



INTRODUCTION	
MILLING	
TURNING AND BORING	
HEAVY TURNING	
GROOVING, PROFILING AND CUT-OFF	
API RING-GROOVE MACHINING	
INDEXABLE DRILLING	
TUBE SCARFING	
SPECIAL ENGINEERING	
APPLICATION and TECHNICAL INFORMATION	

**2016 METRIC**

**MILLING**



<b>Usage Reference Guide .....</b>	<b>M 02</b>
<b>Pictorial Index.....</b>	<b>M 03</b>
<b>Milling Cutters</b>	
<i>Hushcut® (light and medium duty).....</i>	<i>M 04-09</i>
<i>Index-O-Cut™.....</i>	<i>M 10-13</i>
<i>High Shear.....</i>	<i>M 14-18</i>
<i>Screw-On Inserts.....</i>	<i>M 19-20</i>
<i>Excelsator® Mill .....</i>	<i>M 21-35</i>
<i>Powermill®.....</i>	<i>M 36-43</i>
<b>Additional Greenleaf Milling Inserts.....</b>	<b>M 44-45</b>
<b>Insert Grade Descriptions .....</b>	<b>M 46</b>
<b>Insert Grade Reference for Milling .....</b>	<b>M 47</b>
<b>Technical Data for Milling.....</b>	<b>M 48-53</b>

## Milling Cutter

## Geometry

Part  
Number

*Insert  
Style*

HUSHCUT® SERIES 11 - MILLING CUTTERS

## EM90S/L 0° Lead End Mill

Right-Hand End Mill Shown

Part Number	Gage	Insert	Stock	Dimensions (millimeters)					Standard Components		*Turn-Up Kit
				A	B	C	D	W	No. of Inserts	Insert Screw	Includes All Standard Components
EM90S-S/L		ADGT-100030RFLD	•	12	16	75	25	9	2	PT-508T	TK-01002
EM90S-160-160		ADGT-100030RFLD	•	16	16	75	25	9	2	PT-508T	TK-01003
EM90S-250-250		ADGT-100030RFLD	•	20	20	82	32	9	2	PT-508T	TK-01003
EM90S-250-250		ADGT-100030RFLD	•	22	25	88	32	9	2	PT-508T	TK-01003
EM90S-250-250		ADGT-100030RFLD	•	25	20	90	40	9	4	PT-542T	TK-00800
EM90S-250-250		ADGT-100030RFLD	•	25	25	96	40	9	4	PT-542T	TK-00800
EM90S-250-250		ADGT-100030RFLD	•	32	25	96	40	9	5	PT-542T	TK-00801
EM90S-250-250		ADGT-100030RFLD	•	32	32	100	40	9	5	PT-542T	TK-00801
EM90S-400-400		ADGT-100030RFLD	•	40	32	100	40	9	5	PT-542T	TK-00801
EM90S-400-400		ADGT-100030RFLD	•	40	32	100	40	9	5	PT-508T	TK-00780
EM90L-250-250		APHT-16040RSPR	•	20	20	87	47	13	2	31267R	TK-00780
EM90L-250-250		APHT-16040RSPR	•	25	25	97	47	13	2	31267R	TK-00780
EM90L-250-250		APHT-16040RSPR	•	25	25	101	95	13	2	31267R	TK-00780
EM90L-250-250		APHT-16040RSPR	•	25	25	105	49	13	3	31267R	TK-00781
EM90L-250-250		APHT-16040RSPR	•	32	32	114	54	13	3	31267R	TK-00781
EM90L-250-250		APHT-16040RSPR	•	32	32	120	73	13	3	31267R	TK-00781
EM90L-250-250		APHT-16040RSPR	•	32	32	167	107	13	3	31267R	TK-00781
EM90L-400-400		APHT-16040RSPR	•	40	32	114	54	13	4	31267R	TK-00782
EM90L-400-400		APHT-16040RSPR	•	40	32	167	1				

### Appropriate Milling Grades

**Tune-Up Kit** (includes all standard components to refurbish cutter)

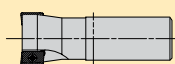
### Stocking Status

*Standard  
Insert*

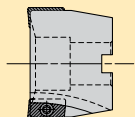
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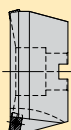
### Hushcut® Series II Milling System



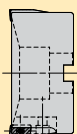
**EM90S/L**  
0° Lead End Mill  
12mm – 50mm Diameter  
page: **M 06**



**FM90S/L**  
0° Lead Face Mill  
40mm – 160mm Diameter  
page: **M 07**

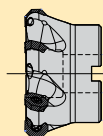


**FM75L**  
75° Lead Face Mill  
50mm – 160mm Diameter  
page: **M 08**



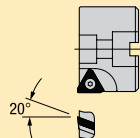
**FMC90L**  
Cartridge Style  
0° Lead Face Mill  
80mm – 250mm Diameter  
page: **M 09**

### Index-O-Cut™ Milling System

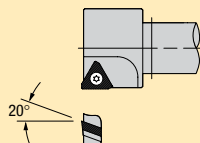


**G-MOFHP**  
High Positive Face Mill  
Octagon Inserts  
51mm – 203mm Diameter  
page: **M 12-13**

### High-Shear Cutting Mills



**FTHP**  
0° Lead Face Mill  
20° Positive Axial Rake  
63mm – 100mm Diameter  
page: **M 16**

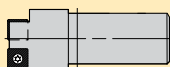


**WSTHP**  
0° Lead End Mill  
20° Positive Axial Rake  
40mm – 63mm Diameter  
page: **M 17**



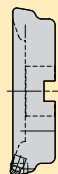
**SHPC**  
45° Lead Face Mill  
Negative Radial,  
20° Positive Axial Rake  
100mm – 160mm Diameter  
page: **M 18**

### Screw-On Insert Style Cutters

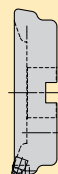


**WSSCC**  
0° Lead End Mill  
Center Cutting  
20mm – 40mm Diameter  
page: **M 20**

### Excelerator® Milling Cutters Ceramic and Carbide Inserts 80 – 315 mm Diameter Cutters

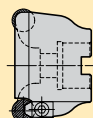


**CP4 Series**  
Face Mill  
Positive Rake Inserts  
Cutters and Nests  
page: **M 22-23**

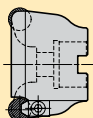


**C4 Series**  
Face Mill  
Negative Rake Inserts  
Cutters and Nests  
page: **M 24-25**

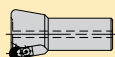
### Excelerator® Milling Cutters Ceramic and Carbide Inserts Up to 100 mm Diameter Cutters



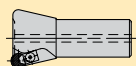
**FMRP**  
Face Mill  
Round Positive Inserts  
50mm – 100mm Diameter  
page: **M 26**



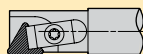
**FMRN**  
Face Mill  
Round Negative Inserts  
50mm – 100mm Diameter  
page: **M 26**



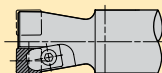
**WSRP**  
End Mill  
Round Positive Inserts  
16mm – 63mm Diameter  
page: **M 27**



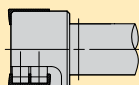
**WSRN**  
End Mill  
Round Negative Inserts  
25mm – 63mm Diameter  
page: **M 28**



**WSTP**  
End Mill  
Triangle Positive Inserts  
12mm – 16mm Diameter  
page: **M 29**

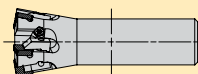


**WSSP**  
End Mill  
Square Positive Inserts  
10mm – 40mm Diameter  
page: **M 30**

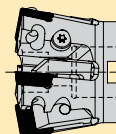


**WSAN**  
End Mill  
Parallelogram Inserts  
25mm – 63mm Diameter  
page: **M 31**

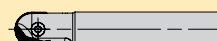
### Excelerator® Milling Cutters Ceramic and Carbide Inserts (continued) Up to 100 mm Diameter Cutters



**XFSP**  
High-Feed End Mill  
Square Positive Inserts  
25mm – 40mm Diameter  
page: **M 32-33**



**XFSP**  
High-Feed Face Mill  
Square Positive Inserts  
55mm Diameter  
page: **M 32-33**



**SSBN**  
Ball Nose End Mill  
Ball Nose Inserts  
10mm – 25mm Diameter  
page: **M 34-35**

### Powermill® Cutters



**M400LNP-A**  
0° Lead Face Mill  
Negative Radial  
Positive Axial  
100mm – 315mm Dia.  
page: **M 38**



**C430LNP-H**  
30° Lead Face Mill  
Negative Radial  
Positive Axial  
200mm – 315mm Dia.  
page: **M 42**



**M402LN-A**  
2° Lead Face Mill  
Negative Radial  
Negative Axial  
100mm – 315mm Dia.  
page: **M 39**



**C430LNP-W**  
30° Lead Face Mill  
Finishing Cutter  
Negative Radial,  
Positive Axial  
200mm – 315mm Dia.  
page: **M 43**



**M430LNP-A**  
30° Lead Face Mill  
Negative Radial,  
Positive Axial  
100mm – 315mm Dia.  
page: **M 41**

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## Hushcut® Series II Milling Cutters

Quiet and free-cutting mills with screw-on insert designs to make the most out of the available horsepower. The free-cutting action results in longer tool life and improved surface finishes. Available in end mills and face mills in a wide range of small to large diameters.



Greenleaf Corporation is continually upgrading its products.  
For the most current information, please visit our web site at:

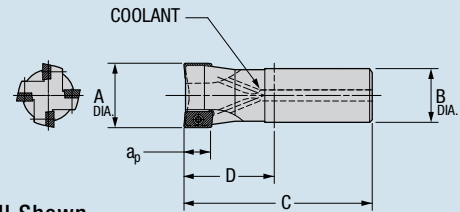
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# EM90S/L

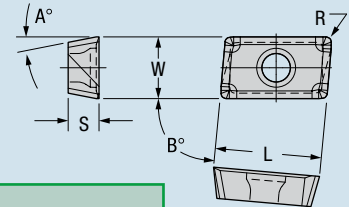
## 0° Lead End Mill



Right-Hand End Mill Shown

Part Number EM90 S/L	Gage Insert	Stock	Dimensions (millimeters)					No. of Inserts	Standard Components Insert Screw	* Tune-Up Kit Includes All Standard Components
			A	B	C	D	ap			
EM90S-12R-16W	ADGT-100308DFRLD	○	12	16	75	25	9	1	PT-589T	TK-01002
EM90S-16R-16W	ADGT-100308DFRLD	●	16	16	75	25	9	2	PT-589T	TK-01003
EM90S-20R-20W	ADGT-100308DFRLD	●	20	20	82	32	9	2	313631	TK-02878
EM90S-22R-25W	ADGT-100308DFRLD	○	22	25	88	32	9	3	313631	TK-02879
EM90S-25R-20W	ADGT-100308DFRLD	●	25	20	90	40	9	4	PT-542T	TK-00860
EM90S-25R-25W	ADGT-100308DFRLD	●	25	25	96	40	9	4	PT-542T	TK-00860
EM90S-32R-25W	ADGT-100308DFRLD	●	32	25	96	40	9	5	PT-542T	TK-00861
EM90S-32R-32W	ADGT-100308DFRLD	●	32	32	100	40	9	5	PT-542T	TK-00861
EM90S-40R-32W	ADGT-100308DFRLD	●	40	32	100	40	9	5	PT-542T	TK-00861
EM90L-20R-20W	APHT-160408PDR**	●	20	20	85	35	13	1	PT-559T	TK-00758
EM90L-25R-20W	APHT-160408PDR**	●	25	20	97	47	13	2	312679	TK-00780
EM90L-25R-25W	APHT-160408PDR**	○	25	25	97	47	13	2	312679	TK-00780
EM90L-25R-25WL	APHT-160408PDR**	○	25	25	151	95	13	2	312679	TK-00780
EM90L-32R-25W	APHT-160408PDR**	●	32	25	105	49	13	3	312679	TK-00781
EM90L-32R-32W	APHT-160408PDR**	●	32	32	114	54	13	3	312679	TK-00781
EM90L-32R-32WM	APHT-160408PDR**	○	32	32	135	75	13	3	312679	TK-00781
EM90L-32R-32WL	APHT-160408PDR**	●	32	32	167	107	13	3	312679	TK-00781
EM90L-40R-32W	APHT-160408PDR**	●	40	32	114	54	13	4	312679	TK-00782
EM90L-40R-32WL	APHT-160408PDR**	●	40	32	167	107	13	4	312679	TK-00782
EM90L-50R-40W	APHT-160408PDR**	●	50	40	123	63	13	5	312679	TK-00783

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.  
 \*\* APET can be used in place of APHT.



## Hushcut® Inserts ADGT/APHT/APET

Inserts	Part Number ISO	GA5036 G-9120 G-915	Part Number ANSI	Dimensions (millimeters)					
				L	W	S	R	A	B
	ADGT-100308DFRLD	● ● ●	ADGT-16222DFR5LD	10,00	6,70	3,50	0,80	16°	84°
	ADGT-100316DFRLD	● ● ●	ADGT-16224DFR5LD	10,00	6,70	3,50	1,60	16°	84°
	APHT-160408PDR	● ● ●	APHT-32.73PD2R	16,50	9,50	4,76	0,80	11°	85°
	APHT-160416PDR	● ● ●	APHT-32.73PD4R	16,50	9,50	4,76	1,60	11°	85°
	APHT-160432PDR	● ● ●	APHT-32.73PD8R	16,50	9,50	4,76	3,20	11°	85°
	APET-160408PDR	● ● ●	APET-32.73D2R	16,76	9,50	4,76	0,80	11°	85°
	APET-160416PDR	● ○ ○	APET-32.73D4R	16,59	9,50	4,76	1,60	11°	85°
	APET-160432PDR	○ ○ ○	APET-32.73D6R	16,59	9,50	4,76	2,38	11°	85°

### GA5036 (MT-CVD coated)

A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

### G-9120 (PVD coated)

Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

### G-915 (PVD coated)

Excellent for high-temp alloys, stainless steel, and low-carbon steels. Should be run at moderate speeds and moderate to high feeds.

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### Inserts and Steel Products

● Stocked Standard

### Inserts Only

○ Stocked or Available Upon Request

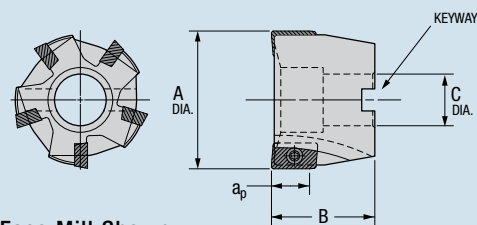
### Steel Products Only

○ 10 Business Days or Less



# FM90S/L

## 0° Lead Face Mill



Right-Hand Face Mill Shown

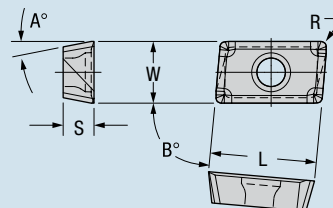
Part Number FM90 S/L	Gage Insert	Stock	Dimensions (millimeters)				No. of Inserts	Keyway	Standard Components	* Tune-Up Kit
			A	B	C	a <sub>p</sub>			Insert Screw	Includes All Standard Components
FM90S-040R	ADGT-100308DFRLD	●	40	40	16	9	6	8	PT-542T	TK-00862
FM90S-050R	ADGT-100308DFRLD	●	50	40	22	9	7	10	PT-542T	TK-00863
FM90S-063R	ADGT-100308DFRLD	●	63	40	22	9	8	10	PT-542T	TK-00864
FM90S-080R	ADGT-100308DFRLD	●	80	50	27	9	9	12	PT-542T	TK-00913
FM90L-050R	APHT-160408PDR**	●	50	40	22	13	5	10	312679	TK-00783
FM90L-063R	APHT-160408PDR**	●	63	40	22	13	6	10	312679	TK-00784
FM90L-080R	APHT-160408PDR**	●	80	50	27	13	7	12	312679	TK-00785
FM90L-100R	APHT-160408PDR**	●	100	50	32	13	8	14	312679	TK-00786
FM90L-125R	APHT-160408PDR**	○	125	63	40	13	10	16	312679	TK-01249
FM90L-160R	APHT-160408PDR**	○	160	63	40	13	12	16	312679	TK-00787


\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

\*\* APET can be used in place of APHT.

# Hushcut® Inserts

## ADGT/APHT/APET



Inserts	Part Number ISO	GA5036 G-9120 G-915	Part Number ANSI	Dimensions (millimeters)					
				L	W	S	R	A	B
	ADGT-100308DFRLD	● ● ●	ADGT-16222DFR5LD	10,00	6,70	3,50	0,80	16°	84°
	ADGT-100316DFRLD	● ● ●	ADGT-16224DFR5LD	10,00	6,70	3,50	1,60	16°	84°
	APHT-160408PDR	● ● ●	APHT-32.73PD2R	16,50	9,50	4,76	0,80	11°	85°
	APHT-160416PDR	● ● ●	APHT-32.73PD4R	16,50	9,50	4,76	1,60	11°	85°
	APHT-160432PDR	● ● ●	APHT-32.73PD8R	16,50	9,50	4,76	3,20	11°	85°
	APET-160408PDR	● ● ●	APET-32.73D2R	16,76	9,50	4,76	0,80	11°	85°
	APET-160416PDR	● ○ ○	APET-32.73D4R	16,59	9,50	4,76	1,60	11°	85°
	APET-160432PDR	○ ○ ○	APET-32.73D6R	16,59	9,50	4,76	2,38	11°	85°

### GA5036 (MT-CVD coated)

A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

### G-9120 (PVD coated)

Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

### G-915 (PVD coated)

Excellent for high-temp alloys, stainless steel, and low-carbon steels. Should be run at moderate speeds and moderate to high feeds.

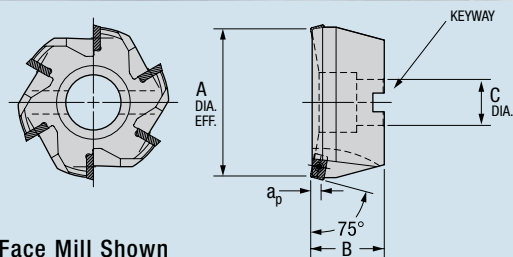
Steel Products Only	Inserts and Inserts Only	Steel Products
10 Business Days or Less <input type="radio"/>	Stocked or Available Upon Request <input type="radio"/>	Stocked Standard <input type="radio"/>

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# FM75L

## 75° Lead Face Mill

Right-Hand Face Mill Shown



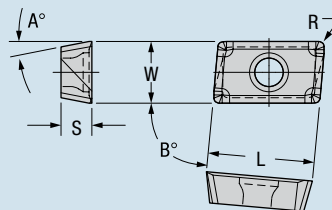
Part Number	Gage  Insert	Stock	Dimensions (millimeters)					No. of Inserts	Keyway	Standard Components 	* Tune-Up Kit Includes All Standard Components
			A	B	C	ap	Bolt Circle				
FM75 S/L											
FM75L-050R	APHT-160408PDR**	○	50	40	22	7,8	N/A	3	10	312679	TK-00781
FM75L-063R	APHT-160408PDR**	○	63	40	22	7,8	N/A	4	10	312679	TK-00782
FM75L-080R	APHT-160408PDR**	○	80	50	27	7,8	N/A	5	12	312679	TK-00783
FM75L-100R	APHT-160408PDR**	●	100	50	32	7,8	N/A	6	14	312679	TK-00784
FM75L-125R	APHT-160408PDR**	○	125	63	40	7,8	N/A	7	16	312679	TK-00785
FM75L-160R	APHT-160408PDR**	○	160	63	40	7,8	66,7	8	16	312679	TK-00786

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

\*\* APET can be used in place of APHT.

# Hushcut® Inserts

## APHT/APET



Inserts 	Part Number ISO				Part Number ANSI	Dimensions (inches)					
		GA5036	G-9120	G-915		L	W	S	R	A	B
APHT/APET	APHT-160408PDR	●	●	●	APHT-32.73PD2R	16,50	9,50	4,76	0,80	11°	85°
	APHT-160416PDR	●	●	●	APHT-32.73PD4R	16,50	9,50	4,76	1,60	11°	85°
	APHT-160432PDR	○	○	○	APHT-32.73PD8R	16,50	9,50	4,76	3,20	11°	85°
	APET-160408PDR	●	●	●	APET-32.73D2R	16,76	9,50	4,76	0,80	11°	85°
	APET-160416PDR	●	○	○	APET-32.73D4R	16,59	9,50	4,76	1,60	11°	85°
	APET-160432PDR	●	●	●	APET-32.73D6R	16,59	9,50	4,76	2,38	11°	85°

### GA5036 (MT-CVD coated)

A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

### G-9120 (PVD coated)

Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

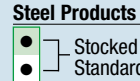
### G-915 (PVD coated)

Excellent for high-temp alloys, stainless steel, and low-carbon steels. Should be run at moderate speeds and moderate to high feeds.

