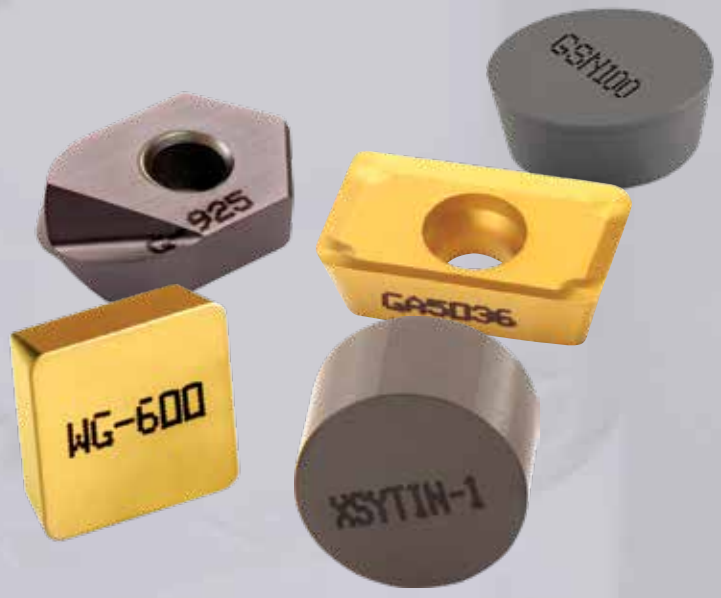
Milling



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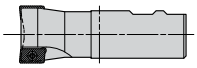
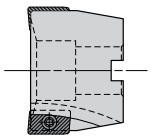
F - 75543 Paris Cedex 11
www.sifom.fr
Tél. : +33 (0)1 48 05 87 46
Fax : +33 (0)1 48 06 07 90
email : sifom@sifom.fr

Pictorial Index

Hushcut® Series II Milling System

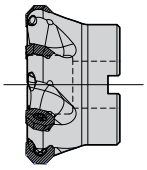


EM90
0° Lead End Mill
12mm – 50mm Diameter
page: M 06



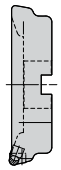
FM90
0° Lead Face Mill
40mm – 160mm Diameter
page: M 06

Index-O-Cut™ Milling System

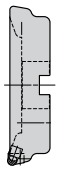


G-MOFHP
High Positive Face Mill
Octagon Inserts
50mm – 200mm Diameter
page: M 10

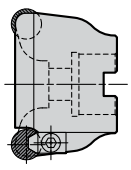
Excelerator Milling Cutters and Inserts



CP4 Series
Face Mill
Positive Rake Inserts
Cutters and Nests
80mm-315mm Diameter
page: M 14

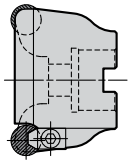


C4 Series
Face Mill
Negative Rake Inserts
Cutters and Nests
80mm-315mm Diameter
page: M 16

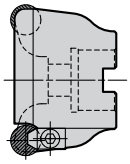


FMRP
Face Mill
Round Positive Inserts
50mm – 100mm Diameter
page: M 18

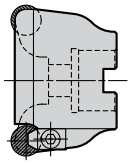
Excelerator Milling Cutters and Inserts *continued*



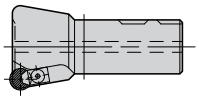
FMRPF
Face Mill (Fine Pitch)
Coolant Fed
Round Positive Inserts
38mm-100mm Diameter
page: M 18



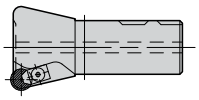
FMRN
Face Mill
Round Negative Inserts
50mm – 100mm Diameter
page: M 19



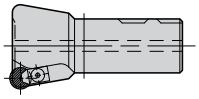
FMRNF
Face Mill (Fine Pitch)
Coolant Fed
Round Negative Inserts
38mm-100mm Diameter
page: M 19



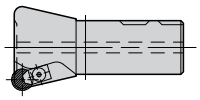
WSRP
End Mill
Round Positive Inserts
16mm – 63mm Diameter
page: M 20



WSRPF
End Mill (Fine Pitch)
Round Positive Inserts
Coolant Fed
20mm-63mm Diameter
page: M 20

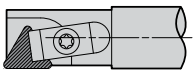


WSRN
End Mill
Round Negative Inserts
25mm – 63mm Diameter
page: M 22

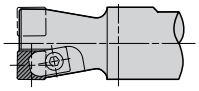


WSRNF
End Mill (Fine Pitch)
Coolant Fed
Round Negative Inserts
25mm – 63mm Diameter
page: M 22

