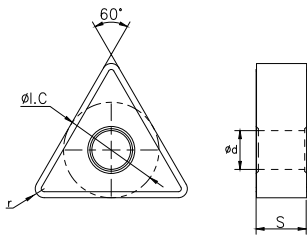


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 16     | 9.525    | 4.76 | 3.81 | 0.4-1.2 |
| 22     | 12.7     | 4.76 | 5.16 | 0.8-1.6 |

| Shape                                                                                                        | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |         |         |
|--------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                                              |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |         |         |         |         |
|                                                                                                              |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GWR0101 | GWR5201 | GWR5251 | GWR0281 |
| <br>M<br>Semi-finishing | TNMG160404-BM | 0.30-4.10  | 0.08-0.25      |        |        |        |        |        | ○      | ○      | ○      | ●      | ○       |         | ○       |         |
|                                                                                                              | TNMG160408-BM | 0.65-4.10  | 0.15-0.45      |        |        |        |        |        | ○      | ○      | ○      | ●      | ○       |         | ○       |         |
|                                                                                                              | TNMG160412-BM | 0.95-4.10  | 0.25-0.65      |        |        |        |        |        | ○      | ○      | ○      | ●      | ○       |         | ○       |         |
|                                                                                                              | TNMG220408-BM | 0.65-4.90  | 0.15-0.45      |        |        |        |        |        | ○      | ○      | ○      | ●      | ○       |         | ○       |         |
|                                                                                                              | TNMG220412-BM | 0.95-4.90  | 0.25-0.65      |        |        |        |        |        | ○      | ○      | ○      | ●      | ○       |         | ○       |         |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock

60° TN□□ With Hole

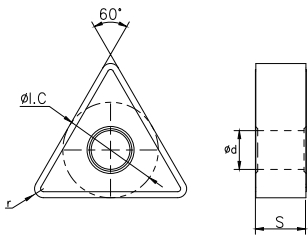


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 16     | 9.525    | 4.76 | 3.81 | 0.4-1.2 |
| 22     | 12.7     | 4.76 | 5.16 | 0.8-1.6 |

| Shape                                                                                                          | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |  |  |  |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--|--|--|--|--|--|--|--|
|                                                                                                                |               |            |                | CVD    |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                | GW0203 | GW0403 | GW3153 | GW4153 |  |  |  |  |  |  |  |  |
| <br>K<br>Semi-<br>finishing | TNMG160404-CM | 0.40-4.10  | 0.08-0.25      |        |        | ◆      | ◇      |  |  |  |  |  |  |  |  |
|                                                                                                                | TNMG160408-CM | 0.80-4.10  | 0.15-0.45      |        |        | ◆      | ◇      |  |  |  |  |  |  |  |  |
|                                                                                                                | TNMG160412-CM | 1.20-4.10  | 0.25-0.65      |        |        | ◆      | ◇      |  |  |  |  |  |  |  |  |
|                                                                                                                | TNMG220412-CM | 1.20-4.90  | 0.25-0.65      |        |        | ◆      | ◇      |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |

Note:◆ Recommended grade ready to stock

60° TN□□ With Hole

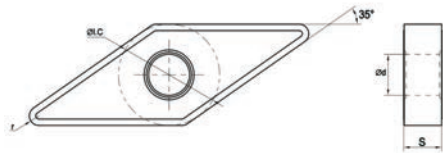


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 16     | 9.525    | 4.76 | 3.81 | 0.4-1.2 |
| 22     | 12.7     | 4.76 | 5.16 | 0.8-1.2 |

| Shape                                                                                                  | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |  |
|--------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
|                                                                                                        |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |        |        |  |
|                                                                                                        |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8281 | GW0101 | GW5251 | GW5281 |  |
| <br>M<br>Roughing | TNMG160404-BR | 0.30-4.10  | 0.08-0.25      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |        | ◇      |        |  |
|                                                                                                        | TNMG160408-BR | 0.65-4.10  | 0.15-0.45      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |        | ◇      |        |  |
|                                                                                                        | TNMG160412-BR | 0.95-4.10  | 0.25-0.65      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |        | ◇      |        |  |
|                                                                                                        | TNMG220408-BR | 0.65-4.90  | 0.15-0.45      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |        | ◇      |        |  |
|                                                                                                        | TNMG220412-BR | 0.95-4.90  | 0.25-0.65      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |        | ◇      |        |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |        |        |        |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |        |        |        |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |        |        |        |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |        |        |        |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |        |        |        |  |

Note:◆ Recommended grade ready to stock

35° VN□□ With Hole

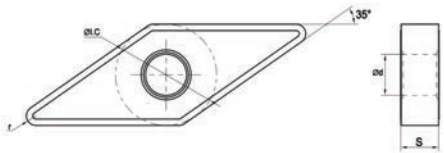


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 16     | 9.525    | 4.76 | 3.81 | 0.4-1.2 |
|        |          |      |      |         |

| Shape                                                                                                          | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |  |  |  |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--|--|--|--|--|--|--|--|
|                                                                                                                |               |            |                | CVD    |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                | GW0203 | GW0403 | GW3153 | GW4153 |  |  |  |  |  |  |  |  |
| <br><br>K<br>Semi-finishing | VNMG160404-CM | 0.40-3.30  | 0.08-0.25      |        |        | ◆      | ◇      |  |  |  |  |  |  |  |  |
|                                                                                                                | VNMG160408-CM | 0.80-3.30  | 0.15-0.45      |        |        | ◆      | ◇      |  |  |  |  |  |  |  |  |
|                                                                                                                | VNMG160412-CM | 1.20-3.30  | 0.25-0.65      |        |        | ◆      | ◇      |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |
|                                                                                                                |               |            |                |        |        |        |        |  |  |  |  |  |  |  |  |

Note:◆Recommended grade ready to stock

35° VN□□ With Hole



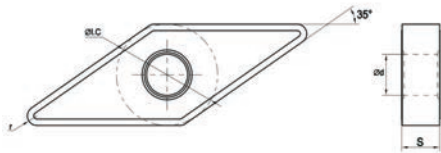
| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 16     | 9.525    | 4.76 | 3.81 | 0.4-1.2 |
|        |          |      |      |         |

| Shape                                                                                                       | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |
|-------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                                             |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |         |
|                                                                                                             |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW80101 |
| <br><br>P<br>Finishing | VNMG160404-AF | 0.26-2.1   | 0.05-0.15      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                             | VNMG160408-AF | 0.52-2.1   | 0.10-0.30      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                             | VNMG160412-AF | 0.78-2.1   | 0.15-0.45      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |

Note:◆Recommended grade ready to stock



35° VN□□ With Hole

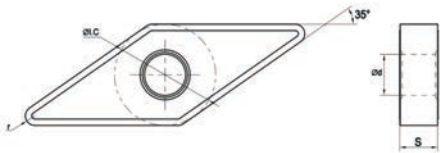


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 11     | 6.35     | 4.76 | 2.26 | 0.4-0.8 |
| 16     | 9.525    | 4.76 | 3.81 | 0.4-0.8 |

| Shape                                                                                                          | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |        |
|----------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                                                |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |        |
|                                                                                                                |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW8101 |
| <br><br>P<br>Semi-finishing | VNMG110404-AS | 0.80-2.50  | 0.15-0.36      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                                | VNMG110408-AS | 1.00-2.50  | 0.17-0.36      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                                | VNMG160404-AS | 0.80-3.00  | 0.15-0.36      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                                | VNMG160408-AS | 1.00-2.50  | 0.17-0.36      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |        |
|                                                                                                                |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note:◆Recommended grade ready to stock

35° VN□□ With Hole

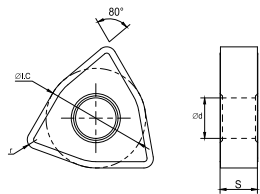


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 16     | 9.525    | 4.76 | 3.81 | 0.4-1.2 |
|        |          |      |      |         |

| Shape                                                                                                       | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |         |         |  |
|-------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|--|
|                                                                                                             |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |         |         |         |         |  |
|                                                                                                             |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW80101 | GW85201 | GW85251 | GW80281 |  |
| <br><br>M<br>Finishing | VNMG160404-BF | 0.25-3.30  | 0.05-0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |         |  |
|                                                                                                             | VNMG160408-BF | 0.55-3.30  | 0.10-0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |         |  |
|                                                                                                             | VNMG160412-BF | 0.75-3.30  | 0.15-0.45      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |         |  |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |  |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |  |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |  |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |  |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |  |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |  |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |  |

Note:◆Recommended grade ready to stock

80° WN□□ With Hole

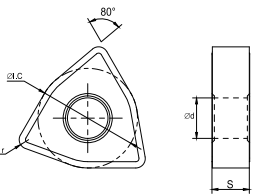


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 8      | 12.7     | 4.76 | 5.16 | 0.4-1.2 |
|        |          |      |      |         |

| Shape                                                                                                     | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |  |
|-----------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|--|
|                                                                                                           |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |         |  |
|                                                                                                           |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW80101 |  |
| <br><br>P<br>Finishing | WNMG080404-AF | 0.26-2.2   | 0.05-0.15      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |  |
|                                                                                                           | WNMG080408-AF | 0.52-2.2   | 0.10-0.30      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |  |
|                                                                                                           | WNMG080412-AF | 0.78-2.2   | 0.15-0.45      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |  |
|                                                                                                           |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |  |
|                                                                                                           |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |  |
|                                                                                                           |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |  |
|                                                                                                           |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |  |
|                                                                                                           |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |  |
|                                                                                                           |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |  |
|                                                                                                           |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |  |

Note:◆ Recommended grade ready to stock

80° WN□□ With Hole

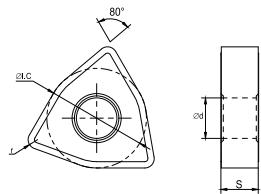


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 8      | 12.7     | 4.76 | 5.16 | 0.4-1.6 |
|        |          |      |      |         |

| Shape                                                                                                            | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |  |
|------------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|--|
|                                                                                                                  |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |         |  |
|                                                                                                                  |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW80101 |  |
| <br><br>P<br>Semi-finishing | WNMG080404-AS | 0.60-4.30  | 0.10-0.30      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |  |
|                                                                                                                  | WNMG080408-AS | 1.20-4.30  | 0.20-0.60      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |  |
|                                                                                                                  | WNMG080412-AS | 1.80-4.30  | 0.30-0.90      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |  |
|                                                                                                                  | WNMG080416-AS | 2.40-4.30  | 0.40-1.20      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |        |        |        |         |  |
|                                                                                                                  |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |  |
|                                                                                                                  |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |  |
|                                                                                                                  |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |  |
|                                                                                                                  |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |  |
|                                                                                                                  |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |  |
|                                                                                                                  |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |  |

Note:◆ Recommended grade ready to stock

80° WN□□ With Hole

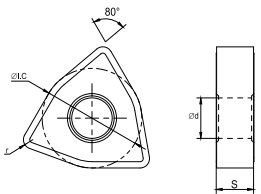


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 6      | 9.525    | 4.76 | 3.81 | 0.8-1.2 |
| 8      | 12.7     | 4.76 | 5.16 | 0.8-1.2 |

| Shape                                                                                               | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |
|-----------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                                     |               |            |                | CVD    |        |        |        |        |        |        | PVD    |        |        |        |         |
|                                                                                                     |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GWR0101 |
| <br>P<br>Turning | WNMG060408-AR | 0.80-4.00  | 0.15-0.50      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                     | WNMG060412-AR | 0.80-4.00  | 0.15-0.50      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                     | WNMG080408-AR | 0.80-4.50  | 0.15-0.55      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                     | WNMG080412-AR | 0.80-4.50  | 0.20-0.55      |        |        | ◆      | ◇      |        |        |        |        |        |        |        |         |
|                                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |

Note:◆ Recommended grade ready to stock

80° WN□□ With Hole

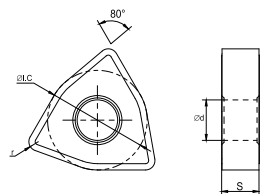


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 6      | 9.525    | 4.76 | 3.81 | 0.4-0.8 |
| 8      | 12.7     | 4.76 | 5.16 | 0.4-1.6 |

| Shape                                                                                                   | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |         |
|---------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|
|                                                                                                         |               |            |                | CVD    |        |        |        |        |        |        | PVD    |        |         |         |         |
|                                                                                                         |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GWR0101 | GWR5201 | GWR5251 |
| <br>M<br>Finishing | WNMG060404-BF | 0.25-2.40  | 0.05-0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |
|                                                                                                         | WNMG060408-BF | 0.50-2.40  | 0.10-0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |
|                                                                                                         | WNMG080404-BF | 0.25-3.20  | 0.05-0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |
|                                                                                                         | WNMG080408-BF | 0.50-3.20  | 0.10-0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |
|                                                                                                         | WNMG080412-BF | 0.75-3.20  | 0.15-0.45      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |
|                                                                                                         | WNMG080416-BF | 1.05-3.20  | 0.20-0.60      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       |         | ◇       |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |

Note:◆ Recommended grade ready to stock

80° WN□□ With Hole

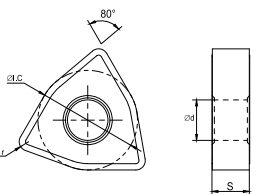


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 6      | 9.525    | 4.76 | 3.81 | 0.4-0.8 |
| 8      | 12.7     | 4.76 | 5.16 | 0.4-1.6 |

| Shape                                                                                                          | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |         |         |
|----------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                                                |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |         |         |         |         |
|                                                                                                                |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GWR0101 | GWR5201 | GWR5251 | GWR0301 |
| <br>M<br>Semi-<br>finishing | WNMG060404-BM | 0.30-2.10  | 0.10-0.30      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |         |
|                                                                                                                | WNMG060408-BM | 0.65-2.10  | 0.15-0.45      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |         |
|                                                                                                                | WNMG080404-BM | 0.30-2.90  | 0.10-0.30      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |         |
|                                                                                                                | WNMG080408-BM | 0.65-2.90  | 0.15-0.45      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |         |
|                                                                                                                | WNMG080412-BM | 0.95-2.90  | 0.20-0.60      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |         |
|                                                                                                                | WNMG080416-BM | 1.25-2.90  | 0.25-0.75      |        |        |        |        |        | ◇      | ◇      | ◇      | ◆      | ◇       |         | ◇       |         |
|                                                                                                                |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                                |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                                |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                                |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock

80° WN□□ With Hole

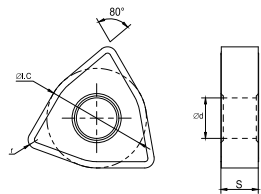


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 6      | 9.525    | 4.76 | 3.81 | 0.4-0.8 |
| 8      | 12.7     | 4.76 | 5.16 | 0.4-1.6 |

| Shape                                                                                                  | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |         |         |         |  |
|--------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|--|
|                                                                                                        |               |            |                | CVD    |        |        |        | PVD    |        |        |        |         |         |         |  |
|                                                                                                        |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8281 | GWR0101 | GWR5251 | GWR0301 |  |
| <br>M<br>Roughing | WNMG060404-BR | 0.30-2.10  | 0.10-0.30      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |         | ◇       |         |  |
|                                                                                                        | WNMG060408-BR | 0.65-2.10  | 0.15-0.45      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |         | ◇       |         |  |
|                                                                                                        | WNMG080404-BR | 0.30-2.90  | 0.10-0.30      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |         | ◇       |         |  |
|                                                                                                        | WNMG080408-BR | 0.65-2.90  | 0.15-0.45      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |         | ◇       |         |  |
|                                                                                                        | WNMG080412-BR | 0.95-2.90  | 0.20-0.60      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |         | ◇       |         |  |
|                                                                                                        | WNMG080416-BR | 1.25-2.90  | 0.25-0.75      |        |        |        |        | ◇      | ◇      | ◇      | ◆      |         | ◇       |         |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |         |         |         |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |         |         |         |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |         |         |         |  |
|                                                                                                        |               |            |                |        |        |        |        |        |        |        |        |         |         |         |  |

Note: ◆ Recommended grade ready to stock

80° WN□□ With Hole

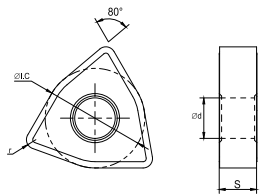


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 8      | 12.7     | 4.76 | 5.16 | 0.4-1.6 |
|        |          |      |      |         |

| Shape                                                                                                      | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |  |  |  |  |  |  |
|------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--|--|--|--|--|--|
|                                                                                                            |               |            |                | CVD    |        |        |        |  |  |  |  |  |  |
|                                                                                                            |               |            |                | GW0203 | GW0403 | GW3153 | GW4153 |  |  |  |  |  |  |
| <br>K<br>Semi-finishing | WNMG080404-CM | 0.08-0.25  | 0.40-2.90      |        |        | ◆      | ◆      |  |  |  |  |  |  |
|                                                                                                            | WNMG080408-CM | 0.15-0.45  | 0.80-2.90      |        |        | ◆      | ◆      |  |  |  |  |  |  |
|                                                                                                            | WNMG080412-CM | 0.25-0.66  | 1.20-2.90      |        |        | ◆      | ◆      |  |  |  |  |  |  |
|                                                                                                            |               |            |                |        |        |        |        |  |  |  |  |  |  |
|                                                                                                            |               |            |                |        |        |        |        |  |  |  |  |  |  |
|                                                                                                            |               |            |                |        |        |        |        |  |  |  |  |  |  |
|                                                                                                            |               |            |                |        |        |        |        |  |  |  |  |  |  |
|                                                                                                            |               |            |                |        |        |        |        |  |  |  |  |  |  |
|                                                                                                            |               |            |                |        |        |        |        |  |  |  |  |  |  |
|                                                                                                            |               |            |                |        |        |        |        |  |  |  |  |  |  |

Note: ◆ Recommended grade ready to stock

80° WN□□ With Hole



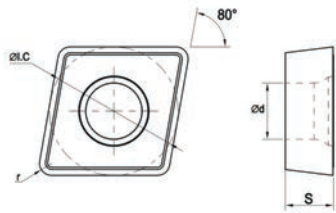
| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 8      | 12.7     | 4.76 | 5.16 | 0.4-1.6 |
|        |          |      |      |         |

| Shape                                                                                                        | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |
|--------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                                              |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |        |
|                                                                                                              |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8281 | GW0101 | GW0101 |
| <br>S<br>Semi-finishing | WNMG080404-DM | 0.40-4.30  | 0.08-0.25      |        |        |        |        | ◇      |        |        | ◇      | ◇      | ◆      |
|                                                                                                              | WNMG080408-DM | 0.80-4.30  | 0.15-0.45      |        |        |        |        | ◇      |        |        | ◇      | ◇      | ◆      |
|                                                                                                              | WNMG080412-DM | 1.20-4.30  | 0.25-0.66      |        |        |        |        | ◇      |        |        | ◇      | ◇      | ◆      |
|                                                                                                              | WNMG080416-DM | 1.60-4.30  | 0.30-0.90      |        |        |        |        | ◇      |        |        | ◇      | ◇      | ◆      |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |        |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |        |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |        |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |        |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |        |
|                                                                                                              |               |            |                |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock



**80° CC□□ With Hole**

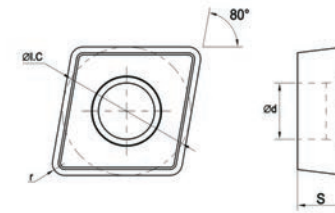


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 6      | 3.65     | 2.38 | 2.8  | 0.4-0.8 |
| 9      | 9.525    | 3.97 | 4.4  | 0.4-0.8 |
| 12     | 12.7     | 4.76 | 5.56 | 0.4-1.2 |

| Shape                                                                               | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |  |
|-------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|--|
|                                                                                     |               |            |                | CVD    |        |        |        |        | PVD    |        |        |        |         |         |  |
|                                                                                     |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW3354 | GW0251 | GW5251 | GW8251 | GW8281 | GW80101 | GW85251 |  |
|  | CCMT060204-GM | 0.40-2.10  | 0.05-0.18      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |  |
|                                                                                     | CCMT060208-GM | 0.80-2.10  | 0.10-0.35      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |  |
|                                                                                     | CCMT09T304-GM | 0.40-3.80  | 0.05-0.18      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |  |
|                                                                                     | CCMT09T308-GM | 0.80-3.20  | 0.10-0.35      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |  |
|                                                                                     | CCMT120404-GM | 0.40-4.30  | 0.05-0.18      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |  |
|                                                                                     | CCMT120408-GM | 0.80-4.30  | 0.10-0.35      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |  |
|                                                                                     | CCMT120412-GM | 1.20-4.30  | 0.15-0.55      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |  |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |         |         |  |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |         |         |  |

Note: ◆ Recommended grade ready to stock

**80° CC□□ With Hole**

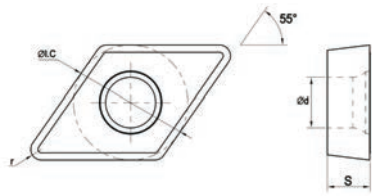


| Length | Size(mm) |      |     |         |
|--------|----------|------|-----|---------|
|        | IC       | S    | d   | r       |
| 6      | 3.65     | 2.38 | 2.8 | 0.4-0.8 |
| 9      | 9.525    | 3.97 | 4.4 | 0.4-0.8 |
|        |          |      |     |         |

| Shape                                                                                                       | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |         |         |  |
|-------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|--|
|                                                                                                             |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |         |         |         |         |  |
|                                                                                                             |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GWR0101 | GWR5201 | GWR5251 | GWR0281 |  |
| <br><br>M<br>Finishing | CCMT060204–GF | 0.30–1.60  | 0.05–0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |  |
|                                                                                                             | CCMT060208–GF | 0.60–1.60  | 0.10–0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |  |
|                                                                                                             | CCMT09T304–GF | 0.30–2.20  | 0.05–0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |  |
|                                                                                                             | CCMT09T308–GF | 0.60–2.40  | 0.10–0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |  |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |  |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |  |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |  |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |  |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |  |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |  |

Note: ◆ Recommended grade ready to stock

**55° DC□□ With Hole**

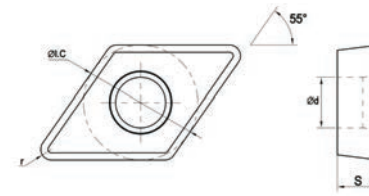


| Length | Size(mm) |      |     |         |
|--------|----------|------|-----|---------|
|        | IC       | S    | d   | r       |
| 7      | 6.35     | 2.38 | 2.8 | 0.4-0.8 |
| 11     | 9.525    | 3.97 | 4.4 | 0.4-1.2 |

| Shape                                                                               | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |         |
|-------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                     |               |            |                | CVD    |        |        |        |        | PVD    |        |        |        |        |         |
|                                                                                     |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW3354 | GW0251 | GW5251 | GW8251 | GW8281 | GW0101 | GW05251 |
|  | DCMT070204-GM | 0.40-2.30  | 0.05-0.20      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |        | ◇       |
|                                                                                     | DCMT070208-GM | 0.80-2.30  | 0.10-0.35      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |        | ◇       |
|                                                                                     | DCMT11T304-GM | 0.40-3.50  | 0.05-0.20      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |        | ◇       |
|                                                                                     | DCMT11T308-GM | 0.80-3.50  | 0.20-0.35      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |        | ◇       |
|                                                                                     | DCMT11T312-GM | 1.20-3.50  | 0.25-0.55      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |        | ◇       |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |         |

Note: ◆ Recommended grade ready to stock

**55° DC□□ With Hole**

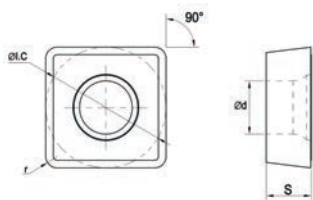


| Length | Size(mm) |      |     |         |
|--------|----------|------|-----|---------|
|        | IC       | S    | d   | r       |
| 7      | 6.35     | 2.38 | 2.8 | 0.4-0.8 |
| 11     | 9.525    | 3.97 | 4.4 | 0.4-1.2 |

| Shape                                                                                                       | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |        |        |
|-------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                                             |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |        |        |        |        |
|                                                                                                             |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GW0101 | GW5201 | GW5251 | GW0281 |
| <br><br>M<br>Finishing | DCMT070204-GF | 0.30-1.50  | 0.05-0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |
|                                                                                                             | DCMT070208-GF | 0.60-1.50  | 0.05-0.20      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |
|                                                                                                             | DCMT11T304-GF | 0.30-2.30  | 0.02-0.10      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |
|                                                                                                             | DCMT11T308-GF | 0.60-2.30  | 0.05-0.26      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |
|                                                                                                             | DCMT11T312-GF | 0.90-2.30  | 0.20-0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇      | ◇      |        |        |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

90° SC□□ With Hole

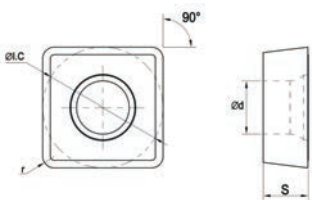


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 9      | 9.525    | 3.97 | 4.4  | 0.4-0.8 |
| 12     | 12.7     | 4.76 | 5.56 | 0.4-1.2 |
|        |          |      |      |         |

| Shape                                                                                                                | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |
|----------------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                                                      |               |            |                | CVD    |        |        |        |        | PVD    |        |        |        |        |        |
|                                                                                                                      |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW3354 | GW0251 | GW5251 | GW8251 | GW8281 | GW0101 | GW5251 |
| <br>General<br>Semi-<br>finishing | SCMT09T304-GM | 0.40-3.10  | 0.05-0.20      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |        | ◇      |
|                                                                                                                      | SCMT09T308-GM | 0.80-3.10  | 0.10-0.35      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |        | ◇      |
|                                                                                                                      | SCMT120404-GM | 0.40-4.20  | 0.05-0.20      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |        | ◇      |
|                                                                                                                      | SCMT120408-GM | 0.80-4.20  | 0.10-0.30      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |        | ◇      |
|                                                                                                                      | SCMT120412-GM | 1.20-4.20  | 0.15-0.55      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |        | ◇      |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

