

THE NEW VALUE FRONTIER



# CA65<sup>15/25</sup> and PR11<sup>25</sup>

## for Stainless Steel Machining

New! MQ  
Chipbreaker

### ■ Innovative Solutions for Stainless Steel Machining

- +Minimize Notching
- +Prevent Burrs
- +Reduce Edge Build-up

ADVANCING PRODUCTIVITY

# New Coated Carbide: CA65<sup>15</sup>/CA65<sup>25</sup> & PR11<sup>25</sup>

CVD Coated Carbide

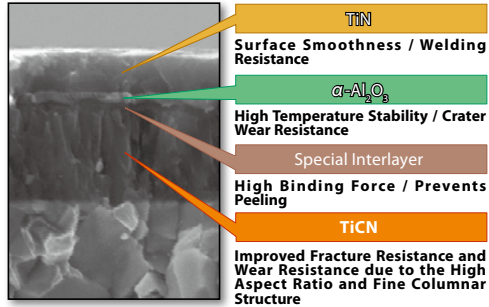
PVD Coated Carbide

- CA65<sup>15</sup>/CA65<sup>25</sup> (CVD coating) and PR11<sup>25</sup> (PVD coating) is applicable to various types of machining such as stainless steel, heat-resistant steel and steel.

## CA65<sup>15/25</sup>

Thin Ultra Fine TiCN Coating

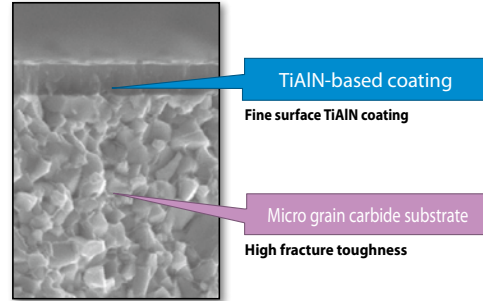
- CVD coated carbide
- Excellent fracture resistance



## PR11<sup>25</sup>

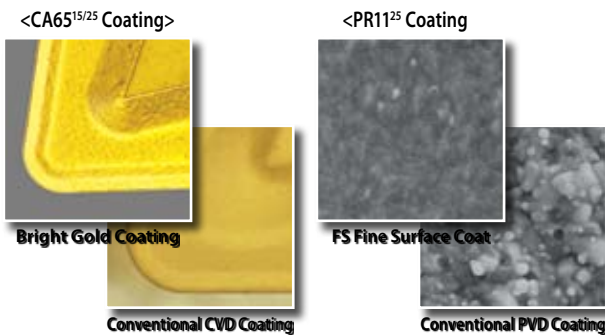
Thin Fine TiAlN Coating

- Excellent fracture toughness and machining stability
- Low cutting resistance

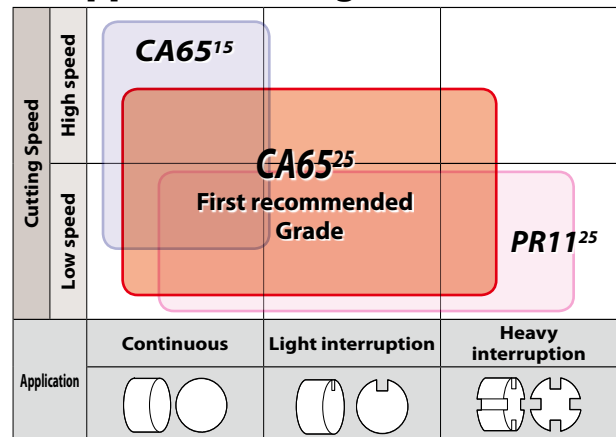


## Smooth Fine Surface Coating

- Reduces adhesion and edge build-up
- Low cutting resistance

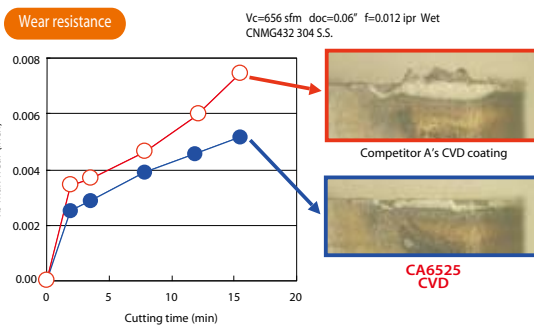
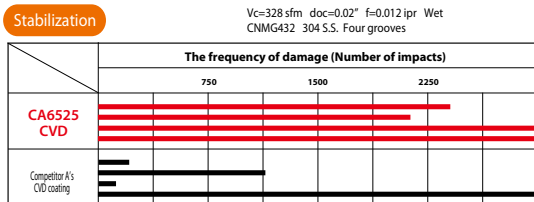