### Greenleaf Sales

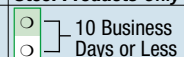
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### Inserts and Steel Products



Stocked or Available Upon Request

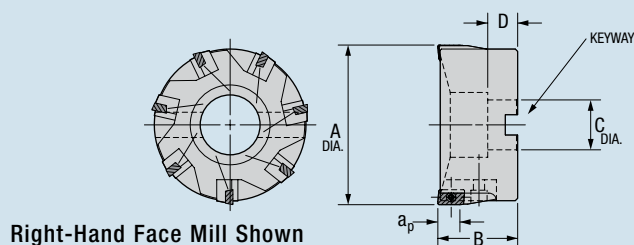
### Steel Products Only



10 Business Days or Less

# FMC90L

## 0° Lead Face Mill, Cartridge Style



Right-Hand Face Mill Shown

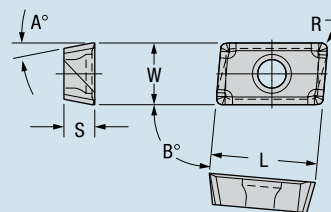
Part Number FMC90L	Gage Insert	Stock	Dimensions (millimeters)					No. of Inserts	Keyway	Standard Components			* Tune-Up Kit Includes All Standard Components
			A	B	C	D	a <sub>p</sub>			Cartridge Screw	Cartridge	Insert Screw	
FMC90L-080R	APHT-160408PDR**	○	80	40	22	20	13	6	10	SHCS M6-1.0 x 16mm	MC90L-R	312679	TK-02199
FMC90L-100R	APHT-160408PDR**	●	100	63	40	28	13	7	16	SHCS M6-1.0 x 16mm	MC90L-R	312679	TK-02200
FMC90L-125R	APHT-160408PDR**	○	125	63	40	28	13	8	16	SHCS M6-1.0 x 20mm	MC90L-R	312679	TK-02201
FMC90L-160R	APHT-160408PDR**	○	160	63	40	28	13	10	16	SHCS M6-1.0 x 20mm	MC90L-R	312679	TK-02202
FMC90L-200R	APHT-160408PDR**	○	200	63	60	32	13	12	25	SHCS M6-1.0 x 20mm	MC90L-R	312679	TK-02203
FMC90L-250R	APHT-160408PDR**	○	250	63	60	32	13	16	25	SHCS M6-1.0 x 20mm	MC90L-R	312679	TK-02204


\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

\*\* APET can be used in place of APHT.

## Hushcut® Inserts

### APHT/APET



Inserts	Part Number ISO	GA5036 G-9120 G-915	Part Number ANSI	Dimensions (inches)					
				L	W	S	R	A	B
 APHT/APET	APHT-160408PDR	● ● ●	APHT-32.73PD2R	16,50	9,50	4,76	0,80	11°	85°
	APHT-160416PDR	● ○ ○	APHT-32.73PD4R	16,50	9,50	4,76	1,60	11°	85°
	APHT-160432PDR	● ● ●	APHT-32.73PD8R	16,50	9,50	4,76	3,20	11°	85°
	APET-160408PDR	● ● ●	APET-32.73D2R	16,76	9,50	4,76	0,80	11°	85°
	APET-160416PDR	● ● ●	APET-32.73D4R	16,59	9,50	4,76	1,60	11°	85°
	APET-160432PDR	○ ○ ○	APET-32.73D6R	16,59	9,50	4,76	2,38	11°	85°

#### GA5036 (MT-CVD coated)

A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

#### G-9120 (PVD coated)

Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

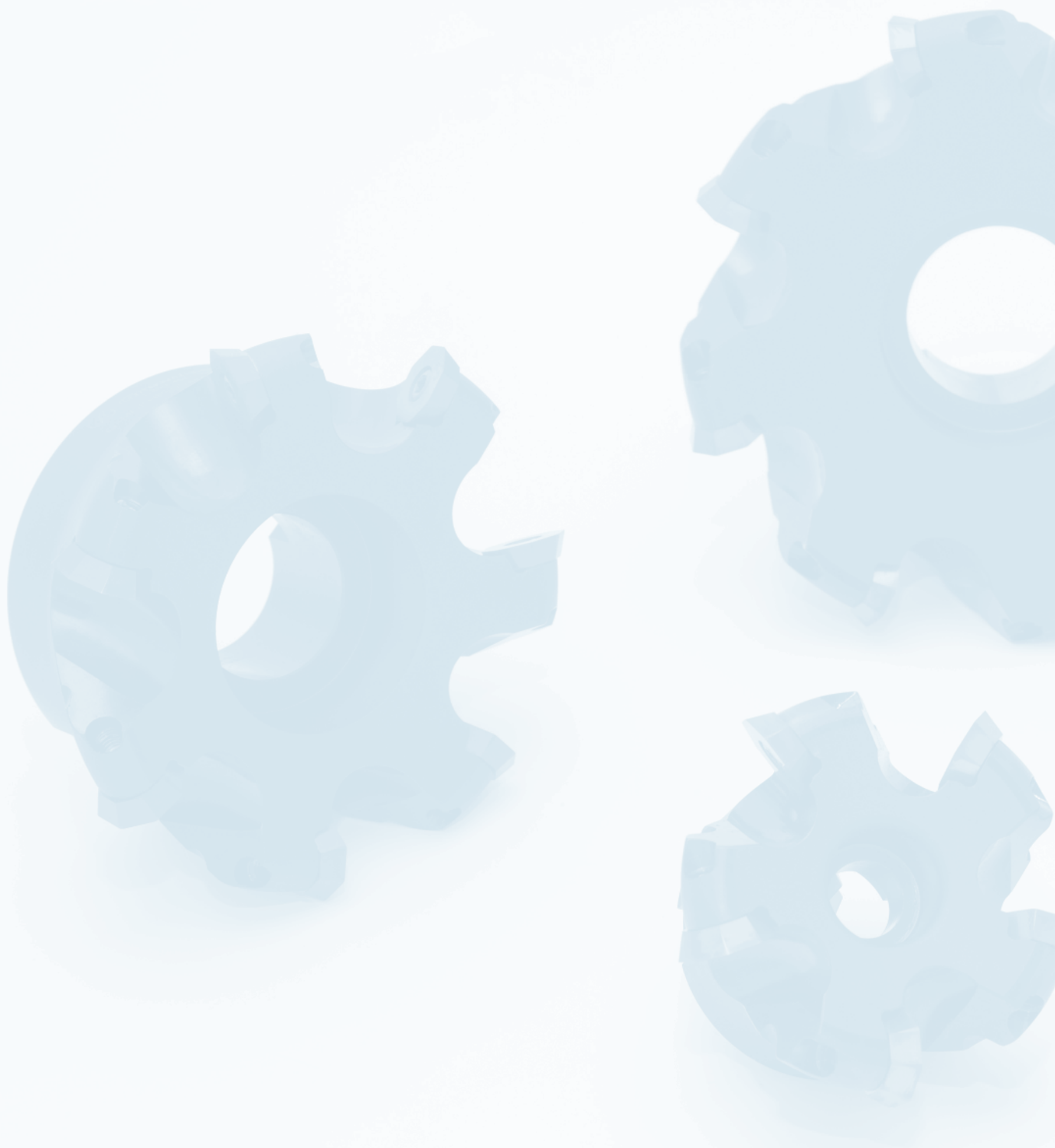
#### G-915 (PVD coated)

Excellent for high-temp alloys, stainless steel, and low-carbon steels. Should be run at moderate speeds and moderate to high feeds.

Inserts and Steel Products Only	Inserts Only	Steel Products
10 Business Days or Less <input type="checkbox"/>	Stocked or Available Upon Request <input type="checkbox"/>	Stocked Standard <input type="checkbox"/>

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## Index-O-Cut™ Milling Cutters

The Index-O-Cut™ is a high-performance milling system for all materials thanks to its high-shear cutting action and the 45° lead angle on the octagon-style insert. These mills are capable of running at higher speeds and feeds than the competition with low horsepower consumption.

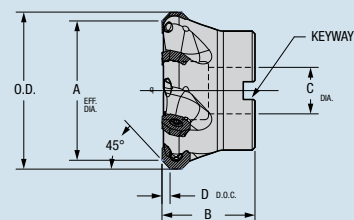
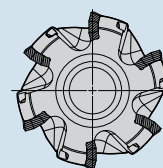


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# G-MOFHP

## Face Mill: High Positive

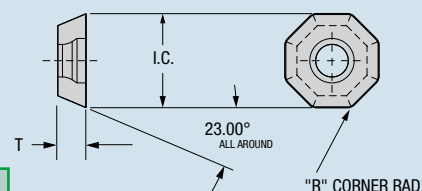
Part Number	Gage Insert	Stock	Dimensions (mm)					No. of Inserts	Keyway	Standard Components	*Tune-Up Kit
			A	O.D.	B	C	DOC** D			Insert Screw	Includes All Standard Components
G-MOFHP-0545E050	00EW-060416	●	50	59,4	40	22	4,39	4	10	PT-546-T	TK-03249
G-MOFHP-0545E063	00EW-060416	●	63	72,4	40	22	4,39	5	10	PT-546-T	TK-03165
G-MOFHP-0545E080	00EW-060416	○	80	89,4	50	27	4,39	6	12	PT-546-T	TK-03250
G-MOFHP-0545E100	00EW-060416	●	100	109,4	50	32	4,39	7	14	PT-546-T	TK-03444
G-MOFHP-0545E125	00EW-060416	●	125	134,4	63	40	4,39	8	16	PT-546-T	TK-03445
G-MOFHP-0545E150	00EW-060416	●	150	159,4	63	40	4,39	9	16	PT-546-T	TK-03651
G-MOFHP-0545E800	00EW-060416	●	200	209,4	63	60	4,39	10	25	PT-546-T	TK-03437


\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

\*\*Maximum depth of cut is 7,92mm.

# 00EW Insert

## Octagon



Inserts	Part Number		Part Number	Dimensions (mm)		
	ISO	G-9120 G-915	ANSI	A	T	R
	00EW-060416	● ●	00EW-534	15,875	4,763	1,588

### G-9120 (PVD coated)

Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

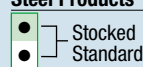
### G-915 (PVD coated)

Excellent for high-temp alloys, stainless steel, and low-carbon steels. Should be run at moderate speeds and moderate to high feeds.

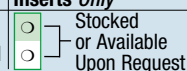
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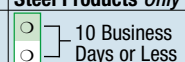
### Inserts and Steel Products



### Inserts Only



### Steel Products Only





# Performance Calculations

## Starting Speeds and Feeds for Index-O-Cut™ (M12)

Work Material	Insert Grades	Hardness (Hrc)	Cutting Speed (m/min)	Maximum Feed per Tooth (mm)
Low-Carbon Steel / Free Machining	G-9120	<25	365-487	0,12-0,25
Alloy Steel (4140, 4130, 6150, 8620)	G-9120	15-30	274-426	0,10-0,17
High-Carbon Steel (1080,1541, Nitralloy, 52100)	G-9120	25-40	182-304	0,07-0,15
Tool Steel (A6, D2, P-20, H-13)	G-9120	<30	243-365	0,10-0,20
High-Temp (Inconel, Hastelloy, Waspaloy)	G-915	<35	121-243	0,07-0,17
Stainless Steel (304, 316, 17-4 PH)	G-915	<32	274-457	0,10-0,22

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## High-Shear Milling Cutters

Greenleaf's high-shear face milling cutters are industry's first choice when surface finish and material removal rate are a priority in materials such as aluminum, high-temp alloy, stainless steel or low-carbon steel. The zero-degree lead face mills offer a protected screw-on insert pocket design with an anvil backup or cartridge design in a diameter range from 40-160mm, which gives greater life to the cutter body.

The Greenleaf 45-degree face mill has a through-pocket wedge-behind design, which offers complete face adjustability to dial in the face runout and maximum chip gullets to allow even the most difficult-to-machine materials to exit the cut freely. This feature extends insert life and aids in achieving the desired surface finish.

- 40-100mm diameter, zero-degree lead are offered in a fixed pocket design.
- 100-160mm diameter, zero-degree and 45-degree lead are offered in adjustable pocket designs to pre-set face runout.



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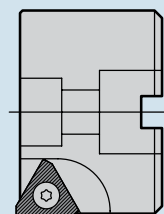
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# FTHP

## Milling Cutters: High Shear


Right-Hand Face Mill Shown



Part Number		Gage	Stock	Dimensions (millimeters)				No. Of Inserts	Standard Components		* Tune-Up Kit
Right Hand	Left Hand	Insert		A	B	C	Keyway		Anvil	Insert Screw	Includes All Standard Components
FTHP-500063R		TPCB-2204PF-R	○	63	40	22	10	4	308429	SE03-23	TK-00652
	FTHP-500063L	TPCB-2204PF-L	○	63	40	22	10	4	308429	SE03-23	TK-00652
FTHP-500080R		TPCB-2204PF-R	○	80	50	27	12	4	308429	SE03-23	TK-00652
	FTHP-500080L	TPCB-2204PF-L	○	80	50	27	12	4	308429	SE03-23	TK-00652
FTHP-5000100R		TPCB-2204PF-R	○	100	50	32	14	5	308429	SE03-23	TK-02234
	FTHP-5000100L	TPCB-2204PF-L	○	100	50	32	14	5	308429	SE03-23	TK-02234

\*Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

## TPCB Insert

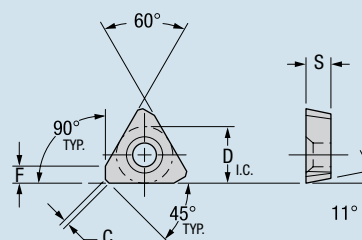
Inserts	Part Number ISO	GA5036	G-915	G-53	Part Number ANSI	Dimensions (millimeters)			
						D	S	F	C
	TPCB-2204PF-R	○	●	○	TPCB-43P8F-R	12,70	4,76	3,18	1,12
	TPCB-2204PF-L	○	●	○	TPCB-43P8F-L	12,70	4,76	3,18	1,12

**GA5036 (MT-CVD coated)** A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

**G-915 (PVD coated)** Excellent for high-temp alloys, stainless steel, and low carbon steels. Should be run at moderate speeds and moderate to high feeds.

**G-53 (uncoated)** General purpose grade for steel and steel alloys. Good combination of toughness and wear resistance for milling, or as an all-around grade for mixed production applications.

"J" finish available upon request



### Greenleaf Sales

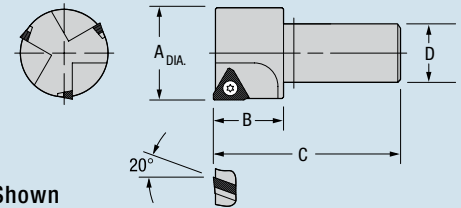
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### Inserts and Steel Products

Inserts and Steel Products	Inserts Only	Steel Products Only
<div>●</div> Stocked Standard	<div>○</div> Stocked or Available Upon Request	<div>○</div> 10 Business Days or Less

## WSTHP

### End Mill: Screw-On Inserts




Right-Hand End Mill Shown

Part Number		Gage	Stock	Dimensions (millimeters)				No. Of Inserts	Standard Components		* Tune-Up Kit
Right Hand	Left Hand	Insert		A	B	C	D		Anvil	Insert Screw	Includes All Standard Components
WSTHP-4032R		TPCB-2204PF-R	○	40	42	115	32	2	308429	SE03-23	TK-00650
	WSTHP-4032L	TPCB-2204PF-L	○	40	42	115	32	2	308429	SE03-23	TK-00650
WSTHP-5032R		TPCB-2204PF-R	●	50	42	115	32	3	308429	SE03-23	TK-00651
	WSTHP-5032L	TPCB-2204PF-L	○	50	42	115	32	3	308429	SE03-23	TK-00651
WSTHP-6332R		TPCB-2204PF-R	○	63	42	115	32	4	308429	SE03-23	TK-00652
	WSTHP-6332L	TPCB-2204PF-L	○	63	42	115	32	4	308429	SE03-23	TK-00652

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

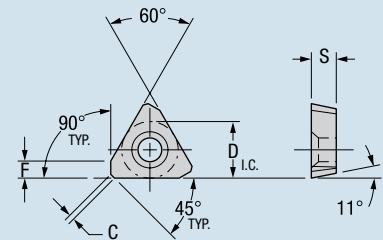
## TPCB Insert

Inserts	Part Number ISO	GA5036	G-915	G-53	Part Number ANSI	Dimensions (millimeters)			
						D	S	F	C
	TPCB-2204PF-R	○	●	○	TPCB-43P8F-R	12,70	4,76	3,18	1,12
	TPCB-2204PF-L	○	●	○	TPCB-43P8F-L	12,70	4,76	3,18	1,12

**GA5036 (MT-CVD coated)** A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

**G-915 (PVD coated)** Excellent for high-temp alloys, stainless steel, and low carbon steels. Should be run at moderate speeds and moderate to high feeds.

**G-53 (uncoated)** General purpose grade for steel and steel alloys. Good combination of toughness and wear resistance for milling, or as an all-around grade for mixed production applications.



"J" finish available upon request

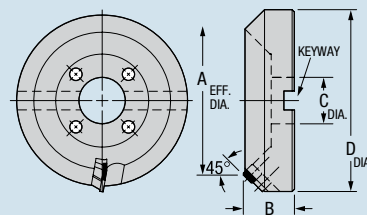
Inserts and Steel Products Only	Inserts Only	Steel Products
10 Business Days or Less <input type="checkbox"/>	Stocked or Available Upon Request <input type="checkbox"/>	Stocked Standard <input type="checkbox"/>

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# SHPC-345 45° Lead

45° Lead Face Mill, Negative Radial  
20° Positive Axial

Right-Hand Face Mill Shown



Part Number		Gage		Dimensions (millimeters)							Standard Components			* Tune-Up Kit
Right Hand	Left Hand	† Insert	Stock	A	B	C	D	Keyway	Bolt Circle	No. of Inserts	Wedge	Wedge Screw	Back-Up Plate	Includes All Standard Components
SHPC-12-345-100R	—	SECN-42A6FR4	○	100	50	32	130	14	—	6	430996	STCM-11	307788	TK-02161
—	SHPC-12-345-100L	SECN-42A6FR4	○	100	50	32	130	14	—	6	430996	STCM-11	307788	TK-02161
SHPC-12-345-125R	—	SECN-42A6FR4	○	125	63	40	155	16	—	8	430996	STCM-11	307788	TK-02162
—	SHPC-12-345-125L	SECN-42A6FR4	○	125	63	40	155	16	—	8	430996	STCM-11	307788	TK-02162
SHPC-12-345-160R	—	SECN-42A6FR4	●	160	63	40	190	16	66,7	10	430996	STCM-11	307788	TK-02165
—	SHPC-12-345-160L	SECN-42A6FR4	○	160	63	40	190	16	66,7	10	430996	STCM-11	307788	TK-02165

† SECN-42A6F CAN BE USED FOR FINISHING, BUT THERE IS NOT 1,5mm CORNER RADIUS ON THE FLAT.

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

## SECN Insert

Inserts	Part Number	GA5036	GA5125	G-9120	G-915	G-910	Part Number	Dimensions (millimeters)			
	ANSI						ANSI	D	S	F	R
	SECN-42A6FR4	●	○	●	●	●	SECN-42A6FR4	12,70	3,18	2,38	0,25

**GA5036 (MT-CVD coated)** A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

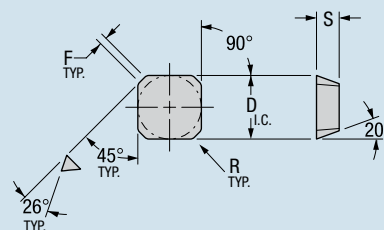
**GA5125 (MT-CVD coated)** A high-performance carbide milling grade especially suited for manganese steel. Also applicable on chrome-moly steel, tool steel and similar high alloy steels.

### G-9120 (PVD coated)

Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

**G-915 (PVD coated)** Excellent for high-temp alloys, stainless steel, and low carbon steels. Should be run at moderate speeds and moderate to high feeds.

**G-910 (PVD coated)** A grade for high-temp alloys, stainless steel, and low carbon steels. A medium speed grade and should be applied at moderate to high feed rates.



"J" polish available upon request.