90° SC□□ With Hole

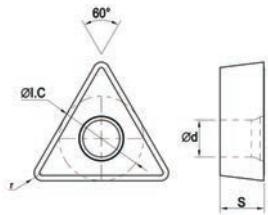


| Length | Size(mm) |      |     |         |
|--------|----------|------|-----|---------|
|        | IC       | S    | d   | r       |
| 9      | 9.525    | 3.97 | 4.4 | 0.4-0.8 |
|        |          |      |     |         |
|        |          |      |     |         |

| Shape                                                                                                   | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |         |         |
|---------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                                         |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |         |         |         |         |
|                                                                                                         |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GWR0101 | GWR5201 | GWR5251 | GWR0281 |
| <br>M<br>Finishing | SCMT09T304-GF | 0.30-2.40  | 0.05-0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                         | SCMT09T308-GF | 0.60-2.40  | 0.10-0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                         |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock

**60° TC□□ With Hole**

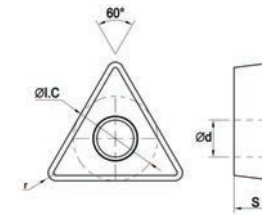


| Length | Size(mm) |      |     |         |
|--------|----------|------|-----|---------|
|        | IC       | S    | d   | r       |
| 9      | 5.56     | 2.38 | 2.2 | 0.4-0.8 |
| 11     | 6.35     | 2.38 | 2.8 | 0.4-1.2 |
| 16     | 9.525    | 3.97 | 4.4 | 0.4-1.2 |

| Shape                                                                                                                    | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |
|--------------------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|                                                                                                                          |               |            |                | CVD    |        |        |        |        | PVD    |        |        |        |         |         |
|                                                                                                                          |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW3354 | GW0251 | GW5251 | GW8251 | GW8281 | GW80101 | GW85251 |
| <br><br>General<br>Semi-<br>finishing | TCMT090204-GM | 0.40-2.90  | 0.05-0.20      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |
|                                                                                                                          | TCMT090208-GM | 0.80-2.90  | 0.10-0.35      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |
|                                                                                                                          | TCMT110204-GM | 0.40-3.30  | 0.05-0.20      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |
|                                                                                                                          | TCMT110208-GM | 0.80-3.30  | 0.10-0.35      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |
|                                                                                                                          | TCMT110212-GM | 1.20-3.30  | 0.15-0.55      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |
|                                                                                                                          | TCMT16T304-GM | 0.40-4.90  | 0.05-0.20      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |
|                                                                                                                          | TCMT16T308-GM | 0.80-4.90  | 0.10-0.35      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |
|                                                                                                                          | TCMT16T312-GM | 1.20-4.90  | 0.15-0.55      | ◆      | ◇      | ◆      |        | ◇      | ◇      |        | ◆      | ◇      |         | ◇       |
|                                                                                                                          |               |            |                |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                          |               |            |                |        |        |        |        |        |        |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock

**60° TC□□ With Hole**

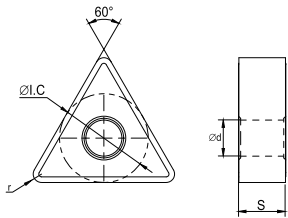


| Length | Size(mm) |      |     |         |
|--------|----------|------|-----|---------|
|        | IC       | S    | d   | r       |
| 9      | 5.56     | 2.38 | 2.2 | 0.4-0.8 |
| 11     | 6.35     | 2.38 | 2.8 | 0.4-1.2 |
| 16     | 9.525    | 3.97 | 4.4 | 0.4-1.2 |

| Shape                                                                                                       | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |         |         |
|-------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                                             |               |            |                | CVD    |        |        |        | PVD    |        |        |        |        |         |         |         |         |
|                                                                                                             |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW0251 | GW5251 | GW8241 | GW8251 | GW8281 | GWR0101 | GWR5201 | GWR5251 | GWR0281 |
| <br><br>M<br>Finishing | TCMT090204-GF | 0.30-1.80  | 0.05-0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                             | TCMT090208-GF | 0.60-2.20  | 0.10-0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                             | TCMT110204-GF | 0.30-2.20  | 0.05-0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                             | TCMT110208-GF | 0.60-3.30  | 0.10-0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                             | TCMT110212-GF | 1.20-3.30  | 0.20-0.40      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                             | TCMT16T304-GF | 0.30-3.30  | 0.05-0.15      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                             | TCMT16T308-GF | 0.60-3.30  | 0.10-0.30      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                             | TCMT16T312-GF | 1.20-3.30  | 0.10-0.40      |        |        |        |        |        | ◆      | ◇      | ◆      |        | ◇       | ◇       |         |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                                             |               |            |                |        |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock

**60° TN□□ With Hole**

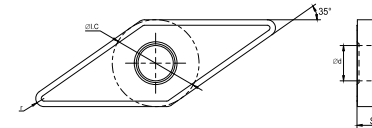


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 16     | 9.525    | 4.76 | 3.81 | 0.1-0.4 |
|        |          |      |      |         |
|        |          |      |      |         |

| Shape                                                                                                              | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |
|--------------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                                                    |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |         |
|                                                                                                                    |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0051 | GW0201 | GW5051 | GW8251 | GW5251 | GW50101 |
| <br>Small<br>Parts<br>Machining | TNGG160401-FS | 0.4-1.5    | 0.02-0.06      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                    | TNGG160402-FS | 0.6-2.0    | 0.04-0.08      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                    | TNGG160404-FS | 0.8-2.5    | 0.06-0.10      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |

Note: ◆ Recommended grade ready to stock

**35° VN□□ With Hole**



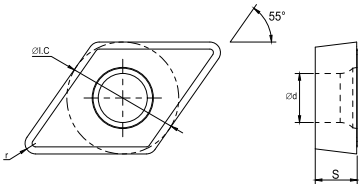
| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 11     | 6.35     | 4.76 | 3.81 | 0.2-0.8 |
|        |          |      |      |         |
|        |          |      |      |         |

| Shape                                                                                                                | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |
|----------------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                                                      |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |         |
|                                                                                                                      |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0051 | GW0201 | GW5051 | GW8251 | GW5251 | GW50101 |
| <br>Small<br>Parts<br>Machining | VNGG160402-FS | 0.4-2.0    | 0.02-0.06      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                      | VNGG160404-FS | 0.8-2.5    | 0.04-0.08      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                      | VNGG160408-FS | 1.0-3.0    | 0.06-0.12      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |

Note: ◆ Recommended grade ready to stock

GW  
CUTTING TOOLS  
FOR SMALL-PARTS

55° DC□□ With Hole



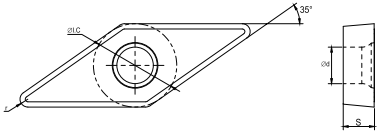
| Length | Size(mm) |      |     |         |
|--------|----------|------|-----|---------|
|        | IC       | S    | d   | r       |
| 11     | 9.525    | 3.97 | 4.4 | 0.1-0.8 |
|        |          |      |     |         |
|        |          |      |     |         |

| Shape                                                                                                                | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |
|----------------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                                                      |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |         |
|                                                                                                                      |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0051 | GW0201 | GW5051 | GW8251 | GW5251 | GW50101 |
| <br>Small<br>Parts<br>Machining | DCGT11T301-FS | 0.10-1.50  | 0.02-0.06      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                      | DCGT11T302-FS | 0.20-2.00  | 0.05-0.12      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                      | DCGT11T304-FS | 0.20-2.50  | 0.08-0.25      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                      | DCGT11T308-FS | 0.30-3.00  | 0.10-0.30      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |        |         |

Note: ◆ Recommended grade ready to stock



35° VB□□ With Hole

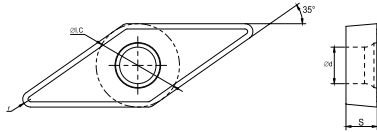


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 11     | 6.35     | 3.18 | 2.81 | 0.1-0.4 |
|        |          |      |      |         |
|        |          |      |      |         |

| Shape                                                                                                              | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |         |         |
|--------------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|                                                                                                                    |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |         |         |
|                                                                                                                    |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0051 | GW0201 | GW5051 | GW8251 | GWR5251 | GWR0101 |
| <br>Small<br>Parts<br>Machining | VBGT110301-FS | 0.1-1.5    | 0.02-0.06      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                    | VBGT110302-FS | 0.2-2.0    | 0.05-0.12      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                    | VBGT110304-FS | 0.2-2.5    | 0.08-0.25      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock

35° VC□□ With Hole

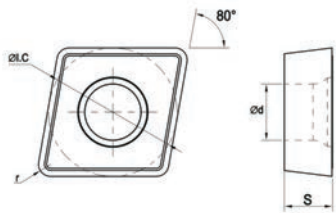


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 11     | 6.35     | 3.18 | 2.81 | 0.1-0.4 |
|        |          |      |      |         |
|        |          |      |      |         |

| Shape                                                                                                                | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |         |         |
|----------------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|                                                                                                                      |               |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |         |         |
|                                                                                                                      |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0051 | GW0201 | GW5051 | GW8251 | GWR5251 | GWR0101 |
| <br>Small<br>Parts<br>Machining | VCGT110301-FS | 0.1-1.5    | 0.02-0.06      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                      | VCGT110302-FS | 0.2-2.0    | 0.05-0.12      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                      | VCGT110304-FS | 0.2-2.5    | 0.08-0.25      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                      |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock

80° CC□□ With Hole

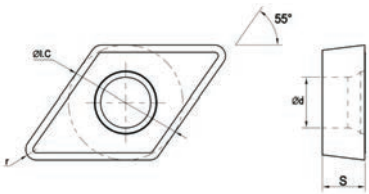


| Length | Size(mm) |      |     |     |
|--------|----------|------|-----|-----|
|        | IC       | S    | d   | r   |
| 9      | 9.525    | 3.97 | 4.4 | 0.1 |
| 9      | 9.525    | 3.97 | 4.4 | 0.2 |
| 9      | 9.525    | 3.97 | 4.4 | 0.4 |

| Shape                                                                                                              | Type             | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |         |         |
|--------------------------------------------------------------------------------------------------------------------|------------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|                                                                                                                    |                  |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |         |         |
|                                                                                                                    |                  |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0051 | GW0201 | GW5051 | GW8251 | GWR5251 | GWR0101 |
| <br>Small<br>Parts<br>Machining | CCGT09T301R/L-UF | 0.1-1.5    | 0.05-0.15      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                    | CCGT09T302R/L-UF | 0.2-2      | 0.05-0.2       |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                    | CCGT09T304R/L-UF | 0.4-2.5    | 0.05-0.25      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                    |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock

55° DC□□ With Hole

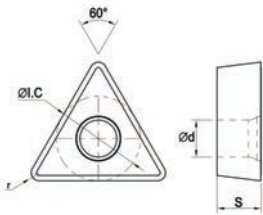


| Length | Size(mm) |      |     |          |
|--------|----------|------|-----|----------|
|        | IC       | S    | d   | r        |
| 7      | 6.35     | 2.38 | 2.8 | 0.05-0.2 |
| 11     | 9.525    | 3.97 | 4.4 | 0.1-0.2  |
|        |          |      |     |          |

| Shape                                                                                                                | Type              | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |         |         |
|----------------------------------------------------------------------------------------------------------------------|-------------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|                                                                                                                      |                   |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |         |         |
|                                                                                                                      |                   |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0051 | GW0201 | GW5051 | GW8251 | GWR5251 | GWR0101 |
| <br>Small<br>Parts<br>Machining | DCGT0702005R/L-UF | 0.1-1      | 0-0.1          |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                      | DCGT070201R/L-UF  | 0.1-1.5    | 0.05-0.15      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                      | DCGT070202R/L-UF  | 0.2-2      | 0.05-0.2       |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                      | DCGT11T301R/F-UF  | 0.1-1.5    | 0.05-0.15      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                      | DCGT11T302R/F-UF  | 0.2-2      | 0.05-0.2       |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                      |                   |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                      |                   |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                      |                   |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                      |                   |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                      |                   |            |                |        |        |        |        |        |        |        |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock

60° TC□□ With Hole

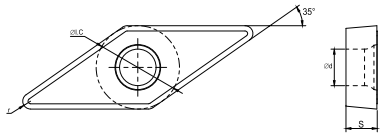


| Length | Size(mm) |      |     |         |
|--------|----------|------|-----|---------|
|        | IC       | S    | d   | r       |
| 11     | 6.35     | 3.18 | 2.8 | 0.1-0.2 |
|        |          |      |     |         |
|        |          |      |     |         |

| Shape                                                                                                              | Type             | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |         |         |
|--------------------------------------------------------------------------------------------------------------------|------------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|                                                                                                                    |                  |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |         |         |
|                                                                                                                    |                  |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0051 | GW0201 | GW5051 | GW8251 | GWR5251 | GWR0101 |
| <br>Small<br>Parts<br>Machining | TCGT110301R/L-UF | 0.1-1.5    | 0.05-0.15      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                    | TCGT110302R/L-UF | 0.2-2      | 0.05-0.2       |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                    |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock

35° VC□□ With Hole

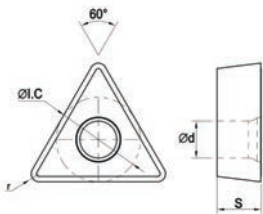


| Length | Size(mm) |      |     |         |
|--------|----------|------|-----|---------|
|        | IC       | S    | d   | r       |
| 8      | 4.76     | 2.38 | 2.3 | 0.1-0.2 |
| 11     | 6.35     | 3.18 | 2.8 | 0.1-0.2 |
|        |          |      |     |         |
|        |          |      |     |         |

| Shape                                                                                                                | Type             | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |         |         |
|----------------------------------------------------------------------------------------------------------------------|------------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|                                                                                                                      |                  |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |         |         |
|                                                                                                                      |                  |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0051 | GW0201 | GW5051 | GW8251 | GWR5251 | GWR0101 |
| <br>Small<br>Parts<br>Machining | VCGT080201R/L-UF | 0.1-1.5    | 0.05-0.15      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                      | VCGT080202R/L-UF | 0.2-2      | 0.05-0.2       |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                      | VCGT110301R/L-UF | 0.1-1.5    | 0.05-0.15      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                      | VCGT110302R/L-UF | 0.2-2      | 0.05-0.2       |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                      |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                      |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                      |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                      |                  |            |                |        |        |        |        |        |        |        |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock

60° TN□□ With Hole

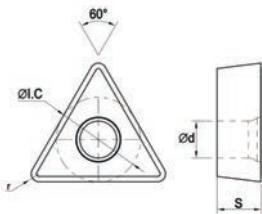


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 16     | 9.525    | 4.76 | 3.81 | 0.2-0.8 |
|        |          |      |      |         |
|        |          |      |      |         |

| Shape                                                                                                              | Type            | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |
|--------------------------------------------------------------------------------------------------------------------|-----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                                                    |                 |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |         |
|                                                                                                                    |                 |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0051 | GW0201 | GW5051 | GW8251 | GW5251 | GW50101 |
| <br>Small<br>Parts<br>Machining | TNGG160402R/L-F | 0.1-1.5    | 0.05-0.15      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                    | TNGG160404R/L-F | 0.2-2      | 0.05-0.2       |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                    | TNGG160408R/L-F | 0.4-2.5    | 0.05-0.2       |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                    |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                    |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                    |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                    |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                    |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |         |

Note: ◆ Recommended grade ready to stock

60° TN□□ With Hole

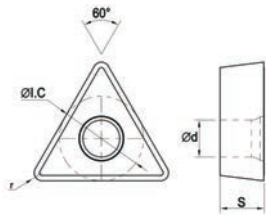


| Length | Size(mm) |      |      |         |
|--------|----------|------|------|---------|
|        | IC       | S    | d    | r       |
| 16     | 9.525    | 4.76 | 3.81 | 0.2-0.8 |
|        |          |      |      |         |
|        |          |      |      |         |

| Shape                                                                                                                | Type            | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |         |
|----------------------------------------------------------------------------------------------------------------------|-----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                                                                                                                      |                 |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |         |
|                                                                                                                      |                 |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0051 | GW0201 | GW5051 | GW8251 | GW5251 | GW50101 |
| <br>Small<br>Parts<br>Machining | TNGG160402R/L-M | 0.2-2      | 0.05-0.12      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                      | TNGG160404R/L-M | 0.2-2.5    | 0.08-0.25      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                      | TNGG160408R/L-M | 0.3-3      | 0.1-0.3        |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |        |         |
|                                                                                                                      |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                      |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                      |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                      |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |         |
|                                                                                                                      |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |         |

Note: ◆ Recommended grade ready to stock

**60° TP□□ With Hole**

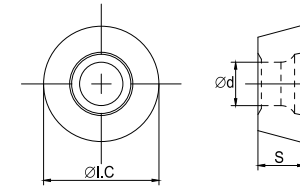


| Length | Size(mm) |      |     |         |
|--------|----------|------|-----|---------|
|        | IC       | S    | d   | r       |
| 8      | 4.76     | 2.38 | 2.3 | 0.2-0.4 |
| 9      | 5.56     | 2.38 | 3.2 | 0.2-0.4 |
| 11     | 6.35     | 3.16 | 3.3 | 0.2-0.4 |

| Shape                                                                                                              | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |         |         |
|--------------------------------------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|                                                                                                                    |               |            |                | CVD    |        |        |        |        |        |        | PVD    |        |        |         |         |
|                                                                                                                    |               |            |                | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0051 | GW0201 | GW5051 | GW8251 | GW85251 | GW80101 |
| <br>Small<br>Parts<br>Machining | TPGH080202R/L | 0.2-1      | 0.02-0.1       |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                    | TPGH080204R/L | 0.4-1.5    | 0.05-0.1       |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                    | TPGH090202R/L | 0.2-1      | 0.02-0.1       |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                    | TPGH090204R/L | 0.4-1.5    | 0.05-0.1       |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                    | TPGH110302R/L | 0.2-1.5    | 0.02-0.15      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                    | TPGH110304R/L | 0.4-1.5    | 0.05-0.15      |        |        |        |        |        |        | ◆      | ◆      | ◇      |        |         |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                                                    |               |            |                |        |        |        |        |        |        |        |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock

**RC□□ With Hole**

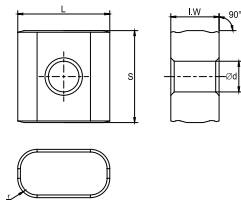


| Length | Size(mm) |      |      |
|--------|----------|------|------|
|        | IC       | S    | d    |
| 8      | 8        | 3.18 | 3.36 |
| 10     | 10       | 3.18 | 4.4  |
| 12     | 12.7     | 4.76 | 4.4  |
| 16     | 16       | 6.35 | 5.5  |
| 20     | 20       | 6.35 | 6.5  |
| 25     | 25       | 7.94 | 7.2  |
| 32     | 32       | 9.52 | 9.5  |

| Shape                                                                                                                | Type       | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |        |
|----------------------------------------------------------------------------------------------------------------------|------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                                                      |            |            |                | CVD    |        |        |        |        |        |        | PVD    |        |        |        |        |
|                                                                                                                      |            |            |                | GW3153 | GW4153 | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8251 | GW8281 |
| <br>Train<br>Wheel<br>Profiling | RCMX0803MO | 0.50-3.00  | 0.15-0.40      | ◆      |        | ◆      |        |        |        |        |        |        |        |        |        |
|                                                                                                                      | RCMX1003MO | 1.50-4.00  | 0.25-0.50      | ◆      |        | ◆      |        |        |        |        |        |        |        |        |        |
|                                                                                                                      | RCMX1204MO | 2.50-5.00  | 0.30-0.60      | ◆      |        | ◆      |        |        |        |        |        |        |        |        |        |
|                                                                                                                      | RCMX1606MO | 3.00-7.00  | 0.40-0.75      | ◆      |        | ◆      |        |        |        |        |        |        |        |        |        |
|                                                                                                                      | RCMX2006MO | 3.50-9.00  | 0.48-0.90      | ◆      |        | ◆      |        |        |        |        |        |        |        |        |        |
|                                                                                                                      | RCMX2507MO | 4.00-12.00 | 0.55-1.20      | ◆      |        | ◆      |        |        |        |        |        |        |        |        |        |
|                                                                                                                      | RCMX3209MO | 5.00-15.00 | 0.65-1.50      | ◆      |        | ◆      |        |        |        |        |        |        |        |        |        |
|                                                                                                                      |            |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                      |            |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                      |            |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

Train Wheel Turning Inserts

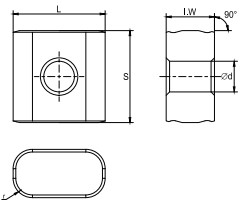


| Length | Size(mm) |     |       |      |   |
|--------|----------|-----|-------|------|---|
|        | L        | I.W | S     | d    | r |
| 19     | 19.05    | 10  | 19.05 | 6.35 | 4 |
|        |          |     |       |      |   |
|        |          |     |       |      |   |

| Shape                                                                                                             | Type             | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |        |
|-------------------------------------------------------------------------------------------------------------------|------------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                                                   |                  |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |        |
|                                                                                                                   |                  |            |                | GW3153 | GW4153 | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8251 | GW8281 |
| <br>Train<br>Wheel<br>Trimming | 175.32-191940-22 | 2.00-5.00  | 0.20-0.60      | ◆      | ◆      |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                   |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                   |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                   |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                   |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                   |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                   |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                   |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

Train Wheel Turning Inserts



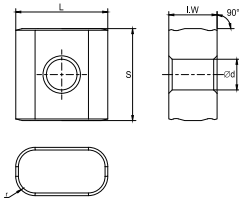
| Length | Size(mm) |     |       |      |   |
|--------|----------|-----|-------|------|---|
|        | L        | I.W | S     | d    | r |
| 19     | 19.05    | 10  | 19.05 | 6.35 | 4 |
|        |          |     |       |      |   |
|        |          |     |       |      |   |

| Shape                                                                                                               | Type             | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |        |
|---------------------------------------------------------------------------------------------------------------------|------------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                                                     |                  |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |        |
|                                                                                                                     |                  |            |                | GW3153 | GW4153 | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8251 | GW8281 |
| <br>Train<br>Wheel<br>Trimming | 175.32-191940-24 | 2.00-5.00  | 0.20-0.60      | ◆      | ◆      |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                     |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                     |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                     |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                     |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                     |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                     |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                     |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock



Train Wheel Turning Inserts



| Length | Size(mm) |     |       |      |   |
|--------|----------|-----|-------|------|---|
|        | L        | I.W | S     | d    | r |
| 19     | 19.05    | 10  | 19.05 | 6.35 | 4 |
|        |          |     |       |      |   |
|        |          |     |       |      |   |

| Shape                                                                                                             | Type             | Ap<br>(mm) | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |        |        |        |
|-------------------------------------------------------------------------------------------------------------------|------------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                                                   |                  |            |                | CVD    |        |        |        |        |        | PVD    |        |        |        |        |        |
|                                                                                                                   |                  |            |                | GW3153 | GW4153 | GW2154 | GW3154 | GW2254 | GW3254 | GW2354 | GW3354 | GW0251 | GW5251 | GW8251 | GW8281 |
| <br>Train<br>Wheel<br>Trimming | 175.32-191940-28 | 2.00-5.00  | 0.20-0.60      | ◆      |        | ◆      |        |        |        |        |        |        |        |        |        |
|                                                                                                                   |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                   |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                   |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                   |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                   |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                   |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                   |                  |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

GW  
CUTTING TOOLS  
PARTING GROOVING TOOLS



Parting and Grooving Inserts

Naming Rules

|      |                |
|------|----------------|
| G    | ±0.025         |
| M    | ±0.05<br>±0.13 |
| Code | Grade          |

2.Tolerance grade

|      |            |
|------|------------|
| 500  | 5.0        |
| 400  | 4.0        |
| 300  | 3.0        |
| 200  | 2.0        |
| Code | Width (mm) |

4.Cutting Edge Width

|      |                   |
|------|-------------------|
| Code | Application       |
| EC   | Parting& Grooving |
| ED   | Parting           |
| ER   | Profile           |

1.Application Code

|      |             |
|------|-------------|
| Code | Application |
| R    | Right       |
| L    | Left        |
| N    | Neutral     |

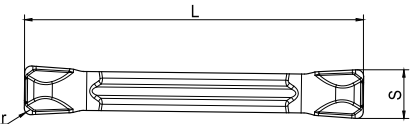
3.Cutting Direction

|      |
|------|
| Code |
| C    |
| G    |
| J    |
| M    |
| T    |

5.Chip Breaker Code

EDM300C

Parting and Grooving Inserts



| Width | Size(mm) |       |    |
|-------|----------|-------|----|
|       | S        | r±0.1 | L  |
| 200   | 2.0      | 0.2   | 20 |
| 300   | 3.0      | 0.4   | 20 |
| 400   | 4.0      | 0.4   | 20 |
| 500   | 5.0      | 0.4   | 25 |

| Shape                                                                                 | Type      | Fn<br>(mm/rev) | Grade  |        |        |        |        |        |        |        |        |         |         |
|---------------------------------------------------------------------------------------|-----------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|                                                                                       |           |                | CVD    |        |        |        |        | PVD    |        |        |        |         |         |
|                                                                                       |           |                | GW2154 | GW2254 | GW2354 | GW3154 | GW3254 | GW0251 | GW8241 | GW8251 | GW5281 | GWR0101 | GWR5251 |
|  | EDMN200-C | 0.05-0.18      |        |        |        |        | ◆      | ◇      |        | ◆      |        |         |         |
|                                                                                       | EDMN300-C | 0.07-0.25      |        |        |        |        | ◆      | ◇      |        | ◆      |        |         |         |
|                                                                                       | EDMN400-C | 0.08-0.30      |        |        |        |        | ◆      | ◇      |        | ◆      |        |         |         |
|                                                                                       | EDMN500-C | 0.09-0.35      |        |        |        |        | ◆      | ◇      |        | ◆      |        |         |         |
|                                                                                       |           |                |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                       |           |                |        |        |        |        |        |        |        |        |        |         |         |
|                                                                                       |           |                |        |        |        |        |        |        |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock

Parting and Grooving Inserts

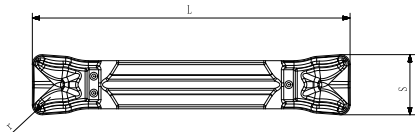


| Width | Size(mm) |       |    |
|-------|----------|-------|----|
|       | S        | r±0.1 | L  |
| 200   | 2.0      | 0.2   | 20 |
| 300   | 3.0      | 0.4   | 20 |
| 400   | 4.0      | 0.4   | 20 |
| 500   | 5.0      | 0.4   | 25 |

| Shape                                                                               | Type      | Fn<br>(mm/rev) | Grade       |        |        |        |        |             |        |        |        |         |         |
|-------------------------------------------------------------------------------------|-----------|----------------|-------------|--------|--------|--------|--------|-------------|--------|--------|--------|---------|---------|
|                                                                                     |           |                | CVD Coating |        |        |        |        | PVD Coating |        |        |        |         |         |
|                                                                                     |           |                | GW2154      | GW2254 | GW2354 | GW3154 | GW3254 | GW0251      | GW8241 | GW8251 | GW5281 | GWR0101 | GWR5251 |
|  | EDMN200-J | 0.04-0.12      |             |        |        |        | ◆      | ◇           |        | ◆      |        |         |         |
|                                                                                     | EDMN300-J | 0.04-0.16      |             |        |        |        | ◆      | ◇           |        | ◆      |        |         |         |
|                                                                                     | EDMN400-J | 0.05-0.18      |             |        |        |        | ◆      | ◇           |        | ◆      |        |         |         |
|                                                                                     | EDMN500-J | 0.05-0.20      |             |        |        |        | ◆      | ◇           |        | ◆      |        |         |         |
|                                                                                     |           |                |             |        |        |        |        |             |        |        |        |         |         |
|                                                                                     |           |                |             |        |        |        |        |             |        |        |        |         |         |
|                                                                                     |           |                |             |        |        |        |        |             |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock

Parting and Grooving Inserts

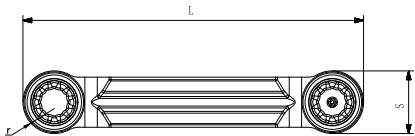


| Width | Size(mm) |       |      |
|-------|----------|-------|------|
|       | S        | r±0.1 | L    |
| 300   | 3        | 0.4   | 21.1 |
| 400   | 4        | 0.8   | 26.4 |
| 500   | 5        | 0.8   | 27.2 |
| 600   | 6        | 0.8   | 27.5 |

| Shape                                                                                 | Type      | Fn<br>(mm/rev) | Grade       |        |        |        |        |             |        |        |        |        |        |
|---------------------------------------------------------------------------------------|-----------|----------------|-------------|--------|--------|--------|--------|-------------|--------|--------|--------|--------|--------|
|                                                                                       |           |                | CVD Coating |        |        |        |        | PVD Coating |        |        |        |        |        |
|                                                                                       |           |                | GW2154      | GW2254 | GW2354 | GW3154 | GW3254 | GW0251      | GW8241 | GW8251 | GW5281 | GW0101 | GW5251 |
|  | ECMN300-T | 0.05-0.18      |             |        |        |        | ◆      | ◇           |        | ◆      |        |        |        |
|                                                                                       | ECMN400-T | 0.07-0.25      |             |        |        |        | ◆      | ◇           |        | ◆      |        |        |        |
|                                                                                       | ECMN500-T | 0.08-0.3       |             |        |        |        | ◆      | ◇           |        | ◆      |        |        |        |
|                                                                                       | ECMN600-T | 0.09-0.35      |             |        |        |        | ◆      | ◇           |        | ◆      |        |        |        |
|                                                                                       |           |                |             |        |        |        |        |             |        |        |        |        |        |
|                                                                                       |           |                |             |        |        |        |        |             |        |        |        |        |        |
|                                                                                       |           |                |             |        |        |        |        |             |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

Parting and Grooving Inserts

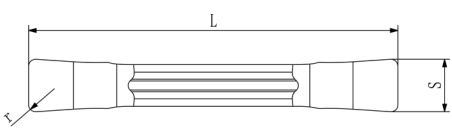


| Width | Size(mm) |       |      |
|-------|----------|-------|------|
|       | S        | r±0.1 | L    |
| 300   | 3.0      | 1.5   | 21.1 |
| 400   | 4.0      | 2     | 26.4 |
| 500   | 5.0      | 2.5   | 27.2 |
| 600   | 6.0      | 3     | 27.5 |

| Shape                                                                               | Type      | Fn<br>(mm/rev) | Grade       |        |        |        |        |             |        |        |        |         |         |
|-------------------------------------------------------------------------------------|-----------|----------------|-------------|--------|--------|--------|--------|-------------|--------|--------|--------|---------|---------|
|                                                                                     |           |                | CVD Coating |        |        |        |        | PVD Coating |        |        |        |         |         |
|                                                                                     |           |                | GW2154      | GW2254 | GW2354 | GW3154 | GW3254 | GW0251      | GW8241 | GW8251 | GW5281 | GWR0101 | GWR5251 |
|  | ERMN300-T | 0.05-0.18      |             |        |        |        | ◆      | ◇           |        | ◆      |        |         |         |
|                                                                                     | ERMN400-T | 0.07-0.25      |             |        |        |        | ◆      | ◇           |        | ◆      |        |         |         |
|                                                                                     | ERMN500-T | 0.08-0.3       |             |        |        |        | ◆      | ◇           |        | ◆      |        |         |         |
|                                                                                     | ERMN600-T | 0.09-0.35      |             |        |        |        | ◆      | ◇           |        | ◆      |        |         |         |
|                                                                                     |           |                |             |        |        |        |        |             |        |        |        |         |         |
|                                                                                     |           |                |             |        |        |        |        |             |        |        |        |         |         |
|                                                                                     |           |                |             |        |        |        |        |             |        |        |        |         |         |

Note: ◆ Recommended grade ready to stock

Parting and Grooving Inserts

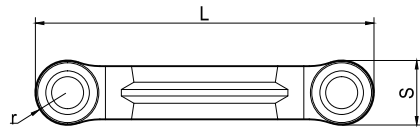


| Width | Size(mm) |       |    |
|-------|----------|-------|----|
|       | S        | r±0.1 | L  |
| 200   | 2.0      | 0.2   | 21 |
| 300   | 3.0      | 0.4   | 21 |
| 400   | 4.0      | 0.4   | 21 |
| 500   | 5.0      | 0.4   | 26 |

| Shape                                                                                 | Type       | Fn<br>(mm/rev) | Grade       |        |        |        |        |             |        |        |        |        |        |
|---------------------------------------------------------------------------------------|------------|----------------|-------------|--------|--------|--------|--------|-------------|--------|--------|--------|--------|--------|
|                                                                                       |            |                | CVD Coating |        |        |        |        | PVD Coating |        |        |        |        |        |
|                                                                                       |            |                | GW2154      | GW2254 | GW2354 | GW3154 | GW3254 | GW0251      | GW8241 | GW8251 | GW5281 | GW0101 | GW5251 |
|  | MGGN200-GL | 0.05-0.18      |             |        |        |        |        | ◇           |        | ◆      |        |        |        |
|                                                                                       | MGGN300-GL | 0.07-0.25      |             |        |        |        |        | ◇           |        | ◆      |        |        |        |
|                                                                                       | MGGN400-GL | 0.08-0.3       |             |        |        |        |        | ◇           |        | ◆      |        |        |        |
|                                                                                       | MGGN500-GL | 0.09-0.35      |             |        |        |        |        | ◇           |        | ◆      |        |        |        |
|                                                                                       |            |                |             |        |        |        |        |             |        |        |        |        |        |
|                                                                                       |            |                |             |        |        |        |        |             |        |        |        |        |        |
|                                                                                       |            |                |             |        |        |        |        |             |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

**Parting and Grooving Inserts**



| Width | Size(mm) |       |      |
|-------|----------|-------|------|
|       | S        | r±0.1 | L    |
| 200   | 2.0      | 1.0   | 16.0 |
| 300   | 3.0      | 1.5   | 21.0 |
| 400   | 4.0      | 2.0   | 21.0 |
| 500   | 5.0      | 2.5   | 26.0 |
| 600   | 6.0      | 3.0   | 26.0 |
| 800   | 8.0      | 4.0   | 31.0 |

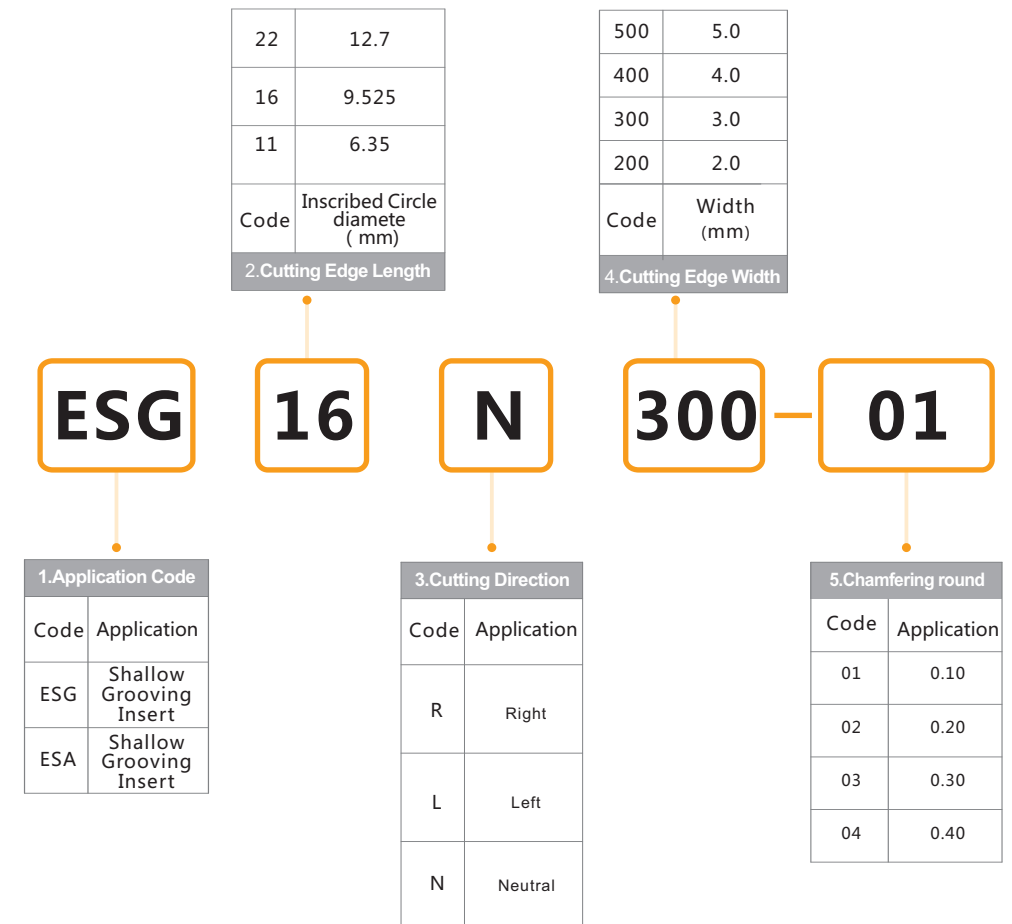
| Shape | Type      | Fn<br>(mm/rev) | Grade       |        |        |        |        |        |             |        |        |        |        |  |
|-------|-----------|----------------|-------------|--------|--------|--------|--------|--------|-------------|--------|--------|--------|--------|--|
|       |           |                | CVD Coating |        |        |        |        |        | PVD Coating |        |        |        |        |  |
|       |           |                | GW2154      | GW2254 | GW2354 | GW3154 | GW3254 | GW0251 | GW8241      | GW8251 | GW5281 | GW0101 | GW5251 |  |
|       | ERMN200-M | 0.05-0.15      |             |        |        |        | ◆      | ◇      |             | ◆      |        |        |        |  |
|       | ERMN300-M | 0.08-0.18      |             |        |        |        | ◆      | ◇      |             | ◆      |        |        |        |  |
|       | ERMN400-M | 0.10-0.20      |             |        |        |        | ◆      | ◇      |             | ◆      |        |        |        |  |
|       | ERMN500-M | 0.12-0.23      |             |        |        |        | ◆      | ◇      |             | ◆      |        |        |        |  |
|       | ERMN600-M | 0.15-0.27      |             |        |        |        | ◆      | ◇      |             | ◆      |        |        |        |  |
|       | ERMN800-M | 0.18-0.35      |             |        |        |        | ◆      | ◇      |             | ◆      |        |        |        |  |
|       |           |                |             |        |        |        |        |        |             |        |        |        |        |  |

Note: ◆ Recommended grade ready to stock

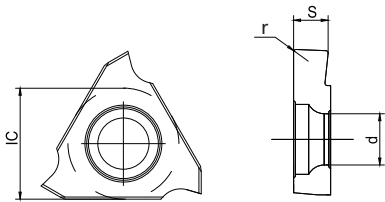
**Grinded Grooving Inserts**

**NEW**

**Naming Rule**



**Shallow Grooving Inserts**

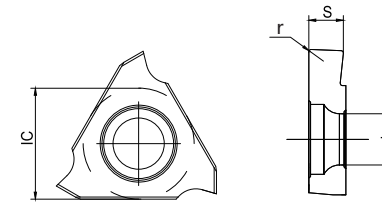


| Width | Size(mm) |      |     |     |
|-------|----------|------|-----|-----|
|       | IC       | S    | d   | r   |
| 110   | 9.525    | 1.10 | 4.4 | 0.1 |
| 125   | 9.525    | 1.25 | 4.4 | 0.2 |
| 145   | 9.525    | 1.45 | 4.4 | 0.2 |
| 150   | 9.525    | 1.50 | 4.4 | 0.2 |
| 175   | 9.525    | 1.75 | 4.4 | 0.2 |
| 185   | 9.525    | 1.85 | 4.4 | 0.2 |
| 200   | 9.525    | 2.00 | 4.4 | 0.2 |
| 250   | 9.525    | 2.50 | 4.4 | 0.2 |
| 300   | 9.525    | 3.00 | 4.4 | 0.2 |

| Shape                                                                               | Type        | Ap<br>apmax/mm | Grade       |        |        |        |        |             |        |        |        |         |         |
|-------------------------------------------------------------------------------------|-------------|----------------|-------------|--------|--------|--------|--------|-------------|--------|--------|--------|---------|---------|
|                                                                                     |             |                | CVD Coating |        |        |        |        | PVD Coating |        |        |        |         |         |
|                                                                                     |             |                | GW2154      | GW2254 | GW2354 | GW3154 | GW3254 | GW0251      | GW8241 | GW8251 | GW5251 | GWR0101 | GWR5251 |
|  | ESG16R/L110 | 2.00           |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                     | ESG16R/L125 | 2.00           |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                     | ESG16R/L145 | 2.50           |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                     | ESG16R/L150 | 2.50           |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                     | ESG16R/L175 | 2.50           |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                     | ESG16R/L185 | 2.50           |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                     | ESG16R/L200 | 2.50           |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                     | ESG16R/L250 | 2.50           |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                     | ESG16R/L300 | 2.50           |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |

Note: ◆ Recommended grade ready to stock

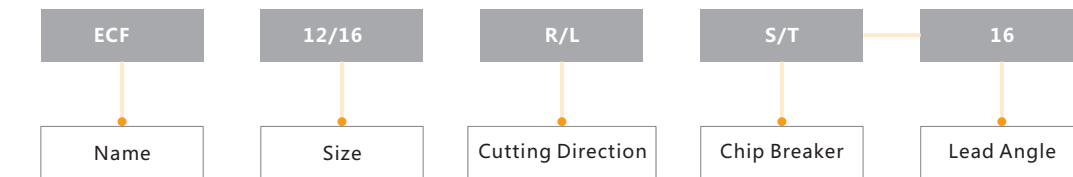
**Shallow Grooving Inserts**



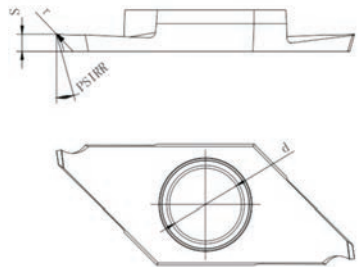
| Width | Size(mm) |      |     |     |
|-------|----------|------|-----|-----|
|       | IC       | S    | d   | r   |
| 125   | 9.525    | 1.25 | 4.4 | 0.1 |
| 125   | 9.525    | 1.25 | 4.4 | 0.2 |
| 150   | 9.525    | 1.50 | 4.4 | 0.1 |
| 150   | 9.525    | 1.50 | 4.4 | 0.2 |
| 200   | 9.525    | 2.00 | 4.4 | 0.1 |
| 200   | 9.525    | 2.50 | 4.4 | 0.2 |
| 250   | 9.525    | 2.50 | 4.4 | 0.1 |
| 250   | 9.525    | 2.50 | 4.4 | 0.2 |
| 300   | 9.525    | 3.00 | 4.4 | 0.1 |
| 300   | 9.525    | 3.00 | 4.4 | 0.2 |

| Shape                                                                                 | Type           | Ap<br>apmax/mm | Grade       |        |        |        |        |             |        |        |        |         |         |
|---------------------------------------------------------------------------------------|----------------|----------------|-------------|--------|--------|--------|--------|-------------|--------|--------|--------|---------|---------|
|                                                                                       |                |                | CVD Coating |        |        |        |        | PVD Coating |        |        |        |         |         |
|                                                                                       |                |                | GW2154      | GW2254 | GW2354 | GW3154 | GW3254 | GW0251      | GW8241 | GW8251 | GW5251 | GWR0101 | GWR5251 |
|  | ESA22R/L125-01 | 2.00           |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                       | ESA22R/L125-02 |                |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                       | ESA22R/L150-01 | 3.50           |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                       | ESA22R/L150-02 |                |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                       | ESA22R/L200-01 |                |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                       | ESA22R/L200-02 |                |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                       | ESA22R/L250-01 | 4.00           |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                       | ESA22R/L250-02 |                |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                       | ESA22R/L300-01 |                |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |
|                                                                                       | ESA22R/L300-02 |                |             |        |        |        |        | ◇           |        | ◆      | ◆      |         |         |

Note: ◆ Recommended grade ready to stock



**Special Parting Inserts**



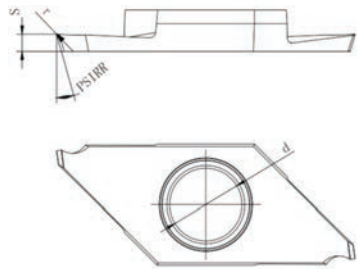
| Width | Size(mm) |      |     |      |
|-------|----------|------|-----|------|
|       | PSIRR    | S    | d   | r    |
| 50    | 16°      | 0.50 | 5.2 | 0.03 |
| 70    |          | 0.70 | 5.2 | 0.03 |
| 100   |          | 1.00 | 5.2 | 0.03 |
| 125   |          | 1.25 | 5.2 | 0.03 |
| 150   |          | 1.50 | 5.2 | 0.03 |
| 200   |          | 2.00 | 5.2 | 0.03 |
| 50    | 0°       | 0.50 | 5.2 | 0.03 |
| 70    |          | 0.70 | 5.2 | 0.03 |
| 100   |          | 1.00 | 5.2 | 0.03 |
| 125   |          | 1.25 | 5.2 | 0.03 |
| 150   |          | 1.50 | 5.2 | 0.03 |
| 200   |          | 2.00 | 5.2 | 0.03 |
| 100   | 16°      | 1.00 | 5.2 | 0.08 |
| 150   |          | 1.50 | 5.2 | 0.08 |
| 200   |          | 2.00 | 5.2 | 0.08 |
| 100   | 0°       | 1.00 | 5.2 | 0.08 |
| 150   |          | 1.50 | 5.2 | 0.08 |
| 200   |          | 2.00 | 5.2 | 0.08 |

| Shape                                                                               | Type            | Ap<br>apmax/mm | Grade       |        |        |        |        |             |        |        |        |        |        |
|-------------------------------------------------------------------------------------|-----------------|----------------|-------------|--------|--------|--------|--------|-------------|--------|--------|--------|--------|--------|
|                                                                                     |                 |                | CVD Coating |        |        |        |        | PVD Coating |        |        |        |        |        |
|                                                                                     |                 |                | GW2154      | GW2254 | GW2354 | GW3154 | GW3254 | GW0251      | GW8241 | GW8251 | GW5251 | GW0101 | GW5251 |
|  | ECF12R/L050S-16 | 5.00           |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L070S-16 | 8.00           |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L100S-16 | 12.00          |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|  | ECF12R/L125S-16 | 12.00          |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L150S-16 |                |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L200S-16 |                |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L050S    | 5.00           |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L070S    | 8.00           |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L100S    | 12.00          |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L125S    |                |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L150S    |                |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L200S    |                |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L100T-16 |                |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L150T-16 |                |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L200T-16 |                |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L100T    |                |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L150T    |                |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |
|                                                                                     | ECF12R/L200T    |                |             |        |        |        |        | ●           |        | ○      | ●      |        | ○      |

Note: ◆ Recommended grade ready to stock



**Special Parting Inserts**



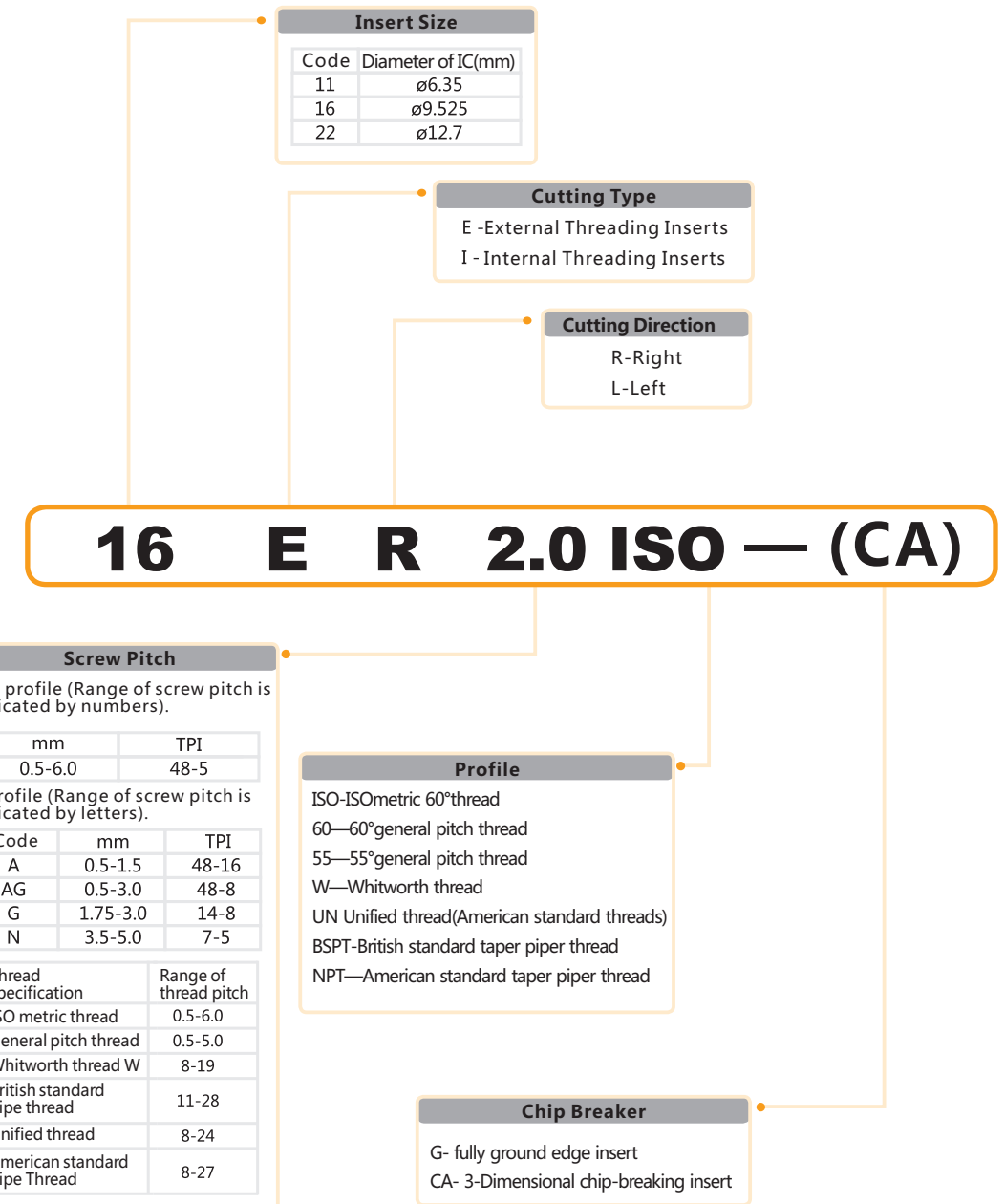
| Width | Size(mm) |      |     |      |
|-------|----------|------|-----|------|
|       | PSIRR    | S    | d   | r    |
| 150   | 16°      | 1.50 | 5.2 | 0.05 |
| 200   |          | 2.00 | 5.2 | 0.05 |
| 150   |          | 1.50 | 5.2 | 0.05 |
| 200   |          | 2.00 | 5.2 | 0.05 |
| 150   | 0°       | 1.50 | 5.2 | 0.08 |
| 200   |          | 2.00 | 5.2 | 0.08 |
| 150   |          | 1.50 | 5.2 | 0.08 |
| 200   |          | 2.00 | 5.2 | 0.08 |

| Shape                                                                               | Type            | Ap<br>apmax/mm | Grade       |        |        |        |        |             |        |        |        |        |         |
|-------------------------------------------------------------------------------------|-----------------|----------------|-------------|--------|--------|--------|--------|-------------|--------|--------|--------|--------|---------|
|                                                                                     |                 |                | CVD Coating |        |        |        |        | PVD Coating |        |        |        |        |         |
|                                                                                     |                 |                | GW2154      | GW2254 | GW2354 | GW3154 | GW3254 | GW0251      | GW8241 | GW8251 | GW5251 | GW0101 | GW05251 |
|  | ECF16R/L150S-16 | 16.00          |             |        |        |        |        | ◆           |        | ◇      | ◆      |        | ◇       |
|                                                                                     | ECF16R/L200S-16 |                |             |        |        |        |        | ◆           |        | ◇      | ◆      |        | ◇       |
|                                                                                     | ECF16R/L150S    |                |             |        |        |        |        | ◆           |        | ◇      | ◆      |        | ◇       |
|                                                                                     | ECF16R/L200S    |                |             |        |        |        |        | ◆           |        | ◇      | ◆      |        | ◇       |
|                                                                                     | ECF16R/L150T-16 |                |             |        |        |        |        | ◆           |        | ◇      | ◆      |        | ◇       |
|                                                                                     | ECF16R/L200T-16 |                |             |        |        |        |        | ◆           |        | ◇      | ◆      |        | ◇       |
|                                                                                     | ECF16R/L150T    |                |             |        |        |        |        | ◆           |        | ◇      | ◆      |        | ◇       |
|                                                                                     | ECF16R/L200T    |                |             |        |        |        |        | ◆           |        | ◇      | ◆      |        | ◇       |