## Application Range

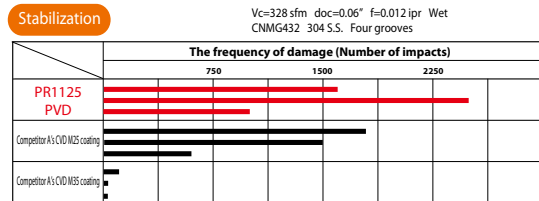


## Cutting capability

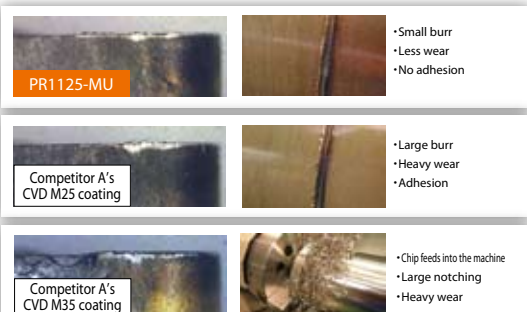
### Cutting Performance of CA6525



### Cutting Performance of PR1125

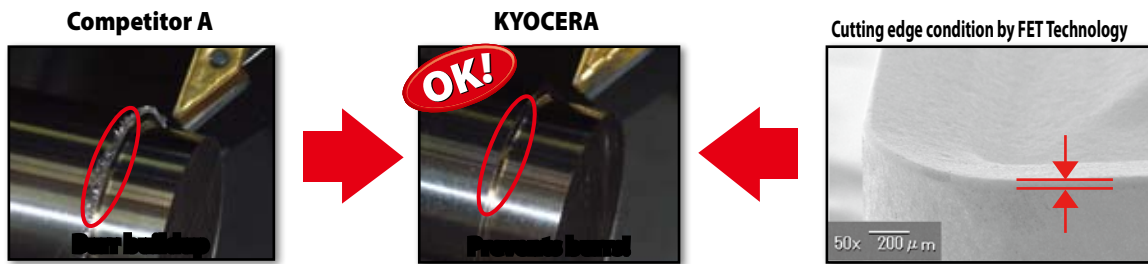


Wear resistance and burr condition Vc=394 sfm doc=0.04" f=0.006 ipr Wet CNMG432 304 S.S. Cutting Time: 30min



## ■ New Edge Preparation

- Introducing the 'FET Technology' (Fine Edge Treatment) which provides excellent edge strength *and* sharp rake angles.
- Minimized R honing

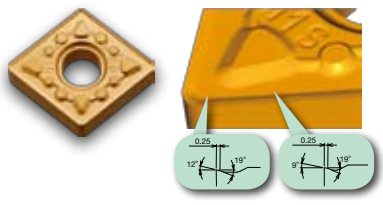


## ■ Features of New Chipbreakers for Stainless Machining

### ■ Chip control oriented

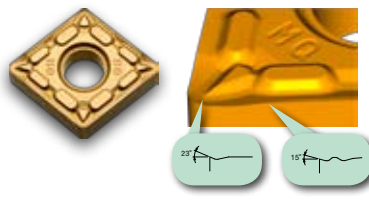
#### MS Chipbreaker

- First recommended chipbreaker from medium to roughing
- Positive land
- Tough cutting edge
- Good chip control



#### MQ Chipbreaker

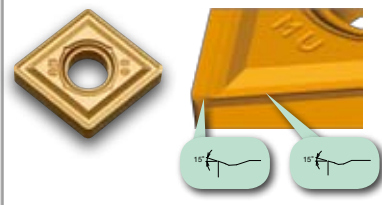
- From finishing to medium
- Large rake angle with circular edge line
- Low cutting force and good chip control



### ■ Sharpness oriented

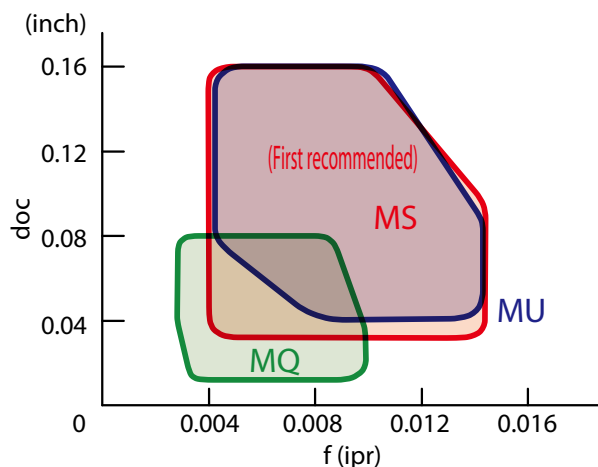
#### MU Chipbreaker

- From medium to roughing
- Large rake angle and low cutting resistance
- Reduces notching & burrs



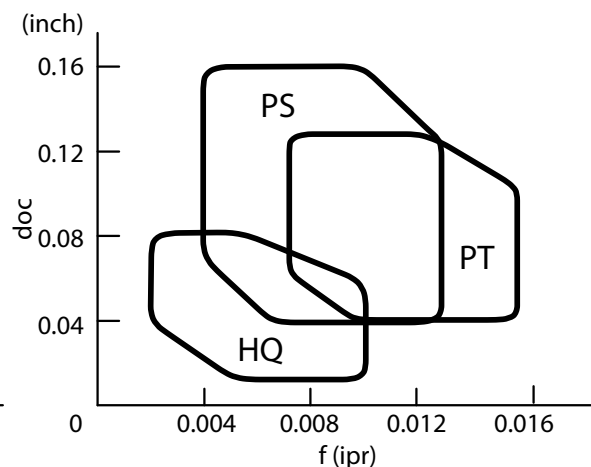
### ● Special Chipbreaker for Stainless Steel

Sharp edge with large positive land and large rake angle

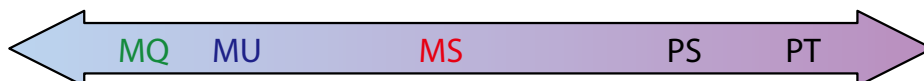


### ● Optional Chipbreaker

Higher edge strength than MS, MQ and MU



Sharpness ←



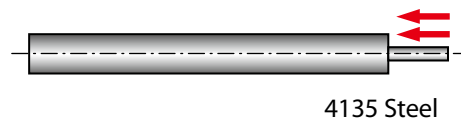
→ Strength

# CA65 Series for Steel Applications

Kyocera's new MQ chipbreaker prevents adhesion, chattering, and burrs in general steel applications. It is also effective for interrupted cutting of soft steel and preventing chip biting in low carbon steel.