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### Inserts and Steel Products

● Stocked Standard  
○ Stocked or Available Upon Request

### Inserts Only

○ Stocked or Available Upon Request

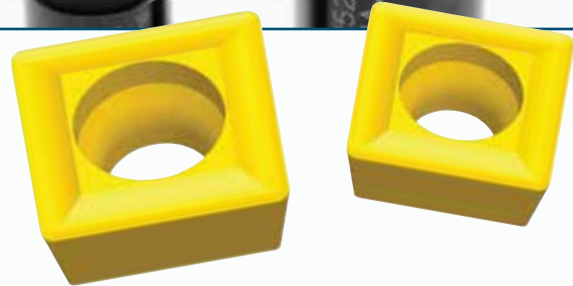
### Steel Products Only

○ 10 Business Days or Less

## Screw-On Insert Milling Cutters

The special-duty end mills utilize the screw-on insert concept for simplicity and maximum chip clearance without hardware interference. This provides longer tool life and better surface finishes.

*Center Cutting*



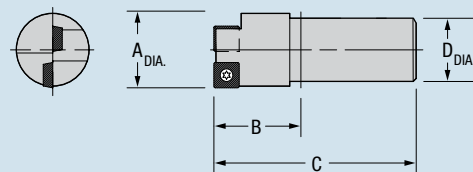
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[www.greenleafglobalsupport.com](http://www.greenleafglobalsupport.com)



# WSSCC

## 0° Lead End Mill, Center Cutting



Right-Hand End Mill Shown


Part Number		Gage	Stock	Dimensions (millimeters)				No. of Inserts	Standard Components	* Tune-Up Kit	Optional Insert
Right Hand	Left Hand**	Insert		A	B	C	D		Insert Screw	Includes All Standard Components	
WSSCC-2020R		SPMT-070308	○	20	35	115	20	2	PT-543-T	TK-00737	SPMW-070308
	WSSCC-2020L	SPMT-070308	○	20	35	115	20	2	PT-543-T	TK-00737	SPMW-070308
WSSCC-2525R		SPMT-09T308	●	25	35	115	25	2	PT-559-T	TK-00738	SPMW-09T308
	WSSCC-2525L	SPMT-09T308	○	25	35	115	25	2	PT-559-T	TK-00738	SPMW-09T308
WSSCC-3232R		SPMT-120408	○	32	45	125	32	2	PT-588-T	TK-00739	SPMW-120408
	WSSCC-3232L	SPMT-120408	○	32	45	125	32	2	PT-588-T	TK-00739	SPMW-120408
WSSCC-4032R		SPMT-120408	○	40	45	125	32	2	PT-588-T	TK-00739	SPMW-120408
	WSSCC-4032L	SPMT-120408	○	40	45	125	32	2	PT-588-T	TK-00739	SPMW-120408

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

\*\* Left-Hand cutters are made to order only.

# Screw-On Inserts

## SPMT-X2

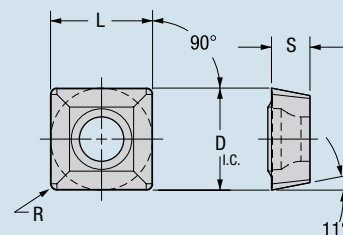
Inserts	Part Number	GA5036 G-935	Part Number	Dimensions (millimeters)			
	ISO		ANSI	D	L	S	R
	SPMT-070308-X2	● ●	SPMT-2.522-X2	7,94	7,94	3,18	0,80
	SPMT-09T308-X2	● ●	SPMT-32.52-X2	9,53	9,53	3,96	0,80
	SPMT-120408-X2	● ●	SPMT-432-X2	12,70	12,70	4,76	0,80

### GA5036 (MT-CVD coated)

A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

### G-935 (PVD coated)

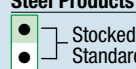
For steel where additional resistance to mechanical and thermal shock is required. For moderate speeds and feeds.



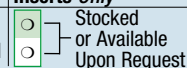
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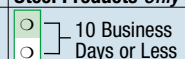
### Inserts and Steel Products



### Inserts Only



### Steel Products Only



# Excelsior® Milling Cutters

High-velocity cutters with ceramic inserts for use in high-temp alloys, hard metals, cast irons at high speeds and accelerated feed rates. Precision nests provide multiple insert configurations and body protection.

## Greenleaf Excelsior® Mills Set-Up and Operational Procedures

1. Thoroughly clean all insert pockets.
2. Install the inserts, making sure that they are properly seated in the pocket, and torque the insert clamp screws to the correct torque as indicated on the body of the Excelsior Milling Cutter.
3. Use Greenleaf Excelsior Mills only on machines that have adequate shield guards.
4. Run the Greenleaf Excelsior Mills using cutting parameters as recommended by the Greenleaf Tech Team. Contact Greenleaf at:  
+814-763-2915 US  
+31-45-404-1774 EU  
+86-731-89954796 CN
5. For safety purposes, do not exceed the maximum RPM's etched on the Excelsior Mill. Note: There are two max RPM numbers. One (the lower RPM number) is for using the mill with carbide inserts and the other is for usage with ceramic inserts.



## Application Tips

- Air blast is highly recommended for hard milling applications.
- Maximum insert life can be achieved at a radial width of cut based on 40-60 percent of cutter diameter.
- As the width-of-cut ratio decreases, feed should be increased to maintain acceptable average chip thickness.
- Balanced toolholders are critical when operating at 10,000 RPM and higher.
- Keep tool length overhang as short as possible.
- Ramping or helical interpolation are the preferred methods of entry into the cut.
- Maintain cutter engagement as much as possible; frequent entry and exit into cuts can decrease insert life.
- When using round insert cutters, the effective cutting diameter depends on the actual depth of cut.

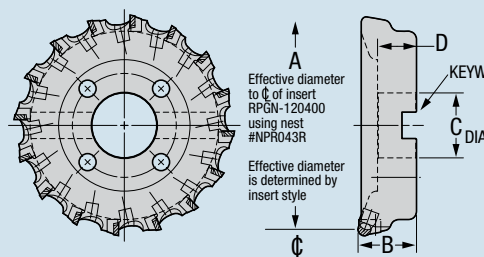
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# CP4 Series

## Positive Rake Face Mill

Right-Hand  
Face Mill Shown



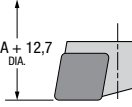
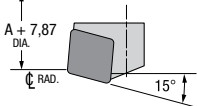
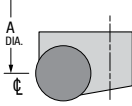
Cutter Part Number		Stock	Dimensions (millimeters)				Keyway	Bolt Circle	No. of Inserts	Standard Components			* Tune-Up Kit
Right Hand	Left Hand		A	B	C	D				Wedge	Wedge Screw	Nest Screw	
CP-4080R	—	●	80	50	27	22	12	—	6	425605	MS-1595	CO-5018	TK-01604
—	CP-4080L	○	80	50	27	22	12	—	6	425605	MS-1595	CO-5018	TK-01604
CP-4100R	—	●	100	50	32	25	14	—	8	425605	MS-1595	CO-5018	TK-01963
—	CP-4100L	○	100	50	32	25	14	—	8	425605	MS-1595	CO-5018	TK-01963
CP-4125R	—	●	125	63	40	28	16	—	10	425605	MS-1595	CO-5018	TK-01593
—	CP-4125L	○	125	63	40	28	16	—	10	425605	MS-1595	CO-5018	TK-01593
CP-4160R	—	○	160	63	40	28	16	66,7	12	425605	MS-1595	CO-5018	TK-01694
—	CP-4160L	○	160	63	40	28	16	66,7	12	425605	MS-1595	CO-5018	TK-01694
CP-4200R	—	○	200	63	60	38	25	101,6	16	425605	MS-1595	CO-5018	TK-01921
—	CP-4200L	○	200	63	60	38	25	101,6	16	425605	MS-1595	CO-5018	TK-01921
CP-4250R	—	○	250	63	60	38	25	101,6	20	425605	MS-1595	CO-5018	TK-01962
—	CP-4250L	○	250	63	60	38	25	101,6	20	425605	MS-1595	CO-5018	TK-01962
CP-4315R	—	○	315	80	60	38	25	101,6 177,8	24	425605	MS-1595	CO-5018	TK-01976
—	CP-4315L	○	315	80	60	38	25	101,6 177,8	24	425605	MS-1595	CO-5018	TK-01976

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.  
Cutters are supplied less insert and nest. Nest must be purchased separately. See below.

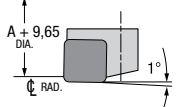
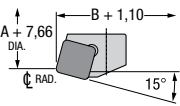
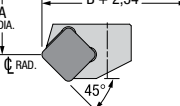
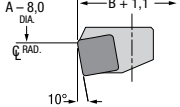
Insert shape, size and quantity must be determined after choosing cutter and nest.  
Left-hand cutters can be built to order.

## CP4 Series

### Nests

Inserts	Nest Part Number		Stock		Gage
	Right Hand	Left Hand	R	L	
	NPC043R	—	●	—	CPGN-120412
	—	NPC043L	—	○	CPGN-120412
	NPC1543R	—	●	—	CPGN-120412
	—	NPC1543L	—	○	CPGN-120412
	NPR043R	—	●	—	RPGN-120400
	—	NPR043L	—	○	RPGN-120400

The filler block nest, NPB, will act as a replacement for the inserts and insert nests. The filler block nest must be locked securely in place with the wedge to insure cutter integrity.

Inserts	Nest Part Number		Stock		Gage
	Right Hand	Left Hand	R	L	
	NPS143R	—	●	—	SPGN-120416
	—	NPS143L	—	○	SPGN-120416
	NPS1543R	—	●	—	SPGN-120416
	—	NPS1543L	—	○	SPGN-120416
	NPS4543R	—	●	—	SPGN-120416
	—	NPS4543L	—	○	SPGN-120416
	XFNP8043R	—	●	—	SPGN-120412
	—	XFNP8043L	—	○	SPGN-120412

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### Inserts and Steel Products

● Stocked Standard

### Inserts Only




○ Stocked or Available Upon Request

### Steel Products Only

○ 10 Business Days or Less

# CP4 Series

## Positive Inserts

Inserts	Part Number									Part Number	Dimensions (millimeters)			
	ISO	WG-300	WG-600	XSXTIN-1	G-9230	GA5036	GA5125	G-9120	G-915	ANSI	D	L	S	R
	CPGN-120412	●	●	●	○	●	○	○	●	CPGN-433	12,70	12,90	4,76	1,20
	CPGN-120416	●	○	○	○	●	○	○	●	CPGN-434	12,70	12,90	4,76	1,60
	RPGN-120400	●	●	●	○	●	●	●	●	RPGN-43	12,70	—	4,76	—
	SPGN-120412	●	●	○	○	●	●	●	●	SPGN-433	12,70	12,70	4,76	1,20
	SPGN-120416	●	○	○	○	●	○	○	●	SPGN-434	12,70	12,70	4,76	1,60

### WG-300® and WG-600® (Whiskered Ceramic)

Used for milling high-temp alloys and hardened material above 45 Rc.

### XSXTIN™-1 (Phase-Toughened)

Ideal for use in interrupted cuts, scale and milling. Capable of extreme feed rates. Excels at machining steels, cast and ductile irons, high-temp alloys and other challenging materials.

### G-9230 (PVD coated)

Carbide grade for medium to heavy machining of nickel alloys, cobalt alloys, titanium alloys, stainless steels and alloyed irons.

### GA5036 (MT-CVD coated)

A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

### GA5125 (MT-CVD coated)

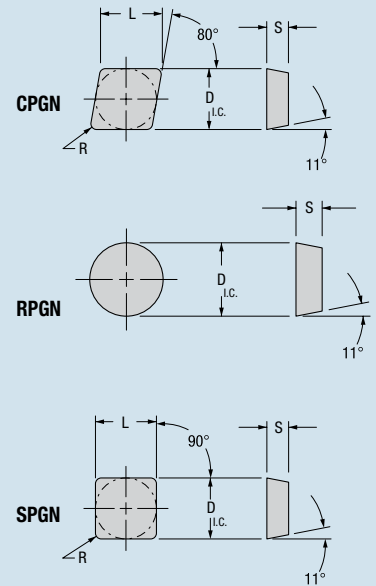
A high-performance carbide milling grade especially suited for manganese steel. Also applicable on chrome-moly steel, tool steel and similar high alloy steels.

### G-9120 (PVD coated)

Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

### G-915 (PVD coated)




Excellent for high-temp alloys, stainless steel, and low carbon steels. Should be run at moderate speeds and moderate to high feeds.



Cutter Part Number	Screw Torque Setting
CP-4080R/L	9,6 Nm
CP-4100R/L	9,6 Nm
CP-4125R/L	9,6 Nm
CP-4160R/L	9,6 Nm
CP-4200R/L	9,6 Nm
CP-4250R/L	9,6 Nm
CP-4315R/L	9,6 Nm

For additional nose radii, call Greenleaf Technical Service.

For available edge preps, please reference page AT119 or contact Greenleaf Technical Service.

Inserts and Steel Products Only	Inserts Only	Steel Products
10 Business Days or Less 	Stocked or Available Upon Request 	Stocked Standard 

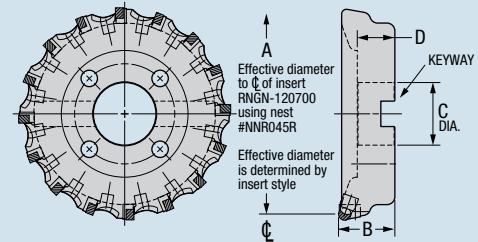
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# C4 Series

## Negative Rake Face Mill

Right-Hand  
Face Mill Shown



Cutter Part Number		Stock	Dimensions (millimeters)				Keyway	Bolt Circle	No. of Inserts	Standard Components			* Tune-Up Kit
Right Hand	Left Hand		A	B	C	D				Wedge	Wedge Screw	Nest Screw	
C-4080R	—	●	80	50	27	22	12	—	6	425605	MS-1595	CO-5018	TK-01604
—	C-4080L	○	80	50	27	22	12	—	6	425605	MS-1595	CO-5018	TK-01604
C-4100R	—	●	100	50	32	25	14	—	8	425605	MS-1595	CO-5018	TK-01963
—	C-4100L	○	100	50	32	25	14	—	8	425605	MS-1595	CO-5018	TK-01963
C-4125R	—	●	125	63	40	28	16	—	10	425605	MS-1595	CO-5018	TK-01593
—	C-4125L	○	125	63	40	28	16	—	10	425605	MS-1595	CO-5018	TK-01593
C-4160R	—	●	160	63	40	28	16	66,7	12	425605	MS-1595	CO-5018	TK-01694
—	C-4160L	○	160	63	40	28	16	66,7	12	425605	MS-1595	CO-5018	TK-01694
C-4200R	—	●	200	63	60	32	25	101,6	16	425605	MS-1595	CO-5018	TK-01921
—	C-4200L	○	200	63	60	32	25	101,6	16	425605	MS-1595	CO-5018	TK-01921
C-4250R	—	○	250	63	60	32	25	101,6	20	425605	MS-1595	CO-5018	TK-01962
—	C-4250L	○	250	63	60	32	25	101,6	20	425605	MS-1595	CO-5018	TK-01962
C-4315R	—	○	315	80	60	32	25	101,6 177,8	24	425605	MS-1595	CO-5018	TK-01976
—	C-4315L	○	315	80	60	32	25	101,6 177,8	24	425605	MS-1595	CO-5018	TK-01976

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

Cutters are supplied less insert and nest. Nest must be purchased separately. See below.

Insert shape, size and quantity must be determined after choosing cutter and nest.

Left-hand cutters can be built to order.

# C4 Series

## Nests

Inserts	Nest Part Number		Stock		Gage
	Right Hand	Left Hand	R	L	
	NNC043R	—	●	—	CNGN-120412
	—	NNC043L	—	●	CNGN-120412
	NNC045R	—	●	—	CNGN-120712
	—	NNC045L	—	●	CNGN-120712
	NNC1543R	—	●	—	CNGN-120412
	—	NNC1543L	—	●	CNGN-120412
	NNC1545R	—	●	—	CNGN-120712
	—	NNC1545L	—	●	CNGN-120712
	NNR043R	—	●	—	RNGN-120400
	—	NNR043L	—	●	RNGN-120400
	NNR045R	—	●	—	RNGN-120700
	—	NNR045L	—	●	RNGN-120700

Inserts	Nest Part Number		Stock		Gage
	Right Hand	Left Hand	R	L	
	NNS143R	—	●	—	SNGN-120416
	—	NNS143L	—	●	SNGN-120416
	NNS145R	—	●	—	SNGN-120716
	—	NNS145L	—	●	SNGN-120716
	NNS1543R	—	●	—	SNGN-120416
	—	NNS1543L	—	○	SNGN-120416
	NNS1545R	—	—	○	SNGN-120716
	—	NNS1545L	—	○	SNGN-120716
	NNS4543R	—	●	—	SNGN-120416
	—	NNS4543L	—	○	SNGN-120416
	NNS4545R	—	—	○	SNGN-120716
	—	NNS4545L	—	○	SNGN-120716

For applications which will not require the maximum number of inserts, the filler block nest, NNB, will act as a replacement for the inserts and insert nests.

The filler block nest must be locked securely in place with the wedge to insure cutter integrity.

### Greenleaf Sales

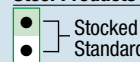
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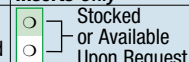
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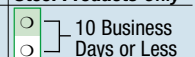
### Inserts and Steel Products



### Inserts Only






### Steel Products Only



# C4 Series

## Negative Inserts

Inserts	Part Number ISO	WG-300	WG-600	XSYTIN-1	GSN100	G-9230	GA5036	GA5125	G-9120	G-915	Part Number ANSI	Dimensions (millimeters)			
												D	L	S	R
	CNGN-120412	●	●	●	○	○	○	○	○	○	CNGN-433	12,70	12,90	4,76	1,20
	CNGN-120416	●	●	●	○	○	○	○	○	○	CNGN-434	12,70	12,90	4,76	1,60
	CNGN-120712	●	●	●	○	○	○	○	○	○	CNGN-453	12,70	12,90	7,94	1,20
	CNGN-120716	●	●	●	○	○	○	○	○	○	CNGN-454	12,70	12,90	7,94	1,60
	RNGN-120400	●	●	●	○	○	○	○	○	○	RNGN-43	12,70	—	4,76	—
	RNGN-120700	●	●	●	○	○	○	○	○	○	RNGN-45	12,70	—	7,94	—
	SNGN-120412	●	●	●	○	○	○	○	○	○	SNGN-433	12,70	12,70	4,76	1,20
	SNGN-120416	●	●	●	○	○	○	○	○	○	SNGN-434	12,70	12,70	4,76	1,60
	SNGN-120712	●	●	●	○	○	○	○	○	○	SNGN-453	12,70	12,70	7,94	1,20
	SNGN-120716	●	●	●	○	○	○	○	○	○	SNGN-454	12,70	12,70	7,94	1,60

### WG-300® and WG-600® (Whiskered Ceramic)

Used for milling high-temp alloys and hardened material above 45 Rc.

### XSYTIN™-1 (Phase-Toughened)

Ideal for use in interrupted cuts, scale and milling. Capable of extreme feed rates. Excels at machining steels, cast and ductile irons, high-temp alloys and other challenging materials.

### GSN100™ (Silicon Nitride Ceramic)

For high-speed turning, grooving and milling of gray and ductile cast irons.

### G-9230 (PVD coated)

Carbide grade for medium to heavy machining of nickel alloys, cobalt alloys, titanium alloys, stainless steels and alloyed irons.

### GA5036 (MT-CVD coated)

A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

### GA5125 (MT-CVD coated)

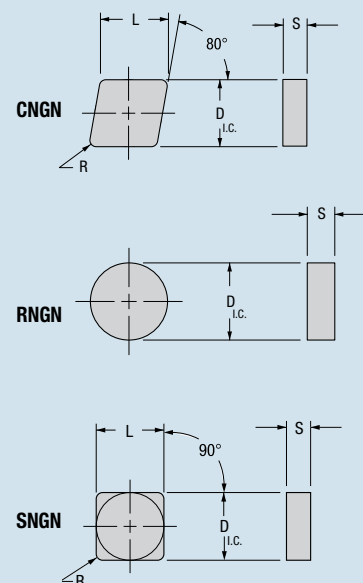
A high-performance carbide milling grade especially suited for manganese steel. Also applicable on chrome-moly steel, tool steel and similar high alloy steels.

### G-9120 (PVD coated)

Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

### G-915 (PVD coated)

Excellent for high-temp alloys, stainless steel, and low carbon steels. Should be run at moderate speeds and moderate to high feeds.