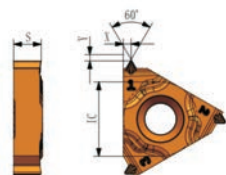
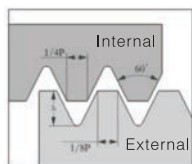
Note: ◆ Recommended grade ready to stock

# Threading Inserts

## Naming Rules



## ISO Metric Thread

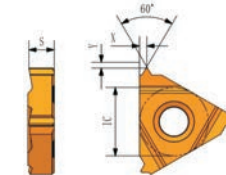
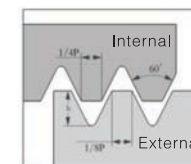


Standard:R262(DIN 13) Tolerance Class:6g/6H

★ With End

| Shape | Type           | Range of thread pitch |            | Insert Dimestions(mm) |      |     |     | Coating |        |
|-------|----------------|-----------------------|------------|-----------------------|------|-----|-----|---------|--------|
|       |                | mm                    | pitch/inch | IC                    | S    | X   | Y   | GW8251  | GW5201 |
|       | 16ER1.00ISO-CA | 1                     |            | 9.525                 | 3.52 | 0.7 | 0.6 | ◆       | ◇      |
|       | 16ER1.25ISO-CA | 1.25                  |            | 9.525                 | 3.52 | 0.9 | 0.7 | ◆       | ◇      |
|       | 16ER1.50ISO-CA | 1.5                   |            | 9.525                 | 3.52 | 1   | 0.8 | ◆       | ◇      |
|       | 16ER1.75ISO-CA | 1.75                  |            | 9.525                 | 3.52 | 1.1 | 0.9 | ◆       | ◇      |
|       | 16ER2.00ISO-CA | 2                     |            | 9.525                 | 3.52 | 1.2 | 0.9 | ◆       | ◇      |
|       | 16ER2.50ISO-CA | 2.5                   |            | 9.525                 | 3.52 | 1.5 | 1.1 | ◆       | ◇      |
|       | 16ER3.00ISO-CA | 3                     |            | 9.525                 | 4.65 | 1.7 | 1.2 | ◆       | ◇      |
|       | 16IR1.00ISO-CA | 1                     |            | 9.525                 | 3.52 | 0.7 | 0.6 | ◆       | ◇      |
|       | 16IR1.25ISO-CA | 1.25                  |            | 9.525                 | 3.52 | 0.8 | 0.6 | ◆       | ◇      |
|       | 16IR1.50ISO-CA | 1.5                   |            | 9.525                 | 3.52 | 0.9 | 0.7 | ◆       | ◇      |
|       | 16IR1.75ISO-CA | 1.75                  |            | 9.525                 | 3.52 | 1   | 0.8 | ◆       | ◇      |
|       | 16IR2.00ISO-CA | 2                     |            | 9.525                 | 3.52 | 1.1 | 0.8 | ◆       | ◇      |
|       | 16IR2.50ISO-CA | 2.5                   |            | 9.525                 | 3.52 | 1.4 | 1   | ◆       | ◇      |
|       | 16IR3.00ISO-CA | 3                     |            | 9.525                 | 4.65 | 1.5 | 1.1 | ◆       | ◇      |

## ISO Metric Thread

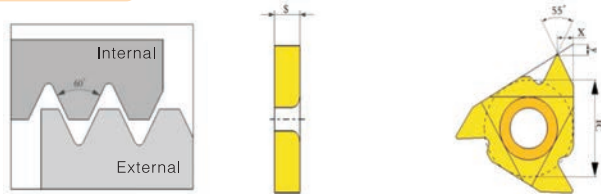


Standard:R262(DIN 13) Tolerance Class:6g/6H

★ With End

| Shape | Type          | Range of thread pitch |            | Insert Dimestions(mm) |      |     |     | Coating |        |
|-------|---------------|-----------------------|------------|-----------------------|------|-----|-----|---------|--------|
|       |               | mm                    | pitch/inch | IC                    | S    | X   | Y   | GW8251  | GW5201 |
|       | 16ER1.00ISO-G | 1                     |            | 9.525                 | 3.52 | 0.7 | 0.6 | ◆       | ◇      |
|       | 16ER1.25ISO-G | 1.25                  |            | 9.525                 | 3.52 | 0.9 | 0.7 | ◆       | ◇      |
|       | 16ER1.50ISO-G | 1.5                   |            | 9.525                 | 3.52 | 1   | 0.8 | ◆       | ◇      |
|       | 16ER1.75ISO-G | 1.75                  |            | 9.525                 | 3.52 | 1.1 | 0.9 | ◆       | ◇      |
|       | 16ER2.00ISO-G | 2                     |            | 9.525                 | 3.52 | 1.2 | 0.9 | ◆       | ◇      |
|       | 16ER2.50ISO-G | 2.5                   |            | 9.525                 | 3.52 | 1.5 | 1.1 | ◆       | ◇      |
|       | 16ER3.00ISO-G | 3                     |            | 9.525                 | 4.65 | 1.7 | 1.2 | ◆       | ◇      |
|       | 22ER3.50ISO-G | 3.5                   |            | 12.7                  | 4.65 | 2.3 | 1.6 | ◆       | ◇      |
|       | 22ER4.00ISO-G | 4                     |            | 12.7                  | 4.65 | 2.3 | 1.6 | ◆       | ◇      |
|       | 22ER4.50ISO-G | 4.5                   |            | 12.7                  | 4.65 | 2.4 | 1.7 | ◆       | ◇      |
|       | 22ER5.00ISO-G | 5                     |            | 12.7                  | 4.65 | 2.5 | 1.7 | ◆       | ◇      |
|       | 11IR1.00ISO-G | 1                     |            | 6.35                  | 3.05 | 0.7 | 0.6 | ◆       | ◇      |
|       | 11IR1.25ISO-G | 1.25                  |            | 6.35                  | 3.05 | 0.9 | 0.8 | ◆       | ◇      |
|       | 11IR1.50ISO-G | 1.5                   |            | 6.35                  | 3.05 | 1   | 0.8 | ◆       | ◇      |
|       | 11IR1.75ISO-G | 1.75                  |            | 6.35                  | 3.05 | 1.1 | 0.9 | ◆       | ◇      |
|       | 16IR1.00ISO-G | 1                     |            | 9.525                 | 3.52 | 0.7 | 0.6 | ◆       | ◇      |
|       | 16IR1.25ISO-G | 1.25                  |            | 9.525                 | 3.52 | 0.8 | 0.6 | ◆       | ◇      |
|       | 16IR1.50ISO-G | 1.5                   |            | 9.525                 | 3.52 | 0.9 | 0.7 | ◆       | ◇      |
|       | 16IR1.75ISO-G | 1.75                  |            | 9.525                 | 3.52 | 1   | 0.8 | ◆       | ◇      |
|       | 16IR2.00ISO-G | 2                     |            | 9.525                 | 3.52 | 1.1 | 0.8 | ◆       | ◇      |
|       | 16IR2.50ISO-G | 2.5                   |            | 9.525                 | 3.52 | 1.4 | 1   | ◆       | ◇      |
|       | 16IR3.00ISO-G | 3                     |            | 9.525                 | 4.65 | 1.5 | 1.1 | ◆       | ◇      |
|       | 22IR3.50ISO-G | 3.5                   |            | 12.7                  | 4.65 | 2.3 | 1.6 | ◆       | ◇      |
|       | 22IR4.00ISO-G | 4                     |            | 12.7                  | 4.65 | 2.3 | 1.6 | ◆       | ◇      |
|       | 22IR4.50ISO-G | 4.5                   |            | 12.7                  | 4.65 | 2.4 | 1.7 | ◆       | ◇      |
|       | 22IR5.00ISO-G | 5                     |            | 12.7                  | 4.65 | 2.5 | 1.7 | ◆       | ◇      |

## 55°/60°General Pitch Thread

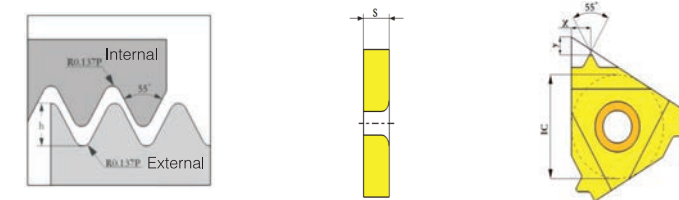


★ Without End

| Shape | Type     | Range of thread pitch |            | Insert Dimestions(mm) |      |     |     | Coating |        |
|-------|----------|-----------------------|------------|-----------------------|------|-----|-----|---------|--------|
|       |          | mm                    | pitch/inch | IC                    | S    | X   | Y   | GW8251  | GW5201 |
|       | 16ERA55  | 0.5–1.5               | 48–16      | 9.525                 | 3.52 | 0.9 | 0.8 | ◆       | ◇      |
|       | 16ERAG55 | 0.5–3.0               | 48–8       | 9.525                 | 3.52 | 1.7 | 1.2 | ◆       | ◇      |
|       | 16ERG55  | 1.75–3.0              | 14–8       | 9.525                 | 3.52 | 1.7 | 1.2 | ◆       | ◇      |
|       | 22ERN55  | 3.5–5.0               | 7–5        | 12.7                  | 4.65 | 2.5 | 1.7 | ◆       | ◇      |
|       | 11IRA55  | 0.5–1.5               | 48–16      | 6.35                  | 3.52 | 0.9 | 0.8 | ◆       | ◇      |
|       | 16IRA55  | 0.5–1.5               | 48–16      | 9.525                 | 3.52 | 0.9 | 0.8 | ◆       | ◇      |
|       | 16IRAG55 | 0.5–3.0               | 48–8       | 9.525                 | 3.52 | 1.7 | 1.2 | ◆       | ◇      |
|       | 16IRG55  | 1.75–3.0              | 14–8       | 9.525                 | 3.52 | 1.7 | 1.2 | ◆       | ◇      |
|       | 22IRN55  | 3.5–5.0               | 7–5        | 12.7                  | 4.65 | 2.5 | 1.7 | ◆       | ◇      |

| Shape | Type     | Range of thread pitch |            | Insert Dimestions(mm) |      |     |     | Coating |        |
|-------|----------|-----------------------|------------|-----------------------|------|-----|-----|---------|--------|
|       |          | mm                    | pitch/inch | IC                    | S    | X   | Y   | GW8251  | GW5201 |
|       | 16ERA60  | 0.5–1.5               | 48–16      | 9.525                 | 3.52 | 0.9 | 0.8 | ◆       | ◇      |
|       | 16ERAG60 | 0.5–3.0               | 48–8       | 9.525                 | 3.52 | 1.7 | 1.2 | ◆       | ◇      |
|       | 16ERG60  | 1.75–3.0              | 14–8       | 9.525                 | 3.52 | 1.7 | 1.2 | ◆       | ◇      |
|       | 22ERN60  | 3.5–5.0               | 7–5        | 12.7                  | 4.65 | 2.5 | 1.7 | ◆       | ◇      |
|       | 11IRA60  | 0.5–1.5               | 48–16      | 6.35                  | 3.52 | 0.9 | 0.8 | ◆       | ◇      |
|       | 16IRA60  | 0.5–1.5               | 48–16      | 9.525                 | 3.52 | 0.9 | 0.8 | ◆       | ◇      |
|       | 16IRAG60 | 0.5–3.0               | 48–8       | 9.525                 | 3.52 | 1.7 | 1.2 | ◆       | ◇      |
|       | 16IRG60  | 1.75–3.0              | 14–8       | 9.525                 | 3.52 | 1.7 | 1.2 | ◆       | ◇      |
|       | 22IRN60  | 3.5–5.0               | 7–5        | 12.7                  | 4.65 | 2.5 | 1.7 | ◆       | ◇      |

## Whitworth Thread

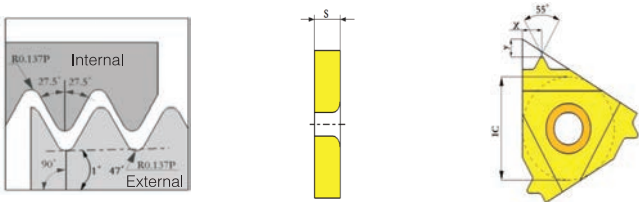


Standard: B.S.84: 1956, DIN259, ISO288/1:1982  
Tolerance class: Medium class A

★ With End

| Shape | Type    | Range of thread pitch |            | Insert Dimestions(mm) |      |     |     | Coating |        |
|-------|---------|-----------------------|------------|-----------------------|------|-----|-----|---------|--------|
|       |         | mm                    | pitch/inch | IC                    | S    | X   | Y   | GW8251  | GW5201 |
|       | 16ER8W  |                       | 8          | 9.525                 | 3.52 | 1.5 | 1.2 | ◆       | ◇      |
|       | 16ER9W  |                       | 9          | 9.525                 | 3.52 | 1.7 | 1.2 | ◆       | ◇      |
|       | 16ER10W |                       | 10         | 9.525                 | 3.52 | 1.5 | 1.1 | ◆       | ◇      |
|       | 16ER11W |                       | 11         | 9.525                 | 3.52 | 1.5 | 1.1 | ◆       | ◇      |
|       | 16ER12W |                       | 12         | 9.525                 | 3.52 | 1.4 | 1.1 | ◆       | ◇      |
|       | 16ER14W |                       | 14         | 9.525                 | 3.52 | 1.2 | 1   | ◆       | ◇      |
|       | 16ER16W |                       | 16         | 9.525                 | 3.52 | 1.1 | 0.9 | ◆       | ◇      |
|       | 16ER18W |                       | 18         | 9.525                 | 3.52 | 1   | 0.8 | ◆       | ◇      |
|       | 16ER19W |                       | 19         | 9.525                 | 3.52 | 1   | 0.8 | ◆       | ◇      |
|       | 16IR8W  |                       | 8          | 9.525                 | 3.52 | 1.5 | 1.2 | ◆       | ◇      |
|       | 16IR9W  |                       | 9          | 9.525                 | 3.52 | 1.7 | 1.2 | ◆       | ◇      |
|       | 16IR10W |                       | 10         | 9.525                 | 3.52 | 1.5 | 1.1 | ◆       | ◇      |
|       | 16IR11W |                       | 11         | 9.525                 | 3.52 | 1.5 | 1.1 | ◆       | ◇      |
|       | 16IR12W |                       | 12         | 9.525                 | 3.52 | 1.4 | 1.1 | ◆       | ◇      |
|       | 16IR14W |                       | 14         | 9.525                 | 3.52 | 1.2 | 1   | ◆       | ◇      |
|       | 16IR16W |                       | 16         | 9.525                 | 3.52 | 1.1 | 0.9 | ◆       | ◇      |
|       | 16IR18W |                       | 18         | 9.525                 | 3.52 | 1   | 0.8 | ◆       | ◇      |
|       | 16IR19W |                       | 19         | 9.525                 | 3.52 | 1   | 0.8 | ◆       | ◇      |

**British Standard Taper Piper Thread**

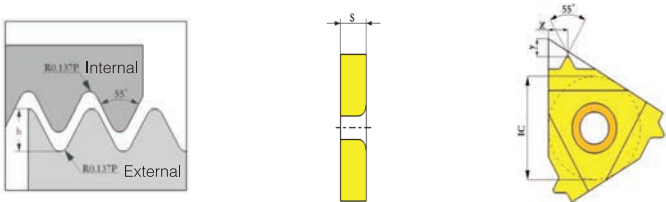


Standard: B.S.21 : 1985  
Tolerance class: BSPT

★ With End

| Shape                                                                               | Type       | Range of thread pitch |            | Insert Dimensions (mm) |      |     |     | Coating |        |
|-------------------------------------------------------------------------------------|------------|-----------------------|------------|------------------------|------|-----|-----|---------|--------|
|                                                                                     |            | mm                    | pitch/inch | IC                     | S    | X   | Y   | GW8251  | GW5201 |
|    | 16ER11BSPT |                       | 11         | 9.525                  | 3.52 | 1.5 | 1.1 | ◆       | ◇      |
|                                                                                     | 16ER14BSPT |                       | 14         | 9.525                  | 3.52 | 1.2 | 1   | ◆       | ◇      |
|                                                                                     | 16ER19BSPT |                       | 19         | 9.525                  | 3.52 | 0.9 | 0.8 | ◆       | ◇      |
|                                                                                     | 16ER28BSPT |                       | 28         | 9.525                  | 3.52 | 0.6 | 0.6 | ◆       | ◇      |
|   | 16IR11BSPT |                       | 11         | 9.525                  | 3.52 | 1.5 | 1.1 | ◆       | ◇      |
|                                                                                     | 16IR14BSPT |                       | 14         | 9.525                  | 3.52 | 1.2 | 1   | ◆       | ◇      |
|                                                                                     | 16IR19BSPT |                       | 19         | 9.525                  | 3.52 | 0.9 | 0.8 | ◆       | ◇      |
|                                                                                     | 16IR28BSPT |                       | 28         | 9.525                  | 3.52 | 0.6 | 0.6 | ◆       | ◇      |
|  |            |                       |            |                        |      |     |     |         |        |
|                                                                                     |            |                       |            |                        |      |     |     |         |        |
|                                                                                     |            |                       |            |                        |      |     |     |         |        |
|                                                                                     |            |                       |            |                        |      |     |     |         |        |
|                                                                                     |            |                       |            |                        |      |     |     |         |        |
|                                                                                     |            |                       |            |                        |      |     |     |         |        |
|                                                                                     |            |                       |            |                        |      |     |     |         |        |
|                                                                                     |            |                       |            |                        |      |     |     |         |        |

**Unified Thread**

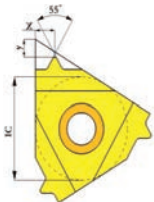
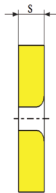
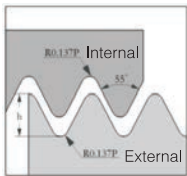


Standard: ANSI B1.1:74  
Tolerance class: 2A/2B

★ With End

| Shape                                                                                 | Type     | Range of thread pitch |            | Insert Dimensions (mm) |      |     |     | Coating |        |
|---------------------------------------------------------------------------------------|----------|-----------------------|------------|------------------------|------|-----|-----|---------|--------|
|                                                                                       |          | mm                    | pitch/inch | IC                     | S    | X   | Y   | GW8251  | GW5201 |
|   | 16ER8UN  |                       | 8          | 9.525                  | 3.52 | 1.6 | 1.2 | ◆       | ◇      |
|                                                                                       | 16ER10UN |                       | 10         | 9.525                  | 3.52 | 1.5 | 1.1 | ◆       | ◇      |
|                                                                                       | 16ER12UN |                       | 12         | 9.525                  | 3.52 | 1.4 | 1.1 | ◆       | ◇      |
|                                                                                       | 16ER14UN |                       | 14         | 9.525                  | 3.52 | 1.2 | 1   | ◆       | ◇      |
|                                                                                       | 16ER16UN |                       | 16         | 9.525                  | 3.52 | 1.1 | 0.9 | ◆       | ◇      |
|                                                                                       | 16ER18UN |                       | 18         | 9.525                  | 3.52 | 1   | 0.8 | ◆       | ◇      |
|                                                                                       | 16ER20UN |                       | 20         | 9.525                  | 3.52 | 0.9 | 0.8 | ◆       | ◇      |
|                                                                                       | 16ER24UN |                       | 24         | 9.525                  | 3.52 | 0.8 | 0.7 | ◆       | ◇      |
|  | 16IR8UN  |                       | 8          | 9.525                  | 3.52 | 1.5 | 1.1 | ◆       | ◇      |
|                                                                                       | 16IR10UN |                       | 10         | 9.525                  | 3.52 | 1.5 | 1.1 | ◆       | ◇      |
|                                                                                       | 16IR12UN |                       | 12         | 9.525                  | 3.52 | 1.4 | 1.1 | ◆       | ◇      |
|                                                                                       | 16IR14UN |                       | 14         | 9.525                  | 3.52 | 1.2 | 0.9 | ◆       | ◇      |
|                                                                                       | 16IR16UN |                       | 16         | 9.525                  | 3.52 | 1.1 | 0.9 | ◆       | ◇      |
|                                                                                       | 16IR18UN |                       | 18         | 9.525                  | 3.52 | 1   | 0.8 | ◆       | ◇      |
|                                                                                       | 16IR20UN |                       | 20         | 9.525                  | 3.52 | 0.9 | 0.8 | ◆       | ◇      |
|                                                                                       | 16IR24UN |                       | 24         | 9.525                  | 3.52 | 0.8 | 0.7 | ◆       | ◇      |
|  |          |                       |            |                        |      |     |     |         |        |
|                                                                                       |          |                       |            |                        |      |     |     |         |        |
|                                                                                       |          |                       |            |                        |      |     |     |         |        |
|                                                                                       |          |                       |            |                        |      |     |     |         |        |

**American Standard Taper Piper Thread**



Standard: USAS B.21:1968  
Tolerance class: NPT

★ With End

| Shape                                                                               | Type        | Range of thread pitch |            | Insert Dimestions(mm) |      |     |     | Coating |        |
|-------------------------------------------------------------------------------------|-------------|-----------------------|------------|-----------------------|------|-----|-----|---------|--------|
|                                                                                     |             | mm                    | pitch/inch | IC                    | S    | X   | Y   | GW8251  | GW5201 |
|    | 16ER8NPT    |                       | 8          | 9.525                 | 3.52 | 1.8 | 1.3 | ◆       | ◇      |
|                                                                                     | 16ER11.5NPT |                       | 11.5       | 9.525                 | 3.52 | 1.5 | 1.1 | ◆       | ◇      |
|                                                                                     | 16ER14NPT   |                       | 14         | 9.525                 | 3.52 | 1.2 | 0.9 | ◆       | ◇      |
|                                                                                     | 16ER18NPT   |                       | 18         | 9.525                 | 3.52 | 1   | 0.8 | ◆       | ◇      |
|                                                                                     | 16ER27NPT   |                       | 27         | 9.525                 | 3.52 | 0.8 | 0.7 | ◆       | ◇      |
|                                                                                     | 16IR8NPT    |                       | 8          | 9.525                 | 3.52 | 1.8 | 1.3 | ◆       | ◇      |
|  | 16IR11.5NPT |                       | 11.5       | 9.525                 | 3.52 | 1.5 | 1.1 | ◆       | ◇      |
|                                                                                     | 16IR14NPT   |                       | 14         | 9.525                 | 3.52 | 1.2 | 0.9 | ◆       | ◇      |
|                                                                                     | 16IR18NPT   |                       | 18         | 9.525                 | 3.52 | 1   | 0.8 | ◆       | ◇      |
|                                                                                     | 16IR27NPT   |                       | 27         | 9.525                 | 3.52 | 0.8 | 0.7 | ◆       | ◇      |
|  |             |                       |            |                       |      |     |     |         |        |
|                                                                                     |             |                       |            |                       |      |     |     |         |        |
|                                                                                     |             |                       |            |                       |      |     |     |         |        |
|                                                                                     |             |                       |            |                       |      |     |     |         |        |
|                                                                                     |             |                       |            |                       |      |     |     |         |        |
|                                                                                     |             |                       |            |                       |      |     |     |         |        |

**GW**  
**CUTTING TOOLS**  
**MILLING INSERTS**







Recommendation of Milling Grade

| ISO                       | Classification | CVD    |        |  | PVD     |         |         |
|---------------------------|----------------|--------|--------|--|---------|---------|---------|
| P<br>Steel                | 01             |        |        |  |         |         |         |
|                           | 10             |        |        |  | GW0151  | GW8251  |         |
|                           | 20             |        |        |  |         |         | GW0251  |
|                           | 30             |        |        |  |         |         |         |
|                           | 40             |        |        |  |         |         |         |
| M<br>Stainless Steel      | 01             |        |        |  |         |         |         |
|                           | 10             |        |        |  |         |         |         |
|                           | 20             |        |        |  | GW8241  | GW8251  |         |
|                           | 30             |        |        |  |         |         | GW5251  |
|                           | 40             |        |        |  |         |         |         |
| K<br>Cast Iron            | 01             |        |        |  |         |         |         |
|                           | 10             | GW0203 |        |  | GW0151  | GW8251  |         |
|                           | 20             |        |        |  |         |         | GW5251  |
|                           | 30             |        | GW0403 |  |         |         |         |
|                           | 40             |        |        |  |         |         |         |
| S<br>Heat Resistant Alloy | 01             |        |        |  |         |         |         |
|                           | 10             |        |        |  | GWR0101 |         |         |
|                           | 20             |        |        |  |         | GWR5201 | GWR5251 |
|                           | 30             |        |        |  |         |         |         |
|                           | 40             |        |        |  |         |         | GWR0291 |