## Prevents chattering during steel machining

- Sharp cutting due to CA65 series small R honing



Chattering and burrs



CVD Chipbreaker for steel

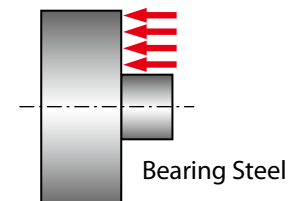
No chattering and burrs



CA6525-MQ

## Prevents cutting edge damage during steel machining

- CA65 prevents cutting edge damage due to thin film coating
- Less damage caused by chip biting at corner wall, boring and machining of sticky materials



Damage from chip biting



CVD Chipbreaker for steel

No damage from chip biting = Increased Tool Life



CA6525-MQ

Case Studies

### 316 S.S. (Austenitic Stainless Steel)

<ul style="list-style-type: none"> <li>• Connector</li> <li>• Vc=394 sfm</li> <li>• doc=0.08"</li> <li>• f=0.008 ipr</li> <li>• WET</li> <li>• CNMG432MS (CA6525)</li> </ul>	
<b>CA65<sup>25</sup></b>	580pcs/edge
Competitor A	200pcs/edge
<ul style="list-style-type: none"> <li>• Compared to Competitor A's coated grade, the MS chipbreaker (CA6525) shows good chip evacuation and wear resistance while improving the tool life by almost 200%.</li> </ul>	

### 316 S.S. (Austenitic Stainless Steel)

<ul style="list-style-type: none"> <li>• Nozzle</li> <li>• Vc=394 sfm</li> <li>• ap=0.10"</li> <li>• f=0.006 ipr</li> <li>• WET</li> <li>• CNMG432MS (CA6525)</li> </ul>	
<b>CA65<sup>25</sup></b>	30pcs/edge
Competitor B	15pcs/edge
<ul style="list-style-type: none"> <li>• Kyocera's tool life is two times longer than Competitor B with improved chip evacuation.</li> </ul>	

### 316 S.S. (Austenitic Stainless Steel)

<ul style="list-style-type: none"> <li>• Shaft</li> <li>• Vc=361 sfm</li> <li>• doc=0.039"-0.059"</li> <li>• f=0.005 ipr</li> <li>• WET</li> <li>• CNMG431MQ (PR1125)</li> </ul>	
<b>PR11<sup>25</sup></b>	350 pcs/edge
Competitor M	300pcs/edge
<ul style="list-style-type: none"> <li>• MQ chipbreaker (PR1125) produced 50 more pieces per edge.</li> </ul>	

### 304 S.S. (Austenitic Stainless Steel)

<ul style="list-style-type: none"> <li>• Bushing</li> <li>• Vc=390 sfm</li> <li>• doc=0.008"</li> <li>• f=0.002 ipr</li> <li>• WET</li> <li>• TNMG332MQ (CA6525)</li> </ul>	
<b>CA65<sup>25</sup></b>	7000 pcs/edge
Competitor S	3500 pcs/edge
<ul style="list-style-type: none"> <li>• Kyocera's CA6525 with the MQ chipbreaker produced twice as many parts per edge as the competitor's equivalent grade.</li> </ul>	

### 303 S.S. (Austenitic Stainless Steel)

<ul style="list-style-type: none"> <li>• Connector</li> <li>• Vc=328~394 sfm</li> <li>• doc=0.06~0.08"</li> <li>• f=0.005~0.006 ipr</li> <li>• WET</li> <li>• CNMG432MS (PR1125)</li> </ul>	
<b>PR11<sup>25</sup></b>	180pcs/edge
Competitor G	120pcs/edge
<ul style="list-style-type: none"> <li>• Kyocera's CVD coating lasts 50% longer than Competitor G.</li> </ul>	

### 316L S.S. (Austenitic Stainless Steel)

<ul style="list-style-type: none"> <li>• Shaft</li> <li>• Vc=328 sfm</li> <li>• doc=0.02~0.04"</li> <li>• f=0.006 ipr</li> <li>• WET</li> <li>• DNMG431MS (PR1125)</li> </ul>	
<b>PR11<sup>25</sup></b>	1pcs/edge
Competitor H	0.5pcs/edge
<ul style="list-style-type: none"> <li>• Kyocera's tool life is increased 100% when compared to Competitor H. (Competitor H was not able to cut even 1 workpiece)</li> <li>• Edge condition is excellent compared to Competitor H.</li> </ul>	