Cutter Part Number	Screw Torque Setting
C-4080R/L	9,6 Nm
C-4100R/L	9,6 Nm
C-4125R/L	9,6 Nm
C-4160R/L	9,6 Nm
C-4200R/L	9,6 Nm
C-4250R/L	9,6 Nm
C-4315R/L	9,6 Nm

For additional nose radii, call Greenleaf Technical Service.

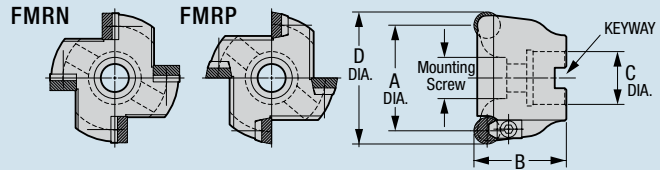
For available edge preps, please reference page AT119 or contact Greenleaf Technical Service.

Inserts and Steel Products Only	Inserts Only	Steel Products
10 Business Days or Less	Stocked or Available Upon Request	Stocked Standard

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# FMRP-FMRN

## Round Insert Face Mill



Right-Hand Cutter Shown

Part Number		Gage	Stock	Dimensions (millimeters)				Mounting Screw	No. of Inserts	Keyway	Standard Components				* Tune-Up Kit Includes All Std. Components
Right Hand	Left Hand	Insert		A	B	C	D				Anvil	Anvil Screw	Clamp	Clamp Screw	
FMRP-050R		RPGN-120400	●	50	40	22	62,7	M10	4	10	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01446
	FMRP-050L	RPGN-120400	○	50	40	22	62,7	M10	4	10	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01446
FMRP-063R		RPGN-120400	●	63	40	22	75,7	M10	4	10	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01446
	FMRP-063L	RPGN-120400	●	63	40	22	75,7	M10	4	10	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01446
FMRP-080R		RPGN-120400	●	80	50	27	92,7	M12	5	12	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01445
	FMRP-080L	RPGN-120400	○	80	50	27	92,7	M12	5	12	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01445
FMRP-100R		RPGN-120400	○	100	50	32	112,7	M16	6	14	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01447
	FMRP-100L	RPGN-120400	○	100	50	32	112,7	M16	6	14	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01447

\*\* For Insert RPGN-120300, use anvil 312780. For insert RPGN-120700, use no anvil.

Part Number		Gage	Stock	Dimensions (millimeters)				Mounting Screw	No. of Inserts	Keyway	Standard Components				* Tune-Up Kit Includes All Std. Components
Right Hand	Left Hand	Insert		A	B	C	D				Anvil	Anvil Screw	Clamp	Clamp Screw	
FMRN-050R		RNGN-120400	●	50	40	22	62,7	M10	4	10	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02699
	FMRN-050L	RNGN-120400	○	50	40	22	62,7	M10	4	10	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02699
FMRN-063R		RNGN-120400	●	63	40	22	75,7	M10	4	10	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02699
	FMRN-063L	RNGN-120400	○	63	40	22	75,7	M10	4	10	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02699
FMRN-080R		RNGN-120400	●	80	50	27	92,7	M12	5	12	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02700
	FMRN-080L	RNGN-120400	○	80	50	27	92,7	M12	5	12	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02700
FMRN-100R		RNGN-120400	●	100	50	32	112,7	M16	6	14	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02701
	FMRN-100L	RNGN-120400	○	100	50	32	112,7	M16	6	14	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02701

\*\* For Insert RNGN-120300, use anvil 313596. For insert RNGN-120700, use no anvil.

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

Left-Hand cutters are made to order only.

† Hole to suit.

## RPGN, RNGN Insert

Inserts	Part Number	WG-300	WG-600	XSXTIN-1	GSN100	GA5036	GA5125	G-9120	G-915	Part Number	Dimensions (millimeters)	
	ISO									ANSI	D	S
	RPGN-120300	○	○	○	○	●	○	○	●	RPGN-42	12,70	3,18
	RPGN-120400	●	●	●	●	●	●	●	●	RPGN-43	12,70	4,76
	RNGN-120300	○	○	●	○	○	○	○	●	RNGN-42	12,70	3,18
	RNGN-120400	●	●	●	●	○	○	○	●	RNGN-43	12,70	4,76
	RNGN-120700	●	●	●	●	○	○	○	●	RNGN-45	12,70	7,94

WG-300® and WG-600® (Whiskered Ceramic) Used for milling high-temp alloys and hardened material above 45 Rc.

XSXTIN™ -1(Phase-Toughened) Ideal for use in interrupted cuts, scale and milling. Capable of extreme feed rates. Excels at machining steels, cast and ductile irons, high-temp alloys and other challenging materials.

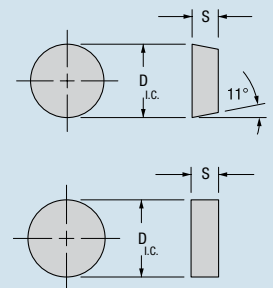
GSN100™ (Silicon Nitride Ceramic) For high-speed turning, grooving and milling of gray and ductile cast irons.

GA5036 (MT-CVD coated) A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

GA5125 (MT-CVD coated) A high-performance carbide milling grade especially suited for manganese steel. Also applicable on chrome-moly steel, tool steel and similar high alloy steels.

G-9120 (PVD coated) Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

G-915 (PVD coated) Excellent for high-temp alloys, stainless steel, and low carbon steels. Should be run at moderate speeds and moderate to high feeds.



For available edge preps, please reference page AT119 or contact Greenleaf Technical Service.

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### Inserts and Steel Products

● Stocked Standard  
○ Stocked or Available Upon Request

### Inserts Only

○ Stocked or Available Upon Request

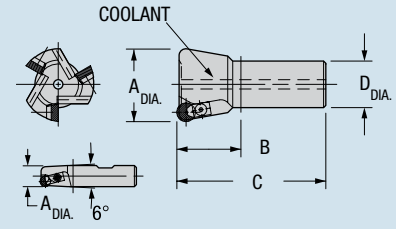
### Steel Products Only

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# WSRP *Excelerator*® Mill

## End Mill: Round Positive Inserts

Right-Hand Cutter Shown



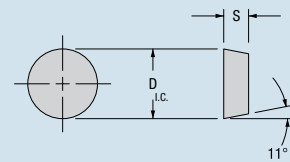
Part Number		Gage	Stock	Dimensions (millimeters)				No. Of Inserts	Standard Components				*Tune-Up Kit Includes All Std. Components
Right Hand	Left Hand	Insert		A	B	C	D		Anvil	Anvil Screw	Clamp	Clamp Screw	
† WSRP-1616R		RPGN-060200	●	16	32	80	16	2	—	—	430879	SHCS M2.5-.45x6mm	TK-01335
	† WSRP-1616L	RPGN-060200	○	16	32	80	16	2	—	—	430879	SHCS M2.5-.45x6mm	TK-01335
† WSRP-2020R		RPGN-070300	●	20	32	82	20	2	—	—	429323	MS-1156	TK-01339
	† WSRP-2020L	RPGN-070300	○	20	32	82	20	2	—	—	429323	MS-1156	TK-01339
WSRP-2520RA		RPGN-070300	●	25	32	82	20	3	—	—	429323	MS-1156	TK-01840
	WSRP-2520LA	RPGN-070300	○	25	32	82	20	3	—	—	429323	MS-1156	TK-01840
WSRP-2520R		RPGN-090300	●	25	32	82	20	3	—	—	425716	MS-1156	TK-01325
	WSRP-2520L	RPGN-090300	○	25	32	82	20	3	—	—	425716	MS-1156	TK-01325
WSRP-3225R		RPGN-090300	●	32	32	88	25	3	—	—	425716	MS-1156	TK-01325
	WSRP-3225L	RPGN-090300	○	32	32	88	25	3	—	—	425716	MS-1156	TK-01325
WSRP-4032R		RPGN-120400	●	40	45	105	32	3	—	—	3025-1	438920	TK-01340
	WSRP-4032L	RPGN-120400	○	40	45	105	32	3	—	—	3025-1	438920	TK-01340
WSRP-5040R		RPGN-120400	●	50	45	115	40	3	308341	FHCS M3-0.5x6mm	3025-1	438920	TK-01360
	WSRP-5040L	RPGN-120400	○	50	45	115	40	3	308341	FHCS M3-0.5x6mm	3025-1	438920	TK-01360
WSRP-6340R		RPGN-120400	●	63	45	115	40	4	308341	FHCS M3-0.5x6mm	3025-1	438920	TK-01357
	WSRP-6340L	RPGN-120400	○	63	45	115	40	4	308341	FHCS M3-0.5x6mm	3025-1	438920	TK-01357


† No thru-tool coolant is available on WSRP-1616 and WSRP-2020 cutters

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

\*\* Left-Hand cutters are made to order only.

## RPGN Insert



Inserts	Part Number	ISO						Part Number	Dimensions (millimeters)	
	ISO	WG-300	WG-600	XSNTIN-1	GSA100	GA5036	GA5125	G-9120	G-915	ANSI
	RPGN-060200	●	●	○	●	○	●	●	●	RPGN-21.5
	RPGN-070300	●	●	●	●	○	●	●	●	RPGN-2.52
	RPGN-090300	●	●	●	●	○	●	●	●	RPGN-32
	RPGN-120400	●	●	●	●	●	●	●	●	RPGN-43

**WG-300® and WG-600® (Whiskered Ceramic)** Used for milling high-temp alloys and hardened material above 45 Rc.

**XSNTIN™ -1 (Phase-Toughened)** Ideal for use in interrupted cuts, scale and milling. Capable of extreme feed rates. Excels at machining steels, cast and ductile irons, high-temp alloys and other challenging materials.

**GSA100™ (Silicon Nitride Ceramic)** For high-speed turning, grooving and milling of gray and ductile cast irons.

**GA5036 (MT-CVD coated)** A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

**GA5125 (MT-CVD coated)** A high-performance carbide milling grade especially suited for manganese steel. Also applicable on chrome-moly steel, tool steel and similar high alloy steels.

**G-9120 (PVD coated)** Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

**G-915 (PVD coated)** Excellent for high-temp alloys, stainless steel, and low carbon steels. Should be run at moderate speeds and moderate to high feeds.

Cutter Part Number	Screw Torque Setting	Max RPM Carbide	Max RPM Ceramic
WSRP-1616R/L	1,7 Nm	15,000	40,000
WSRP-2020R/L	3,4 Nm	12,500	35,000
WSRP-2520R/L	3,4 Nm	9,500	26,000
WSRP-2520RA/LA	3,4 Nm	9,500	26,000
WSRP-3225R/L	3,4 Nm	7,500	21,000
WSRP-4032R/L	3,4 Nm	6,200	19,500
WSRP-5040R/L	3,4 Nm	4,600	13,000
WSRP-6340R/L	13,6 Nm	3,800	10,000

For available edge preps, please reference page ATI19 or contact Greenleaf Technical Service.

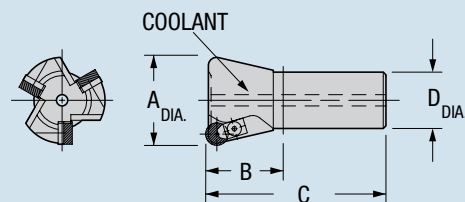
Inserts and Steel Products Only		Inserts Only	Steel Products
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	<input type="radio"/>		Stocked Standard

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# WSRN *Excelerator*® Mill

## End Mill: Round Negative Inserts



Right-Hand End Mill Shown

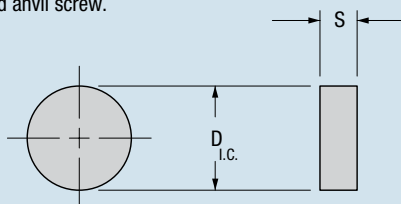
Part Number		Gage	Stock	Dimensions (millimeters)				No. Of Inserts	Standard Components				* Tune-Up Kit Includes All Std. Components	Optional Components	
Right Hand	Left Hand	Insert		A	B	C	D		**Anvil	Anvil Screw	Clamp	Clamp Screw		Insert	Shim
† WSRN-2520R		RNGN-090300	●	25	30	80	20	2	—	—	425716	MS-1156	TK-01321	—	—
	† WSRN-2520L	RNGN-090300	○	25	30	80	20	2	—	—	425716	MS-1156	TK-01321	—	—
WSRN-3225R		RNGN-090300	●	32	30	86	25	3	—	—	425716	MS-1156	TK-01325	—	—
	WSRN-3225L	RNGN-090300	○	32	30	86	25	3	—	—	425716	MS-1156	TK-01325	—	—
WSRN-4032R		RNGN-120400	●	40	45	105	32	3	—	—	3025-1	438920	TK-01340	—	—
	WSRN-4032L	RNGN-120400	○	40	45	105	32	3	—	—	3025-1	438920	TK-01340	—	—
†† WSRN-5040R		RNGN-120400	●	50	45	115	40	3	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02702	RNGN-120300	313596
	†† WSRN-5040L	RNGN-120400	○	50	45	115	40	3	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02702	RNGN-120300	313596
†† WSRN-6340R		RNGN-120400	●	63	45	115	40	4	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02699	RNGN-120300	313596
	†† WSRN-6340L	RNGN-120400	○	63	45	115	40	4	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02699	RNGN-120300	313596


\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

† This shank does not have any flats.

†† To use insert RNGN-120700, remove the anvil and anvil screw.

### RNGN Insert



Inserts	Part Number	Dimensions (millimeters)						Part Number	Dimensions (millimeters)	
	ISO	WG-300	WG-600	XSXTIN-1	GSN100	G-9120	G-915	ANSI	D	S
	RNGN-090300	●	●	○	○	○	○	RNGN-32	9,53	3,18
	RNGN-120300	●	●	○	○	○	○	RNGN-42	12,70	3,18
	RNGN-120400	●	●	●	○	○	○	RNGN-43	12,70	4,76

**WG-300® and WG-600® (Whiskered Ceramic)** Used for milling high-temp alloys and hardened material above 45 Rc.

**XSXTIN™ -1 (Phase-Toughened)** Ideal for use in interrupted cuts, scale and milling. Capable of extreme feed rates. Excels at machining steels, cast and ductile irons, high-temp alloys and other challenging materials.

**GSN100™ (Silicon Nitride Ceramic)** For high-speed turning, grooving and milling of gray and ductile cast irons.

**G-9120 (PVD coated)** Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

**G-915 (PVD coated)** Excellent for high-temp alloys, stainless steel, and low carbon steels. Should be run at moderate speeds and moderate to high feeds.

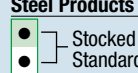
For available edge preps, please reference page AT119 or contact Greenleaf Technical Service.

Cutter Part Number	Screw Torque Setting	Max RPM Carbide	Max RPM Ceramic
WSRN-2520R/L	3,4 Nm	9,500	26,000
WSRN-3225R/L	3,4 Nm	7,500	21,000
WSRN-4032R/L	13,6 Nm	6,200	16,500
WSRN-5040R/L	13,6 Nm	4,600	13,000
WSRN-6340R/L	13,6 Nm	3,800	10,000

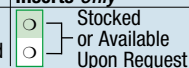
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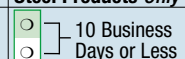
### Inserts and Steel Products



### Inserts Only

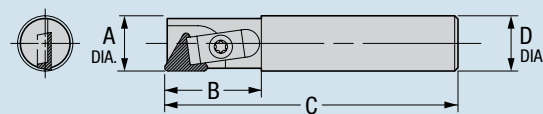


### Steel Products Only



# WSTP *Excelsator*® Mill

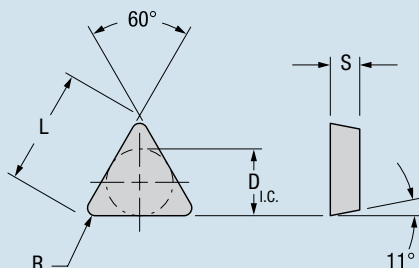
## End Mill: Triangle Positive Inserts




Right-Hand End Mill Shown

Part Number		Gage		Dimensions (millimeters)					Standard Components		* Tune-Up Kit
Right Hand	Left Hand	Insert	Stock	A	B	C	D	No. Of Inserts	Clamp	Clamp Screw	Includes All Standard Components
WSTP-1212R		TPGN-110308	●	12	22	67	12	1	429871	PT-317T	TK-00897
	WSTP-1212L	TPGN-110308	○	12	22	67	12	1	429871	PT-317T	TK-00897
WSTP-1412R		TPGN-110308	●	14	25	70	12	1	429871	PT-317T	TK-00897
	WSTP-1412L	TPGN-110308	○	14	25	70	12	1	429871	PT-317T	TK-00897
WSTP-1616R		TPGN-110308	●	16	25	85	16	1	429871	PT-317T	TK-00897
	WSTP-1616L	TPGN-110308	○	16	25	85	16	1	429871	PT-317T	TK-00897

\*Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.



## TPGN Insert

Inserts	Part Number	WG-300	GSN100	GA5036	G-9120	G-915	Part Number	Dimensions (millimeters)			
	ISO						ANSI	L	D	S	R
	TPGN-110308	●	○	●	●	○	TPGN-222	11,0	6,35	3,18	0,80

**WG-300® (Whiskered Ceramic)** Used for milling high-temp alloys and hardened material above 45 Rc.

**GSN100™ (Silicon Nitride Ceramic)** For high-speed turning, grooving and milling of gray and ductile cast irons.

**GA5036 (MT-CVD coated)** A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

**G-9120 (PVD coated)** Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

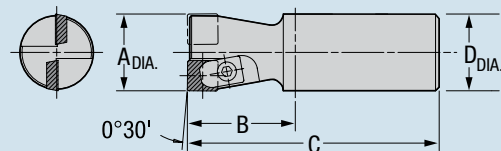
**G-915 (PVD coated)** Excellent for high-temp alloys, stainless steel, and low carbon steels. Should be run at moderate speeds and moderate to high feeds.

Cutter Part Number	Screw Torque Setting	Max RPM Carbide	Max RPM Ceramic
WSTP-1212R/L	2,3 Nm	19,000	35,000
WSTP-1412R/L	2,3 Nm	17,000	35,000
WSTP-1616R/L	2,3 Nm	15,000	35,000

For available edge preps, please reference page ATI19 or contact Greenleaf Technical Service.

Inserts and Steel Products Only	Inserts Only	Steel Products
10 Business Days or Less <input type="checkbox"/>	Stocked or Available Upon Request <input type="checkbox"/>	Stocked Standard <input type="checkbox"/>

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# WSSP *Excelerator*® Mill

## End Mill: Square Positive Inserts

Right-Hand End Mill Shown

Part Number		Gage	Stock	Dimensions (millimeters)				No. Of Inserts	Standard Components		* Tune-Up Kit
Right Hand	Left Hand	Insert		A	B	C	D		Clamp	Clamp Screw	Includes All Standard Components
WSSP-1010R		SPGN-060208	●	10	12	52	10	1	429871	PT-317T	TK-00897
	WSSP-1010L	SPGN-060208	○	10	12	52	10	1	429871	PT-317T	TK-00897
WSSP-1212R		SPGN-060208	●	12	22	67	12	1	429871	PT-317T	TK-00897
	WSSP-1212L	SPGN-060208	○	12	22	67	12	1	429871	PT-317T	TK-00897
WSSP-1616R		SPGN-060308	●	16	25	73	16	2	430879	SHCS M2.5-0.45x6mm	TK-01335
	WSSP-1616L	SPGN-060308	○	16	25	73	16	2	430879	SHCS M2.5-0.45x6mm	TK-01335
WSSP-2020R		SPGN-060308	●	20	25	75	20	2	430879	SHCS M2.5-0.45x6mm	TK-01335
	WSSP-2020L	SPGN-060308	○	20	25	75	20	2	430879	SHCS M2.5-0.45x6mm	TK-01335
WSSP-2520R		SPGN-090308	●	25	32	82	20	2	429706	MS-1156	TK-01336
	WSSP-2520L	SPGN-090308	○	25	32	82	20	2	429706	MS-1156	TK-01336
WSSP-3225R		SPGN-090308	●	32	45	101	25	3	429706	MS-1156	TK-01337
	WSSP-3225L	SPGN-090308	○	32	45	101	25	3	429706	MS-1156	TK-01337
WSSP-4032R		SPGN-120408	●	40	45	105	32	3	3127-C	SHCS M5-0.8x12mm	TK-01338
	WSSP-4032L	SPGN-120408	○	40	45	105	32	3	3127-C	SHCS M5-0.8x12mm	TK-01338

\*Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

## SPGN Insert

Inserts	Part Number ISO	WG-300	WG-600	XSYTIN-1	G-9230	GA5036	GA5125	G-9120	G-915	Part Number ANSI	Dimensions (millimeters)			
											D	L	S	R
	SPGN-060208	●	○	●	○	●	○	●	○	SPGN-21.52	6,35	6,35	2,38	0,80
	SPGN-060308	●	○	●	○	●	○	●	○	SPGN-222	6,35	6,35	3,18	0,80
	SPGN-090308	●	○	●	○	●	○	●	○	SPGN-322	9,53	9,53	3,18	0,80
	SPGN-120408	●	○	●	○	●	○	●	○	SPGN-432	12,70	12,70	4,76	0,80
	SPGN-120412	●	○	●	○	●	○	●	○	SPGN-433	12,70	12,70	4,76	1,20

**WG-300® and WG-600® (Whiskered Ceramic)** Used for milling high-temp alloys and hardened material above 45 Rc.

**XSYTIN™ -1 (Phase-Toughened)** Ideal for use in interrupted cuts, scale and milling. Capable of extreme feed rates. Excels at machining steels, cast and ductile irons, high-temp alloys and other challenging materials.