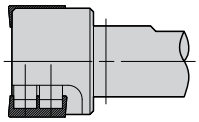
Excelerator Milling Cutters and Inserts *continued*



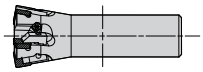
WSTP
End Mill
Positive Triangle Inserts
12mm – 16mm Diameter
page: M 24



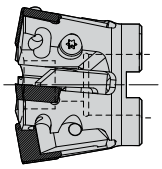
WSSP
End Mill
Positive Square Inserts
10mm – 40mm Diameter
page: M 25



WSAN
End Mill
Parallelogram Inserts
25mm – 63mm Diameter
page: M 26



XFSP
High-Feed Face Mill
Square Positive Inserts
25mm – 40mm Diameter
page: M 27



XFSP
High-Feed Face Mill
Square Positive Inserts
55mm Diameter
page: M 27

SSBN
Ball Nose End Mill
Ball Nose Inserts
10mm – 25mm Diameter
page: M 30

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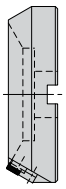
Powermill® Cutters



M430LNP-A
30° Lead Face Mill
Negative Radial,
Positive Axial
100mm – 315mm Dia.
page: M 34

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Hushcut® Series II Milling Cutters

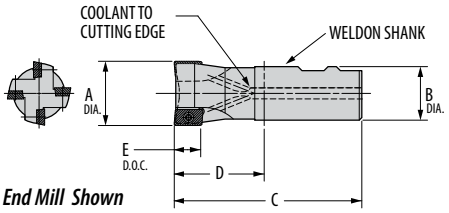
Quiet and free-cutting mills with screw-on insert designs to make the most out of the available power. The free-cutting action results in longer tool life and improved surface finishes. Available in end mills and face mills in a wide range of small to large diameters.

Greenleaf Tune-Up Kits

A Tune-Up Kit consists of all the standard hardware to refurbish a particular toolholder, boring bar, or milling cutter. A toolholder will have a readily visible, laser-inscribed Tune-Up Kit number on it for ease in ordering. This number will prevent any confusion created by searching a catalog for hardware, and it will help reduce downtime.

EM90S/L

0° Lead End Mill



Right-Hand End Mill Shown

Part Number	Gage Insert	Dimensions (mm)					No. of Inserts	Standard Components	*Tune-Up Kit
		A	B	C	D	E			
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

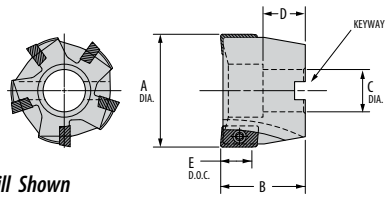
NOTE: For information on screw torque settings, please refer to the chart on page M38.

** 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.*

FM90S/L

0° Lead Face Mill



Right-Hand Face Mill Shown

Part Number	Gage Insert	Dimensions (mm)					No. of Inserts	Keyway	Standard Components	*Tune-Up Kit
		A	B	C	D	E				
FM90S-040R	ADGT-100308DFRLD	40	40	16	18	9	6	8	PT-542T	TK-00862
FM90S-050R	ADGT-100308DFRLD	50	40	22	20	9	7	10	PT-542T	TK-00863
FM90S-063R	ADGT-100308DFRLD	63	40	22	20	9	8	10	PT-542T	TK-00864
FM90S-080R	ADGT-100308DFRLD	80	50	27	22	9	9	12	PT-542T	TK-00913
FM90L-050R	APHT-160408PDR**	50	40	22	20	13	5	10	312679	TK-00783
FM90L-063R	APHT-160408PDR**	63	40	22	20	13	6	10	312679	TK-00784
FM90L-080R	APHT-160408PDR**	80	50	27	22	13	7	12	312679	TK-00785
FM90L-100R	APHT-160408PDR**	100	50	32	25	13	8	14	312679	TK-00786
FM90L-125R	APHT-160408PDR**	125	63	40	28	13	10	16	312679	TK-01249
FM90L-160R	APHT-160408PDR**	160	63	40	28	13	12	16	312679	TK-00787

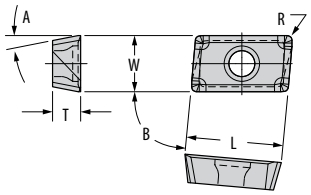
NOTE: For information on screw torque settings, please refer to the chart on page M38.