## Recommendation of Inserts and Chip Breakers

|                                       |          |             |          |                         |            |          |
|---------------------------------------|----------|-------------|----------|-------------------------|------------|----------|
| Should Milling Inserts                |          |             |          |                         |            |          |
|                                       | APMT-XR  | APMT-GM     | APMT-M2  | APMT-H2                 | ADMT-JT    | TPKT     |
| Length                                | 11、16    | 11、16       | 11、16    | 11、16                   | 11         | 04-19    |
| Page                                  | B-5      | B-5         | B-6      | B-6                     | B-7        | B-8      |
| Double-side Should Milling Inserts    |          |             |          |                         |            |          |
|                                       | ANMX     | ANKT-M      | LNGU-GM  | WNMU-GM                 | XNEX-GL/GM |          |
| Length                                | 11、15    | 04、06、09、11 | 11       | 05、08                   | 08         |          |
| Page                                  | B-9      | B-10        | B-11     | B-11                    | B-12       |          |
| Profile Milling Inserts               |          |             |          |                         |            |          |
|                                       | RPMW     | RPMT-JM     | RPMT-GM  | RDKT                    | RPMT-XR    | RPMT     |
| Length                                | 08、10、12 | 08、10、12、16 | 08、10、12 | 08-20                   | 08、10、12   | 08、10、12 |
| Page                                  | B-13     | B-13        | B-14     | B-15                    | B-16       | B-17     |
| Single-side High Feed Milling Inserts |          |             |          |                         |            |          |
|                                       | EPNW-GH  | LPGT-GM     | SDMT-GM  | SDMT-GH                 | SOMT-GM    | SOMT-GH  |
| Length                                | 06       | 01          | 12、15    | 06-15                   | 10         | 14       |
| Page                                  | B-18     | B-18        | B-19     | B-19                    | B-20       | B-20     |
| Double-side High Feed Milling Inserts |          |             |          | 45°Face Milling Inserts |            |          |
|                                       | LNMU-GM  | LOGU-MM     | BLMP-GM  |                         | SEMT-GM    | SEER-GM  |
| Length                                | 03       | 03          | 04-11    | Length                  | 12         | 12、15    |
| Page                                  | B-21     | B-21        | B-22     | Page                    | B-27       | B-27     |

|                                                 |            |                       |            |         |         |
|-------------------------------------------------|------------|-----------------------|------------|---------|---------|
| Super Alloy Titanium Alloy                      |            |                       |            |         |         |
|                                                 | RPHX-DF    | RPHX-DM               | APMT-DF    | SDMT-DM | LNMU-MS |
| Length                                          | 10、12      | 10、12                 | 11、16      | 06、09   | 03      |
| Page                                            | B-24       | B-24                  | B-25       | B-25    | B-26    |
| Double-side Cost-effective Face Milling Inserts |            |                       |            |         |         |
|                                                 | SNMU-GM    | SNMX-GM               | SNGX-GF    | PNCU-GM | HNMG-R  |
| Length                                          | 13         | 12、16                 | 09         | 09      | 09      |
| Page                                            | B-28       | B-29                  | B-29       | B-30    | B-31    |
| Double-side Cost-effective Face Milling Inserts |            |                       |            |         |         |
|                                                 | HNMG-M     | XNMU-MM               | XNMU-GR    | ONHU-AR | ONHU-AF |
| Length                                          | 09         | 07                    | 09         | 05      | 05      |
| Page                                            | B-31       | B-32                  | B-32       | B-33    | B-33    |
| Double-side Cost-effective Face Milling Inserts |            | Helix Milling Inserts |            |         |         |
|                                                 | ONMU-GM/GR |                       | APKT-PM/KM | SP-KM   | SP-PM   |
| Length                                          | 09         | Length                | 15         | 12      | 12      |
| Page                                            | B-34       | Page                  | B-35       | B-35    | B-35    |

|                         |      |      |      |
|-------------------------|------|------|------|
| Helical Milling Inserts |      |      |      |
|                         | CNHX | LNKT | LNKX |
| Length                  | 16   | 16   | 12   |
| Page                    | B-36 | B-36 | B-37 |



## Milling Insert Code Key

|                                                                                    |                                                                                    |                                                                                    |                         |             |              |                                                                                    |      |             |              |                                                                                     |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------|-------------|--------------|------------------------------------------------------------------------------------|------|-------------|--------------|-------------------------------------------------------------------------------------|
|   |   |   | B                       | Y           | N            |   | N    | N           | N            |  |
|   |   |   | H                       | Y           | Single       |   | R    | N           | Single       |  |
|   |   |   | C                       | Y           | N            |   | F    | N           | Double       |  |
|   |   |   | J                       | Y           | Double       |   | A    | Y           | N            |  |
|   |   |   | W                       | Y           | N            |   | M    | Y           | Single       |  |
|   |   |   | T                       | Y           | Single       |   | G    | Y           | Double       |  |
|   |   |   | Q                       | Y           | N            |   | X    | ---         | ---          | Special Type                                                                        |
|  |  |  | U                       | Y           | Double       |  |      |             |              |                                                                                     |
| 1.Shape                                                                            |                                                                                    |                                                                                    | 4.Chip Breaker and Hole |             |              |                                                                                    |      |             |              |                                                                                     |
|                                                                                    |                                                                                    |                                                                                    | Code                    | Center Hole | Chip Breaker | Insert Profile                                                                     | Code | Center Hole | Chip Breaker | Insert Profile                                                                      |

A

P

M

T

| 2.Clearance Angle |                 |      |                 | 3.Tolerance |            |            |        |                                     |                  |        |             |             |             |
|-------------------|-----------------|------|-----------------|-------------|------------|------------|--------|-------------------------------------|------------------|--------|-------------|-------------|-------------|
| Code              | Clearance Angle | Code | Clearance Angle | Code        | m (mm)     | d=I.C      | S (mm) | Inscribed Circle                    | Regular Triangle | Square | 80° Rhombus | 55° Rhombus | 35° Rhombus |
| A                 | 3°              | B    | 5°              | A           | ±0.005     | ±0.025     | ±0.025 | 6.35                                | ±0.08            | ±0.08  | ±0.08       | ±0.11       | ±0.16       |
| C                 | 7°              | D    | 15°             | F           | ±0.005     | ±0.013     | ±0.025 | 9.525                               | ±0.08            | ±0.08  | ±0.08       | ±0.11       | ±0.16       |
| E                 | 20°             | F    | 25°             | C           | ±0.013     | ±0.025     | ±0.025 | 12.7                                | ±0.13            | ±0.13  | ±0.13       | ±0.15       | ---         |
| G                 | 30°             | N    | 0°              | H           | ±0.013     | ±0.013     | ±0.025 | 15.875                              | ±0.15            | ±0.15  | ±0.15       | ±0.18       | ---         |
| P                 | 11°             | O    | Others          | E           | ±0.025     | ±0.025     | ±0.025 | 19.05                               | ±0.15            | ±0.15  | ±0.15       | ±0.18       | ---         |
|                   |                 |      |                 | G           | ±0.025     | ±0.025     | ±0.13  | 25.4                                | ---              | ±0.18  | ---         | ---         | ---         |
|                   |                 |      |                 | J           | ±0.005     | ±0.05±0.13 | ±0.025 | ♦ Tolerance of Inscribed Circle(mm) |                  |        |             |             |             |
|                   |                 |      |                 | K           | ±0.013     | ±0.05±0.13 | ±0.025 | Inscribed Circle                    | Regular Triangle | Square | 80° Rhombus | 55° Rhombus | 35° Rhombus |
|                   |                 |      |                 | L           | ±0.025     | ±0.05±0.13 | ±0.025 | 6.35                                | ±0.05            | ±0.05  | ±0.05       | ±0.05       | ±0.05       |
|                   |                 |      |                 | M           | ±0.08±0.18 | ±0.05±0.13 | ±0.13  | 9.525                               | ±0.05            | ±0.05  | ±0.05       | ±0.05       | ±0.05       |
|                   |                 |      |                 | N           | ±0.08±0.18 | ±0.05±0.13 | ±0.025 | 12.7                                | ±0.08            | ±0.08  | ±0.08       | ±0.08       | ±0.08       |
|                   |                 |      |                 | U           | ±0.13±0.38 | ±0.08±0.25 | ±0.13  | 15.875                              | ±0.10            | ±0.10  | ±0.10       | ±0.10       | ±0.10       |
|                   |                 |      |                 |             |            |            |        | 19.05                               | ±0.10            | ±0.10  | ±0.10       | ±0.10       | ±0.10       |
|                   |                 |      |                 |             |            |            |        | 25.4                                | ---              | ±0.13  | ---         | ---         | ±0.13       |

|                                |    |    |    |    |    |    |    |
|--------------------------------|----|----|----|----|----|----|----|
| 32.00                          |    |    | 32 |    |    |    |    |
| 31.75                          |    |    | 31 |    |    |    |    |
| 25.40                          |    |    | 25 | 25 |    |    |    |
| 25.00                          | 25 | 25 | 25 |    |    |    |    |
| 20.00                          |    |    | 20 |    |    |    |    |
| 19.05                          | 19 |    | 19 | 19 | 33 |    |    |
| 16.00                          |    | 19 | 16 |    |    |    |    |
| 15.875                         | 16 |    | 15 | 16 | 27 |    |    |
| 12.70                          | 12 | 15 | 12 | 12 | 22 | 22 | 08 |
| 12.00                          |    |    | 12 |    |    |    |    |
| 10.00                          |    |    | 10 |    |    |    |    |
| 9.525                          | 09 | 11 | 09 | 09 | 16 | 16 | 06 |
| 8.00                           |    |    | 08 |    |    |    |    |
| 6.35                           | 06 | 07 |    |    | 11 | 11 |    |
| 6.00                           |    |    | 06 |    |    |    |    |
| 5.56                           |    |    |    |    | 09 |    |    |
| 5.50                           |    |    | 05 |    |    |    |    |
| 3.97                           |    |    |    |    | 06 |    |    |
| Inscribed Circle diameter (mm) |    |    |    |    |    |    |    |
|                                | C  | D  | R  | S  | T  | V  | W  |
| Insert Shape                   |    |    |    |    |    |    |    |
| 5.Cutting Edge Length          |    |    |    |    |    |    |    |

|                                                                                     |                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 12                                                                                  | 12.70                                                                               |
| 10                                                                                  | 11.11                                                                               |
| T9                                                                                  | 9.72                                                                                |
| 09                                                                                  | 9.52                                                                                |
| 07                                                                                  | 7.94                                                                                |
| T6                                                                                  | 6.75                                                                                |
| 06                                                                                  | 6.35                                                                                |
| 05                                                                                  | 5.56                                                                                |
| T4                                                                                  | 4.96                                                                                |
| 04                                                                                  | 4.76                                                                                |
| T3                                                                                  | 3.97                                                                                |
| 03                                                                                  | 3.18                                                                                |
| T2                                                                                  | 2.78                                                                                |
| 02                                                                                  | 2.38                                                                                |
| T1                                                                                  | 1.98                                                                                |
| 01                                                                                  | 1.59                                                                                |
| T0                                                                                  | 0.99                                                                                |
| 00                                                                                  | 0.79                                                                                |
| Code                                                                                | Thickness(mm)                                                                       |
|  |  |
| 6.Thickness                                                                         |                                                                                     |

16

05

PD

E

R

GM

| 7.Approach angle/Relief angle                                                         |                                                                                       |   |       |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---|-------|
|  |  |   |       |
| A                                                                                     | 45°                                                                                   | A | 3°    |
| D                                                                                     | 60°                                                                                   | B | 5°    |
| E                                                                                     | 75°                                                                                   | C | 7°    |
| F                                                                                     | 85°                                                                                   | D | 15°   |
| P                                                                                     | 90°                                                                                   | E | 20°   |
| Z                                                                                     | other                                                                                 | F | 25°   |
|                                                                                       |                                                                                       | G | 30°   |
|                                                                                       |                                                                                       | N | 0°    |
|                                                                                       |                                                                                       | P | 11°   |
|                                                                                       |                                                                                       | Z | other |

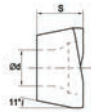
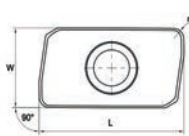
| 8.Cutting Edge Code                                                                   |                                                                                       |                                                                                       |               |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------|
|  |  |  |               |
| F                                                                                     | 0-5°                                                                                  | 0-0.10                                                                                | k(or no code) |
| E                                                                                     | 1-10°                                                                                 | 1-0.15                                                                                |               |
| T                                                                                     | 2-15°                                                                                 | 2-0.20                                                                                | P             |
| S                                                                                     | 3-20°                                                                                 | 3-0.25                                                                                | W             |
|                                                                                       | 4-25°                                                                                 | 4-0.30                                                                                | Q             |
|                                                                                       | 5-30°                                                                                 | 5-0.35                                                                                |               |
|                                                                                       | 1-10°                                                                                 | 6-0.40                                                                                |               |
|                                                                                       | 1-10°                                                                                 | 7-0.45                                                                                |               |

### 9.Chip Breaker

### 10.Cutting Direction Code

|   |         |
|---|---------|
| R | Right   |
| L | Left    |
| N | Neutral |

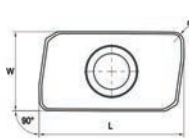
**AP□□ Inserts**



| Length | Size(mm) |     |      |     |
|--------|----------|-----|------|-----|
|        | L        | W   | S    | r   |
| 11     | 11.35    | 6.2 | 3.5  | 0.8 |
| 16     | 17.35    | 9.3 | 5.26 | 0.8 |

| Shape                                                                             | Type            | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|-----------------------------------------------------------------------------------|-----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                   |                 |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW0101 | GW5201 | GW5251 | GW0291 |
|  | APMT1135PDER-XR | 2.50-7.50  | 0.05-0.25      |        |        | ◆      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|                                                                                   | APMT1605PDER-XR | 3.50-10.00 | 0.07-0.50      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|                                                                                   |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                   |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

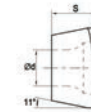
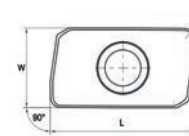


| Length | Size(mm) |     |      |     |
|--------|----------|-----|------|-----|
|        | L        | W   | S    | r   |
| 11     | 11.35    | 6.2 | 3.5  | 0.8 |
| 16     | 17.35    | 9.3 | 5.26 | 0.8 |

| Shape                                                                               | Type              | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|-------------------------------------------------------------------------------------|-------------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                     |                   |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW0101 | GW5201 | GW5251 | GW0291 |
|  | APMT1135PDER-GM   | 2.50-7.50  | 0.05-0.25      |        |        | ◆      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|                                                                                     | APMT160408PDER-GM | 3.50-10.00 | 0.07-0.50      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|                                                                                     |                   |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                     |                   |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

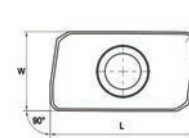
**AP□□ Inserts**



| Length | Size(mm) |     |      |     |
|--------|----------|-----|------|-----|
|        | L        | W   | S    | r   |
| 11     | 11.35    | 6.2 | 3.5  | 0.8 |
| 16     | 17.35    | 9.2 | 4.76 | 0.8 |

| Shape                                                                               | Type              | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|-------------------------------------------------------------------------------------|-------------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                     |                   |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW0101 | GW5201 | GW5251 | GW0291 |
|  | APMT1135PDER-M2   | 2.50-7.50  | 0.05-0.25      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|                                                                                     | APMT160408PDER-M2 | 3.50-10.00 | 0.07-0.30      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|                                                                                     |                   |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                     |                   |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

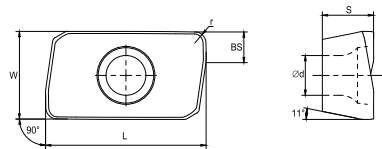


| Length | Size(mm) |     |      |     |
|--------|----------|-----|------|-----|
|        | INSL     | W   | S    | r   |
| 11     | 11.35    | 6.2 | 3.5  | 0.8 |
| 16     | 17.35    | 9.2 | 4.76 | 0.8 |

| Shape                                                                                 | Type              | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |         |         |         |         |
|---------------------------------------------------------------------------------------|-------------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                       |                   |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWR0101 | GWR5201 | GWR5251 | GWR0291 |
|  | APMT1135PDER-H2   | 2.50-7.50  | 0.05-0.25      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                       | APMT160408PDER-H2 | 3.50-10.00 | 0.07-0.30      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                       |                   |            |                |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                       |                   |            |                |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock

**AD□□ Inserts**

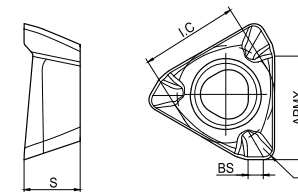


| Length | Size(mm) |     |     |         |         |
|--------|----------|-----|-----|---------|---------|
|        | L        | W   | S   | BS      | r       |
| 11     | 11       | 6.7 | 3.8 | 1.4-2.1 | 0.2-1.2 |

| Shape | Type            | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |         |         |         |         |
|-------|-----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|       |                 |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW80101 | GW85201 | GW85251 | GW80291 |
|       | ADMT11T302ER-JT | 2.0-6.0    | 0.06-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | ADMT11T304ER-JT | 2.2-8.0    | 0.08-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | ADMT11T308ER-JT | 2.5-10.0   | 0.10-0.18      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | ADMT11T312ER-JT | 2.8-10.0   | 0.08-0.2       |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |

Note: ◆ Recommended grade ready to stock

**TP□□ Inserts**

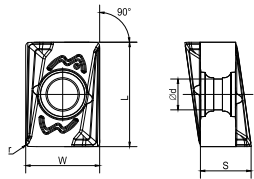


| Length | Size(mm) |     |      |         |         |
|--------|----------|-----|------|---------|---------|
|        | IC       | S   | APMX | BS      | r       |
| 4      | 3.9      | 2.1 | 3.5  | 0.5-0.7 | 0.2-0.4 |
| 6      | 5.3      | 2.8 | 4.7  | 0.6-1.2 | 0.2-0.8 |
| 10     | 6.9      | 4   | 7    | 0.5-1.3 | 0.4-1.6 |
| 15     | 10.7     | 5   | 11   | 0.5-2.0 | 0.4-2.4 |
| 19     | 13.5     | 6   | 15   | 0.5-2.0 | 0.4-3.2 |

| Shape | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |         |         |         |         |
|-------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|       |               |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW80101 | GW85201 | GW85251 | GW80291 |
|       | TPKT040202R-M | 0.50-3.00  | 0.04-0.08      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | TPKT040204R-M | 0.50-3.00  | 0.04-0.08      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | TPKT060302R-M | 1.00-4.00  | 0.04-0.10      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | TPKT060304R-M | 1.00-4.00  | 0.04-0.10      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | TPKT060308R-M | 1.00-4.00  | 0.04-0.10      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | TPKT100404R-M | 2.00-6.00  | 0.05-0.12      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | TPKT100408R-M | 2.00-6.00  | 0.05-0.12      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | TPKT100416R-M | 2.00-6.00  | 0.05-0.12      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | TPKT150508R-M | 3.00-9.00  | 0.07-0.17      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | TPKT150516R-M | 3.00-9.00  | 0.07-0.17      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | TPKT150524R-M | 3.00-12.00 | 0.07-0.17      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | TPKT190608R-M | 4.50-12.00 | 0.09-0.22      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | TPKT190616R-M | 4.50-12.00 | 0.09-0.22      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | TPKT190624R-M | 4.50-12.00 | 0.09-0.22      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|       | TPKT190632R-M | 4.50-12.00 | 0.09-0.22      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |

Note: ◆ Recommended grade ready to stock

**AN□□ Inserts**

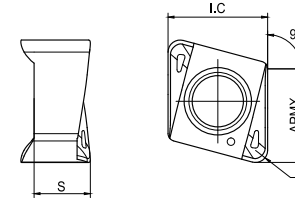


| Length | Size(mm) |     |     |      |    |         |
|--------|----------|-----|-----|------|----|---------|
|        | L        | W   | S   | APMX | BS | r       |
| 11     | 11.85    | 8.4 | 5.7 |      |    | 0.4-0.8 |
| 15     | 15.430   | 11  | 7.3 |      |    | 0.8-1.6 |

| Shape                                                                             | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |         |         |         |         |
|-----------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                   |               |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW80101 | GW85201 | GW85251 | GW80291 |
|  | ANMX110504PNR | 2.00-9.00  | 0.10-0.20      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                   | ANMX110508PNR | 3.00-9.00  | 0.10-0.20      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                   | ANMX150608PNR | 4.50-12.00 | 0.10-0.20      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                   | ANMX150616PNR | 5.00-12.00 | 0.10-0.20      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |

Note: ◆ Recommended grade ready to stock

**AN□□ Inserts**

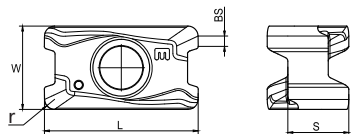


| Length | Size(mm) |         |         |         |         |
|--------|----------|---------|---------|---------|---------|
|        | IC       | S       | APMX    | BS      | r       |
| 4      | 4        | 3.1     | 3.5     | -       | 0.2-0.8 |
| 6      | 6.6      | 4.2-5.0 | 5.8-6.2 | 0.6-1.0 | 0.4-2.0 |
| 9      | 8.6      | 5.7-6.3 | 8       | 0.8-1.2 | 0.4-1.6 |
| 11     | 10.7     | 8.1     | 10.5    | 1       | 0.8     |

| Shape                                                                                 | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |         |         |         |         |
|---------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                       |               |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW80101 | GW85201 | GW85251 | GW80291 |
|  | ANKT040202R-M | 0.50-3.00  | 0.04-0.08      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                       | ANKT040204R-M | 1.00-3.00  | 0.06-0.12      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                       | ANKT040208R-M | 1.00-3.00  | 0.06-0.12      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                       | ANKT060304R-M | 0.50-5.00  | 0.07-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                       | ANKT060308R-M | 1.00-5.00  | 0.07-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                       | ANKT060312R-M | 1.00-5.00  | 0.07-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                       | ANKT060316R-M | 2.00-4.50  | 0.07-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                       | ANKT060320R-M | 2.00-4.50  | 0.07-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                       | ANKT090408R-M | 2.50-7.00  | 0.07-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                       | ANKT090416R-M | 2.50-7.00  | 0.07-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                       | ANKT110608R-M | 3.50-10.0  | 0.09-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |

Note: ◆ Recommended grade ready to stock

**LN□□ Inserts**

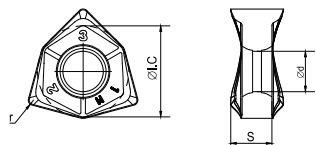


| Length | Size(mm) |      |     |     |         |
|--------|----------|------|-----|-----|---------|
|        | L        | S    | W   | BS  | r       |
| 11     | 12.16    | 4.83 | 6.6 | 1.4 | 0.4-1.2 |

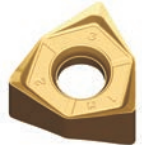
| Shape                                                                             | Type              | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-----------------------------------------------------------------------------------|-------------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|                                                                                   |                   |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWRF0101 | GWRF5201 | GWRF5251 | GWRF0291 |
|  | LNGU110404ERGE-GM | apmax=10   | 0.50-1.50      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|                                                                                   | LNGU110408ERGE-GM | apmax=10   | 0.50-1.50      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|                                                                                   | LNGU110412ERGE-GM | apmax=10   | 0.50-1.50      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|                                                                                   |                   |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

**WN□□ Inserts**

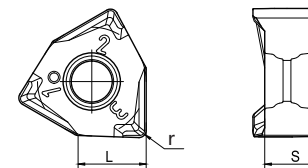


| Length | Size(mm) |     |     |
|--------|----------|-----|-----|
|        | S        | d   | r   |
| 5      | 4.2      | 3.4 | 0.8 |
| 8      | 6.65     | 6.2 | 0.8 |

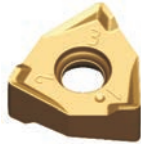
| Shape                                                                               | Type            | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------------------------------------------------------------------------------------|-----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|                                                                                     |                 |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWRF0101 | GWRF5201 | GWRF5251 | GWRF0291 |
|  | WNMU050408EN-GM | 0.50-5.00  | 0.10-0.30      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|                                                                                     | WNMU080608EN-GM | 0.80-8.00  | 0.10-0.30      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|                                                                                     |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|                                                                                     |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

**XN□□ Inserts**

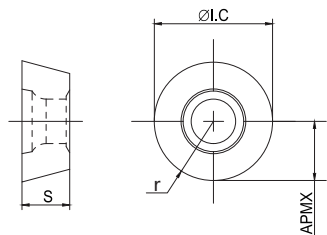


| Length | Size(mm) |      |
|--------|----------|------|
|        | L        | S    |
| 08     | 7.5      | 6.45 |

| Shape                                                                                | Type            | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|--------------------------------------------------------------------------------------|-----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|                                                                                      |                 |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWRF0101 | GWRF5201 | GWRF5251 | GWRF0291 |
|  | XNEX080608TR-GL | 0.80-8.00  | 0.10-0.30      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|                                                                                      | XNEX080612TR-GL | 0.80-8.00  | 0.10-0.30      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|                                                                                      | XNEX080608TR-GM | 0.80-8.00  | 0.10-0.30      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|                                                                                      |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

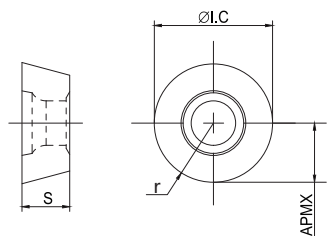
**RP□□ Inserts**



| Length | Size(mm) |     |      |      |
|--------|----------|-----|------|------|
|        | r        | I.C | S    | APMX |
| 8      | 4        | 8   | 2.78 | 4    |
| 10     | 5        | 10  | 3.18 | 5    |
| 12     | 6        | 12  | 4.76 | 6    |

| Shape                                                                             | Type       | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |         |         |         |         |
|-----------------------------------------------------------------------------------|------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                   |            |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW80101 | GW85201 | GW85251 | GW80291 |
|  | RPMW08T2MO | 1.00–3.00  | 0.05–0.25      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                   | RPMW1003MO | 1.50–4.00  | 0.05–0.30      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                   | RPMW1204MO | 1.50–5.00  | 0.05–0.35      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                   |            |            |                |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock

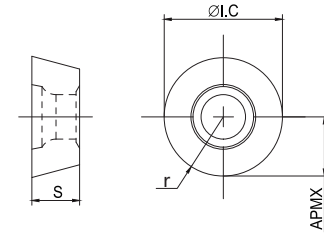


| Length | Size(mm) |     |      |      |
|--------|----------|-----|------|------|
|        | r        | I.C | S    | APMX |
| 8      | 4        | 8   | 2.78 | 4    |
| 10     | 5        | 10  | 3.97 | 5    |
| 12     | 6        | 12  | 4.76 | 6    |
| 16     | 8        | 16  | 6.35 | 8    |

| Shape                                                                               | Type           | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |         |         |         |         |
|-------------------------------------------------------------------------------------|----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                     |                |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW80101 | GW85201 | GW85251 | GW80291 |
|  | RPMT08T2MOE-JM | 1.00–1.30  | 0.05–0.25      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                     | RPMT10T3MOE-JM | 1.50–4.00  | 0.05–0.30      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                     | RPMT1204MOE-JM | 1.50–5.00  | 0.05–0.35      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                     | RPMT1606MOE-JM | 2.00–6.50  | 0.10–0.40      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |

Note: ◆ Recommended grade ready to stock

**RP□□ Inserts**

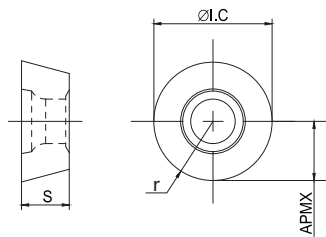


| Length | Size(mm) |     |      |      |
|--------|----------|-----|------|------|
|        | r        | I.C | S    | APMX |
| 8      | 4        | 8   | 2.78 | 4    |
| 10     | 5        | 10  | 3.18 | 5    |
| 12     | 6        | 12  | 4.76 | 6    |

| Shape                                                                               | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |         |         |         |         |
|-------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                     |               |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW80101 | GW85201 | GW85251 | GW80291 |
|  | RPMT08T2MO-GM | 1.50–4.00  | 0.10–0.30      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                     | RPMT10T3MO-GM | 1.80–5.00  | 0.10–0.50      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                     | RPMT1204MO-GM | 2.00–6.50  | 0.10–0.50      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock

**RD□□ Inserts**

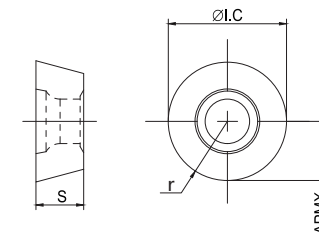


| Length | Size(mm) |     |      |      |
|--------|----------|-----|------|------|
|        | r        | I.C | S    | APMX |
| 8      | 4        | 8   | 3.18 | 4    |
| 10     | 5        | 10  | 3.97 | 5    |
| 12     | 6        | 12  | 4.76 | 6    |
| 16     | 8        | 16  | 5.56 | 8    |
| 20     | 10       | 20  | 6.35 | 10   |

| Shape | Type       | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|-------|------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|       |            |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW0101 | GW5201 | GW5251 | GW0291 |
|       | RDKT0803MO | 1.00-3.00  | 0.05-0.25      |        |        | ◆      | ◆      | ◆      | ◆      | ◆      | ◆      |        |        |        |        |
|       | RDKT10T3MO | 1.50-4.00  | 0.05-0.30      |        |        | ◆      | ◆      | ◆      | ◆      | ◆      | ◆      |        |        |        |        |
|       | RDKT1204MO | 1.50-5.00  | 0.05-0.35      |        |        | ◆      | ◆      | ◆      | ◆      | ◆      | ◆      |        |        |        |        |
|       | RDKT1604MO | 2.00-6.50  | 0.10-0.40      |        |        | ◆      | ◆      | ◆      | ◆      | ◆      | ◆      |        |        |        |        |
|       | RDKT1605MO | 2.00-6.50  | 0.10-0.40      |        |        | ◆      | ◆      | ◆      | ◆      | ◆      | ◆      |        |        |        |        |
|       | RDKT1606MO | 2.00-6.50  | 0.10-0.40      |        |        | ◆      | ◆      | ◆      | ◆      | ◆      | ◆      |        |        |        |        |
|       | RDKT2006MO | 3.00-8.00  | 0.10-0.40      |        |        | ◆      | ◆      | ◆      | ◆      | ◆      | ◆      |        |        |        |        |

Note: ◆ Recommended grade ready to stock

**RP□□ Inserts**



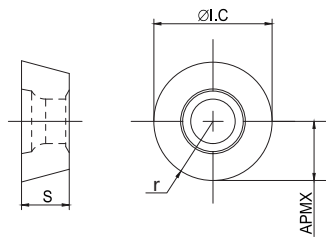
| Length | Size(mm) |     |      |      |
|--------|----------|-----|------|------|
|        | r        | I.C | S    | APMX |
| 8      | 4        | 8   | 2.78 | 4    |
| 10     | 5        | 10  | 3.97 | 5    |
| 12     | 6        | 12  | 4.76 | 6    |

| Shape | Type        | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|-------|-------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|       |             |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW0101 | GW5201 | GW5251 | GW0291 |
|       | RPMW0803-XR | 1.00-1.30  | 0.05-0.25      |        |        | ◆      | ◆      | ◆      | ◆      | ◆      | ◆      |        |        |        |        |
|       | RPMW10T3-XR | 1.50-4.00  | 0.05-0.30      |        |        | ◆      | ◆      | ◆      | ◆      | ◆      | ◆      |        |        |        |        |
|       | RPMW1204-XR | 1.50-5.00  | 0.05-0.35      |        |        | ◆      | ◆      | ◆      | ◆      | ◆      | ◆      |        |        |        |        |
|       |             |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|       |             |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|       |             |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|       |             |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock



**RP□□ Inserts**

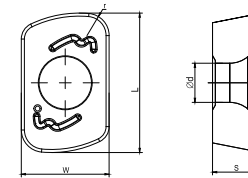


| Length | Size(mm) |     |      |      |
|--------|----------|-----|------|------|
|        | r        | I.C | S    | APMX |
| 8      | 4        | 8   | 2.78 | 4    |
| 10     | 5        | 10  | 3.97 | 5    |
| 12     | 6        | 12  | 4.76 | 6    |

| Shape                                                                              | Type       | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|------------------------------------------------------------------------------------|------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                    |            |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW0101 | GW5201 | GW5251 | GW0291 |
|  | RPMT08T2MO | 1.5-4.0    | 0.1-0.3        |        |        | ◆      | ◆      | ◆      | ◆      | ◆      | ◆      |        |        |        |        |
|                                                                                    | RPMT10T3MO | 1.8-5.0    | 0.1-0.5        |        |        | ◆      | ◆      | ◆      | ◆      | ◆      | ◆      |        |        |        |        |
|                                                                                    | RPMT1204MO | 2-6.5      | 0.1-0.5        |        |        | ◆      | ◆      | ◆      | ◆      | ◆      | ◆      |        |        |        |        |
|                                                                                    |            |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                    |            |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

**EP□□ Inserts**

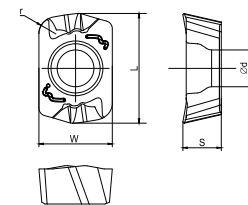


| Size(mm) |      |     |      |     |
|----------|------|-----|------|-----|
| W        | S    | d   | L    | r   |
| 6.28     | 3.18 | 2.8 | 9.79 | 1.6 |

| Shape                                                                               | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|-------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                     |               |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW0101 | GW5201 | GW5251 | GW0291 |
|  | EPNW0603TN-GH | apmax=1.5  | 0.15-0.50      |        |        | ○      | ●      | ○      | ●      | ●      | ○      |        |        |        |        |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

**LP□□ Inserts**

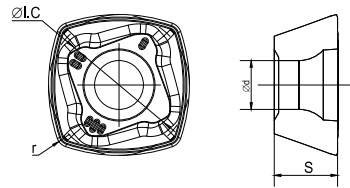


| Size(mm) |      |     |      |   |
|----------|------|-----|------|---|
| W        | S    | d   | L    | r |
| 4.19     | 2.19 | 2.1 | 6.26 | 1 |

| Shape                                                                                 | Type            | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|---------------------------------------------------------------------------------------|-----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                       |                 |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW0101 | GW5201 | GW5251 | GW0291 |
|  | LPGT010210ER-GM | apmax=1    | 0.50-1.50      |        |        | ○      | ●      | ○      | ●      | ●      | ○      |        |        |        |        |
|                                                                                       |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                       |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

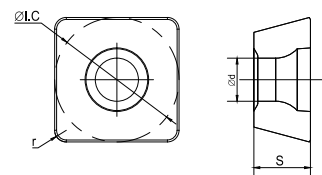
**SD□□ Inserts**



| Length | Size(mm) |      |     |
|--------|----------|------|-----|
|        | I.C      | S    | r   |
| 12     | 12.7     | 5.56 | 1.2 |
| 15     | 15.875   | 5.56 | 1.2 |

| Shape | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |               |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | SDMT120512-GM | 0.50-2.00  | 0.60-1.20      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       | SDMT150512-GM | 0.80-3.00  | 0.60-1.20      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       |               |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |               |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

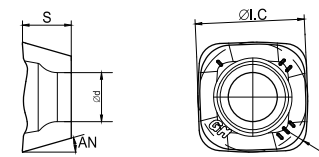


| Length | Size(mm) |      |     |
|--------|----------|------|-----|
|        | I.C      | S    | r   |
| 6      | 6.35     | 2.58 | 0.8 |
| 9      | 9.525    | 3.97 | 1.2 |
| 12     | 12.7     | 4.76 | 1.2 |
| 15     | 15.875   | 5.56 | 2   |

| Shape | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |               |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | SDMT06T208-GH | 0.50-1.20  | 0.50-1.00      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       | SDMT09T312-GH | 0.50-1.80  | 0.50-1.00      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       | SDMT120412-GH | 0.50-2.00  | 0.60-1.20      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       | SDMT150520-GH | 0.80-3.00  | 0.60-1.20      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |

Note: ◆ Recommended grade ready to stock

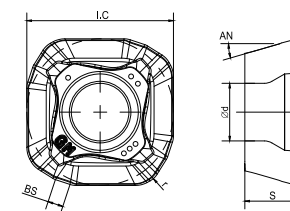
**SO□□ Inserts**



| Length | Size(mm) |      |     |   |       |
|--------|----------|------|-----|---|-------|
|        | I.C      | S    | d   | r | AN(°) |
| 10     | 10.3     | 4.58 | 4.6 | 2 | 16    |

| Shape | Type            | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|-----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |                 |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | SOMT100420ER-GM | 0.10-1.20  | 0.20-2.00      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

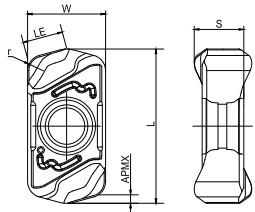


| Length | Size(mm) |      |     |     |   |       |
|--------|----------|------|-----|-----|---|-------|
|        | I.C      | S    | d   | BS  | r | AN(°) |
| 14     | 14.76    | 5.56 | 5.8 | 1.6 | 2 | 16    |

| Shape | Type            | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|-----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |                 |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | SOMT140520ER-GH | 0.50-2.00  | 0.42-2.00      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

**LN□□ Inserts**

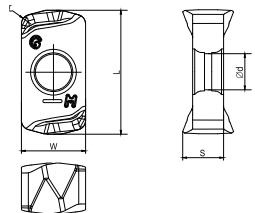


| Length | Size(mm) |      |     |     |     |
|--------|----------|------|-----|-----|-----|
|        | r        | APMX | L   | I.C | S   |
| 3      | 1.2      | 1    | 3.2 | 6   | 4.3 |

| Shape                                                                             | Type           | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|-----------------------------------------------------------------------------------|----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                   |                |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW0101 | GW5201 | GW5251 | GW0291 |
|  | LNMU0303ZER-GM | 0.20–2.00  | 0.50–1.30      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|                                                                                   |                |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                   |                |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                   |                |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

**LO□□ Inserts**

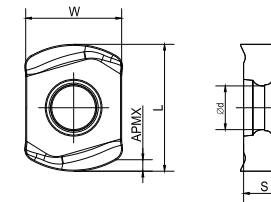


| Length | Size(mm) |      |      |      |   |
|--------|----------|------|------|------|---|
|        | W        | S    | d    | L    | r |
| 3      | 6.2      | 3.96 | 3.45 | 11.9 | 1 |

| Shape                                                                               | Type            | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |         |         |         |         |
|-------------------------------------------------------------------------------------|-----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                     |                 |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWR0101 | GWR5201 | GWR5251 | GWR0291 |
|  | LOGU030310ER-GM | apmax=1    | 0.50-1.50      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                     |                 |            |                |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                     |                 |            |                |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                     |                 |            |                |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock

**BL□□ Inserts**



| Length | Size(mm) |      |      |      |
|--------|----------|------|------|------|
|        | L        | W    | S    | APMX |
| 4      | 6        | 4.2  | 2.5  | 0.5  |
| 6      | 9        | 6.39 | 3.73 | 1    |
| 9      | 11.9     | 9.18 | 4.8  | 1.5  |
| 11     | 14.6     | 11.2 | 6.5  | 2    |

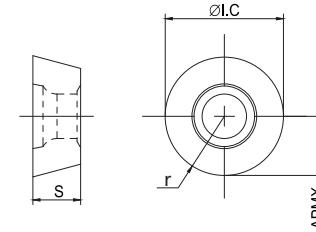
| Shape                                                                               | Type         | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |         |         |         |         |
|-------------------------------------------------------------------------------------|--------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                     |              |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWR0101 | GWR5201 | GWR5251 | GWR0291 |
|  | BLMP0402R-GM | 0.10-0.50  | 0.20-1.50      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                     | BLMP0603R-GM | 0.10-1.00  | 0.30-2.50      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                     | BLMP0904R-GM | 0.10-1.50  | 0.30-3.50      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                     | BLMP1105R-GM | 0.30-2.00  | 0.30-4.00      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |

Note: ◆ Recommended grade ready to stock

**GW**  
**CUTTING TOOLS**  
**HEAT RESISTANT ALLOYS /**  
**TITANIUM ALLOYS**



**RP□□ Inserts**

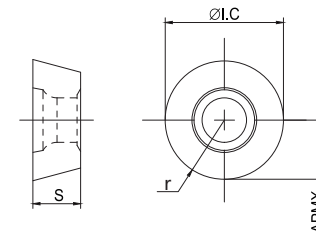


| Length | Size(mm) |     |      |      |
|--------|----------|-----|------|------|
|        | r        | I.C | S    | APMX |
| 10     | 5        | 10  | 3.18 | 5    |
| 12     | 6        | 12  | 4.76 | 6    |

| Shape | Type        | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |          |          |          |
|-------|-------------|------------|----------------|--------|--------|--------|--------|--------|----------|----------|----------|
|       |             |            |                | GW0203 | GW0403 | GW8241 | GW8251 | GW5281 | GWFR0101 | GWFR5201 | GWFR5251 |
|       | RPHX10T3-DF | 1.50-4.00  | 0.05-0.30      |        |        | ◇      |        | ◇      |          | ◆        | ◆        |
|       | RPHX1204-DF | 1.50-5.00  | 0.05-0.35      |        |        | ◇      |        | ◇      |          | ◆        | ◆        |
|       |             |            |                |        |        |        |        |        |          |          |          |

Note: ◆ Recommended grade ready to stock

**RP□□ Inserts**

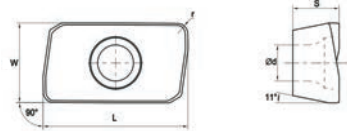


| Length | Size(mm) |     |      |      |
|--------|----------|-----|------|------|
|        | r        | I.C | S    | APMX |
| 10     | 5        | 10  | 3.18 | 5    |
| 12     | 6        | 12  | 4.76 | 6    |

| Shape | Type        | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |          |          |          |
|-------|-------------|------------|----------------|--------|--------|--------|--------|--------|----------|----------|----------|
|       |             |            |                | GW0203 | GW0403 | GW8241 | GW8251 | GW5281 | GWFR0101 | GWFR5201 | GWFR5251 |
|       | RPHX10T3-DM | 1.80-5.00  | 0.10-0.50      |        |        | ◇      |        | ◇      |          | ◆        | ◆        |
|       | RPHX1204-DM | 2.00-6.50  | 0.10-0.50      |        |        | ◇      |        | ◇      |          | ◆        | ◆        |
|       |             |            |                |        |        |        |        |        |          |          |          |

Note: ◆ Recommended grade ready to stock

**AP□□ Inserts**

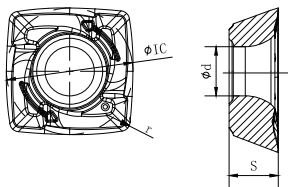


| Length | Size(mm) |     |      |       |
|--------|----------|-----|------|-------|
|        | L        | W   | S    | r     |
| 11     | 11.4     | 6.2 | 3.5  | 0.8   |
| 16     | 17.25    | 9.2 | 4.76 | 0.8、3 |

| Shape | Type              | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |          |          |          |          |
|-------|-------------------|------------|----------------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |                   |            |                | GW0203 | GW0403 | GW8241 | GW8251 | GW5281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | APMT1135PDER-DF   | 2.5-7.5    | 0.05-0.25      |        |        | ◇      |        | ◇      |          | ◆        | ◆        |          |
|       | APMT160408PDER-DF | 3.5-10     | 0.07-0.5       |        |        | ◇      |        | ◇      |          | ◆        | ◆        |          |
|       | APMT160430PDER-DF | 5.0-10     | 0.2-0.5        |        |        | ◇      |        | ◇      |          | ◆        | ◆        |          |
|       |                   |            |                |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

**SD□□ Inserts**

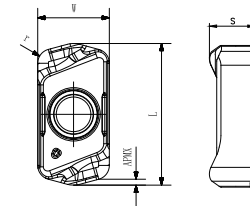


| Length | Size(mm) |      |     |
|--------|----------|------|-----|
|        | I.C      | S    | r   |
| 6      | 6.35     | 2.78 | 0.5 |
| 9      | 9        | 3.5  | 0.7 |

| Shape | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |          |          |          |          |
|-------|---------------|------------|----------------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |               |            |                | GW0203 | GW0403 | GW8241 | GW8251 | GW5281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | SDMT06T205-DM |            | 0.1-1.0        |        |        | ◇      |        | ◇      |          | ◆        | ◆        |          |
|       | SDMT09T307-DM |            | 0.2-1.2        |        |        | ◇      |        | ◇      |          | ◆        | ◆        |          |
|       |               |            |                |        |        |        |        |        |          |          |          |          |
|       |               |            |                |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

**LN□□ Inserts**



| Length | Size(mm) |      |      |      |     |
|--------|----------|------|------|------|-----|
|        | W        | S    | APMX | L    | r   |
| 3      | 6        | 3.75 | 1    | 11.8 | 1.2 |
|        |          |      |      |      |     |

| Shape | Type            | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |          |          |          |          |
|-------|-----------------|------------|----------------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |                 |            |                | GW0203 | GW0403 | GW8241 | GW8251 | GW5281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | LNMTU0303ZER-MS | 0.2-2.0    | 0.5-1.3        |        |        | ◇      |        | ◇      |          | ◆        | ◆        |          |
|       |                 |            |                |        |        |        |        |        |          |          |          |          |
|       |                 |            |                |        |        |        |        |        |          |          |          |          |
|       |                 |            |                |        |        |        |        |        |          |          |          |          |

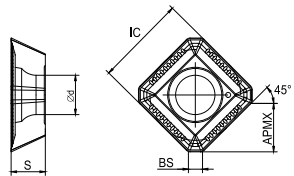
Note: ◆ Recommended grade ready to stock

## MILLING INSERTS

45° Face Milling Inserts /  
88° Approaching Angle

Cost-effective Face Milling Inserts

### SE□□ Inserts

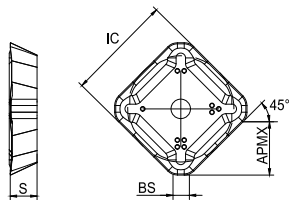


| Length | Size(mm) |      |      |      |
|--------|----------|------|------|------|
|        | BS       | APMX | I.C  | S    |
| 12     | 1.5      | 6.5  | 12.7 | 4.76 |

| Shape | Type            | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|-----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |                 |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | SEMT1204AFTN-GM | 3.00-8.50  | 0.09-0.16      |        |        | ◆      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

### SE□□ Inserts

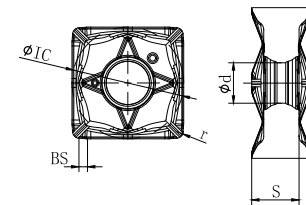


| Length | Size(mm) |      |        |      |
|--------|----------|------|--------|------|
|        | BS       | APMX | I.C    | S    |
| 12     | 1.5      | 6.5  | 12.7   | 3.19 |
| 15     | 2        | 8.5  | 15.875 | 4.76 |

| Shape | Type        | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|-------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |             |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | SEER1203-GM | 1.50-6.00  | 0.10-0.25      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       | SEER1504-GM | 1.50-8.00  | 0.10-0.25      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       |             |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |             |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

### SN□□ Inserts

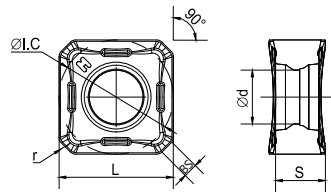


| Length | Size(mm) |     |    |     |
|--------|----------|-----|----|-----|
|        | I.C      | S   | BS | r   |
| 13     | 13       | 5.5 | 1  | 0.8 |

| Shape | Type            | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|-----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |                 |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | SNMU130508EN-GM | 1.0-5.0    | 0.1-0.25       |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |                 |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

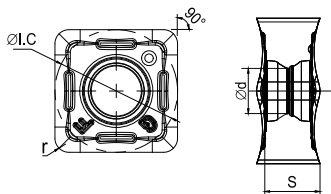
**SN□□ Inserts**



| Length | Size(mm) |     |     |
|--------|----------|-----|-----|
|        | I.C      | S   | BS  |
| 12     | 12.7     | 6.4 | 1.5 |
| 16     | 16       | 7.7 | 1.8 |

| Shape | Type           | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|-------|----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|       |                |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW8251 | GW8281 | GW8251 | GW8281 |
|       | SNMX1205ANN-GM | 1.00-6.00  | 0.15-0.50      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|       | SNMX1606ANN-GM | 1.00-6.00  | 0.15-0.50      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|       |                |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|       |                |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

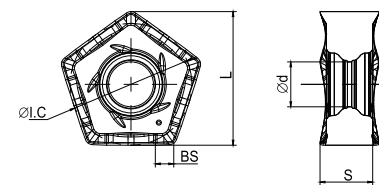


| Length | Size(mm) |     |         |
|--------|----------|-----|---------|
|        | I.C      | S   | r       |
| 9      | 9.525    | 5.5 | 0.8-1.1 |

| Shape | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|-------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|       |               |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW8251 | GW8281 | GW8251 | GW8281 |
|       | SNGX090408-GF | 2.50-7.50  | 0.08-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|       | SNGX090411-GF | 2.50-7.50  | 0.08-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|       |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|       |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

**PN□□ Inserts**



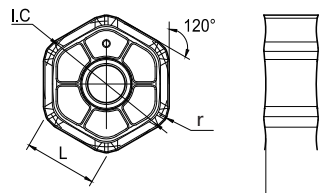
| Length | Size(mm) |      |      |     |    |
|--------|----------|------|------|-----|----|
|        | L        | S    | d    | BCH | BS |
| 09     | 12.2     | 13.4 | 5.35 | 4.5 | 2  |
|        |          |      |      |     |    |

| Shape | Type            | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|-------|-----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|       |                 |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW8251 | GW8281 | GW8251 | GW8281 |
|       | PNCU0905GNEN-GM | 0.50-3.00  | 0.20-0.60      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|       |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|       |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|       |                 |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock



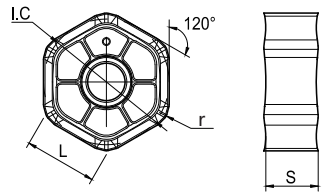
**HN□□ Inserts**



| Length | Size(mm) |      |     |
|--------|----------|------|-----|
|        | I.C      | S    | r   |
| 9      | 15.875   | 5.56 | 1.2 |

| Shape                                                                             | Type           | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|-----------------------------------------------------------------------------------|----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                   |                |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW0101 | GW5201 | GW5251 | GW0291 |
|  | HNMG0907ANSN-R | 1.50-4.00  | 0.20-0.70      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|                                                                                   |                |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                   |                |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                   |                |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

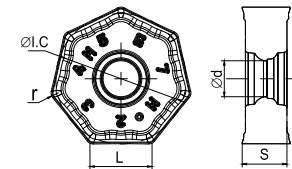


| Length | Size(mm) |      |     |
|--------|----------|------|-----|
|        | I.C      | S    | r   |
| 9      | 15.875   | 5.56 | 1.2 |

| Shape                                                                               | Type           | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|-------------------------------------------------------------------------------------|----------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                     |                |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW0101 | GW5201 | GW5251 | GW0291 |
|  | HNMG0907ANSN-M | 1.00-3.00  | 0.05-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|                                                                                     |                |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                     |                |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                     |                |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

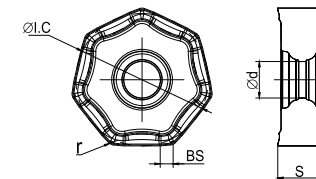
**XN□□ Inserts**



| Length | Size(mm) |     |   |     |
|--------|----------|-----|---|-----|
|        | I.C      | S   | d | r   |
| 7      | 12       | 5.8 | 4 | 0.8 |

| Shape                                                                               | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |         |         |         |         |
|-------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
|                                                                                     |               |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWR0101 | GWR5201 | GWR5251 | GWR0291 |
|  | XNMU070508—MM | 0.2—3.0    | 0.05—0.2       |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |         |         |         |         |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |         |         |         |         |
|                                                                                     |               |            |                |        |        |        |        |        |        |        |        |         |         |         |         |

Note: ◆ Recommended grade ready to stock

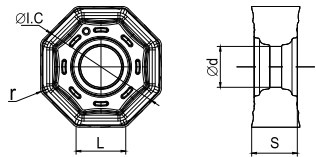


| Length | Size(mm) |     |     |    |     |
|--------|----------|-----|-----|----|-----|
|        | I.C      | S   | d   | BS | r   |
| 9      | 19.05    | 5.9 | 5.5 |    | 1.2 |

| Shape                                                                                 | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |        |        |        |        |
|---------------------------------------------------------------------------------------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                                                                       |               |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GW0101 | GW5201 | GW5251 | GW0291 |
|  | XNMG090612-GR | 0.3-3.0    | 0.05-0.3       |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |        |        |        |        |
|                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                       |               |            |                |        |        |        |        |        |        |        |        |        |        |        |        |