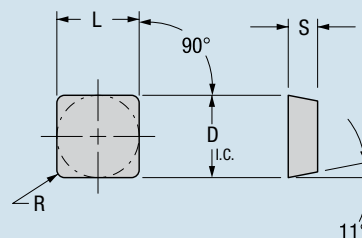
**G-9230 (PVD coated)** Carbide grade for medium to heavy machining of nickel alloys, cobalt alloys, titanium alloys, stainless steels and alloyed irons.

**GA5036 (MT-CVD coated)** A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

**GA5125 (MT-CVD coated)** A high-performance carbide milling grade especially suited for manganese steel. Also applicable on chrome-moly steel, tool steel and similar high alloy steels.

**G-9120 (PVD coated)** Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

**G-915 (PVD coated)** Excellent for high-temp alloys, stainless steel, and low carbon steels. Should be run at moderate speeds and moderate to high feeds.



Cutter Part Number	Screw Torque Setting	Max RPM Carbide	Max RPM Ceramic
WSSP-1010R/L	2,3 Nm	25,000	40,000
WSSP-1212R/L	2,3 Nm	19,000	40,000
WSSP-1616R/L	1,7 Nm	15,000	40,000
WSSP-2020R/L	1,7 Nm	12,500	35,000
WSSP-2520R/L	3,4 Nm	9,500	26,000
WSSP-3225R/L	3,4 Nm	7,500	21,000
WSSP-4032R/L	13,6 Nm	6,200	16,500

For available edge preps, please reference page AT119 or contact Greenleaf Technical Service.

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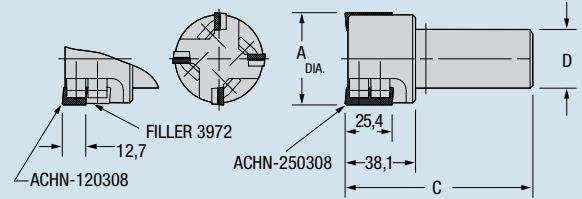
### Inserts and Steel Products

Inserts Only	Steel Products Only
● Stocked Standard	● Stocked or Available Upon Request
○	○ 10 Business Days or Less

# WSAN

## End Mill: Parallelogram Inserts


Right-Hand  
End Mill Shown



Part Number		Gage Insert		Dimensions (millimeters)			No. Of Inserts	Standard Components				* Tune-Up Kit	Optional Components	
Right Hand	Left Hand	Max 25mm DOC	Stock	A	C	D		Anvil	Anvil Screw	Clamp	Clamp Screw	Includes All Standard Components	Max 12,7 DOC Insert	Filler
WSAN-2520R		ACHN-250308	●	25	95	20	2	—	—	410756		TK-01351	ACHN-120308	3972
	WSAN-2520L	ACHN-250308-LH	○	25	95	20	2	—	—	410756		TK-01351	ACHN-120308-LH	3972
WSAN-2525R		ACHN-250308	○	25	101	25	2	—	—	410756		TK-01351	ACHN-120308	3972
	WSAN-2525L	ACHN-250308-LH	○	25	101	25	2	—	—	410756		TK-01351	ACHN-120308-LH	3972
WSAN-3225R		ACHN-250308	●	32	101	25	2	—	—	410756		TK-01351	ACHN-120308	3972
	WSAN-3225L	ACHN-250308-LH	○	32	101	25	2	—	—	410756		TK-01351	ACHN-120308-LH	3972
WSAN-4032R		ACHN-250308	●	40	105	32	3	AAP-3224	FHCS M3-0.5x6mm	410756		TK-01617	ACHN-120308	3972
	WSAN-4032L	ACHN-250308-LH	○	40	105	32	3	AAP-3224-LH	FHCS M3-0.5x6mm	410756		TK-02229	ACHN-120308-LH	3972
WSAN-5040R		ACHN-250308	●	50	115	40	4	AAP-3224	FHCS M3-0.5x6mm	410756		TK-01616	ACHN-120308	3972
	WSAN-5040L	ACHN-250308-LH	○	50	115	40	4	AAP-3224-LH	FHCS M3-0.5x6mm	410756		TK-02230	ACHN-120308-LH	3972
WSAN-6340R		ACHN-250308	●	63	115	40	4	AAP-3224	FHCS M3-0.5x6mm	410756		TK-01616	ACHN-120308	3972
	WSAN-6340L	ACHN-250308-LH	○	63	115	40	4	AAP-3224-LH	FHCS M3-0.5x6mm	410756		TK-02230	ACHN-120308-LH	3972

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

## ACHN Insert

Inserts	Part Number	WG-300	XSYTIN-1	GSN100	G-9230	GA5036	G-9120	Part Number	Dimensions (millimeters)			
	ISO							ANSI	S	W	L	R
	ACHN-250308	●	●	●	●	○	○	ACHN-3422	3,18	9,50	25,40	0,80
	ACHN-120308	●	○	●	○	○	○	ACHN-3222	3,18	9,50	12,70	0,80
	ACHN-250308LH	○	○	○	○	○	○	ACHN-3422LH	3,18	9,50	25,40	0,80
	ACHN-120308LH	○	○	○	○	○	○	ACHN-3222LH	3,18	9,50	12,70	0,80

**WG-300® (Whiskered Ceramic)** Used for milling high-temp alloys and hardened material above 45 Rc.

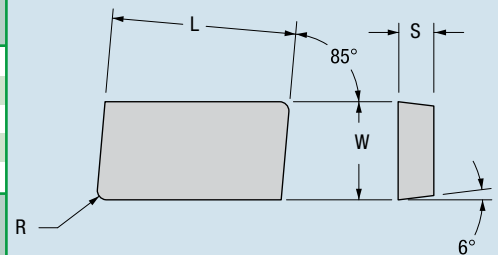
**XSYTIN™ -1 (Phase-Toughened)** Ideal for use in interrupted cuts, scale and milling. Capable of extreme feed rates. Excels at machining steels, cast and ductile irons, high-temp alloys and other challenging materials.

**GSN100™ (Silicon Nitride Ceramic)** For high-speed turning, grooving and milling of gray and ductile cast irons.

**G-9230 (PVD coated)** Carbide grade for medium to heavy machining of nickel alloys, cobalt alloys, titanium alloys, stainless steels and alloyed irons.

**GA5036 (MT-CVD coated)** A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

**G-9120 (PVD coated)** Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.



For available edge preps, please reference page ATI19 or contact Greenleaf Technical Service.

Inserts and Steel Products Only		Inserts Only	Steel Products
10 Business Days or Less	<input type="checkbox"/>	Stocked or Available Upon Request	<input type="checkbox"/>
	<input type="checkbox"/>		<input type="checkbox"/>

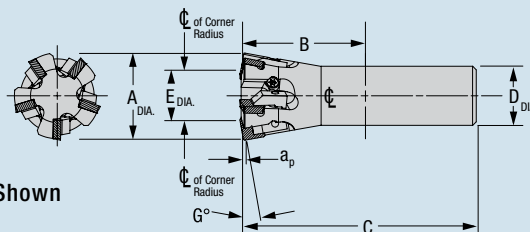
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# Excelerator® XF

## Positive High-Feed Mills

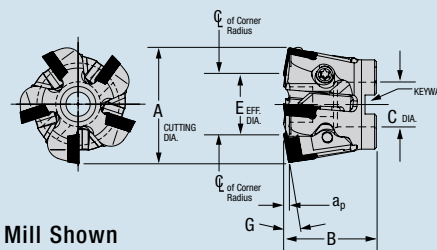
Right-Hand End Mill Shown



### 25mm and 40mm High-Feed End Mill: Square Positive Inserts

Cutter Order Number	Insert	Stock	Dimensions (millimeters)							No. of Inserts	Standard Components		* Tune-Up Kit Includes All Standard Components	Screw Torque Setting	Max RPM Ceramic	Max RPM Carbide
			A	B	C	D	E	ap	G		Clamp	Clamp Screw				
XFSP-2520-EM	SPGN-060308	●	25	32	82	20	14,0	0,79	10°	4	431402	PT-542-T	TK-01868	1,7 Nm	26,000	9,500
XFSP-4032-EM	SPGN-090308	●	40	45	105	32	22,8	1,32	10°	5	313256	SE02-01	TK-01905	4,0 Nm	16,500	6,200

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter. Add L to part number for left-hand cutter.



### 55mm High-Feed Face Mill: Square Positive Inserts

Right-Hand Face Mill Shown

Cutter Order Number	Insert	Stock	Dimensions (millimeters)							No. of Inserts	Standard Components			* Tune-Up Kit Includes All Standard Components	Screw Torque Setting	Max RPM Ceramic	Max RPM Carbide
			A	B	C	E	ap	G	Keyway		Clamp	Clamp Screw	Mount Screw				
XFSP-055-FM	SPGN-120408	●	55	40	22	31,52	1,93	10°	10,4	5	431628	SE03-72	SHCS M10-1.5	TK-02228	7,9 Nm	13,300	4,600

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter. Add L to part number for left-hand cutter.

## SPGN Insert

Inserts	Part Number ISO	Dimensions (millimeters)								Part Number ANSI	Dimensions (millimeters)			
		WG-300	WG-600	XSYTIN-1	GSN100	G-9230	GA5036	GA5125	G-9120	G-915	D	L	S	R
	SPGN-060308	●	●	○	○	●	○	●	●	SPGN-222	6,35	6,35	3,18	0,80
	SPGN-090308	●	●	●	○	●	○	●	●	SPGN-322	9,53	9,53	3,18	0,80
	SPGN-120408	●	●	○	○	●	○	●	●	SPGN-432	12,70	12,70	4,76	0,80

**WG-300® and WG-600® (Whiskered Ceramic)** Used for milling high-temp alloys and hardened material above 45 Rc.

**XSYTIN™ -1 (Phase-Toughened)** Ideal for use in interrupted cuts, scale and milling. Capable of extreme feed rates. Excels at machining steels, cast and ductile irons, high-temp alloys and other challenging materials.

**GSN100™ (Silicon Nitride Ceramic)** For high-speed turning, grooving and milling of gray and ductile cast irons.

**G-9230 (PVD coated)** Carbide grade for medium to heavy machining of nickel alloys, cobalt alloys, titanium alloys, stainless steels and alloyed irons.

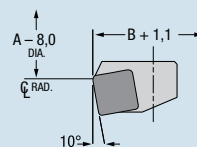
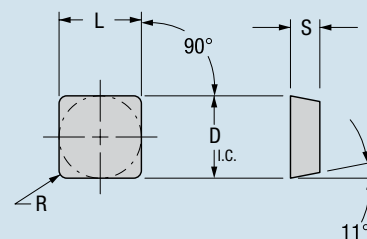
**GA5036 (MT-CVD coated)** A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

**GA5125 (MT-CVD coated)** A high-performance carbide milling grade especially suited for manganese steel. Also applicable on chrome-moly steel, tool steel and similar high alloy steels.

**G-9120 (PVD coated)** Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

**G-915 (PVD coated)** Excellent for high-temp alloys, stainless steel, and low carbon steels. Should be run at moderate speeds and moderate to high feeds.

For available edge preps, please reference page ATI19 or contact Greenleaf Technical Service.



## XFNPS Nest

Nest Part Number		Gage Insert
Right Hand	Left Hand	
XFNPS8043R	—	SPGN-120412
—	XFNPS8043L	SPGN-120412

Nest used with CP4 Series mills shown on M14.

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## Inserts and Steel Products

Inserts Only	Steel Products Only
● Stocked Standard	● Stocked or Available Upon Request
○ 10 Business Days or Less	○ 10 Business Days or Less

# Performance Calculations

## Starting Speeds and Feeds for Excelsator® XF (M32)

Work Material	Insert Grades	Vc (m/min)	25mm Diameter			40mm Diameter			55mm Diameter			CP4 80-315mm h <sub>m</sub>
			RPM	v <sub>f</sub>	f <sub>z</sub>	RPM	v <sub>f</sub>	f <sub>z</sub>	RPM	v <sub>f</sub>	f <sub>z</sub>	
Hardened Steel (60-65rc)	WG-600	213	2713	2604	0,24	1696	1950	0,23	1233	1541	0,25	0,050
Hardened Steel (50-59rc)	WG-600	244	3108	4103	0,33	1942	3592	0,37	1412	2612	0,37	0,076
Hardened Steel (40-49rc)	WG-600	427	5439	6744	0,31	3400	6460	0,38	2472	4697	0,38	0,076
Steel (30-39rc)	WG-600	427	5439	7079	0,33	3400	6800	0,40	2472	5438	0,44	0,076
Steel	GA5036	183	2331	3916	0,42	1457	3351	0,46	1060	2332	0,44	0,127
	WG-600	244	3108	5221	0,42	1943	4372	0,45	1413	3250	0,46	0,127
High-Strength Alloys	G-915	30	387	584	0,38	243	610	0,50	177	505	0,57	0,10
Cast Iron	GSN100	763	11850	16865	0,36	8140	16535	0,41	6200	14173	0,46	0,13
	GA5023	365	5688	9245	0,41	3907	8940	0,46	2977	7010	0,47	0,13
Maximum Stepmover (mm)			14,2			21,8			28,7			
a <sub>p</sub> Max (mm)			0,8			1,4			1,9			1,9
a <sub>e</sub> Max (mm)			25mm			40mm			55mm			

AVERAGE CHIP THICKNESS

## D.O.C. vs Effective Diameter for Excelsator® XF (M32)

Metric		25	40	55	80	100	125	160	200	250	315
a <sub>p</sub> (mm)	0,25	14,3	23,0	31,8	72,2	92,2	117,2	152,2	192,2	242,2	307,2
	0,5	17,2	25,9	34,7	75,1	95,1	120,1	155,1	195,1	245,1	310,1
	0,75	20,5	28,8	37,5	78,0	98,0	123,0	158,0	198,0	248,0	313,0
	1,0		31,7	40,4	80,9	100,9	125,9	160,9	200,9	250,9	315,9
	1,27		34,6	43,3	83,8	103,8	128,8	163,8	203,8	253,8	318,8
	1,5		37,5	46,2	86,6	106,6	131,6	166,6	206,6	256,6	321,6
	1,77			49,1	89,5	109,5	134,5	169,5	209,5	259,5	324,5
	2,0			51,9	92,4	112,4	139,9	174,9	214,9	264,9	329,9

## Hard-Milling Speeds and Feeds for Excelsator® End Mills (M27-M31)

Insert	Recommended Axial Depth (ap=mm)	45-55 R/c		55-60 R/c		60-62 R/c	
		210-365 m/min Starting Speed (v)	0,08-0,15 mm Starting Feed (fz = mm)	150-275 m/min Starting Speed (v)	0,06-0,1 mm Starting Feed (fz = mm)	120-210 m/min Starting Speed (v)	0,05-0,9 mm Starting Feed (fz = mm)
ACHN 250308	0,9	260	0,09	210	0,064	170	0,064
RPGN 060200	0,8	260	0,10	210	0,076	170	0,064
RPGN 070300	1,0	260	0,10	210	0,076	170	0,064
RPGN 090300	1,1	260	0,11	210	0,076	170	0,064
RPGN 120400	1,2	260	0,11	210	0,089	170	0,076
RNGN 090300	1,1	260	0,13	210	0,076	170	0,064
RNGN 120400	1,2	260	0,13	210	0,089	170	0,076
SPGN 060208	0,8	260	0,08	210	0,064	170	0,056
SPGN 060308	0,9	260	0,09	210	0,064	170	0,064
SPGN 090308	0,9	260	0,09	210	0,064	170	0,064
SPGN 120408	1,0	260	0,09	210	0,076	170	0,064
TPGN 110308	0,8	260	0,08	210	0,064	170	0,056

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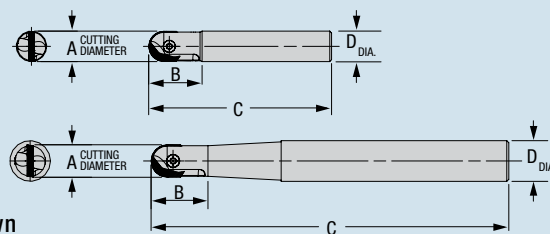
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# Excelsior® Ball Nose

## End Mills

U. S. Patent No. 8,177,459 B2

Right-Hand End Mill Shown




Part Number		Gage		Dimensions (inches)				Standard Component	* Tune-Up Kit Includes All Standard Components	Screw Torque Setting	Max RPM Ceramic	Max RPM Carbide
Short Series	Extended Series	Insert	Stock	A	B	C	D	Insert Screw				
SSBN-M010	—	GBN-M010	●	10	17	100	16	SM30-082	TK-02291	2,0 Nm	40,000	40,000
—	SSBN-M010E	GBN-M010	●	10	17	180	16	SM30-082	TK-02291	2,0 Nm	40,000	40,000
SSBN-M012	—	GBN-M012	●	12	19	110	16	SM40-106	TK-02292	2,9 Nm	40,000	40,000
—	SSBN-M012E	GBN-M012	●	12	19	200	16	SM40-106	TK-02292	2,9 Nm	40,000	40,000
SSBN-M016	—	GBN-M016	●	16	25.4	130	20	SM50-138	TK-02293	4,4 Nm	40,000	40,000
—	SSBN-M016E	GBN-M016	●	16	25.4	220	20	SM50-138	TK-02293	4,4 Nm	40,000	40,000
SSBN-M020	—	GBN-M020	●	20	32	140	25	SM60-165	TK-02294	5,8 Nm	40,000	40,000
—	SSBN-M020E	GBN-M020	●	20	32	250	25	SM60-165	TK-02294	5,8 Nm	40,000	40,000
SSBN-M025	—	GBN-M025	●	25	36	150	32	SM70-210	TK-02295	9,2 Nm	40,000	40,000
—	SSBN-M025E	GBN-M025	●	25	36	250	32	SM70-210	TK-02295	9,2 Nm	40,000	40,000

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.  
Add L to part number for left-hand cutter.

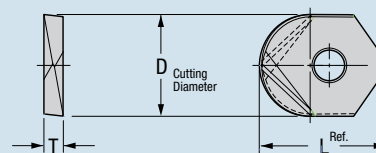
## GBN Inserts

U. S. Patent No. 8,177,459 B2

Inserts	Part Number	WG-600	G-925	Part Number	Dimensions (inches)		
	ISO			ANSI	L	T	D
	GBN-M010	●	●	GBN-0375	12,7	3,18	10
	GBN-M012	●	●	GBN-0500	17,0	4,78	12
	GBN-M016	●	●	GBN-0625	20,3	4,78	16
	GBN-M020	●	●	GBN-0750	22,9	4,78	20
	GBN-M025	●	●	GBN-1000	31,2	4,78	25

**WG-600® (Whiskered Ceramic)** Used for milling high-temp alloys and hardened material above 45 Rc.

**G-925 (Multi-layer CVD coated)** Specifically designed for machining abrasive and difficult-to-machine materials. Should be used when milling high-temp alloys, titanium and other refractory metals, stainless steel and many cast irons. Excellent resistance to notching and deformation makes it suitable for moderate feeds at moderate to high speeds.



For available edge preps, please reference page ATI19 or contact Greenleaf Technical Service.