** 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, and APET



Inserts	Part Number ISO	Steel P			Stainless Steel M		Cast Iron K		Heat-Resistant Super Alloys S		Part Number ANSI	Dimensions (mm)					
		GA5036	G-915	G-9120	G-915	G-9230	G-915	GA5023	G-915	G-9230		L	W	T	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-32.73XD2R	16,76	9,50	4,76	0,80	11°	85°
	APET-160416PDR	◆	▲	●	◆	▲	◆	▲	◆	▲	APET-32.73XD4R	16,59	9,50	4,76	1,60	11°	85°
	APET-160432PDR	◆	▲	●	◆	▲	◆	▲	◆	▲	APET-32.73XD6R	16,59	9,50	4,76	2,38	11°	85°

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated

First Choice ◆ Second Choice ● Alternative ▲

***Grade descriptions** — pages M 36–37*

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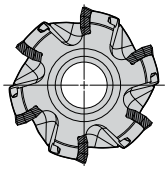
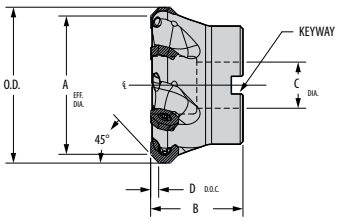
Index-O-Cut™ Milling Cutters

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 power consumption.

Greenleaf Tune-Up Kits

A Tune-Up Kit consists of all the standard hardware to refurbish a particular toolholder, boring bar, or milling cutter. A toolholder will have a readily visible, laser-inscribed Tune-Up Kit number on it for ease in ordering. This number will prevent any confusion created by searching a catalog for hardware, and it will help reduce downtime.





Index-O-Cut™

G-MOFHP Face Mill

Part Number	Gage Insert	Dimensions (mm)					No. of Inserts	Keyway	Standard Components	*Tune-Up Kit
		A	O.D.	B	C	D**				
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-0545E200	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.*

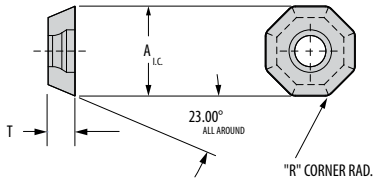
*** Maximum depth of cut is 0.173".*

NOTE: For information on screw torque settings, please refer to the chart on page M38.

NOTE: Index-O-Cut excelerator mills can be ordered in differential pitch for all diameters.

Index-O-Cut™ Inserts

00EW



Inserts	Part Number ISO	Steel			Stainless Steel		Cast Iron		Heat-Resistant Super Alloys		Part Number ANSI	Dimensions (mm)		
		P			M		K		S					
		G-915	G-9120	G-9230	G-915	G-9230	G-915	GA5023	G-915	G-9230		A	T	R
	**00EW-060416**	◆	◆	▲	◆	▲	▲	◆	◆	▲	**00EW-534**	15,88	4,76	1,59

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated

First Choice ◆ Second Choice ● Alternative ▲

Grade descriptions — pages M 36–37

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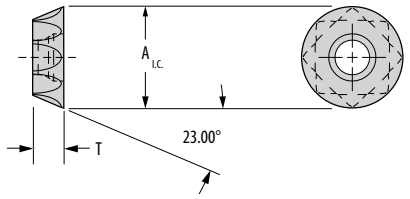
Index-O-Cut™ Inserts

ROEW



Inserts	Part Number ISO	Steel P		Stainless Steel M		Cast Iron K		Heat-Resistant Super Alloys S		Part Number ANSI	Dimensions (mm)	
		G-915	G-9120	G-915	G-9230	G-915	GA5023	G-915	G-9230		A	T
	ROEW-060416	◆	◆	◆	▲	▲	◆	◆	▲	ROEW-534	15,88	4,78