## Case Studies

<b>440C S.S.</b> (Martensitic Stainless Steel)	
<ul style="list-style-type: none"> <li>Housing</li> <li>Vc=400 sfm</li> <li>doc=0.04-0.08"</li> <li>f=0.007 ipr</li> <li>WET</li> <li>CNMG432MS (CA6525)</li> </ul>	
<b>CA65<sup>25</sup></b>	More than 4,000pcs/edge
Competitor I	2,000pcs/edge
<ul style="list-style-type: none"> <li>MS chipbreaker (CA6525) doubled the tool life of Competitor I.</li> </ul>	

<b>17-4 PH</b> (Precipitation hardening Stainless Steel)	
<ul style="list-style-type: none"> <li>Sleeve</li> <li>Vc=328 sfm</li> <li>doc=0.02"</li> <li>f=0.006 ipr</li> <li>WET</li> <li>TNMG332MU (CA6525)</li> </ul>	
<b>CA65<sup>25</sup></b>	350pcs/edge
Competitor J	200pcs/edge
<ul style="list-style-type: none"> <li>Compared to Competitor J, CA6525 provided better chip control with longer tool life.</li> </ul>	












<b>Permalloy</b>	
<ul style="list-style-type: none"> <li>Housing</li> <li>Vc=262 sfm</li> <li>doc=0.03"</li> <li>f=0.005 ipr</li> <li>WET</li> <li>WNMG432MU (CA6525)</li> </ul>	
<b>CA65<sup>25</sup></b>	34pcs/edge
Competitor K	12pcs/edge
<ul style="list-style-type: none"> <li>By changing the edge face machining and the chipbreaker, chip evacuation was improved, the machine did not stop operating, and tool life was extended.</li> </ul>	


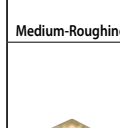

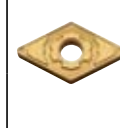
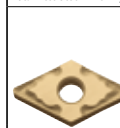






<b>Cast 316</b> (Stainless steel cast steel)	
<ul style="list-style-type: none"> <li>Valve seat</li> <li>Vc=394 sfm</li> <li>doc=0.04"</li> <li>f=0.004 ipr</li> <li>WET</li> <li>CNMG432MS (CA6525)</li> </ul>	
<b>CA65<sup>25</sup></b>	69pcs/edge
Competitor L	30pcs/edge
<ul style="list-style-type: none"> <li>The tool life is two times as long as Competitor L.</li> <li>The chip evacuation is equivalent.</li> </ul>	

<b>Inconel 718 (High-Temp. Alloy)</b>	
<ul style="list-style-type: none"> <li>Shaft</li> <li>Vc=164 sfm</li> <li>doc=0.08in/per cut</li> <li>f=0.004 ipr</li> <li>Wet</li> <li>CNMG432PS</li> </ul>	
<b>CA65<sup>25</sup></b>	3 pcs/edge
Competitor M	1.5 pcs/edge
<ul style="list-style-type: none"> <li>CA65<sup>25</sup> machined more than twice as many workpieces as Competitor M.</li> <li>Cutting edge condition of CA6525 was better than Competitor M.</li> </ul>	

<b>Inconel 718 (High-Temp. Alloy)</b>	
<ul style="list-style-type: none"> <li>Shaft</li> <li>Vc=164 sfm</li> <li>doc=0.08in/per cut</li> <li>f=0.004 ipr</li> <li>Wet</li> <li>CNMG432MS</li> </ul>	
<b>PR1125</b>	3 pcs/edge
Competitor N	3 pcs/edge
<ul style="list-style-type: none"> <li>PR11<sup>25</sup> showed superior wear resistance and machining stability compared with Competitor N.</li> </ul>	











Stock Items











Shape	Description	Dimension (inch)					Stock Grades		
		I.C.	Thickness	Hole	Corner-R	Relief Angle	CVD Coated		PVD Coated
							CA 6515	CA 6525	PR 1125
	CNMG 431HQ 432HQ 433HQ	0.500	0.187	0.203	0.016 0.031 0.047	-	● ● ●	● ○ ●	● ● ●
	Finishing-Medium								
	CNMG 431PS 432PS 433PS 434PS	0.500	0.187	0.203	0.016 0.031 0.047 0.063	-	● ● ● ●	● ● ● ●	● ● ● ●
	Medium-Roughing								
	CNMG 543PS 544PS	0.625	0.25	0.25	0.047 0.063	-	● ●	● ●	● ●
	Medium-Roughing								
	CNMG 432PT 433PT	0.500	0.187	0.203	0.031 0.047	-	● ●	● ●	● ●
	Medium-Roughing								
	CNMG 542PT 543PT 544PT	0.625	0.25	0.25	0.031 0.047 0.063	-	● ● ●	● ● ●	● ● ●
	Roughing								
	CNMG 431 432 433	0.500	0.187	0.203	0.016 0.031 0.047	-	● ● ●	● ● ●	● ● ●
	Stainless Steel Finishing								
	Stainless Steel Finishing								
	CNMG 431GU 432GU	0.500	0.187	0.203	0.016 0.031	-	● ●	● ●	● ●
	Stainless Steel Medium-Roughing								
	CNMG 432HU 433HU	0.500	0.187	0.203	0.031 0.047	-	● ●	● ●	● ●
	Stainless Steel Medium-Roughing								
	CNMG 431MQ 432MQ	0.500	0.187	0.203	0.016 0.031	-	● ●	● ●	● ●
	Stainless Steel Medium-Roughing								
	CNMG 431MS 432MS 433MS 434MS	0.500	0.187	0.203	0.016 0.031 0.047 0.063	-	● ● ● ●	● ● ● ●	● ● ● ●
	Stainless Steel Medium-Roughing								
	CNMG 431MU 432MU 433MU	0.500	0.187	0.203	0.016 0.031 0.047	-	● ● ●	● ● ●	● ● ●
	Stainless Steel Medium-Roughing								
	CNMG 431TK 432TK	0.500	0.187	0.203	0.016 0.031	-	● ●	● ●	● ●
	Finishing-Medium								
	DNMG 431HQ 432HQ	0.500	0.187	0.203	0.016 0.031	-	● ●	● ●	● ●
	DNMG 441HQ 442HQ	0.500	0.25	0.203	0.016 0.031	-	● ●	● ●	● ●