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### Inserts and Steel Products

● Stocked Standard

### Inserts Only

○ Stocked or Available Upon Request

### Steel Products Only

○ 10 Business Days or Less

# Performance Calculations

## Starting Speeds and Feeds for Exceleator® Ball Nose (M34)

DIN Designation	Work Material Imperial U.S.	Insert Grades	Cutting Speed Vc m/min	Maximum Feed per Tooth fz Insert Diameter		
				10mm	12-16mm	20-25mm
X40CrMoV5-1	H-13 (40Hrc)	G-925	200-400	0,20	0,25	0,30
X40CrMoV5-1	H-13 (41-55Hrc)	G-925 WG-600	175-300 300-650	0,20	0,25	0,30
X40CrMoV5-1	H-13 (56+Hrc)	G-925 WG-600	150-225 250-450	0,15	0,27	0,27
X100CrMoV5-1	A2 (<40Hrc)	G-925	200-400	0,22	0,25	0,30
X100CrMoV5-1	A2 (41-54Hrc)	G-925 WG-600	200-300 300-650	0,20	0,25	0,30
X100CrMoV5-1	A2 (55+Hrc)	G-925 WG-600	150-275 200-425	0,17	0,22	0,27
40CrMnNiMo8-6-4	P-20 (<40Hrc)	G-925	200-400	0,20	0,30	0,35
40CrMnNiMo8-6-4	P-20 (41-54Hrc)	G-925 WG-600	150-300 300-750	0,20	0,25	0,01
X155CrVMo12-1	D-2 (<40Hrc)	G-925	150-300	0,20	0,25	0,30
X155CrVMo12-1	D-2 (41-54Hrc)	G-925 WG-600	120-250 275-550	0,15	0,20	0,25
X155CrVMo12-1	D-2 (55+Hrc)	G-925 WG-600	110-175 300-500	0,15	0,20	0,25
25CrMo4 - 50CrMo4	4130-4150 (<45Hrc)	G-925	200-425	0,20	0,25	0,30
Ferritic & Martensitic Alloys	400 Series SS (<40Hrc)	G-925	200-400	0,01	0,30	0,35
Ferritic & Martensitic Alloys	400 Series SS (41-55Hrc)	G-925 WG-600	175-300 300-900	0,20	0,25	0,30
Austenitic Alloys	300 Series SS (<41Hrc)	G-925	120-300	0,20	0,30	0,35
ISO-S Material	High-Temp (<42Hrc)	G-925	100-200	0,20	0,25	0,30
ISO-S Material	High-Temp (35-45Hrc)	WG-600	300-1200	0,05 – 0,08 actual chip thickness recommended		
Cast Iron	1691-85 (<40Hrc)	G-925 WG-600	200-450 1000-4000	0,01	0,3	0,35

For roughing operations, maximum recommended Width of Cut (WOC) and Depth of Cut (DOC) are 30 percent of ball diameter.

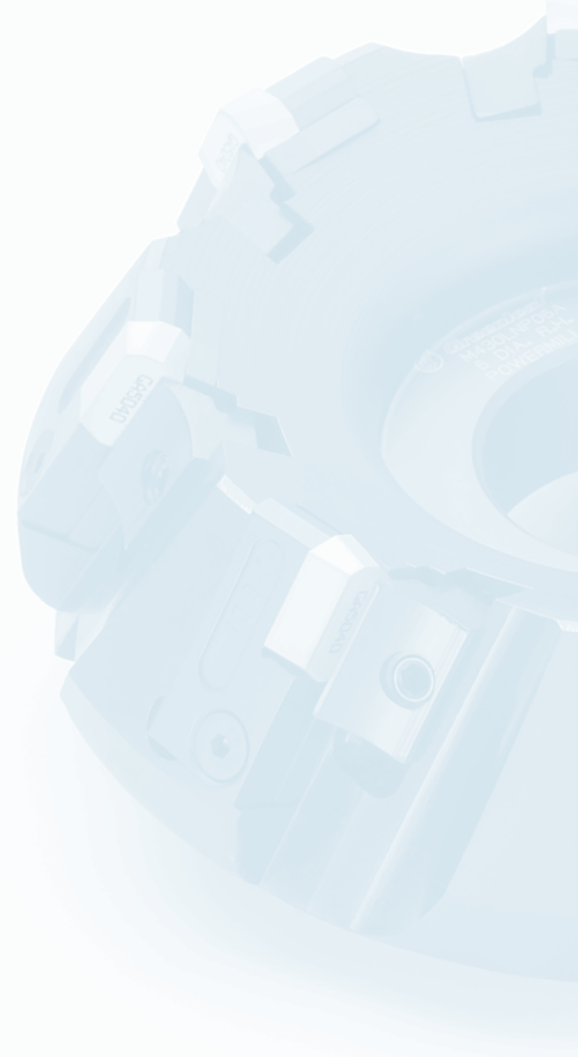
## DOC vs Effective Diameter for Exceleator® Ball Nose (M34)

Insert Diameter	Metric Depth of Cut (DOC)										
	0,13	0,25	0,38	0,64	0,89	1,27	2,54	3,18	3,81	5,08	6,35
10	2,18	3,07	3,73	4,75	5,54	6,48	8,43	8,99	9,32	9,50	
12	2,51	3,56	4,34	5,54	6,45	7,62	10,1	11,0	11,6	12,4	12,7
16	2,85	3,99	4,85	6,22	7,29	8,61	11,63	12,7	13,6	14,8	15,5
20	3,1	4,37	5,33	6,83	8,03	9,50	13,0	14,2	15,2	16,8	18,0
25	3,58	5,05	6,17	7,92	9,35	11,1	15,2	16,8	18,1	20,3	22,0

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## Powermill® Milling Cutters

Ideal for heavy-duty cutting in severe interruptions and uneven surfaces. Replaceable components maximize cutter life while providing deep depths of cut. Also available as end mills, face mills and sinusoidal.



*Greenleaf Corporation is continually upgrading its products.  
For the most current information, please visit our web site at:*

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

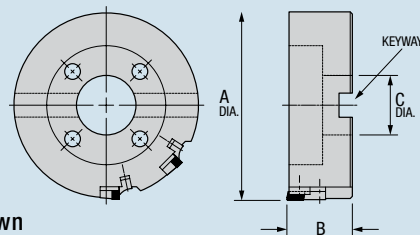
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# Powermill® M400LNP-A

0° Lead, Neg-Pos

Right-Hand Face Mill Shown



Part Number		Gage		Dimensions (millimeters)					No. of Inserts	Standard Components				* Tune-Up Kit Includes All Std. Components	Optional Components	
Right Hand	Left Hand	Insert	Stock	A	B	C	Keyway	Bolt Circle		Wedge	Wedge Screw	† Anvil	Back-Up Plate††		Long Insert	Anvil
M400LNP100AR	—	LNP-335-90R	○	100	63	32	14	—	6	430992	STCM-8	S-90R	—	TK-02206	LNP-34.57-90R	S-91R
—	M400LNP100AL	LNP-335-90L	○	100	63	32	14	—	6	430992	STCM-8	S-90L	—	TK-02205	LNP-34.57-90L	S-91L
M400LNP125AR	—	LNP-335-90R	○	125	63	40	16	—	6	430992	STCM-8	S-90R	303414	TK-02208	LNP-34.57-90R	S-91R
—	M400LNP125AL	LNP-335-90L	○	125	63	40	16	—	6	430992	STCM-8	S-90L	303414	TK-02207	LNP-34.57-90L	S-91L
M400LNP160AR	—	LNP-335-90R	●	160	63	40	16	66,7	8	430992	STCM-8	S-90R	303414	TK-02210	LNP-34.57-90R	S-91R
—	M400LNP160AL	LNP-335-90L	○	160	63	40	16	66,7	8	430992	STCM-8	S-90L	303414	TK-02209	LNP-34.57-90L	S-91L
M400LNP200AR	—	LNP-335-90R	○	200	63	60	25	101,6	10	430992	STCM-8	S-90R	303414	TK-02613	LNP-34.57-90R	S-91R
—	M400LNP200AL	LNP-335-90L	○	200	63	60	25	101,6	10	430992	STCM-8	S-90L	303414	TK-02616	LNP-34.57-90L	S-91L
M400LNP250AR	—	LNP-335-90R	●	250	63	60	25	101,6	12	430992	STCM-8	S-90R	303414	TK-02214	LNP-34.57-90R	S-91R
—	M400LNP250AL	LNP-335-90L	○	250	63	60	25	101,6	12	430992	STCM-8	S-90L	303414	TK-02213	LNP-34.57-90L	S-91L
M400LNP315AR	—	LNP-335-90R	○	315	80	60	25	101,6 177,8	16	430992	STCM-8	S-90R	303414	TK-02061	LNP-34.57-90R	S-91R
—	M400LNP315AL	LNP-335-90L	○	315	80	60	25	101,6 177,8	16	430992	STCM-8	S-90L	303414	TK-02215	LNP-34.57-90L	S-91L

Maximum depth of cut with furnished parts is 17,3mm. When using the optional insert and anvil, the depth of cut is 26,9mm.

† Uses Anvil Screw FHCS M5-0.8x20mm. †† Uses Back-Up Plate Screw FHCS M3-0.5x10mm.

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

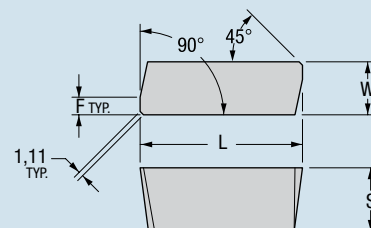
## LNP Insert

Inserts	Part Number	GA5036	GA5125	G-9120	Part Number	Dimensions (millimeters)			
	ANSI				ANSI	S	W	L	F
	LNP-335-90R	●	●	○	LNP-335-90R	7,94	9,53	19,05	3,18
	LNP-335-90L	●	●	○	LNP-335-90L	7,94	9,53	19,05	3,18
	LNP-34.57-90R	●	○	○	LNP-34.57-90R	11,10	9,53	28,58	3,18
	LNP-34.57-90L	●	○	○	LNP-34.57-90L	11,10	9,53	28,58	3,18

**GA5036 (MT-CVD coated)** A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

**GA5125 (MT-CVD coated)** A high-performance milling grade especially suited for manganese steel. Also applicable on chrome-moly steel, tool steel and similar high alloy steels.

**G-9120 (PVD coated)** Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.



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### Inserts and Steel Products

●	Stocked Standard
○	

### Inserts Only

○	Stocked or Available Upon Request
○	

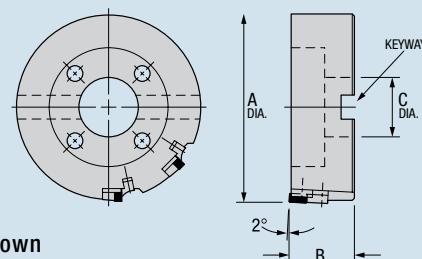
### Steel Products Only

○	10 Business Days or Less
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# Powermill® M402LN-A

2° Lead, Neg-Neg

Right-Hand Face Mill Shown



Part Number		Gage	Stock	Dimensions (millimeters)					No. of Inserts	Standard Components				* Tune-Up Kit Includes All Standard Components	Optional Components	
Right Hand	Left Hand	** Insert		A	B	C	Keyway	Bolt Circle		Wedge	Wedge Screw	† Anvil	Back-Up Plate††		Long Insert	††† Anvil
M402LN100AR		General Purpose LNE-335	○	100	63	32	14	—	6	430992	STCM-8	S-21M	—	TK-02216	General Purpose LNE-34.57	S-2M
	M402LN100AL		○	100	63	32	14	—	6	430992	STCM-8	S-21M	—	TK-02216		S-2M
M402LN125AR			○	125	63	40	16	—	6	430992	STCM-8	S-21M	303414	TK-02217		S-2M
	M402LN125AL		○	125	63	40	16	—	6	430992	STCM-8	S-21M	303414	TK-02217		S-2M
M402LN160AR		Finisher LNE-335F	●	160	63	40	16	66.7	8	430992	STCM-8	S-21M	303414	TK-02062	Finisher LNE-34.57F	S-2M
	M402LN160AL		○	160	63	40	16	66.7	8	430992	STCM-8	S-21M	303414	TK-02062		S-2M
M402LN200AR		Powersine® LNES-335	○	200	63	60	25	101,6	10	430992	STCM-8	S-21M	303414	TK-02218	Powersine® LNES-34.57	S-2M
	M402LN200AL		○	200	63	60	25	101,6	10	430992	STCM-8	S-21M	303414	TK-02218		S-2M
M402LN250AR		Powersine® LNES-335	●	250	63	60	25	101,6	12	430992	STCM-8	S-21M	303414	TK-02219	Powersine® LNES-34.57	S-2M
	M402LN250AL		○	250	63	60	25	101,6	12	430992	STCM-8	S-21M	303414	TK-02219		S-2M
M402LN315AR		Powersine® LNES-335	○	315	80	60	25	101,6 177,8	16	430992	STCM-8	S-21M	303414	TK-02063	Powersine® LNES-34.57	S-2M
	M402LN315AL		○	315	80	60	25	101,6 177,8	16	430992	STCM-8	S-21M	303414	TK-02063		S-2M

Maximum depth of cut with furnished parts is 17,3mm. When using the optional insert and anvil, the depth of cut is 26,9mm.

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.



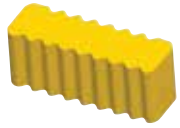
\*\* Specify: General Purpose – LNE, Powersine® – LNES, or Finisher – LNEF.

† Uses Anvil Screw FHCS M5-0.8x20mm.

†† Uses Back-Up Plate Screw FHCS M3-0.5x10mm.

††† Used with insert LNE-34.57.

## LNE, LNES Insert

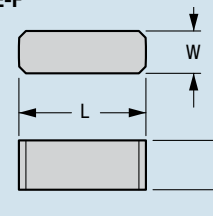
Inserts	Part Number	GA5036 GA5125 G-9120	Part Number	Dimensions (millimeters)		
	ANSI		ANSI	S	W	L
	LNE-335	● ○ ●	LNE-335	7,94	9,53	19,05
	LNE-34.57	● ● ●	LNE-34.57	11,10	9,53	28,58
	LNE-335F	● ○ ○	LNE-335F	7,94	9,53	19,05
	LNE-34.57F	● ○ ○	LNE-34.57F	11,10	9,53	28,58
	LNES-335	● ● ○	LNES-335	7,94	9,53	19,05
	LNES-34.57	● ○ ○	LNES-34.57	11,10	9,53	28,58

**GA5036 (MT-CVD coated)** A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

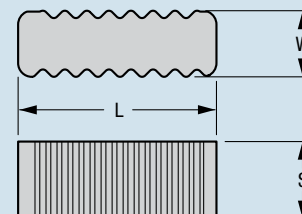
**GA5125 (MT-CVD coated)** A high-performance milling grade especially suited for manganese steel. Also applicable on chrome-moly steel, tool steel and similar high alloy steels.

**G-9120 (PVD coated)** Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

LNE/LNE-F



LNES



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	<input type="checkbox"/>		Stocked Standard

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## Finishing Inserts (LNE-F)

Finishing inserts incorporating a 2° approach angle ground on the surface-generating edge of the insert are available to suit certain cutters in this range. When these inserts are an available option, they are listed at the bottom of the page with the standard insert. Finishing inserts should be used in complete sets for optimum results.

This is unlike “wiper” inserts which are designed to be higher on the cutter face and can be used in one or in a limited number of positions.

Finishing inserts will generally insure a better surface finish by their increased progressive wiping action on the surface being generated.

We do not recommend the use of finishing inserts under all conditions. Standard inserts will produce better life between indexes, and in the majority of cases the finish produced will be satisfactory for all but the most demanding situations.

## Sinusoidal Inserts (LNE-S)

Sinusoidal inserts having a “wavy” or sine wave type edge have been designed to suit the Powermill® cutter line. This concept allows the chip to be produced as a series of small segments rather than as a continuous band of chip.

The effect is a lowering of cutting forces which is especially helpful when dealing with long spindle extensions to reduce deflective forces. This style of insert does not increase productivity under normal rigid conditions versus a standard insert.

Unique to the Greenleaf Powermill® sinusoidal insert design is the fact that all four edge variations are built into a single insert. There is, therefore, only one insert and not a set of inserts as is common with other manufacturers. The inserts are simply placed into the body with the clearly visible indicator dots in sequence:

•, ••, •••, ••••.

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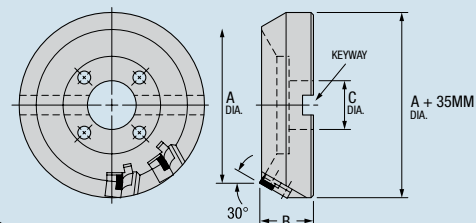
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Inserts and Steel Products	Inserts Only	Steel Products Only
Stocked Standard	Stocked or Available Upon Request	10 Business Days or Less

# Powermill® M430LNP-A

30° Lead, Neg-Pos

Right-Hand Face Mill Shown



Part Number		Gage	No. of Inserts	Wiper	Dimensions (millimeters)					Standard Components				* Tune-Up Kit Includes All Std. Components	Optional Components	
Right Hand	Left Hand	Insert		** Insert	Stock	A	B	C	Keyway	Bolt Circle	Wedge	Wedge Screw	† Anvil	Back-Up Plate††	Long Insert	††† Anvil
M430LNP100AR		LNP-335R	6	LNP-335RW	○	100	63	32	14	—	430992	STCM-8	S-21M	303414	TK-02217	S-2M
	M430LNP100AL	LNP-335L	6	LNP-335LW	○	100	63	32	14	—	430992	STCM-8	S-21M	303414	TK-02217	S-2M
M430LNP125AR		LNP-335R	6	LNP-335RW	○	125	63	40	16	—	430992	STCM-8	S-21M	303414	TK-02217	General Purpose
	M430LNP125AL	LNP-335L	6	LNP-335LW	○	125	63	40	16	—	430992	STCM-8	S-21M	303414	TK-02217	S-2M
M430LNP160AR		LNP-335R	8	LNP-335RW	●	160	63	40	16	66,7	430992	STCM-8	S-21M	303414	TK-02062	LNP-34.57
	M430LNP160AL	LNP-335L	8	LNP-335LW	○	160	63	40	16	66,7	430992	STCM-8	S-21M	303414	TK-02062	R or L
M430LNP200AR		LNP-335R	10	LNP-335RW	○	200	63	60	25	101,6	430992	STCM-8	S-21M	303414	TK-02218	S-2M
	M430LNP200AL	LNP-335L	10	LNP-335LW	○	200	63	60	25	101,6	430992	STCM-8	S-21M	303414	TK-02218	Wiper
M430LNP250AR		LNP-335R	12	LNP-335RW	●	250	63	60	25	101,6	430992	STCM-8	S-21M	303414	TK-02219	LNP-34.57F
	M430LNP250AL	LNP-335L	12	LNP-335LW	○	250	63	60	25	101,6	430992	STCM-8	S-21M	303414	TK-02219	RW or LW
M430LNP315AR		LNP-335R	16	LNP-335RW	○	315	80	60	25	101,6 177,8	430992	STCM-8	S-21M	303414	TK-02063	S-2M
	M430LNP315AL	LNP-335L	16	LNP-335LW	○	315	80	60	25	101,6 177,8	430992	STCM-8	S-21M	303414	TK-02063	S-2M

Maximum depth of cut with standard parts is 12,7 mm. When using the optional insert and anvil, the depth of cut is 22,3 mm.

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter. \*\* See below for explanation of wiper insert.

† Uses Anvil Screw FHCS M5-0.8x20mm. †† Uses Back-Up Plate Screw FHCS M3-0.5x10mm. ††† Used with insert LNP34.57R/L.

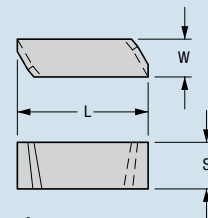
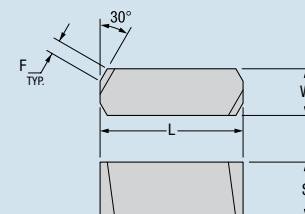
## LNP Insert

Inserts	Part Number	GA5036	GA5125	G-9120	Part Number	Dimensions (millimeters)			
	ANSI				ANSI	S	W	L	F
	LNP-335R	●	○	●	LNP-335R	7,94	9,53	19,05	2,54
	LNP-335L	●	○	●	LNP-335L	7,94	9,53	19,05	2,54
	LNP-335RW	●	○	●	LNP-335RW	7,94	9,02	21,54	N/A
	LNP-335LW	●	○	●	LNP-335LW	7,94	9,02	21,54	N/A
	LNP-34.57R	●	○	●	LNP-34.57R	11,10	9,53	28,58	2,54
	LNP-34.57L	●	○	●	LNP-34.57L	11,10	9,53	28,58	2,54
	LNP-34.57RW	●	○	○	LNP-34.57RW	11,10	9,02	31,19	N/A
	LNP-34.57LW	●	○	○	LNP-34.57LW	11,10	9,02	31,19	N/A

**GA5036 (MT-CVD coated)** A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

**GA5125 (MT-CVD coated)** A high-performance carbide milling grade especially suited for manganese steel. Also applicable on chrome-moly steel, tool steel and similar high alloy steels.

