For Machining Heat-Resistant Alloy

PR005S/PR015S

Providing Stable and Consistent Performance while Machining of Heat-Resistant Alloys

- Improved thermal properties help to reduce sudden fracture and decrease edge wear
- Improved wear resistance with MEGACOAT HARD coating
- New chipbreaker designs improve machining stability

Finishing to Medium Machining  SQ Chipbreaker
For Roughing Applications  SX Chipbreaker
For Machining Heat-Resistant Alloy

**PR005S/PR015S**

Improved Thermal Properties Help to Reduce Sudden Fracture and Edge Wear

1. Newly Developed Substrate Helps to Reduce Sudden Fracture and Notch Wear

   - **PR005S**: Hard, Wear-resistant Grade for High-speed Machining
   - **PR015S**: General Purpose Grade with Excellent Wear Resistance and Stability

   ![Pattern Diagram](image)

   - Improved thermal conductivity by optimum distribution of WC coarse grains
   - Resists heat concentration at the cutting edge to promote stable machining

   **Fracture Resistance Comparison** (Internal Evaluation)

<table>
<thead>
<tr>
<th></th>
<th>PR015S</th>
<th>Competitor A</th>
<th>Competitor B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Impacts</td>
<td>80</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>Average Value of 4 Corners</td>
<td>100</td>
<td>80</td>
<td>60</td>
</tr>
</tbody>
</table>

   Cutting Conditions: Vc = 25 m/min, ap = 1.0 mm, f = 0.10 mm/rev, Wet, CNMG120408 Type
   Workpiece: Nickel-based Superalloy
   Cylindrical Workpiece with 1 Flat Face

2. Improved Wear Resistance with MEGACOAT HARD coating

   **Coating Film Property** (Internal Evaluation)

   - TiCN
   - TiAIN
   - MEGACOAT HARD
   - TiN

   **Wear Resistance Comparison** (Internal Evaluation)

   - Excellent wear resistance with high-hardness and resists boundary damage with improved thermal properties

   Cutting Conditions: Vc = 60 m/min, ap = 1.0 mm, f = 0.20 mm/rev, Wet, CNMG120408 Type
   Workpiece: Nickel-based Superalloy

   Machining Time: 3.5 min
   Competitor D could only reach 2.6 minutes.
New Chipbreaker Designs Improve Machining Stability

Finishing to Medium Machining  SQ Chipbreaker
Extended Tool Life and Improved Efficiency for Mid-range to Finishing Applications in Heat-Resistant Alloys

**SQ Chipbreaker Benefits**
- Reduced Temperature at the Cutting Edge
- Extended Tool Life
- Reduces Burring
- Extended Tool Life and Efficiency Improvements

**Slant Cutting Edge**
Inclined in (-) Direction
Effective for Burr Suppression and Reducing Notching

Special Axial Face Design Decreases Cutting Edge Temperature
Optimal Design Achieved with Simulation Technology

**Simulation of Edge-Temperature Comparison**
Internal Evaluation

Cutting Conditions: Vc = 40 m/min, f = 0.15 mm/rev, CNMG120408 Type, Dry
Workpiece: Nickel-based Superalloy

The newly developed chipbreaker reduces temperature at the cutting edge, thereby improving tool life and machining efficiency in semi-finishing applications

**Applicable Chipbreaker Range**
(ap Indicates Radial Depth of Cut per Side)

**Cutting Force Comparison (Radial Force)**
Internal Evaluation

Cutting Conditions: Vc = 40 m/min, f = 0.15 mm/rev, Wet, CNMG120408 Type
Workpiece: Nickel-based Superalloy

**Wear Resistance Comparison**
Internal Evaluation

Cutting Conditions: Vc = 40 m/min, ap = 1.0 mm, f = 0.20 mm/rev, Wet, CNMG120408 Type
Workpiece: Nickel-based Superalloy
For Roughing SX Chipbreaker
Improved Efficiency for Roughing Applications in Heat-Resistant Alloys