Shape	Description	Dimension (inch)					Stock Grades		
		I.C.	Thickness	Hole	Corner-R	Relief Angle	CVD Coated		PVD Coated
							CA 6515	CA 6525	PR 1125
	DNMG 431PS 432PS 433PS	0.500	0.187	0.203	0.016 0.031 0.047	-	● ● ●	● ● ●	● ● ●
	Medium-Roughing								
	DNMG 441PS 442PS 443PS	0.500	0.25	0.203	0.016 0.031 0.047	-	● ● ●	● ● ●	● ● ●
	Medium-Roughing								
	Medium-Roughing/High Feed								
	DNMG 432PT 433PT	0.500	0.187	0.203	0.031 0.047	-	● ●	● ●	● ●
	Stainless Steel Finishing								
	DNMG 442PT 443PT	0.500	0.25	0.203	0.031 0.047	-	● ●	● ●	● ●
	Stainless Steel Finishing								
	DNMG 431GU 432GU	0.500	0.187	0.203	0.016 0.031	-	● ●	● ●	● ●
	Stainless Steel Medium-Roughing								
	DNMG 441GU 442GU	0.500	0.25	0.203	0.016 0.031	-	● ●	● ●	● ●
	Stainless Steel Medium-Roughing								
	DNMG 432HU 433HU	0.500	0.187	0.203	0.031 0.047	-	● ●	● ●	● ●
	Stainless Steel Medium-Roughing								
	DNMG 442HU 443HU	0.500	0.25	0.203	0.031 0.047	-	● ●	● ●	● ●
	Stainless Steel Finishing-Medium								
	DNMG 431MQ 432MQ	0.500	0.187	0.203	0.016 0.031	-	● ●	● ●	● ●
	Stainless Steel Finishing-Medium								
	DNMG 441MQ 442MQ	0.500	0.25	0.203	0.016 0.031	-	● ●	● ●	● ●
	Stainless Steel Medium-Roughing								
	DNMG 431MS 432MS 433MS	0.500	0.187	0.203	0.016 0.031 0.047	-	● ● ●	● ● ●	● ● ●
	Stainless Steel Medium-Roughing								
	DNMG 441MS 442MS 443MS	0.500	0.25	0.203	0.016 0.031 0.047	-	● ● ●	● ● ●	● ● ●
	Stainless Steel Medium-Roughing								
	DNMG 431MU 432MU	0.500	0.187	0.203	0.016 0.031	-	● ●	● ●	● ●
	Stainless Steel Medium-Roughing								
	DNMG 441MU 442MU	0.500	0.25	0.203	0.016 0.031	-	● ●	● ●	● ●

●:Standard Stock

## Stock Items











Shape	Description	Dimension (inch)					Stock Grades		
							CVD Coated		PVD Coated
		I.C.	Thickness	Hole	Corner-R	Relief Angle	CA 6515	CA 6525	PR 1125
	DNMG 431TK 432TK	0.500	0.187	0.203	0.016 0.031	-	●	●	●
	DNMG 441TK 442TK	0.500	0.250	0.203	0.016 0.031	-	●	●	●
Stainless Steel Medium-Roughing									
	SNMG 432HQ	0.500	0.187	0.203	0.031	-	●	●	●
Finishing-Medium									
	SNMG 432PS 433PS 434PS	0.500	0.187	0.203	0.031 0.047 0.063	-	●	●	●
Medium-Roughing									
	SNMG 432PT 433PT	0.500	0.187	0.203	0.047 0.063	-	●	●	●
Medium-Roughing/High Feed									
	SNMG 432	0.500	0.187	0.203	0.031	-	●	●	●
Roughing									
	SNMG 431MQ 432MQ	0.500	0.187	0.203	0.016 0.031	-	●	●	●
Stainless Steel Finishing-Medium									
	SNMG 431MS 432MS 433MS 434MS	0.500	0.187	0.203	0.016 0.031 0.047 0.063	-	●	●	●
Stainless Steel Medium-Roughing									
	TNMG 331HQ 332HQ	0.375	0.187	0.150	0.016 0.031	-	●	●	●
Finishing-Medium									
	TNMG 331PS 332PS 333PS	0.375	0.187	0.150	0.016 0.031 0.047	-	●	●	●
Medium-Roughing									
		TNMG 432PS 433PS	0.500	0.187	0.203	0.031 0.047	-	●	●