Note: ◆ Recommended grade ready to stock

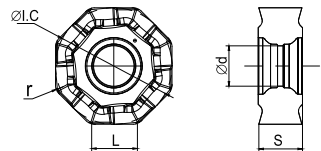
**ON□□ Inserts**



| Length | Size(mm) |      |     |
|--------|----------|------|-----|
|        | I.C      | S    | r   |
| 05     | 12.7     | 4.76 | 0.8 |

| Shape | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |               |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | ONHU050408-AR | 0.8-3.5    | 0.2-0.35       |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       |               |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |               |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |               |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

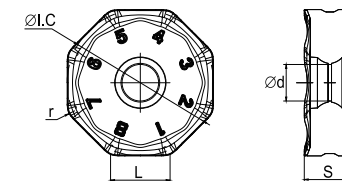


| Length | Size(mm) |      |     |
|--------|----------|------|-----|
|        | I.C      | S    | r   |
| 05     | 12.7     | 4.76 | 0.8 |

| Shape | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |               |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | ONHU050408-AF | 0.5-2.5    | 0.1-0.25       |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       |               |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |               |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |               |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

**ON□□ Inserts**

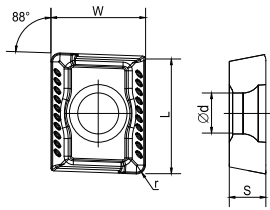


| Length | Size(mm) |     |      |
|--------|----------|-----|------|
|        | I.C      | S   | BS   |
| 09     | 22       | 5.8 | 0.45 |
| 09     | 22       | 5.8 | 2.11 |

| Shape | Type              | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|-------------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |                   |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | ONMU090520ANTN-GM | 0.80-2.50  | 0.10-0.20      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       | ONMU090520ANTN-GR | 1.00-3.50  | 0.10-0.20      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       |                   |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |                   |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

**AP□□ Inserts**

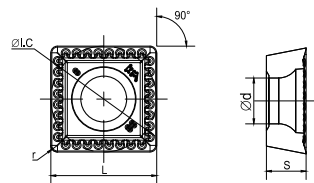


| Length | Size(mm) |      |      |     |     |
|--------|----------|------|------|-----|-----|
|        | L        | W    | S    | d   | r   |
| 15     | 16.33    | 12.7 | 4.76 | 5.4 | 1.2 |

| Shape | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |               |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | APKT150412-PM | 1.2-8      | 0.08-0.2       |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       | APKT150415-KM | 1.2-8      | 0.08-0.2       |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       |               |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |               |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

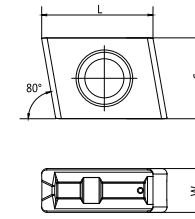
**SP□□ Inserts**



| Length | Size(mm) |      |      |      |     |
|--------|----------|------|------|------|-----|
|        | r        | L    | I.C  | S    | d   |
| 12     | 0.8      | 12.7 | 12.7 | 4.76 | 5.5 |

| Shape | Type          | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|---------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |               |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | SPMT120408-PM | 1.00-6.00  | 0.06-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       | SPMT120408-KM | 1.00-6.00  | 0.06-0.15      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       |               |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |               |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

**CN□□ Inserts**

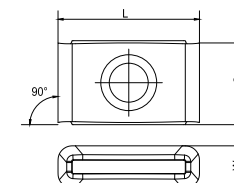


| Type    | Size(mm) |    |     |
|---------|----------|----|-----|
|         | L        | S  | W   |
| 160608T | 16       | 12 | 6.4 |

| Shape | Type        | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|-------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |             |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | CNHX160608T | 1.20-5.50  | 0.20-0.60      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       |             |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |             |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |             |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note: ◆ Recommended grade ready to stock

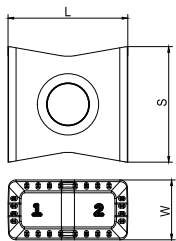
**LN□□ Inserts**



| Type     | Size(mm) |     |      |
|----------|----------|-----|------|
|          | L        | S   | W    |
| 16090416 | 16       | 9.5 | 4.76 |

| Shape | Type         | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|--------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |              |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | LNKT16090416 | 1.60-12.00 | 0.15-0.50      |        |        | ◇      | ◆      | ◇      | ◆      | ◆      | ◇      |          |          |          |          |
|       |              |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |              |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |              |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

LN□□ Inserts



| Type   | Size(mm) |       |      |
|--------|----------|-------|------|
|        | L        | S     | W    |
| 120608 | 12.7     | 12.25 | 6.35 |

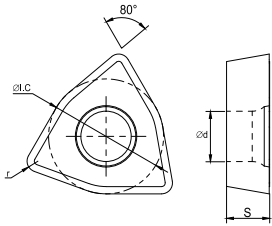
| Shape | Type       | Ap<br>(mm) | Fn<br>(mm/rev) | CVD    |        | PVD    |        |        |        |        |        |          |          |          |          |
|-------|------------|------------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|----------|----------|
|       |            |            |                | GW0203 | GW0403 | GW0151 | GW0251 | GW8241 | GW8251 | GW5251 | GW8281 | GWFR0101 | GWFR5201 | GWFR5251 | GWFR0291 |
|       | LNKX120608 | 2.00-7.00  | 0.10-0.20      |        |        | ◆      | ◆      | ◆      | ◆      | ◆      | ◆      |          |          |          |          |
|       |            |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |            |            |                |        |        |        |        |        |        |        |        |          |          |          |          |
|       |            |            |                |        |        |        |        |        |        |        |        |          |          |          |          |

Note:◆Recommended grade ready to stock

GW  
CUTTING TOOLS  
DRILLING INSERTS



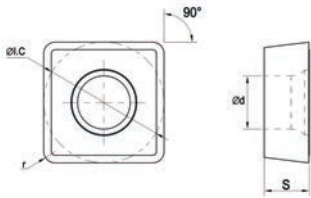
WC□□ Inserts



| Shape                                                                              | Type          | Boring Range<br>( mm ) | Size |       |      |     |     | Application    | Grade  |        |
|------------------------------------------------------------------------------------|---------------|------------------------|------|-------|------|-----|-----|----------------|--------|--------|
|                                                                                    |               |                        | L    | øI.C  | S    | Φd  | r   |                | PVD    |        |
|                                                                                    |               |                        |      |       |      |     |     |                | GW0251 | GW8251 |
|  | WCMT030208—GM | 16—20                  | 3.8  | 5.56  | 2.38 | 2.8 | 0.8 | Semi-finishing | ◆      | ◆      |
|                                                                                    | WCMT040208—GM | 21—25                  | 4.3  | 6.35  | 2.38 | 3.1 | 0.8 |                | ◆      | ◆      |
|                                                                                    | WCMT050308—GM | 26—30                  | 5.4  | 7.94  | 3.18 | 3.2 | 0.8 |                | ◆      | ◆      |
|                                                                                    | WCMT06T308—GM | 31—41                  | 6.5  | 9.525 | 3.97 | 3.7 | 0.8 |                | ◆      | ◆      |
|                                                                                    | WCMT080412—GM | 42—58                  | 8.7  | 12.7  | 4.76 | 4.3 | 1.2 |                | ◆      | ◆      |

Note: ◆ Recommended grade ready to stock

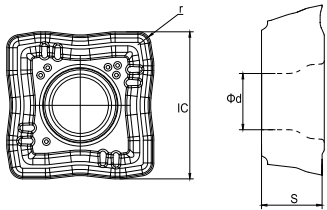
SP□□ Inserts



| Shape                                                                                | Type          | Boring Range<br>( mm ) | Size |      |      |      |     | Application    | Grade  |        |
|--------------------------------------------------------------------------------------|---------------|------------------------|------|------|------|------|-----|----------------|--------|--------|
|                                                                                      |               |                        | L    | øI.C | S    | Φd   | r   |                | PVD    |        |
|                                                                                      |               |                        |      |      |      |      |     |                | GW0251 | GW8251 |
|  | SPMT050204-GM | 12.5-15                | 5    | 5    | 2.38 | 2.2  | 0.4 | Semi-finishing | ◆      | ◆      |
|                                                                                      | SPMT060204-GM | 15.5-21.5              | 6    | 6    | 2.38 | 2.6  | 0.4 |                | ◆      | ◆      |
|                                                                                      | SPMT07T308-GM | 22-27.5                | 7.94 | 7.94 | 3.97 | 2.8  | 0.8 |                | ◆      | ◆      |
|                                                                                      | SPMT090408-GM | 28-33                  | 9.8  | 9.8  | 4.3  | 4.2  | 0.8 |                | ◆      | ◆      |
|                                                                                      | SPMT110408-GM | 34-41                  | 11.5 | 11.5 | 4.76 | 4.4  | 0.8 |                | ◆      | ◆      |
|                                                                                      | SPMT140512-GM | 42-50                  | 14.3 | 14.3 | 5.2  | 5.75 | 1.2 |                | ◆      | ◆      |

Note: ◆ Recommended grade ready to stock

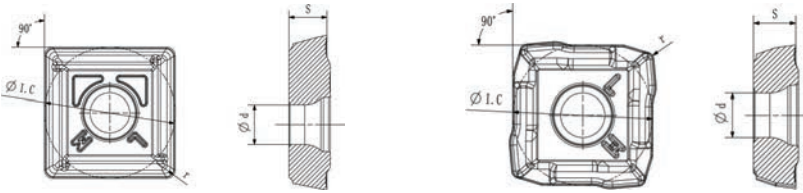
SO□□ Inserts



| Shape                                                                              | Type          | Boring Range<br>( mm ) | Size |      |      |     |     | Application    | Grade  |        |
|------------------------------------------------------------------------------------|---------------|------------------------|------|------|------|-----|-----|----------------|--------|--------|
|                                                                                    |               |                        | L    | øI.C | S    | Φd  | r   |                | PVD    |        |
|                                                                                    |               |                        |      |      |      |     |     |                | GW0251 | GW8251 |
|  | SOMT040204-VP | 13-16                  | 1    | 4.4  | 2.38 | 2.2 | 0.4 | Semi-finishing | ◆      | ◆      |
|                                                                                    | SOMT050204-VP | 13-16                  | 1.2  | 4.9  | 2.38 | 2.2 | 0.4 |                | ◆      | ◆      |
|                                                                                    | SOMT060204-VP | 16.5-17                | 1.8  | 5.7  | 2.38 | 2.6 | 0.4 |                | ◆      | ◆      |
|                                                                                    | SOMT070306-VP | 17.5-19                | 1.8  | 6.8  | 2.8  | 2.6 | 0.6 |                | ◆      | ◆      |
|                                                                                    | SOMT08T306-VP | 22.5-26.5              | 2    | 7.8  | 3.97 | 2.8 | 0.6 |                | ◆      | ◆      |
|                                                                                    | SOMT09T308-VP | 27.5-31.5              | 2.4  | 9.2  | 3.97 | 3.8 | 0.8 |                | ◆      | ◆      |
|                                                                                    | SOMT11T308-VP | 32-36.5                | 3    | 11   | 3.97 | 3.8 | 0.8 |                | ◆      | ◆      |
|                                                                                    | SOMT130408-VP | 37-43                  | 3.2  | 12.8 | 4.4  | 4.5 | 0.8 |                | ◆      | ◆      |

Note:◆Recommended grade ready to stock

SO SP□□ Inserts



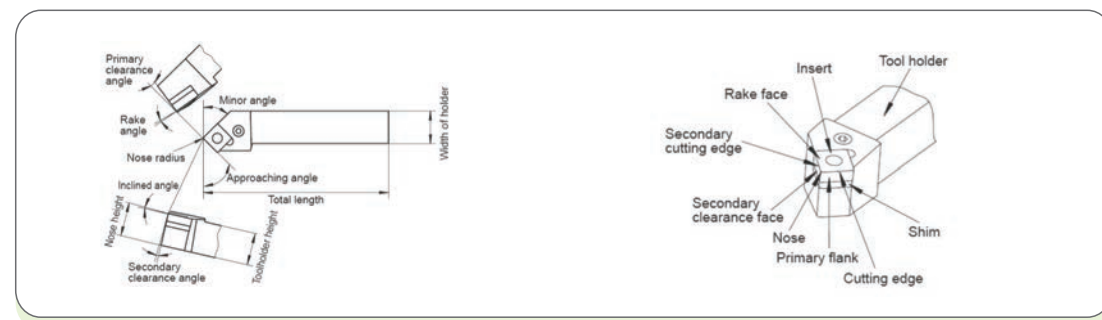
| Shape                                                                                 | Type           | Boring Range<br>( mm ) | Size  |      |      |      | Application      | Grade  |        |
|---------------------------------------------------------------------------------------|----------------|------------------------|-------|------|------|------|------------------|--------|--------|
|                                                                                       |                |                        | øI.C  | S    | Φd   | r    |                  | PVD    |        |
|                                                                                       |                |                        |       |      |      |      |                  | GW0251 | GW8251 |
|    | SOMT050305C-LM | 24-29                  | 8.40  | 3.00 | 3.20 | 0.50 | Medium Machining | ◆      | ◆      |
|                                                                                       | SOMT060406C-LM | 30-41                  | 10.20 | 3.50 | 4.00 | 0.60 |                  | ◆      | ◆      |
|                                                                                       | SOMT070406C-LM | 30-41                  | 12.36 | 4.00 | 4.00 | 0.60 |                  | ◆      | ◆      |
|                                                                                       | SOMT080508C-LM | 44-63                  | 14.90 | 4.50 | 4.70 | 0.80 |                  | ◆      | ◆      |
|                                                                                       | SOMT090608C-LM | 44-63                  | 17.90 | 5.50 | 4.70 | 0.80 |                  | ◆      | ◆      |
|                                                                                       |                |                        |       |      |      | ◆    |                  | ◆      |        |
|  | SPMT050308P-LM | 24-29                  | 8.90  | 3.00 | 3.20 | 0.80 |                  | ◆      | ◆      |
|                                                                                       | SPMT060408P-LM | 30-41                  | 10.70 | 3.50 | 4.00 | 0.80 |                  | ◆      | ◆      |
|                                                                                       | SPMT070410P-LM | 30-41                  | 12.70 | 3.95 | 4.00 | 1.00 |                  | ◆      | ◆      |
|                                                                                       | SPMT080510P-LM | 44-63                  | 15.50 | 4.50 | 4.70 | 1.00 |                  | ◆      | ◆      |
|                                                                                       | SPMT090610P-LM | 44-63                  | 18.60 | 5.50 | 4.70 | 1.00 |                  | ◆      | ◆      |



## Part one: General Technical Information for Turning Machining

### The Functions of Each Part of Turning Tools

#### ● The Names Of Each Part Of Turning Tools



#### ● Effects of Rake Angle

Larger rake angle makes cutting edge sharper, reduces resistant forces of chip flow, diminishes friction and prevents deformation, leading to smaller, less abrasion and higher surface quality. However, too large rake angle would reduce the rigidity and strength of tool. Heat can't be diffused easily. Serious breakage and abrasion on tool would occur, reducing tool life. Please choose rake angle according to machining conditions.

| Value selection  | Situations                                                                                                                                  |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Small rake angle | <ul style="list-style-type: none"> <li>When machining brittle and hard materials;</li> <li>When roughing and interrupted cutting</li> </ul> |
| Big rake angle   | <ul style="list-style-type: none"> <li>When machining Plastic or soft materials;</li> <li>When finishing;</li> </ul>                        |

#### ● Effects of Clearance Angle

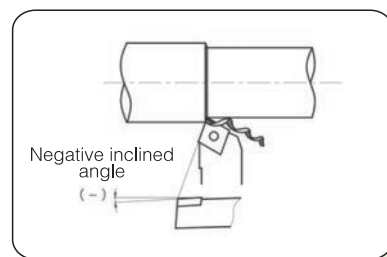
The main function of clearance angle is to reduce the friction between the clearance face of tool and the surface of workpiece. When the rake angle is fixed, larger clearance angle can increase and achieve higher surface quality. However, if clearance angle is too large, the strength of cutting edge would decrease. Also, heat can't be diffused easily and serious abrasion would occur, reducing tool life. The principle of choosing clearance angle: Choose small clearance angle if friction is not serious.

| Value selection       | Situations                                                                                                                                            |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Small clearance angle | <ul style="list-style-type: none"> <li>In order to increase nose strength when roughing</li> <li>When machining brittle and hard materials</li> </ul> |
| Large clearance angle | <ul style="list-style-type: none"> <li>In order to reduce friction when finishing</li> <li>When machining materials easy to be hardened;</li> </ul>   |

#### ● Effects of Inclined Angle

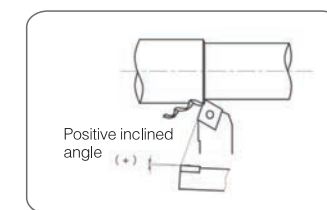
Positive or negative inclined angle determines the direction of chip flow, and also affects the strength and impact resistance of insert nose.

As diagram(1) shows, when the inclined angle is negative, namely nose is in the lowest point as apposed to the bottom of the tool, chips flow to the machined surface of workpiece.



As diagram(2) shows, when inclined angle is positive, namely the nose is in the highest point as apposed to the bottom of the tool, chips flow to the areas of workpiece surface that haven't been machined.

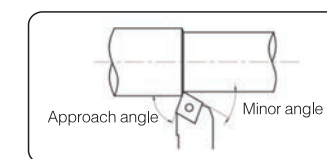
The change of inclined angle also affects insert nose strength and impact resistance. When the inclined angle is negative, the nose is in the lowest point of cutting edge. When the cutting edge enters the workpiece, the contacting point is on the cutting edge or rake face, protecting the nose from impact and increasing the strength of the nose. Normally, negative inclined angle should be chosen for tools with big rake angle. This can not only increase nose strength, but also prevent the



#### ● Effects of Approach Angle

Reducing approach angle increases the strength of tools and enables heat to diffuse easily, improving surface quality. This is because when the approach angle is small, cutting edge width is large, and then the unit width of cutting edge bears less cutting force. Meanwhile, tool life can be improved.

Normally, select 90° approach angle for turning of slender and step shaft; select 45° approach angle for external turning. End surface machining and chamfering. When approach angle is larger, radial force is reduced, cutting is stable, cutting thickness is increased, and chip breaking is excellent.



| Value selection    | Situations                                                                               |
|--------------------|------------------------------------------------------------------------------------------|
| Small approach     | For those materials with high intensity, high hardness and hardened layer on the surface |
| Big approach angle | When rigidity of the machine is not enough                                               |

#### ● Effects of Minor Angle

Minor angle is the main angle that can affect surface quality, and it can also affect tool strength. If the approach angle is too small, the friction between the secondary flank and machined surface of workpiece will increase, causing vibration. The principle of selecting minor angle: Select small minor angle when roughing or when the friction is unaffected and is on vibration. Select large minor angle when finishing.

#### ● Effects of Cutting Edge Grinding

According to different use occasions, choose a cutting edge method from the table below

| Shape of the cutting edge | shape |
|---------------------------|-------|
| sharp edge                |       |
| corner                    |       |
| chamfer                   |       |



Cutting edge grinding is a processing method used to maintain the cutting edge strength. The grinding amount is large, the cutting edge strength is high, not easy to damage, the tool life is improved, but the excessive grinding amount will cause the edge sharpness is not enough, the cutting force will be large, but also may produce vibration.

| Value selection         | Situations                                                                                                                                                                                                                |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Small regrinding amount | <ul style="list-style-type: none"><li>• Finishing machining – small <math>A_p</math> &amp; <math>F_n</math></li><li>• For processing soft materials</li><li>• When the machine or workpiece is not rigid enough</li></ul> |
| Large regrinding amount | <ul style="list-style-type: none"><li>• Rough machining</li><li>• When machining hard materials and intermittent cutting</li><li>• When machine rigidity is good</li></ul>                                                |

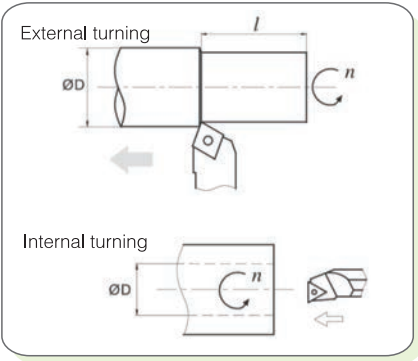
8 Nose Radius

Nose radius significantly affects nose strength and surface quality.  
Large nose radius means higher cutting edge strength, and the abrasion on the rake face and clearance face can be reduced to some extent. However, if the nose radius is too large, radial force will increase, and vibration is easy to occur, affecting machining precision and surface quality

| Value selection   | Situations                                                                                                                                                                                  |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Small nose radius | <ul style="list-style-type: none"><li>● Finishing at small cutting depth</li><li>● Machining parts such as slender shaft</li><li>● When the rigidity of the machine is not enough</li></ul> |
| Large nose radius | <ul style="list-style-type: none"><li>● When roughing</li><li>● When machining hard materials (intermittent cutting)</li><li>● When the rigidity of the machine is good enough</li></ul>    |

Calculation Method of Turning Parameters

1 Calculation of Cutting Speed

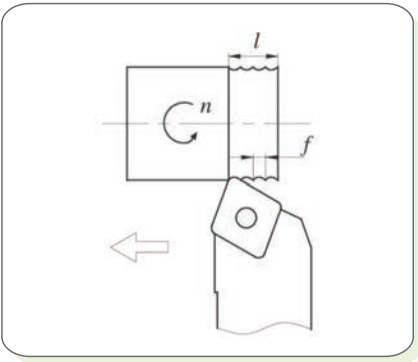


$$V_c = \frac{\pi \times D \times n}{1000} (m/min)$$

In the formula:  
 $V_c$ : Cutting speed(m/min)  
 $n$ : Rotating speed of main axle (rev/min)  
 $D$ : Diameter of workpiece(mm)  
For example: When the rotating speed is 500ev/min and the diameter of workpiece is 80mm, the cutting

$$V_c = \frac{\pi \times D \times n}{1000} = \frac{3.14 \times 80 \times 500}{1000} = 125.6(m/min)$$

2 Calculation of Feed Rate



$$f = \frac{l}{n} (mm/rev)$$

In the formula:  
 $f$ : Feed rate per rotation(mm/rev)  
 $L$ : Cutting length per minute(mm/min)  
 $N$ : Rotating speed of main axle(rev/min)  
For example: When the rotating speed of main axle is 600ev/min, and the cutting length per minute is 150mm/min, the feed rate per rotating should be:

$$f = \frac{l}{n} = \frac{150}{600} = 0.25(mm/rev)$$

### 3 Cutting Time Calculation of External and Internal Turning

$$T = \frac{l}{f \times n} (\text{min})$$

In the formula: T: Cutting time(min)

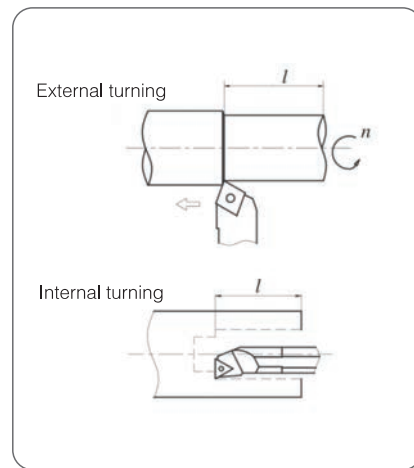
L: length of machined areas(mm)

F: Feed rate(mm/rev)

N: Rotating speed of main axle(rev/min) For

example: When the rotating speed of main axle is 300rev/min, and the feed rate is 0.15mm/rev.the time needed for a cutting length of 180mm should be:

$$T = \frac{l}{f \times n} = \frac{180}{0.15 \times 300} = 4 \text{ min}$$



### 4 Time Calculation End Surface Turning (Constant Linear Speed)

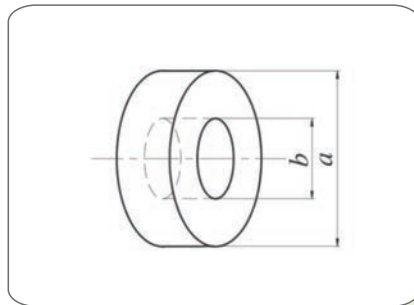
$$T = \frac{\pi \times (a^2 - b^2)}{4000 \times V_c \times f} (\text{min})$$

In the formula: T: Cutting time(min)

Vc: length of machined areas(mm)

F: Cutting speed For end surface without hole,

b=0,the formula is still Valid.



### 5 The Oretical Value Calculation of Machined Surface Roughness

$$R = \frac{f^2}{8r_c} \times 1000 (\mu\text{m})$$

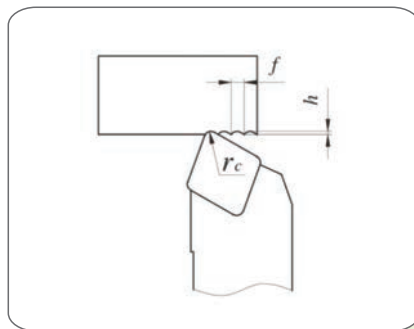
In the formula: R: Theoretical roughness value of machined surface

F: Feed rate(mm/rev)

Rc: Nose radius(mm)

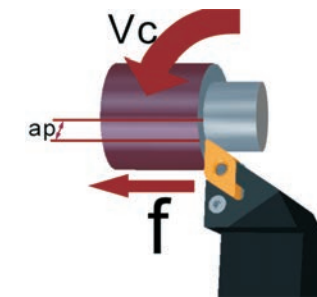
For example: When the feed rate is 0.25mm/rev,and the nose radius is 0.8mm. the theoretical roughness value of machined surface should be:

$$R = \frac{f^2}{8r_c} \times 1000 = \frac{0.25^2}{8 \times 0.8} \times 1000 = 9.76 (\mu\text{m})$$



## The Influence of Three Elements of Turning on Machining

Normally,short machining time,long tool life and high machining precision are expected in machining,so the material quality.hardness.and shape of the workpiece.and properties of machine should be fully considered and then we can select suitable tools and adopt high-efficiency cutting parameters,namely three parameters.



### 1 Cutting Speed(vc)

(1)Definition of cutting speed

When the workpiece is rotating on the machine,the number of is rotation per minute is defined as Rotating speed of main axle(n).Because of its rotation,the cutting speed measured on the contacting point of diameter is defined as linear speed.m/min.Normally,linear,linear speed is considered to measure the effect of cutting speed on machining.