**SX Chipbreaker Benefits**
- Decreased Edge Temperature
- Longer Tool Life
- Suppresses Burr Formation
- Greater Depths of Cut
- Decreased Radial Forces
- Resists Edge Build-up and Improves Efficiency

**Rake Design Decreases Temperature at the Cutting Edge**
Optimal design achieved with CNC simulation technology

**Unique Cutting Edge Design (Handed Insert)**
- 60 Degree Lead Angle (when installed in the toolholder)
- 12 Degree Rake Angle

**Simulation of Edge-Temperature Comparison** (Internal Evaluation)

**Applicable Chipbreaker Range**
(ap indicates Radial Depth of Cut per Side)

**Wear Resistance Comparison** (Internal Evaluation)

Even in larger depths of cut, the SX chipbreaker is able to suppress burr build-up
Increased D.O.C capability and reduced notch wear combine to provide greater machining efficiency
**Recommended Cutting Conditions**

<table>
<thead>
<tr>
<th>Workpiece</th>
<th>Cutting Range</th>
<th>Application</th>
<th>Recommended Chipbreaker</th>
<th>Recommended Grade</th>
<th>Min. - Recommendation</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finishing</td>
<td>Continuous</td>
<td>MQ</td>
<td>PR005S</td>
<td>30 – 55 – 90</td>
<td>0.2 – 0.3 – 1.0</td>
<td>0.05 – 0.08 – 0.15</td>
</tr>
<tr>
<td></td>
<td>Intermittent</td>
<td></td>
<td>PR015S</td>
<td>25 – 45 – 70</td>
<td>0.2 – 0.5 – 1.0</td>
<td>0.05 – 0.1 – 0.2</td>
</tr>
<tr>
<td>Heat-Resistant Alloys</td>
<td>Continuous</td>
<td>MU</td>
<td>PR005S</td>
<td>30 – 55 – 90</td>
<td>0.5 – 1.0 – 2.0</td>
<td>0.1 – 0.15 – 0.3</td>
</tr>
<tr>
<td></td>
<td>Intermittent</td>
<td></td>
<td>PR015S</td>
<td>25 – 45 – 70</td>
<td>0.5 – 1.0 – 2.0</td>
<td>0.1 – 0.15 – 0.3</td>
</tr>
<tr>
<td>Medium</td>
<td></td>
<td>MS</td>
<td>PR005S</td>
<td>30 – 55 – 90</td>
<td>0.5 – 1.0 – 2.0</td>
<td>0.1 – 0.15 – 0.3</td>
</tr>
<tr>
<td></td>
<td>Intermittent</td>
<td></td>
<td>PR015S</td>
<td>25 – 45 – 70</td>
<td>0.5 – 1.0 – 2.0</td>
<td>0.1 – 0.15 – 0.3</td>
</tr>
<tr>
<td></td>
<td>Continuous</td>
<td>SQ</td>
<td>PR005S</td>
<td>30 – 55 – 90</td>
<td>0.3 – 0.5 – 1.5</td>
<td>0.1 – 0.17 – 0.35</td>
</tr>
<tr>
<td></td>
<td>Intermittent</td>
<td></td>
<td>PR015S</td>
<td>25 – 45 – 70</td>
<td>0.3 – 0.5 – 1.5</td>
<td>0.1 – 0.17 – 0.35</td>
</tr>
<tr>
<td>Roughing</td>
<td>Continuous</td>
<td>SX</td>
<td>PR005S</td>
<td>30 – 55 – 90</td>
<td>0.5 – 2.0 – 4.0</td>
<td>0.15 – 0.3 – 0.45</td>
</tr>
<tr>
<td></td>
<td>Intermittent</td>
<td></td>
<td>PR015S</td>
<td>25 – 45 – 70</td>
<td>0.5 – 2.0 – 4.0</td>
<td>0.15 – 0.3 – 0.45</td>
</tr>
</tbody>
</table>

**Caution when Using SX Chipbreaker**

1. **Cutting Edge Height**
   - The center of the cutting edge height of the nose is slanted by 60 degrees based on circled portions in image below.