Shape	Description	Dimension (inch)					Stock Grades		
							CVD Coated		PVD Coated
		I.C.	Thickness	Hole	Corner-R	Relief Angle	CA 6515	CA 6525	PR 1125
	TNMG 332PT 333PT	0.375	0.187	0.150	0.031 0.047	-	●	●	●
Medium-Roughing/High Feed									
	TNMG 331 332 333	0.375	0.187	0.150	0.016 0.031 0.047	-	●	●	●
Roughing									
	TNMG 331GU 332GU	0.375	0.187	0.150	0.016 0.031	-	●	●	●
Stainless Steel Finishing									
	TNMG 332HU 333HU	0.375	0.187	0.150	0.031 0.047	-	●	●	●
Stainless Steel Medium-Roughing									
	TNMG 331MQ 332MQ	0.375	0.187	0.150	0.016 0.031	-	●	●	●
Stainless Steel Finishing-Medium									
	TNMG 331MS 332MS 333MS	0.375	0.187	0.150	0.016 0.031 0.047	-	●	●	●
Stainless Steel Medium-Roughing									
	TNMG 331MU 332MU	0.375	0.187	0.150	0.016 0.031	-	●	●	●
Stainless Steel Medium-Roughing									
	TNMG 331TK 332TK	0.375	0.187	0.150	0.016 0.031	-	●	●	●
Stainless Steel Medium-Roughing									
	TNMG 331 <sup>®</sup> /L-ST 332 <sup>®</sup> /L-ST	0.375	0.187	0.150	0.016 0.031	-	●	●	●
Stainless Steel Medium-Roughing									
	TNGG 331 <sup>®</sup> /L-S 332 <sup>®</sup> /L-S	0.375	0.187	0.150	0.016 0.031	-			●
Finishing Surface Roughness Oriented									

●:Standard Stock















**Stock Items**

Shape	Description	Dimension (inch)					Stock Grades		
							CVD Coated		PVD Coated
		I.C.	Thickness	Hole	Corner-R	Relief Angle	CA 6515	CA 6525	PR 1125
	TNGG 331%/-25R 332%/-25R	0.375	0.187	0.150	0.016 0.031	-		●	
<i>Medium-Roughing Low cutting resistance</i>									
	VNMG 331 332	0.375	0.187	0.150	0.016 0.031	-	●	●	
<i>Roughing</i>									
	VNMG 331GU 332GU	0.375	0.187	0.150	0.016 0.031	-	●	●	
<i>Stainless Steel Finishing</i>									
	VNMG 331MQ 332MQ	0.375	0.187	0.150	0.016 0.031	-	●	●	
<i>Stainless Steel Finishing-Medium</i>									
	VNMG 331MS 332MS 333MS	0.375	0.187	0.150	0.016 0.031 0.047	-	●	●	
<i>Stainless Steel Medium-Roughing</i>									
	VNMG 331MU 332MU	0.375	0.187	0.150	0.016 0.031	-	●	●	
<i>Stainless Steel Medium-Roughing</i>									
	WNMG 431HQ 432HQ	0.500	0.187	5.16	0.016 0.031	-	●	●	
<i>Medium-Roughing</i>									
	WNMG 431PS 432PS 433PS	0.500	0.187	0.203	0.016 0.031 0.047	-	●	●	
<i>Medium-Roughing</i>									
	WNMG 432PT 433PT	0.500	0.187	0.203	0.031 0.047	-	●	●	
<i>Medium-Roughing/High Feed</i>									
	WNMG 431 432 433	0.500	0.187	0.203	0.016 0.031 0.047	-	●	●	
<i>Roughing</i>									

Shape	Description	Dimension (inch)					Stock Grades		
							CVD Coated		PVD Coated
		I.C.	Thickness	Hole	Corner-R	Relief Angle	CA 6515	CA 6525	PR 1125
	WNMG 431GU 432GU	0.500	0.187	0.203	0.016 0.031	-	●	●	
<i>Stainless Steel Finishing</i>									
	WNMG 432HU 433HU	0.500	0.187	0.203	0.031 0.047	-	●	●	
<i>Stainless Steel Medium-Roughing</i>									
	WNMG 431MQ 432MQ	0.500	0.187	0.203	0.016 0.031	-	●	●	
<i>Stainless Steel Finishing-Medium</i>									
	WNMG 431MS 432MS 433MS	0.500	0.187	0.203	0.016 0.031 0.047	-	●	●	
<i>Stainless Steel Medium-Roughing</i>									
	WNMG 431MU 432MU	0.500	0.187	0.203	0.016 0.031	-	●	●	
<i>Stainless Steel Medium-Roughing</i>									
	WNMG 431TK 432TK	0.500	0.187	0.203	0.016 0.031	-	●	●	
<i>Stainless Steel Medium-Roughing</i>									
	CCMT 21.50.5HQ 21.51HQ	0.250	0.094	0.110	0.008 0.016	7°	●	●	
<i>Finishing-Medium</i>									
	CCMT 32.50.5HQ 32.51HQ 32.52HQ	0.375	0.156	0.173	0.008 0.016 0.031	7°	●	●	
<i>Finishing-Medium</i>									
	CCMT 21.50.5GK 21.51GK	0.250	0.094	0.110	0.008 0.016	7°	●	●	
<i>Finishing-Medium</i>									
	CCMT 32.50.5GK 32.51GK	0.375	0.156	0.173	0.008 0.016	7°	●	●	
<i>Finishing-Medium</i>									
	CCMT 431GK 432GK 433GK	0.500	0.187	0.217	0.016 0.031 0.047	7°	●	●	
<i>Finishing-Medium</i>									