(2)Effect of Cutting Speed

Cutting speed has significant effect in tool life.When the cutting speed is increased,cutting temperature will increase and tool life will be shortened.Cutting speed varies according to the different types and hardness of work-piece.The below conclusions are reached after many cutting experiments:

- Normally tool life would be reduced to half when the cutting speed is increased by 20%.Tool life would be 20% of the original life if the cutting speed is raised by 50%.
- Low speed(20-40m/min)cutting could easily cause vibration and shorten tool life.

### 2 Feed Rate(fn)

(1)Definition of feed rate

Feed rate is defined as the moving distance of tool after workpiece rotates for one circle,measured by mm/rotation.

(2)The influence of feed rate

Feed rate is a key factor that determines surface quality.Meanwhile it also affect the range of chip forming and the thickness of chips during machining.

In term of the effect on tool life,small feed rate leads to serious abrasion on clearance face,reducing tool life.

### 3 Cutting Depth(ap)

#### (1) Definition of cutting depth

Cutting depth is defined as the difference between machined surface and unmachined surface. Measured by mm, it is half the difference value between the original diameter and machined diameter.

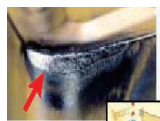
#### (2) Effect of Cutting Depth

Cutting depth should be determined by the machining allowance and shape of workpiece, power and rigidity of machine, and tool rigidity.

The change of cutting depth has little effect on tool life. If the cutting depth is too low, the cutting nose only scrapes the hardened layer on the workpiece surface, reducing tool life. When there is a hardened oxide layer on the workpiece surface, higher cutting depth should be adopted within the possible range of machine's power to avoid cutting noise just cutting the hardened layer of workpiece.

## Blade Wear and Solution

#### (1) Flank Wear



##### Problem:

Higher cutting resistance. Notch wear on flank. Poor roughness of surface or deterioration of accuracy

##### Reason:

Soft grades. Excessive cutting speed. Small flank angle. Low feed

##### Solutions:

Select a higher wear-resistant grade. Reduce cutting speed. Increase flank angle. Increase feed



#### (2) Crater Wear



##### Problem:

Uncontrolled chip. Poor surface quality when finishing. High speed processing carbon steel

##### Reason:

Soft grades. Excessive cutting speed. Excessive feed. The strength of chip breaker insufficient

##### Solutions:

Change to a higher wear-resistant grade. Reduce cutting speed. Reduce feed. Select a higher strength chip breaker

#### (3) Plastic Deformation



##### Problem:

Variation of dimension. Nose wear, cutting edge drapes or passivating, when processing alloy steel. Poor surface roughness

##### Reason:

Soft grade. Excessive cutting speed. Excessive cutting depth and feed rate. Overheat on cutting edge

##### Solutions:

Select a higher red hardness cutting material. Decrease cutting speed. Decrease cutting depth and feed rate. Select a higher thermal conductivity cutting material (CVD + sufficient coolant)

#### (4) Build-Up-Edge



##### Problem:

Workpiece dissolves with cutting edge. Poor surface roughness when finishing. Cutting resistance increased. Cutting soft materials

##### Reason:

Cutting speed too low. Cutting edge obtuse. Unsuitable tool material

##### Solutions:

Increase cutting speed. Increase rake angle. Select small sticking force

#### (5) Chip Hammering



##### Problem:

Part of the cutting edge that does not participate in cutting is damaged by chip hammering, the upper and support of the insert may be damaged.

##### Reason:

Chip folds back to the cutting edge

Solutions: Change the feed rate and choose another type of chip breaker

#### (6) Insert Fracture



##### Problem:

Cutting resistance increased. Poor surface roughness

##### Reason:

Toughness insufficient. Excessive feed rate. Strength of cutting edge insufficient. Instability of the tool

##### Solutions:

Select a tougher grade. Decrease feed rate. Increase honing of cutting edge (chamfering to rounding). Increase the stability and setting angle

#### (7) Thermal Crack



##### Problem:

Crack by heat cycle (often happens in milling and interrupted cutting)

##### Reason:

Toughness of tool grade insufficient. Swell and shrink by cutting heat (cold-thermocycling)

##### Solutions:

Cutting without coolant/sufficient coolant. Select a tougher and more thermal shock resistance grade

#### (8) Chipping



##### Problem:

Sudden fracture of cutting edge (rake face and flank). Instability insert life

##### Reason:

Toughness insufficient. Excessive feed rate. Strength of cutting edge insufficient. Instability of the tool

##### Solutions:

Select a tougher grade. Decrease feed rate. Increase honing of cutting edge (chamfering to rounding). Increase the stability and setting angle

Application Information of Threading

1 Threading inserts cutting method selection

- Please follow the following steps to get the best threading result:
- 1.Select proper thread machining method.
  - 2.Define helical angle and select shim.
  - 3.Select proper insert and tool holder size.
  - 4.By checking reference table of standard threading programs,select feasible cutting parameters.
  - 5.Select feed way.

2 Machining method of threading tools

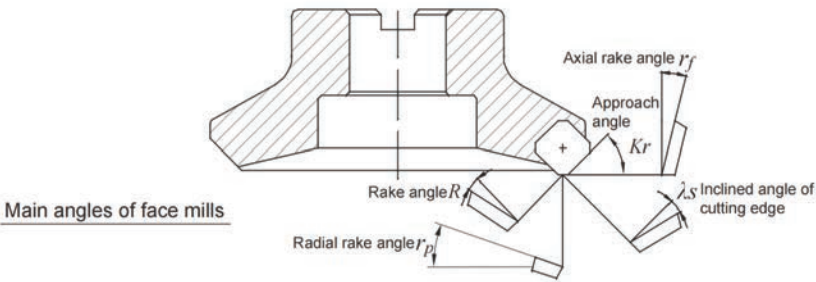
|                              | Right thread | Left thread |
|------------------------------|--------------|-------------|
| Internal threading machining |              |             |
| External threading machining |              |             |

3 In-feed way of threading tools

| Cutting thread method       | Feature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Radial in-feed<br>          | <ul style="list-style-type: none"><li>• Easy operating, high general.</li><li>• V-shape chip caused by long chip steel workpiece will produce big bend stress on cutting edge.</li><li>• It requires low cutting depth, sharp cutting edge and good tough material.</li><li>• Big quantity of heat when cutting ,V-shape chip is hard to control.</li><li>• Because the interface of cutting chips on the right and left side is long, so it is easy to cause vibration and make the cutting edge suffer more overloading.</li></ul> |
| Flank in-feed<br>           | <ul style="list-style-type: none"><li>• Cutting edge suffer small bend stress, stable estate, it is easy for chips formation in deep cutting depth.</li><li>• There are enough space to leave chips flow when flank in-feed.</li><li>• Big abrasion on right flank.</li></ul>                                                                                                                                                                                                                                                        |
| Modified flank in-feed<br>  | <ul style="list-style-type: none"><li>• Right Cutting Edge also engage on cutting depth to a certain extent, it can reduce the abrasion on right side of clearance face.</li><li>• Cutting edge suffer small bend stress, stable estate, it is easy for chips formation in deep cutting depth.</li><li>• Good Cutting Performance.</li></ul>                                                                                                                                                                                         |
| Alternate flank in-feed<br> | <ul style="list-style-type: none"><li>• Cutting edge trade off when machining, equality abrasion on left and right side of clearance face on cutting edge, it can improve the life of tools.</li><li>• Chips are flowing from both of right and left side, good chips flowing.</li><li>• Recommend using in big screw-pitch thread cutting.</li></ul>                                                                                                                                                                                |

Second part:Technical Information About Indexable Miling Tools

Function of Each Part in Face Milling



| Designation                  | Function                                                | Effect                                                                                  |                                        |                                                             |
|------------------------------|---------------------------------------------------------|-----------------------------------------------------------------------------------------|----------------------------------------|-------------------------------------------------------------|
| Axial rake angle $\gamma_f$  | Determining the chip direction                          | Negative,excellent capability of chip removal                                           |                                        |                                                             |
| Radial rake angle $\gamma_p$ | Determining whether the cutting is easy and fast or not | Positive angle:good cutting performance                                                 |                                        |                                                             |
| Approach angle $Kr$          | Determining the chip thickness                          | $Kr \uparrow$ , chip thickness $\uparrow$ ; $Kr \downarrow$ chip thickness $\downarrow$ |                                        |                                                             |
| Rake angle $R_o$             | Determining whether easy and fast the cutting is or not | Poor cutting performance, High- Poor cuttingstrength cutting edge                       | ( - ) $\leftarrow 0 \rightarrow$ ( + ) | Good cutting performance, Lowstrength cutting edge          |
| Inclined angle $\lambda_s$   | Determining the chip flow direction                     | Poor capability of chip removal,High-strength cutting edge                              | ( - ) $\leftarrow 0 \rightarrow$ ( + ) | Good performance of chip removal, Low-strength cutting edge |

1 Milling cutter parameters selection

● Characteristics of Different Rake Angles Combined

|                              |  | Double positive rake angle | Double negative rake angle | Positive and negative negative rake angle |
|------------------------------|--|----------------------------|----------------------------|-------------------------------------------|
| Negative rake angle          |  |                            |                            |                                           |
| 0° rake angle                |  |                            |                            |                                           |
| Positive rake angle          |  |                            |                            |                                           |
| Axial rake angle $\gamma_f$  |  | +                          | -                          | +                                         |
| Radial rake angle $\gamma_p$ |  | +                          | -                          | -                                         |

|                              |   |   |   |   |
|------------------------------|---|---|---|---|
| Applicable material machined | P | ✓ |   | ✓ |
|                              | M | ✓ |   | ✓ |
|                              | K |   | ✓ | ✓ |
|                              | N | ✓ |   |   |
|                              | S | ✓ |   | ✓ |

2 Selection of Approach Angle

● Selection Method of Cutting Tools

| Designation | Schematic diagram | Instruction                                                                                                                                                                           |
|-------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 45°         |                   | Axial force is the largest,it will bend when machining thin-wall workpiece,reducing the precision of workpiece.It can help avoid fringe brekage of workpiece when machining cast iron |
| 75°         |                   | The main force is radial cutting force,in is often used in general face milling                                                                                                       |
| 90°         |                   | The main force is radial cutting force,in is often used in general face milling                                                                                                       |



### 3 Selection of Approach Angle:

The approach angle is formed by insert and tool body. It affects chip thickness. Cutting forces and tool-life. Decreasing the approach angle reduces chip thickness and expands the cutting area between cutting edge and workpiece at a given feed rate. A smaller approach angle also ensures stable entry into or exiting workpiece, protecting the cutting edge and extending tool life. However, this will increase axial cutting forces on the workpiece, thus is not suitable for machining thin workpiece such as thin plate.

| Approach angle | Feed rate per tooth $f_z$ | Maximum chip stickiness $h_{ex}$                                  |
|----------------|---------------------------|-------------------------------------------------------------------|
| 90°            | $f_z$                     | $h_{ex} = f_z \times \sin Kr$                                     |
| 75°            | $f_z$                     | $h_{ex} = 0.96 \times f_z$                                        |
| 60°            | $f_z$                     | $h_{ex} = 0.86 \times f_z$                                        |
| 45°            | $f_z$                     | $h_{ex} = 0.707 \times f_z$                                       |
| Circular Blade | $f_z$                     | $h_{ex} = \frac{\sqrt{IC^2 \times (IC - 2a_p)^2}}{IC} \times f_z$ |

### 4 Pitch Selection

Pitch is the distance between one point on one cutting edge and the same point on the next edge.

| Optimized stability                                                                                                                                                                            |                                                                                     |                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| L ( Low )                                                                                                                                                                                      | M ( Medium )                                                                        | H ( High )                                                                                                               |
|                                                                                                             |  |                                      |
| When the milling width is equal to diameter of cutter, the machining system is stable and main power of machine is sufficient, the use of coarse pitch can achieve high productive efficiency. | Used in general milling and multiple mixed productions.                             | When the milling width is less than diameter of cutter, cutting by maximum edges can achieve high productive efficiency. |

## Milling calculation

### 1 General Formula

$V_c$  : cutting speed ( m/min )

$D_c$  : nominal diameter of milling tool ( mm )

$n$  : spindle speed ( rev/min )

$z_n$  : number of teeth

$Q$  : metal removal rate ( cm<sup>3</sup>/min )

$V_f$  : feed rate of worktable ( feed speed ) ( mm/min )

$f_z$  : feed rate per tooth ( mm/z )

$\pi$  : circumference ratio = 3.14

$T_c$  : machining time ( min )

$f_n$  : feed rate per revolution ( mm/rev )

$L$  : Actual working distance ( mm )

#### ● Cutting speed

$$V_c = \frac{\pi \times D_c \times n}{1000} \text{ ( m/min )}$$

#### ● Spindle speed

$$n = \frac{1000 \times V_c}{\pi \times D_c} \text{ ( rev/min )}$$

#### ● Feed rate of worktable ( feed speed )

$$V_f = f_z \times n \times z_n \text{ ( mm/min )}$$

#### ● Feed rate per tooth

$$f_z = \frac{V_f}{n \times z_n} \text{ ( mm/z )}$$

#### ● Feed rate per revolution

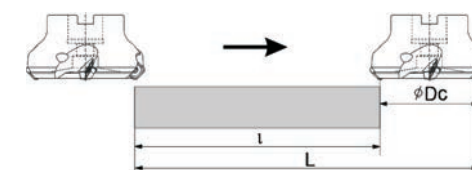
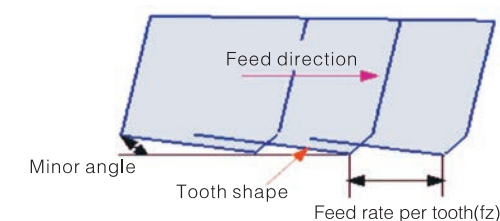
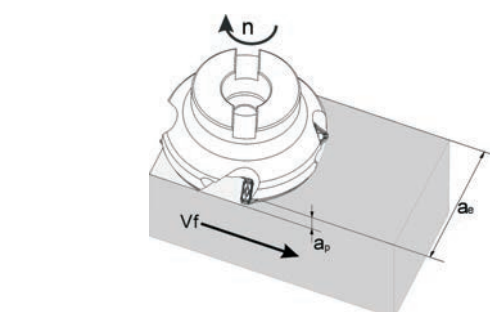
$$f_n = \frac{V_f}{n} \text{ ( mm/rev )}$$

#### ● Machining time

$$T_c = \frac{L}{v_f} \text{ ( min )}$$

#### ● Metal removal rate

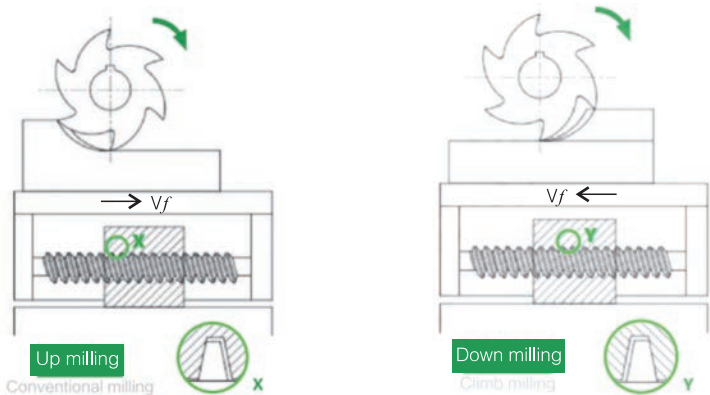
$$Q = \frac{a_p \times a_e \times V_f}{1000} \text{ cm}^3 / \text{min}$$



Difference and Selection Between Down Milling and Up Milling

Climb milling (also called down milling): the feed direction of workpiece is the same as that of the milling rotation at the connecting position.

Conventional milling (also called up milling): the feed direction of workpiece is opposite to that of the milling rotation at the connecting position.



In down milling, the major force of cutting edge is the compressive stress, while in up milling is the tensile stress. The compressive strength of cemented carbide material is much larger than its tensile strength. In down milling, as chips become thin from thick gradually, cutting edge and workpiece press against each other. The friction between edge and workpiece is small, thus reducing the abrasion of edge, the hardening of workpiece surface and the surface roughness (Ra). In up milling, chips become thick from thin gradually. When the insert is cutting into the workpiece, it produces strong friction and more heat than in down milling, and make workpiece surface hardened.

In up milling, because horizontal direction of cutting force milling cutter conducting on workpiece is opposite to the feed direction of workpiece, the lead screw of worktable joints closely with one side of the screw nut. In down milling, the direction of cutting force is the same as the feed direction. When edge's radial force on workpiece is large enough, the worktable will bounce left and right, thus make the gap fall behind. The gap will return to the front side with the continuing rotation of lead screw. At this moment the worktable stops motion, however, it will bounce left and right again when the radial cutting force is large enough again. The periodical bounce of worktable will cause poor surface quality of workpiece and tool breakage.

When using end mills for down milling, the edges always start cutting at the workpiece surface, therefore end mills are not suitable for machining workpiece with hardened surface.

Up milling is recommended for milling thin-wall components or square milling with high requirement for precision.

CVD Grades Comparison Table

| ISO | Grewin           | SANDVIK          | KENNAMETAL                | SecoTool | ISCAR                      | TaeguTec         | Walter                     | TUNGALOY       | KYOCERA          | KORLOY                     | SUMITOMO         | MITSUBISHI                 | ZCC.CT           |
|-----|------------------|------------------|---------------------------|----------|----------------------------|------------------|----------------------------|----------------|------------------|----------------------------|------------------|----------------------------|------------------|
| P10 | GW2154<br>GW3154 | GC4315           | KCP10<br>KC9110           | TP1500   | IC5005<br>IC8150           | TT8115           | WPP05S<br>WPP10S           | T9115          | CA5505<br>CA5515 | NC3215                     | AC810P<br>AC820P | UE6110<br>MY5015           | YBC151<br>YBC152 |
| P20 | GW2254<br>GW3254 | GC4325           | KCP25<br>KC9125<br>KC9225 | TP2500   | IC8150<br>IC8250           | TT5100<br>TT8125 | WKP25S<br>WPP20S<br>WMP20S | T9025<br>T9125 | CA5515<br>CA5525 | NC3225<br>NC3120<br>NC5330 | AC2000<br>AC820P | UE6020<br>MC6025<br>F7030  | YBC251<br>YBC252 |
| P30 | GW2354<br>GW3354 | GC4325<br>GC4335 | KCP30<br>KCP40            | TP3000   | IC8250<br>IC8350           | TT8125<br>TT5100 | WKP35S<br>WPP30S<br>WMP20S | T9135<br>T9035 | CA5525<br>CA5535 | NC3030<br>NC5340<br>NC500H | AC630M<br>AC830P | UE6020U<br>E6035U<br>H6400 | YBC252<br>YBC351 |
| M10 |                  | GC2015           | KCM15                     |          | IC6015<br>IC8150           | TT9215           | WMP20S                     |                | CA6515<br>CA6015 | NC9115                     | AC610M<br>AC630M | US7020<br>MC7015           | YBM251<br>YBM153 |
| M20 |                  | GC2015<br>GC2025 | KCM15<br>KC9225           | TM2000   | IC6025<br>IC8150<br>IC8250 | TT9225           | WMP20S                     | T6020<br>T6130 | CA6515<br>CA6525 | NC9115<br>NC9125<br>NC5330 | AC630M<br>AC830P | US7020<br>MC7015<br>MC7025 | YBM251<br>YBM253 |
| M30 |                  | GC2035<br>GC2025 | KCM25<br>KC9230           | TM4000   | IC6025<br>IC8250<br>IC8350 | TT5100           | WSM45X                     | T6130          | CA6525           | NC5340<br>NC5350<br>NC9135 | AC630M           | MC7025<br>US735<br>F7030   | YBM351           |
| K10 |                  | GC3210<br>GC3215 | KCK05<br>KCK15            | TK1000   | IC5005<br>IC5010           | TT1300           | WAK15<br>WPP01             | T5010<br>T5115 | CA4505<br>CA4010 | NC6315                     | AC410K           | UC5115<br>MY5015           | YBD102<br>YBD152 |
| K20 | GW3153<br>GW4153 | GC3215           | KCK15<br>KCK20            | TK2000   | IC5005<br>IC5010           | TT7105<br>TT7310 | WKP25S<br>WPP10S           | T5115<br>T5125 | CA4515<br>CA4115 | NC6315<br>NC5330           | AC410K<br>AC420K | UC5115<br>UE6110<br>MC5020 | YBD152           |
| K30 | GW0403           | GC3225           | KC9325                    |          | IC5010                     |                  | WKP35S<br>WPP20S           | T5125          |                  | NC5340                     | AC820P           | UE6110                     | YBD252           |



PVD Grades Comparison Table

| ISO | Grewin                       | SANDVIK                    | KENNAMETAL                 | SecoTool                 | ISCAR                    | TaeguTec                   | Walter                    | TUNGALOY                | KYOCERA                  | KORLOY                     | SUMITOMO                   | mitsubishi                 | ZCC.CT                     |
|-----|------------------------------|----------------------------|----------------------------|--------------------------|--------------------------|----------------------------|---------------------------|-------------------------|--------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| P10 | GW0251                       | GC1010<br>GC1025           | KC715M                     |                          | IC807<br>IC907           | TT7030<br>TT7080           | WXM15<br>WSM10<br>WSM10S  |                         | PR730<br>PR830<br>PR1225 |                            | ACP100<br>ACP200           | VP10MF                     | YBG102<br>YBG105           |
| P20 | GW8251<br>GW5251<br>GW0251   | GC1010<br>GC1025<br>GC2030 | KC522M<br>KC525M           | CP200                    | IC807<br>IC907<br>IC3028 | TT7030<br>TT9030<br>TT9080 | WSM20<br>WSM20S<br>WSM21  | AH725<br>AH120<br>GH330 | PR730<br>PR830<br>PR1225 | PC3600                     | ACP200                     | VP15TF<br>VP20RT<br>VP20MF | YBG202<br>YBG205           |
| P30 | GW0251                       | GC1025<br>GC1030           | KC725M<br>KC530M           | CP500                    | IC807<br>IC808<br>IC3028 | TT8080<br>TT9030<br>TT9080 | WSP45S<br>WSP46<br>WSM30S | AH730<br>GH130<br>AH130 | PR660<br>PR1230          | PC3600<br>PC3500<br>PC5300 | ACZ300<br>ACZ350<br>ACZ200 | VP15TF<br>VP30RT<br>VP20MF | YBG302                     |
| M10 | GWR0101<br>GW8241            | GC1025<br>GC1030           | KC715M                     | CP200                    | IC807                    |                            | WSM10<br>WSM10S           |                         | PR630<br>PR730<br>PR1225 | PC8105<br>PC8110           | ACP200                     | VP10MF                     | YBG202<br>YBG205           |
| M20 | GW8241<br>GW5251<br>GW8281   | GC1025<br>GC1030           | KC5025<br>KC715M           | CP200<br>TS2500<br>CP500 | IC354<br>IC807<br>IC3028 | TT9030<br>TT9080           | WSM20<br>WSM20S<br>WSM21  | GH120<br>AH120<br>AH725 | PR660<br>PR730<br>PR1225 | PC8110<br>PC8115<br>PC5300 | ACZ310<br>AC520U<br>ACP300 | VP15TF<br>VP20RT<br>VP20MF | YBG202<br>YBG205<br>YB9320 |
| M30 | GW8281                       | GC1030<br>GC1040<br>GC2030 | KC725M<br>KC5525           | CP500<br>F30M            | IC808<br>IC908           | TT8080<br>TT9030<br>TT9080 | WSP35S<br>WSP36<br>WSM30S | AH130<br>GH130<br>AH730 | PR660<br>PR730           | PC5300<br>PC9530<br>PC5400 | ACZ330<br>AC520U<br>ACZ350 | VP15TF<br>VP30RT<br>MP7030 | YBG302<br>YBG402           |
| K10 | GW0151                       | GC1210                     | KC5010<br>KC510M           | CP200                    | IC910                    |                            | WHH15<br>WXM15            | AH110<br>GH110          | PR510<br>PR905<br>PR1210 | PC8110<br>PC6510           | ACZ310<br>ACK200           | VP10RT                     | YBG102<br>YBG105           |
| K20 | GW8251<br>GW5251<br>GW0251   | GC1020<br>GC1220           | KC5025<br>KC520M<br>KC525M | CP200<br>CP500           | IC808<br>IC908           | TT6080                     | WKK25S                    | AH120<br>GH110<br>AH330 | PR905<br>PR1210          | PC5300                     | ACZ310<br>ACK200           | VP15TF<br>VP20RT           | YBG202                     |
| K30 | GW0251                       | GC1020                     | KC735M<br>KU25T            | CP500                    | IC808<br>IC908           |                            | WKK25S                    | GH130                   |                          | PC5400                     | ACZ330<br>ACK300           | VP15TF<br>VP20RT           | YBG205<br>YBG302           |
| S10 | GWR0101                      | GC1025                     | KC510M<br>KC5510<br>KCS10B | CP200<br>TS2000          | IC806                    | TT9030                     | WSM10<br>WSM10S           | AH905<br>AH110<br>SH730 | PR660<br>PR905           | PC8105<br>PC8110           | EH520Z<br>EH20Z<br>AC510U  | VP10RT<br>VP20RT           | YBS103                     |
| S20 | GW5251<br>GWR5201<br>GWR5251 | GC1025<br>GC2030           | KC522M<br>KC525M<br>KC5525 | CP250<br>TS2500<br>CP500 | IC806<br>IC807<br>IC808  | TT9030<br>TT9080           | WSM20<br>WSM20S<br>WSM21  | AH120<br>AH725          | PR1225<br>PR905          | PC8115<br>PC5300           | EH520Z<br>EH20Z<br>AC520U  | VP15TF<br>VP20RT<br>MP9130 | YBS203                     |
| S30 | GWR0291<br>GWR0301           | GC2030<br>S30T             | KC725M                     | F40M                     | IC8350                   | TT8080<br>TT9030<br>TT9080 | WSM45S<br>WSP46<br>WSM30S | AH725                   | PR905                    | PC5400                     | ACK300<br>AC520U           | VP15TF                     | YBS303                     |