![60 Degree Cutting Edge](image)

2. **Recommended D.O.C.**
   - Recommended depth of cut is no greater than the 60° lead angle; however, larger depths of cut are possible.

<table>
<thead>
<tr>
<th>Description</th>
<th>Recommended D.O.C. External Turning (mm)</th>
<th>Max. D.O.C. Facing (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNMM1204X PQ-SX</td>
<td>0.5 – 2.0 – 4.0</td>
<td>2.0</td>
</tr>
<tr>
<td>CNMM1606X PQ-SX</td>
<td>0.5 – 2.5 – 4.5</td>
<td>2.0</td>
</tr>
<tr>
<td>CNMM1906X PQ-SX</td>
<td>0.5 – 3.0 – 5.0</td>
<td>2.5</td>
</tr>
</tbody>
</table>

3. **Applicable Toolholder**
   - The SX chipbreaker insert requires a different shim than standard inserts.
   - No additional toolholder modifications are necessary when using the applicable Kyocera holders.

<table>
<thead>
<tr>
<th>Insert Description</th>
<th>Applicable Toolholder (Kyocera)</th>
<th>Standard Shim</th>
<th>Shim for SX Chipbreaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNMM1204X PQ-SX</td>
<td>DCLN PQ/2020K-12</td>
<td>DC-44</td>
<td>DC-44-C</td>
</tr>
<tr>
<td></td>
<td>DCLN PQ/2525M-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CNMM1606X PQ-SX</td>
<td>PCLN PQ/2020K-12</td>
<td>LC-42N</td>
<td>LC-42N-C</td>
</tr>
<tr>
<td></td>
<td>PCLN PQ/2525M-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CNMM1906X PQ-SX</td>
<td>PCLN PQ/3232P-19</td>
<td>LC-63</td>
<td>LC-63-C</td>
</tr>
</tbody>
</table>

4. **Unmachined portion varies with insert size**
   - Unmachined portion is reflected below.

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount Uncut (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
</tr>
<tr>
<td>CNMM1204X PQ-SX</td>
<td>4.1</td>
</tr>
<tr>
<td>CNMM1606X PQ-SX</td>
<td>4.8</td>
</tr>
<tr>
<td>CNMM1906X PQ-SX</td>
<td>5.4</td>
</tr>
</tbody>
</table>

5. **Facing**
   - Facing is possible, but turning is recommended.
   - Cutting edge may drop below center in facing operations (Boss remains at the center of the workpiece).

<table>
<thead>
<tr>
<th>Description</th>
<th>Run-out Amount when Facing (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNMM1204X PQ-SX</td>
<td>0.75</td>
</tr>
<tr>
<td>CNMM1606X PQ-SX</td>
<td>0.85</td>
</tr>
<tr>
<td>CNMM1906X PQ-SX</td>
<td>1.05</td>
</tr>
</tbody>
</table>
## Applicable Chipbreaker Range

### (ap Indicates Radial Depth of Cut per Side)

### Stock Items

<table>
<thead>
<tr>
<th>Shape</th>
<th>Description</th>
<th>Dimensions (mm)</th>
<th>Finishing-Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>SX</td>
<td>SNMG 120404MQ 120408MQ</td>
<td>12.70 4.76 5.16 0.4 0.8</td>
<td>● ● ●</td>
</tr>
<tr>
<td>SQ</td>
<td>SNMG 120404MQ 120408MQ</td>
<td>12.70 4.76 5.16 0.4 0.8</td>
<td>● ● ●</td>
</tr>
</tbody>
</table>

**Stock Items**

- **CNMM…XR/L-SX** inserts are single-sided with 2 cutting edges.

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