**G-9120 (PVD coated)** Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.



Wiper Insert

## Wiper Inserts (LNP-RW/LW)

A wiper insert is designed to be higher above the face of the cutter compared to standard inserts and has a broader wiping flat or radius to effectively wipe out any tool marks produced by the tolerance differences in the standard inserts.

Wiper inserts can be used effectively in a single pocket in smaller diameter cutters and in multiples of two or three in larger cutters to produce a superior finish.

The grades selected for wiper inserts will generally be harder (higher 'C' classification) to combat the trend toward more rapid wear caused by the increased surface contact. Wiper inserts should only be used when the required RMS value is very low.

Always bear in mind that the majority of finish problems in milling come from lack of rigidity of the set-up, deflection of the part piece or machine spindle, excessive overhangs, and poor cleanliness and assembly practices in the cutter body. Wiper inserts cannot be expected to resolve these problems.

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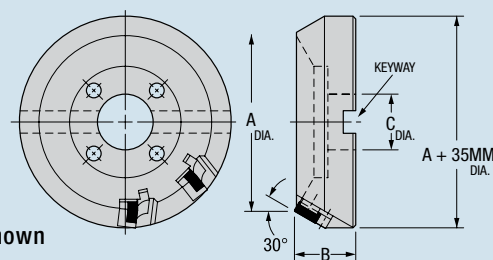
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	<input type="radio"/>	Stocked Standard	<input type="radio"/>

# Powermill® C430LNP-H

## 30° Lead, Neg-Pos, Heavy Duty

Right-Hand Face Mill Shown




Part Number				Dimensions (millimeters)							 Standard Components   				* Tune-Up Kit
Right Hand	Left Hand	Insert	Stock	A	B	C	Keyway	Bolt Circle	No. of Inserts	Wedge	Wedge Screw	† Anvil	Back-Up Plate ††	Includes All Standard Components	
C430LNP200HR	—	LNP-44.57R	○	200	63	60	25	101,6	8	430992	STCM-8	S-24M	303414	TK-02220	
—	C430LNP200HL	LNP-44.57L	○	200	63	60	25	101,6	8	430992	STCM-8	S-24M	303414	TK-02220	
C430LNP250HR	—	LNP-44.57R	○	250	63	60	25	101,6	10	430992	STCM-8	S-24M	303414	TK-02221	
—	C430LNP250HL	LNP-44.57L	○	250	63	60	25	101,6	10	430992	STCM-8	S-24M	303414	TK-02221	
C430LNP315HR	—	LNP-44.57R	○	315	80	60	25	101,6 177,8	12	430992	STCM-8	S-24M	303414	TK-02222	
—	C430LNP315HL	LNP-44.57L	○	315	80	60	25	101,6 177,8	12	430992	STCM-8	S-24M	303414	TK-02222	

Maximum depth is 22,4mm.

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.

† Uses Anvil Screw FHCS M5-0.8x25mm. †† Uses Back-Up Plate Screw FHCS M3-0.5x10mm.

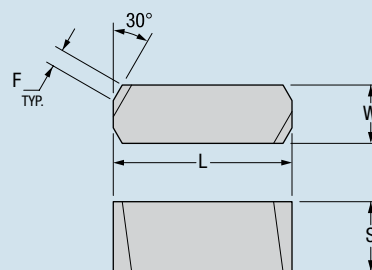
## LNP Insert

Inserts	Part Number	GA5036	GA5125	G-9120	Part Number	Dimensions (millimeters)			
	ANSI				ANSI	S	W	L	F
	LNP-44.57R	●	○	●	LNP-44.57R	11,10	12,70	28,58	2,54
	LNP-44.57L	●	○	●	LNP-44.57L	11,10	12,70	28,58	2,54

**GA5036 (MT-CVD coated)** A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

**GA5125 (MT-CVD coated)** A high-performance carbide milling grade especially suited for manganese steel. Also applicable on chrome-moly steel, tool steel and similar high alloy steels.

**G-9120 (PVD coated)** Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.



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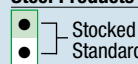
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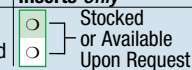
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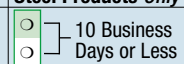
### Inserts and Steel Products



### Inserts Only



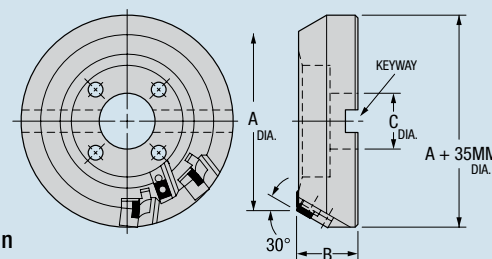
### Steel Products Only



# Powermill® C430LNP-W

## 30° Lead, Neg-Pos, Finishing

Right-Hand Face Mill Shown





Part Number		Gage	No. of Inserts	** Wiper	No. of Inserts	Stock	Dimensions (millimeters)					Standard Components					*Tune-Up Kit Includes All Std. Components	Optional Components
Right Hand	Left Hand	Insert		Insert			A	B	C	Keyway	Bolt Circle	Wedge	Screw	Anvil	Back-Up Plate	Wiper Insert Screw		
C430LNP200WR		LNP-335R	8	YCE-434-01	2	○	200	63	60	25	101,6	430992	STCM-8	S-21M	303414	SE03-70	TK-02223	S-2M
	C430LNP200WL	LNP-335L	8	YCE-434-01	2	○	200	63	60	25	101,6	430992	STCM-8	S-21M	303414	SE03-70	TK-02223	S-2M
C430LNP250WR		LNP-335R	10	YCE-434-01	2	○	250	63	60	25	101,6	430992	STCM-8	S-21M	303414	SE03-70	TK-02224	S-2M
	C430LNP250WL	LNP-335L	10	YCE-434-01	2	○	250	63	60	25	101,6	430992	STCM-8	S-21M	303414	SE03-70	TK-02224	S-2M
C430LNP315WR		LNP-335R	12	YCE-434-01	4	○	315	80	60	25	101,6 177,8	430992	STCM-8	S-21M	303414	SE03-70	TK-02225	S-2M
	C430LNP315WL	LNP-335L	12	YCE-434-01	4	○	315	80	60	25	101,6 177,8	430992	STCM-8	S-21M	303414	SE03-70	TK-02225	S-2M

The effective finish diameter is 25,4 mm less than the "A" diameter.  
Maximum depth is 22,4 mm.

\* Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter. \*\* See below for explanation of wiper insert.

† Uses Anvil Screw FHCS M5-0.8x20mm. †† Uses Back-Up Plate Screw FHCS M3-0.5x10mm. ††† Used with insert LNP34.57R/L.

## LNP, YCE Insert

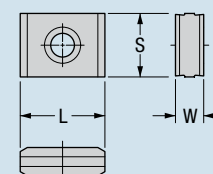
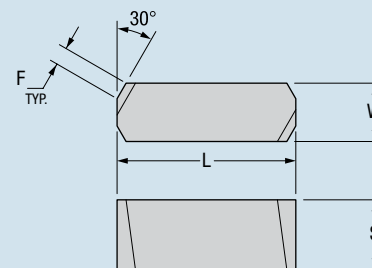
Inserts	Order Number	GA5036	GA5125	G-9120	G-60	Order Number	Dimensions (millimeters)			
	ANSI					ANSI	S	W	L	F
	LNP-335R	●	●	●		LNP-335R	7,94	9,53	19,05	2,54
	LNP-335L	●	○	●		LNP-335L	7,94	9,53	19,05	2,54
	LNP-34.57R	●	●	●		LNP-34.57R	11,10	9,53	28,58	2,54
	LNP-34.57L	●	●	●		LNP-34.57L	11,10	9,53	28,58	2,54
	YCE-434-01				●	YCE-434-01	14,28	6,35	19,05	N/A

**GA5036 (MT-CVD coated)** A high-performance grade for milling steels at high speed. Should be used when milling forged and cast steels and selected ductile irons. A unique combination of toughness and heat resistance makes it suitable for heavy- and light-duty milling at high speeds.

**GA5125 (MT-CVD coated)** A high-performance carbide milling grade especially suited for manganese steel. Also applicable on chrome-moly steel, tool steel and similar high alloy steels.

**G-9120 (PVD coated)** Carbide grade engineered for milling steel castings and steel forgings. Should be run at moderate to heavy feed rates and depths of cut.

**G-60 (uncoated)** Finishing of steel and steel castings under favorable conditions in the wiper configuration.



Wiper Insert

## Wiper Inserts (YCE)

A wiper insert is designed to be higher above the face of the cutter compared to standard inserts and has a broader wiping flat or radius to effectively wipe out any tool marks produced by the tolerance differences in the standard inserts.

The grades selected for wiper inserts will generally be harder (higher 'C' classification) to combat the trend toward more rapid wear caused by the increased surface contact.

Wiper inserts should only be used when the required RMS value is very low.

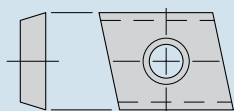
Always bear in mind that the majority of finish problems in milling come from lack of rigidity of the set-up, deflection of the part piece or machine spindle, excessive overhangs, and poor cleanliness and assembly practices in the cutter body. Wiper inserts cannot be expected to resolve these problems.

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	<input type="radio"/>		Stocked Standard

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## Additional Greenleaf Milling Inserts



CDE 313L32  
(418470)

CDE 313L51  
(419469)

CDE 313R41  
(419155)

CDE 313L41  
(419156)

CDE 313R01  
(418991)

CDE 313R51  
(419648)

CDE 313R52  
(424817)

CDE 313L52  
(424818)

CDE 322L02  
(308859)

CDE 313R30  
(418647)

CDE 314L39  
(429251)

CDE 322R02  
(306908)

CDE 322R04  
(428334)

CDE 322L03  
(427241)

CDE 322R03  
(427240)

CDE 322L05  
(306968)

CDE 322R05  
(306871)

CDE 323L05  
(312338)

CDE 323R04  
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CDE 323R23  
(419375)

CDE 323L23  
(427812)



CDE 323R05  
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CDE 323L30  
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CDE 323R31  
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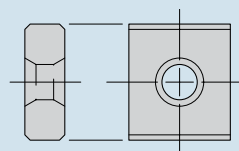
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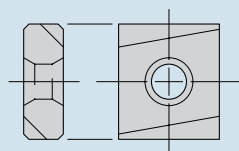
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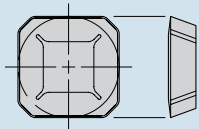
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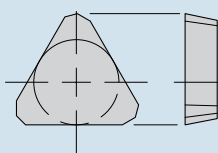
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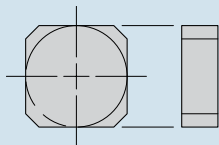
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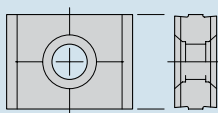
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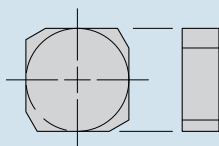
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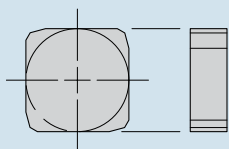
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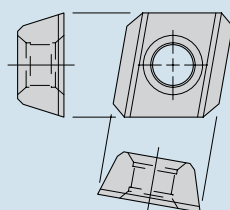
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SNCN63D8



SNCN43E4  
SNCN63E8



SPE 33R01  
(418993)  
SPE 55L04  
(421410)

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## CARBIDE

*Greenleaf offers a comprehensive line of carbide inserts in grades ranging from sub-micron C-1 through C-8 classifications. An industry pioneer in coated carbide, Greenleaf offers a variety of uncoated, MT-CVD coated and PVD-coated grades. Carbide inserts are available in ANSI standard geometries with multi-purpose chip-breakers for heavy roughing through finishing.*

### COATED

**GA5036** A high-performance MT-CVD coated grade for milling steels at high speed. GA5036 should be used when milling forged and cast steels and selected ductile irons. GA5036 has a unique combination of toughness and heat resistance making it suitable for heavy- and light-duty milling at high cutting speeds.

**GA5125** New high-performance MT-CVD coated carbide milling grade especially suited for manganese steel. GA5125 is also applicable on chrome-moly steel, tool steel and similar high alloy steels. GA5125 provides excellent resistance to abrasion, crater wear, thermal shock, deformation and edge build-up. GA5125 should be applied at high speeds with moderate feed rates.

**G-910** PVD-coated grade for milling high-temp alloys, stainless steel, and low carbon steels. G-910 is a medium-speed grade and should be applied at moderate to high feed rates.

**G-9120** PVD-coated grade for milling and turning steel castings and steel forgings. G-9120 is engineered to maximize productivity at moderate to heavy feed rates and depths of cut.

**G-915** Multi-layer PVD-coated grade, excellent for milling and turning high-temp alloys, stainless steel, and low-carbon steels. The multi-layer PVD coating adds heat and abrasion resistance to the tough, shock-resistant substrate. G-915 should be run at moderate speeds and moderate to high feeds in milling and interrupted turning applications.

**G-9230** PVD-coated grade developed for medium to heavy machining of nickel alloys, cobalt alloys, titanium alloys, stainless steels and alloyed irons. G-9230 has superior wear resistance and toughness and is excellent for cast and forged scale machining conditions.

**G-935** Multi-layer PVD-coated grade for steel milling and turning applications requiring additional resistance to mechanical and thermal shock. The multi-layered PVD coating increases the speed capability and wear resistance in tough milling and interrupted turning applications.

### UNCOATED

**G-53** Excellent general-purpose milling grade for steel and steel alloys at moderate speeds and feeds. Good combination of toughness and wear resistance for milling, or as an all-around grade for mixed production applications. G-53 is not recommended for continuous turning.

**G-60** Heavy, rough turning of steel, steel castings, and steel forgings. Apply G-60 at moderate speeds and heavy feed rates and depths of cut. More wear resistant than G-50, but lower in toughness.

## CERAMIC

*Greenleaf is the industry leader in the development and manufacture of ceramic and coated ceramic inserts in ANSI standard and special geometries. Some of the most prominent include:*

### WG-300®

Whisker-reinforced ceramic with excellent wear and shock resistance at high surface speeds. WG-300 is very effective at machining nickel- and cobalt-based super alloys, and other hard materials at metal removal rates up to 10 times higher than carbide.

### WG-600®

Coated whisker-reinforced ceramic offering longer tool life and better performance over uncoated ceramics due to outstanding thermal properties and shock-resistance at high cutting speeds. Application areas include rough and finish turning, as well as high-performance milling of high-strength alloys, hardened steels and select stainless steels. *U.S. Patent No. 6,447,896 B1.*

**XSYPIN™-1** New phase-toughened ceramic capable of extreme feed rates. XSYPIN™-1 excels at machining a wide variety of materials including steels, cast and ductile irons, high-temperature alloys and other challenging metals. XSYPIN™-1 is ideal for use in interrupted cuts, scale, abrasive casting materials and milling.

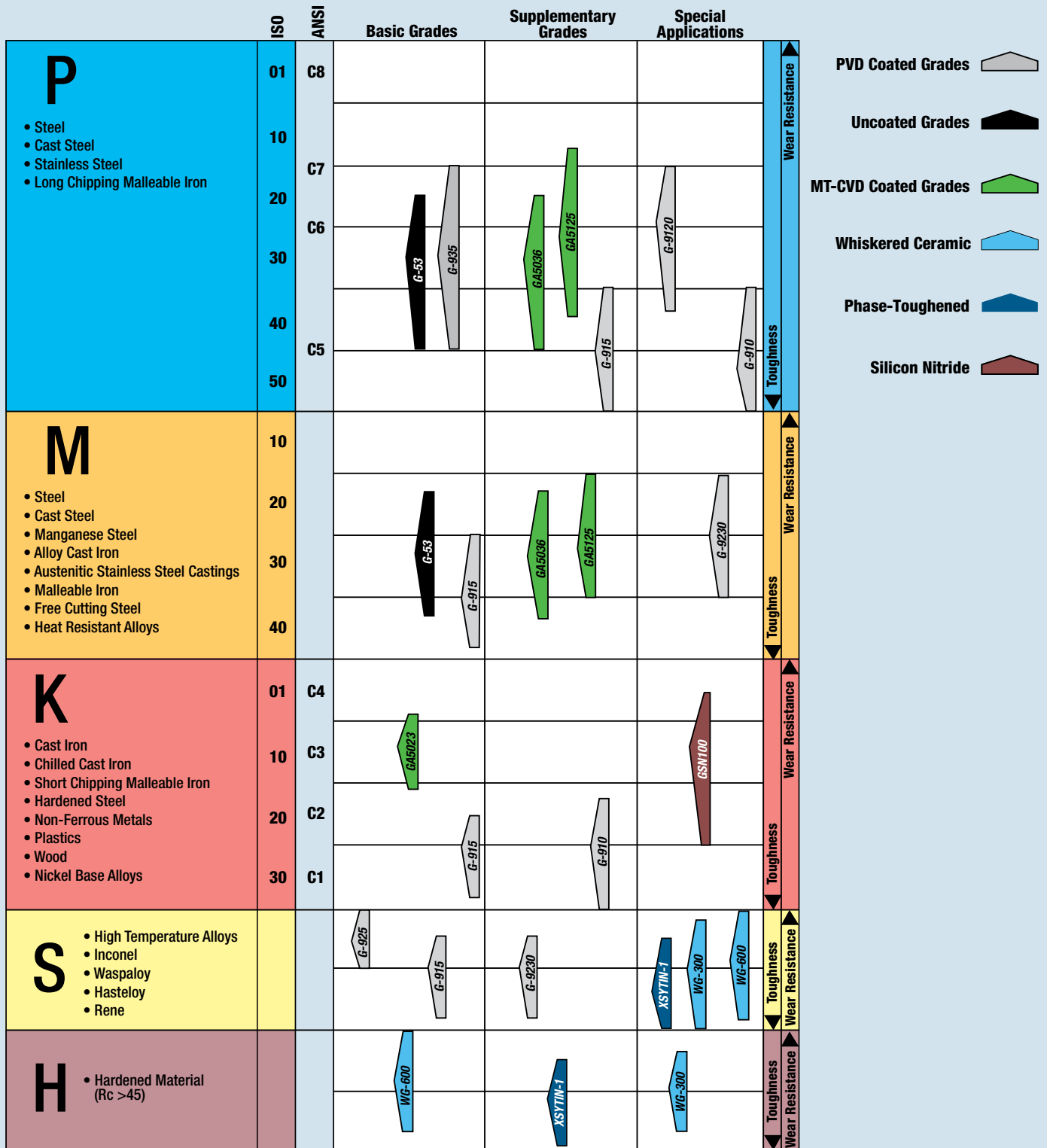
### GSN100™

New engineered blend of silicon nitride and proprietary toughening agents that redefines productivity in the machining of cast iron. GSN100 delivers outstanding tool life at high cutting speeds in turning, grooving and milling applications.

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# Insert Grade Reference for Milling



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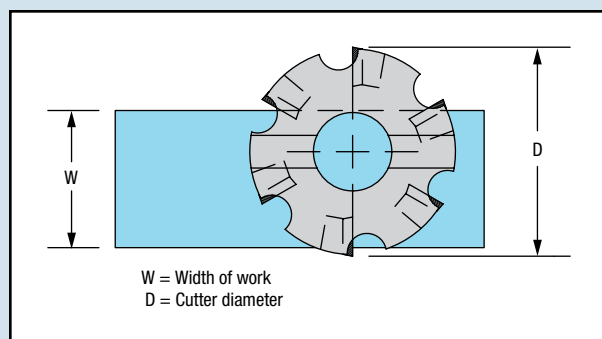
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## Selection of Correct Cutter Diameter

Select a cutter diameter greater than the workpiece width by a ratio of approximately 1.5 to 1. This will ensure that each insert enters the cut without the frictional, no-chip phase which occurs when attempting to cut the full cutter diameter. Also, the insert leaves the part without reducing the chip down to zero. These benefits can greatly extend the insert life.