# Stock Items

Shape	Description	Dimension (inch)					Stock Grades		
		I.C.	Thickness	Hole	Corner-R	Relief Angle	CVD Coated		PVD Coated
							CA 6515	CA 6525	PR 1125
 Medium	CCMT 32.52	0.375	0.156	0.173	0.031	7°	●	●	●
 Finishing-Medium	CPMH 2.51.51HQ 2.51.52HQ	0.313	0.094	0.138	0.016 0.031	11°	●	●	●
	CPMH 321HQ 322HQ	0.375	0.125	0.177	0.016 0.031	11°	●	●	●
 Medium	CPMH 2.51.51 2.51.52	0.313	0.094	0.138	0.016 0.031	11°	●	●	●
	CPMH 321 322	0.375	0.125	0.177	0.016 0.031	11°	●	●	●
 Finishing-Medium	DCMT 21.50.5GK 21.51GK 21.52GK	0.250	0.094	0.110	0.008 0.016 0.031	7°	●	●	●
	DCMT 32.50.5GK 32.51GK 32.52GK	0.375	0.156	0.173	0.008 0.016 0.031	7°	●	●	●
 Finishing-Medium	DCMT 21.51HQ 21.52HQ	0.250	0.094	0.110	0.016 0.031	7°	●	●	●
	DCMT 32.50.5HQ 32.51HQ 32.52HQ	0.375	0.156	0.173	0.008 0.016 0.031	7°	●	●	●
 Finishing-Medium	TPMT 1.81.51HQ	0.219	0.094	0.110	0.016	11°	●	●	●
	TPMT 221HQ 222HQ	0.250	0.125	0.130	0.016 0.031	11°	●	●	●
	TPMT 321HQ 322HQ	0.375	0.125	0.173	0.016 0.031	11°	●	●	●

Shape	Description	Dimension (inch)					Stock Grades		
		I.C.	Thickness	Hole	Corner-R	Relief Angle	CVD Coated		PVD Coated
							CA 6515	CA 6525	PR 1125
 Finishing-Medium	VBMT 221HQ 222HQ	0.250	0.125	0.110	0.016 0.031	5°	●	●	●
	VBMT 331HQ 332HQ	0.375	0.187	0.173	0.016 0.031	5°	●	●	●
 Finishing-Medium	VCMT 1.51.51HQ	0.187	0.094	0.091	0.016	7°	●	●	●
 Finishing-Medium	WPMT 21.51HQ	0.250	0.094	0.110	0.016	11°	●	●	●
	WPMT 321HQ 322HQ	0.375	0.125	0.173	0.016 0.031	11°	●	●	●
 Medium	SPMR 321 322	0.375	0.125	-	0.016 0.031	11°	●	●	●
	SPMR 421 422	0.500	0.125	-	0.016 0.031	11°	●	●	●
 Finishing-Medium	TPMR 221HQ 222HQ	0.250	0.125	-	0.016 0.031	11°	●	●	●
	TPMR 321HQ 322HQ	0.375	0.125	-	0.016 0.031	11°	●	●	●
 Medium	TPMR 221 222	0.250	0.125	-	0.016 0.031	11°	●	●	●
	TPMR 321 322	0.375	0.125	-	0.016 0.031	11°	●	●	●

●:Standard Stock

## ■ Austenitic Stainless Steel (304 S.S., 310 S.S., 316 S.S.)

### Machinability (Hardest to cut)

- Significant work hardening, poor cutting performance, acceleration of wear at cutting edge (notching)
- Heat conductivity is extremely poor (one-quarter of carbon steel)
- Welding or built-up edge occurs easily, cutting resistance increases and edge breakage or chipping is likely
- Chips tend to become longer and stronger, resulting in poor machinability

### Recommended grade

Classification	Grade	Cutting speed (sfm)				
		200	350	500	650	825
M15	CA65 <sup>15</sup>			600 (400-800)		
M25	CA65 <sup>25</sup>		500 (250-750)			
M30	PR11 <sup>25</sup>		400 (225-550)			

### Recommended Chipbreaker

Application	Continuous	Light Interruption	Interruption	Heavy Interruption
doc (inch)				
less than 0.04"	<b>MQ</b>	<b>MQ</b>	<b>MS</b>	
more than 0.04"	<b>MS/MU</b>	<b>MS/MU</b>		
less than 0.04"	<b>MQ</b>	<b>MQ</b>	<b>MS/MU</b>	<b>PS/PT</b>
more than 0.04"	<b>MS/MU</b>	<b>MS/MU</b>		
less than 0.04"	<b>MQ</b>	<b>MQ</b>	<b>MS/MU</b>	<b>PS/PT</b>
more than 0.04"	<b>MS/MU</b>	<b>MS/MU</b>		

## ■ Ferritic Stainless Steel (405 S.S., 410L S.S., 430 S.S.)

### Machinability

- Limited work hardening and more machinable than austenitic steel (less notching and burring)
- Lower hardness due to ferritic structure (will not harden when quenched)
- Heat conductivity is poor (half of carbon steel), temperature at edge rises and likely to wear

### Recommended grade

Classification	Grade	Cutting speed (sfm)				
		200	350	500	650	825
M15	CA65 <sup>15</sup>			625 (425-825)		
M25	CA65 <sup>25</sup>		525 (300-755)			
M30	PR11 <sup>25</sup>		425 (250-600)			