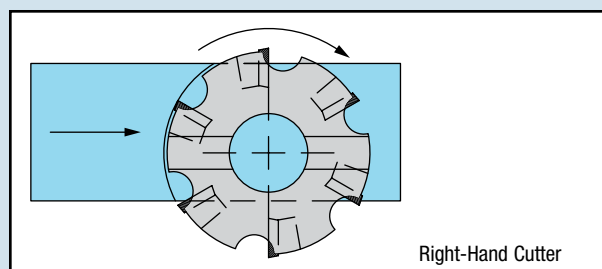
With smaller, low-power machines it will be better to select a smaller cutter and take two passes rather than a large diameter cutter forced to operate at low tooth loads (feed rates) to avoid stalling of the spindle.



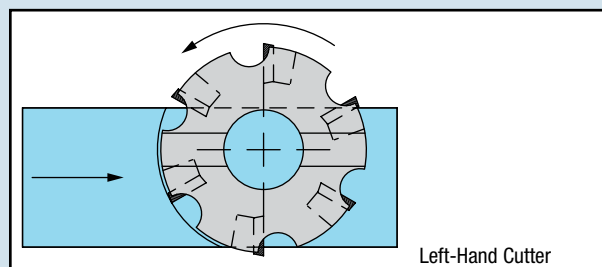
Choose a cutter diameter approximately 1.5 times the workpiece width.

## Hand of Cutters

A *right-hand cutter* is one which, when viewed from above, rotates clockwise relative to the workpiece.



A *left-hand cutter* is one which, when viewed from above, rotates counterclockwise relative to the workpiece.



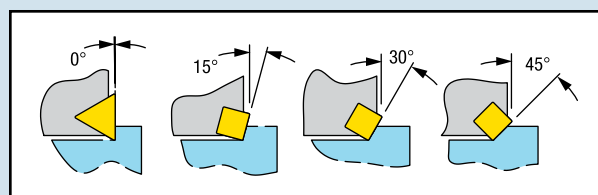
## Lead Angle

The lead angle of a milling cutter is not intended for producing a specific angle on the work. In fact, because of compound angles, a given lead angle will not produce that angle exactly.

The purpose of lead angle is to thin the chip while absorbing a given depth of cut over a greater portion of the insert edge. This results in improved tool life and, for a given horsepower, a greater depth potential.

For example, 30° lead angle is a good choice for face milling in general purpose applications.

The exception to the previous statement is the 0° lead cutter, sometimes called a 90° cutter, which is designed for milling to square shoulders and producing a 90° corner.

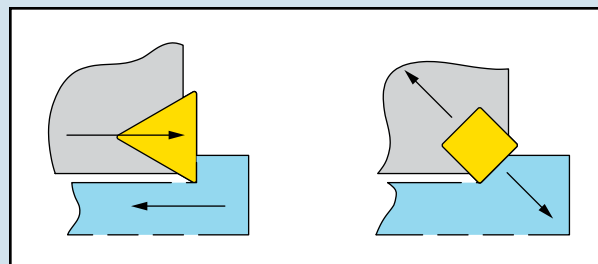


## Lead Angles and Cutting Forces

The lead angle of a milling cutter has a direct effect upon the cutting forces being presented to the workpiece, cutting tool, and machine.

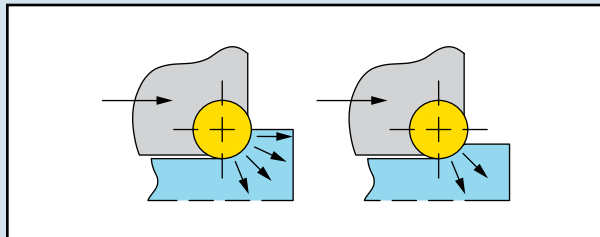
The resultant force is always directly perpendicular to the cutting edge. A lead angle may, therefore, be a major consideration in how we want to direct the forces.

For example, in a thin section workpiece, a high lead angle may cause deflection since there is more tendency to “push” the part away from the cutter. On the other hand, a 0° lead cutter has more deflective force on the machine spindle.

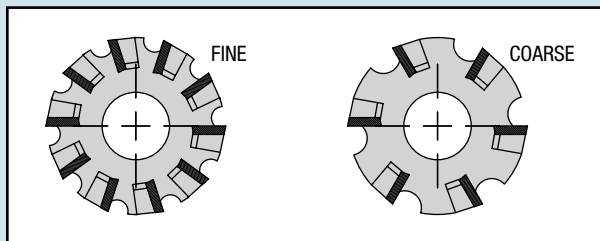


## The Round Insert Cutter

The exception to the rule in lead angle cutting forces is the round insert. With a round insert, the lead angle is entirely dependent upon the depth of cut. As the depth increases, the lead angle decreases. If cutting half the diameter deep, there is effectively 0° lead angle.



In the milling of work hardening materials such as Inconel, and using a round insert cutter, there will be a direct relationship between depth of cut and speed of development of notch wear. The shallower the cut, the slower the notch wear.



## Pitch

The pitch of a milling cutter refers to the numbers of inserts placed into a given diameter.

Cutters for cast iron are often closer pitch to allow the maximum number of teeth to be engaged at one time for smoother cutting, and because cast iron does not need large gullet for the discontinuous chips produced.

For general use, choose a fairly coarse pitch.

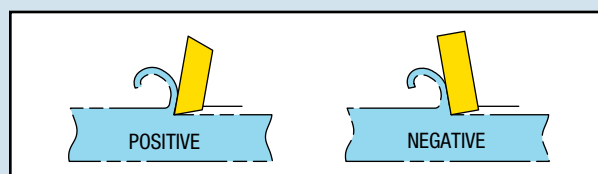
## Negative Versus Positive Geometry

In an indexable cutter, the negative insert is the only one which permits the insert to be turned over and used on both sides. It is the most economical style. Also, it is the strongest insert because all edges are 90° to the faces.

On the minus side, the negative rake tool produces higher cutting forces when compared to the positive rake.

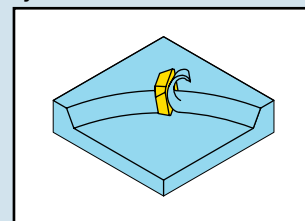
In general, use negative rakes for cast iron, interrupted cuts, and on rigid high-power machining for steels.

Use positive rakes for aluminum, titanium, copper, most stainless steels, thin or easily deflected parts, steels, and nickel alloys.



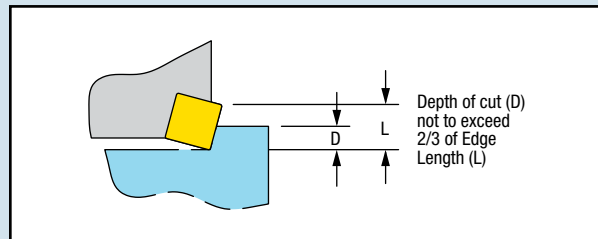
There are many milling cutters with a combination of positive and negative rakes often called shear-angle design. These cutters offer some of both worlds, although inserts are essentially like positive inserts and cannot be turned over. Shear angle cutters do provide continuous chip ejection since the axial rake behaves much like a helix in a flute and takes the chip up and away from the finished surface.

These cutters work well in heavy duty operations with wide widths of cut—especially if combined with a 30° lead angle.



## Depth of Cut

It is a good general rule not to allow depth of cut to exceed 2/3 of the cutting edge length. Remember that in lead angle cutters the cutting edge length in use is not the same as the depth of cut.

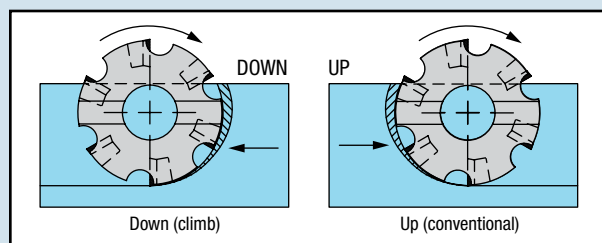


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## Up Milling and Down Milling

This refers to direction of rotation relative to the feed.

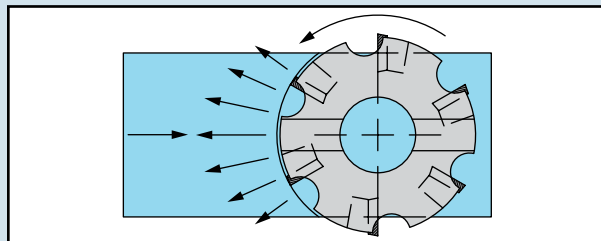


With a modern machine in good condition, down milling will give the best results. This is because the thickest section of the chip is against the insert to avoid welding, and pressure is progressively relieved towards the finished surface.

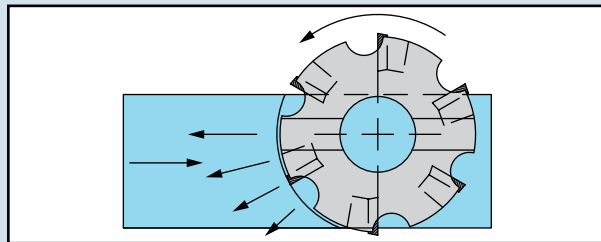
In up milling, friction and pressure build up before the chip starts to form, causing premature edge wear. It should be in rare cases that up milling is needed. This could be, for example, on an older machine with backlash in the table feed.

## Cutter Positioning

Central positioning of the cutter can give rise to vibration if any spindle play is present. This is because of an alternating radial force pushing against the spindle.



Placing the cutter off center will always be a better situation to avoid chatter and vibration and also to improve tool life.

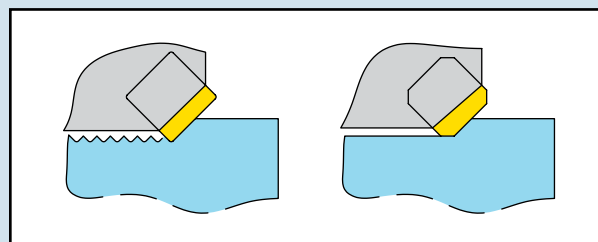


When moving off center, the path of cut is longer since each insert now sweeps a longer arc with each revolution. This may have a measureable impact on tool life, and cutting temperature will tend to increase.

Seek a happy medium by moving off center in small increments until vibration is controlled.

## Surface Finish

In a milling cutter the finish is produced by the highest insert. Since variations exist in the body and the inserts, it is inevitable that some inserts will be higher than others. If the inserts have small corner radii, for example, the highest insert will cut the track and this will determine the finish.



For this reason, most inserts designed especially for milling, use flats on the insert rather than a radius. In this way, the highest insert produces a wiping effect removing the variances of the other inserts and leaving a much improved finish. "Wiper" inserts installed in a few stations can be used for this purpose as well as "finishing" inserts which are available for certain cutters in the Greenleaf line.

## Speed Calculations

Recommended cutting speeds are usually given in surface meters per minute (m/min). Sometimes it is necessary to convert m/min to the correct RPM (rev/min) for a given cutter diameter. The following formulas can be used to make this conversion:

$$\begin{aligned} V_c &= \text{Cutting speed} && \text{m/min} \\ D &= \text{Cutting diameter} && \text{mm} \\ n &= \text{Spindle speed} && \text{rev/min} \end{aligned}$$

$$\text{Cutting speed} \quad V_c = \frac{\pi * D * n}{1000}$$

$$\text{Spindle speed} \quad n = \frac{V_c * 1000}{\pi * D}$$

Cutting speed recommendations are based upon the material to be machined and the cutting tool material which will be used – such as carbide, coated carbide, ceramic, silicon nitride, etc.

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## Feed Rate Calculation

One problem encountered in milling cutter feed rate considerations is that while most milling cutter manufacturers make recommendations in load per tooth or feed per tooth, the machine is calibrated in *millimeters per minute*. It is, therefore, necessary to do a little simple math to get the answers required.

In turning, these problems do not exist since only one insert is involved, and the machine is calibrated in feed per revolution. Feed per revolution is the same as feed per tooth when there is only one insert, so we simply plug in the recommended feed.

With a milling cutter, the feed per tooth is controlled by three factors. These are:

1. The feed rate or table advance in mm per minute.
2. The spindle speed in revolutions per minute.
3. The number of inserts in the milling cutter.

We must make a calculation in order to find out the really critical information needed, such as the feed per tooth or how much work we are asking each insert to perform. Too little work is more often a problem than too much.

If the feed per tooth is very small, let us say less than 0,08mm, then abrasive wear is accelerated. No real chip is produced to take away the heat.

On the other hand, if high feed rates are used and the cutter has many teeth, then power available may be insufficient. This is an important consideration in selecting a cutter, especially larger diameter cutters with fine pitch. Here are the equations you will need to make your calculations:

<b>D</b> = Cutting diameter	mm
<b>L</b> = Machined length	mm
<b>De</b> = Effective diameter	mm
<b>a<sub>p</sub></b> = Depth of cut	mm
<b>ae</b> = Working engagement	mm
<b>Vc</b> = Cutting speed	m/min
<b>Q</b> = Metal removal rate	cm <sup>3</sup> /min
<b>T</b> = Period of engagement	min
<b>z</b> = Number of teeth	Piece
<b>fz</b> = Feed per tooth	mm
<b>fn</b> = Feed per revolution	mm/rev
<b>Vf</b> = Table feed	mm/min
<b>hex</b> = Maximum chip thickness	mm
<b>hm</b> = Average chip thickness	mm
<b>Kc</b> = Specific cutting force	N/mm <sup>2</sup>
<b>n</b> = Spindle speed	rev/min
<b>Pc</b> = Cutting power net	Kw
<b>η</b> = Efficiency	
<b>Kr</b> = Major cutting edge angle	Degrees

$$\text{Table feed: } Vf = fz * n * z$$

$$\text{Feed per revolution: } Fn = \frac{Vf}{n}$$

$$\text{Removal rate: } Q = \frac{a_p * ae * Vf}{1000}$$

$$\text{Average chip thickness: } hm = \frac{\sqrt{ae}}{D}$$

$$\text{Machining time: } T = \frac{L}{Vf}$$

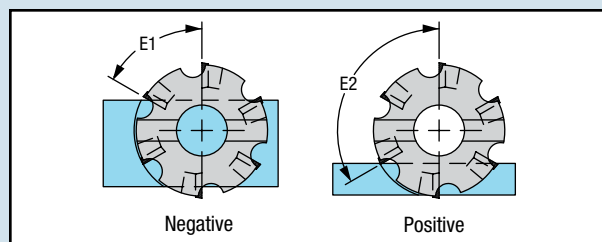
$$\text{Net power: } Pc = \frac{a_p * ae * Vf * Kc}{60000000 * \eta}$$

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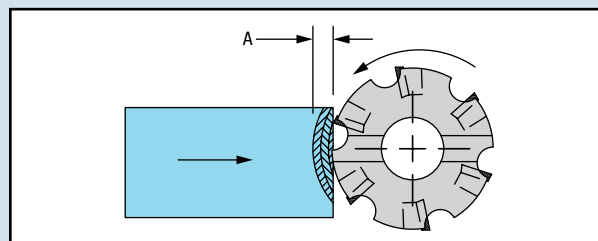
## Angle of Entry

In face milling operations, the angle of entry can have a significant impact upon insert performance. A positive angle of entry can cause breakage or chipping, especially when using positive inserts. Positive angle of entry will occur when the path of cut is narrow relative to cutter diameter.

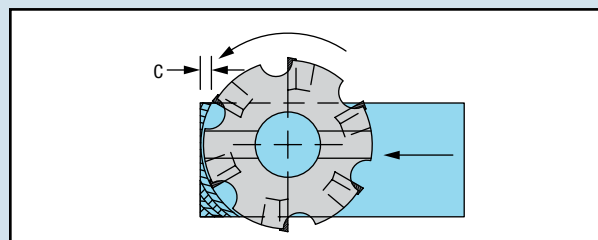


1. When the angle of entry (E1) is less than  $90^\circ$ , the initial impact occurs at a position behind the point of the tool. The insert has a greater section and is stronger here and better able to withstand the impacts.
2. When the angle of entry (E2) is greater than  $90^\circ$ , the initial impact between the insert and the part piece occurs at the point of the tool, which, especially in a positive rake milling cutter, is the weakest section of the insert. This can lead to insert failure.

## Entering and Exiting the Cut



The angle of entry is always adverse as the cut commences. In the illustration, we can see that as the cutter travels through zone A, the angle of entry is changing. It starts out positive as the inserts first start to cut. As the cut progresses, it becomes less and less positive and eventually negative.



With a CNC machine, it is a worthwhile exercise to slow down the feed rate in zone A, especially with positive rake tools and hard to cut materials. As the cutter starts to break through at the end of the cut, another problem area is created in zone C. At this point, the cutter breaks through in the center, leaving two islands of material. Changes of entry angle occur which can result in insert problems. As in entry into the part, a reduction of feed rate can help alleviate chipping or breakage problems if they arise.

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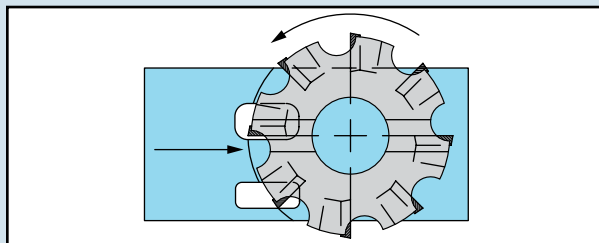
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## Interruptions

Milling is by definition an interrupted operation. In addition, as the cutter crosses voids in the part, changes of entry angle occur. This situation is usually too complex to define in absolute terms relative to a targeted solution. Recognizing this in interrupted parts, try to include some of the following features in the set-up to reduce impact:

1. Negative or negative/positive geometry
2. Use a lead-angle cutter (30° or 45°) if possible
3. Use an impact-resistant carbide grade
4. Use a cutter with medium or fine pitch
5. Keep the load per tooth on the low end



## A Milling Cutter is a Series of Single-Point Tools

It is easy to lose sight of the fact that a milling cutter is nothing more than a series of single-point tools clamped into a rotating holder. If you always keep this in mind, you will be constantly reminded that what is most important to know is what is happening to each tool or insert.

The feed rate in millimeters per minute of machine table travel does not tell you anything important unless or until you calculate the feed per tooth. You cannot calculate the feed per tooth until you know the speed in revolutions per minute and how many teeth are in the cutter. Therefore, it should become second nature to ask, know, and consider the three "golden" variables:

1. How many inserts?
2. How many RPM?
3. What feed in millimeters per minute?

Use this formula to find feed per tooth:

$$\text{Feed per tooth: } fz = \frac{Vf}{n * z}$$

**fz** = Feed per tooth      mm

**Vf** = Table feed      mm/min

**n** = Spindle speed      rev/min

**z** = Number of teeth      Piece

Once you know the feed per tooth, as a very broad general guide, try to keep the feed above 0,08mm per tooth and remember that power limitations usually come into play long before most cutters reach the upper limit. Efficient metal removal will usually dictate working in the 0,1mm to 0,25mm per tooth range.

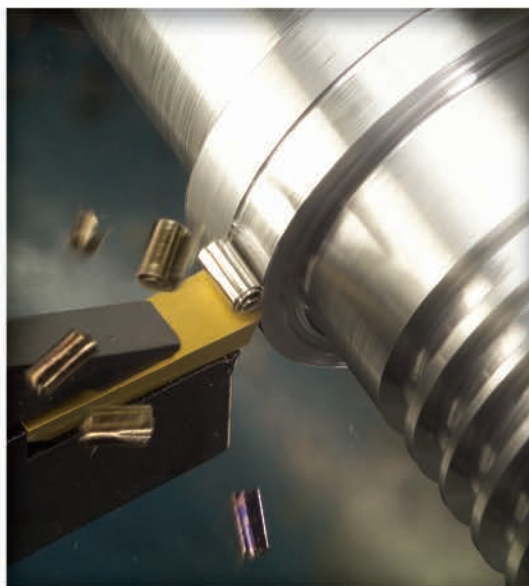
Some heavy-duty cutters can be used as high as 0,75mm or more per tooth, but this will need a machine in the 40+ Kw class – and a larger cutter could well use over 75Kw.

## Greenleaf Excelerator® Mills Setup and Operational Procedures

1. Thoroughly clean all insert pockets.
2. Install the inserts, making sure that they are properly seated in the pocket, and torque the insert clamp screws to the correct torque as indicated on the body of the Excelerator Milling Cutter.
3. Use Greenleaf Excelerator Mills only on machines that have adequate shield guards.
4. Run the Greenleaf Excelerator Mills using cutting parameters as recommended by the Greenleaf Tech Team. Contact Greenleaf at:  
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+86-731-84658507 CN
5. For safety purposes, do not exceed the maximum RPM's etched on the Excelerator Mill. Note: There are two max RPM numbers. One (the lower RPM number) is for using the mill with carbide inserts and the other is for usage with ceramic inserts.

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