### Recommended Chipbreaker

Application	Continuous	Light Interruption	Interruption	Heavy Interruption
doc (inch)				
less than 0.04"	<b>MQ</b>	<b>MQ</b>	<b>MS</b>	
more than 0.04"	<b>MS/MU</b>	<b>MS/MU</b>		
less than 0.04"	<b>MQ</b>	<b>MQ</b>	<b>MS/MU</b>	<b>PS/PT</b>
more than 0.04"	<b>MS/MU</b>	<b>MS/MU</b>		
less than 0.04"	<b>MQ</b>	<b>MQ</b>	<b>MS/MU</b>	<b>PS/PT</b>
more than 0.04"	<b>MS/MU</b>	<b>MS/MU</b>		

## ■ Martensitic Stainless Steel (403 S.S., 410 S.S., 420 S.S.)

### Machinability

- Limited work hardening and more machinable than austenitic steel (less notching and burring)
- High in hardness, likely to cause crater wear
- Heat conductivity is poor (half of carbon steel), temperature at edge rises and likely to wear

### Recommended grade

Classification	Grade	Cutting speed (sfm)				
		200	350	500	650	825
M15	CA65 <sup>15</sup>			625 (425-825)		
M25	CA65 <sup>25</sup>		525 (300-750)			

### Recommended Chipbreaker

Application	Continuous	Light Interruption	Interruption	Heavy Interruption
doc (inch)				
less than 0.04"	<b>MQ</b>	<b>MQ</b>	<b>MS</b>	
more than 0.04"	<b>MS/MU</b>	<b>MS/MU</b>		
less than 0.04"	<b>MQ</b>	<b>MQ</b>	<b>MS/MU</b>	<b>PS/PT</b>
more than 0.04"	<b>MS/MU</b>	<b>MS/MU</b>		

## ■ Precipitation hardening (PH) stainless steel (630 S.S., 631 S.S.)

### Machinability (Hardest to cut)

- High tensile strength (approx. twice that of other stainless steels), high cutting resistance and hard to machine/low machinability
- Heat conductivity is poor, temperature at edge rises and likely to wear

### Recommended grade

Classification	Grade	Cutting speed (sfm)				
		200	350	500	650	825
M15	CA65 <sup>15</sup>		275 (175-375)			
M25	CA65 <sup>25</sup>		230 (125-325)			

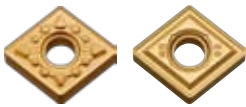

### Recommended Chipbreaker

Application	Continuous	Light Interruption	Interruption	Heavy Interruption
doc (inch)				
less than 0.04"	<b>MQ</b>	<b>MQ</b>	<b>MS</b>	
more than 0.04"	<b>MS/MU</b>	<b>MS/MU</b>		
less than 0.04"	<b>MQ</b>	<b>MQ</b>	<b>MS/MU</b>	<b>PS/PT</b>
more than 0.04"	<b>MS/MU</b>	<b>MS/MU</b>		

### Recommended Cutting Speeds

Stainless Steel Machining	Recommended Cutting Speed (V: sfm)		
	CA65 <sup>15</sup>	CA65 <sup>25</sup>	PR11 <sup>25</sup>
	Continuous	Continuous / Interruption	Continuous / Interruption
Austenitic Stainless	600 (400-800)	500 (250-750)	400 (225-550)
Ferritic Stainless	625 (425-825)	525 (300-755)	425 (250-600)
Martensitic Stainless	625 (425-825)	525 (300-755)	-
Precipitation hardening Stainless	275 (175-375)	230 (125-325)	-

### Troubleshooting

Problem	Troubleshooting
Notching (breakage)	<ul style="list-style-type: none"> <li>• Select grades with high flexural strength such as CA6525, PR1125 to lessen notching (breakage)</li> <li>• Select MU (MS) chipbreaker (with large rake angle, improved cutting performance and less work hardening)</li> </ul>
Burrs	 <p>MS Chipbreaker      MU Chipbreaker</p> <ul style="list-style-type: none"> <li>• Make D.O.C. deeper than work-hardened layer</li> <li>• Vary D.O.C. to reduce D.O.C. notching</li> <li>• Increase the feed rate (higher than 0.1mm/rev), and lessen work hardening</li> <li>• Increase cutting edge angle to reduce cutting forces</li> </ul>
Adhesion/Built-up edge	<ul style="list-style-type: none"> <li>• Choose bright coating CA6515, CA6525 for smooth surface</li> <li>• Select MS/MU chipbreaker with large rake angle</li> <li>• Increase the cutting speed, increase the coolant concentration</li> </ul>
Crater wear	<ul style="list-style-type: none"> <li>• Select SS grades CA6515 and CA6525</li> <li>• Select MU chipbreaker with large rake angle (to improve cutting performance and control temperature at cutting edge)</li> <li>• Decrease the cutting speed to control temperature at cutting edge</li> <li>• Decrease the feed rate to reduce tool pressure</li> </ul>
Chip control	<ul style="list-style-type: none"> <li>• MS chipbreaker: First recommended chipbreaker for medium to roughing applications</li> <li>• MQ chipbreaker: Good chip control for finishing to medium applications</li> </ul>  <p>MS Chipbreaker MQ Chipbreaker</p>