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated

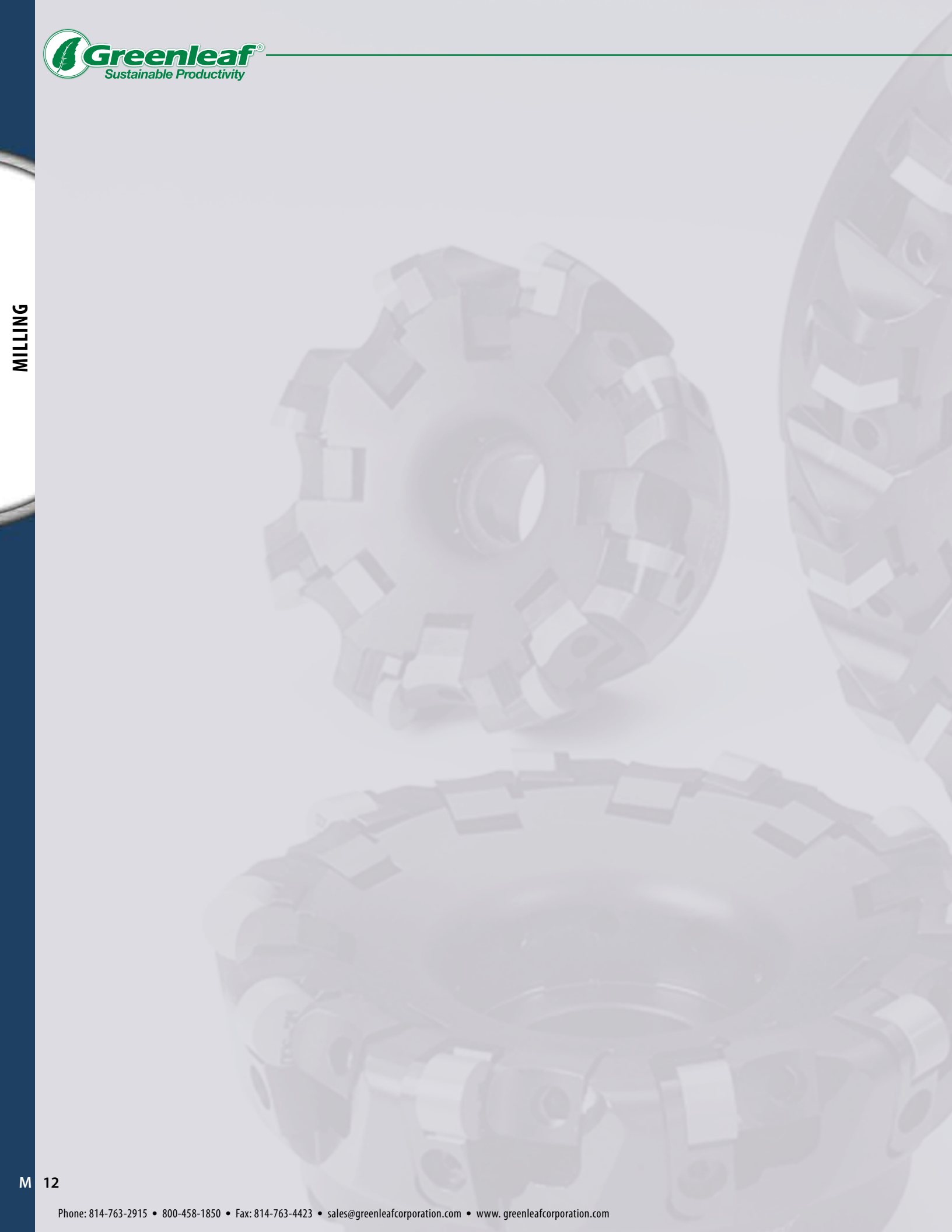
First Choice ◆ Second Choice ● Alternative ▲

Grade descriptions — pages M 36–37

Performance Calculations

Starting Speeds and Feeds for Index-O-Cut™

Work Material	Insert Grades	Hardness (HRc)	Cutting Speed (m/min.)	Maximum Feed per Tooth (IPT)
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
HRSA (Inconel, Hastelloy, Waspaloy)	G-915	<35	46-91	0,07-0,17
Stainless Steel (304, 316, 17-4 PH)	G-915	<32	274-457	0,10-0,22



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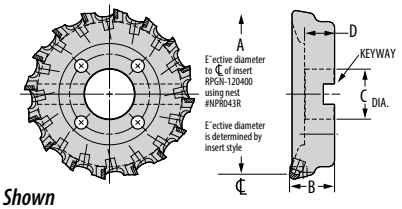
Excelerator® Milling Cutters

High-speed ceramic or standard-speed carbide milling for use in high-temp alloys, hard metals, and cast irons at high speeds and accelerated feed rates. Precision nests provide multiple insert configurations and body protection.

Greenleaf Tune-Up Kits
A Tune-Up Kit consists of all the standard hardware to refurbish a particular toolholder, boring bar, or milling cutter. A toolholder will have a readily visible, laser-inscribed Tune-Up Kit number on it for ease in ordering. This number will prevent any confusion created by searching a catalog for hardware, and it will help reduce downtime.

CP4 Series

Positive Rake Face Mill



Right-Hand End Mill Shown

Part Number		Dimensions (mm)				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	C0-5018	TK-01604
–	CP-4080L	80	50	27	22	12	–	6	425605	MS-1595	C0-5018	TK-01604
CP-4100R	–	100	50	32	25	14	–	8	425605	MS-1595	C0-5018	TK-01963
–	CP-4100L	100	50	32	25	14	–	8	425605	MS-1595	C0-5018	TK-01963
CP-4125R	–	125	63	40	28	16	–	10	425605	MS-1595	C0-5018	TK-01593
–	CP-4125L	125	63	40	28	16	–	10	425605	MS-1595	C0-5018	TK-01593
CP-4160R	–	160	63	40	28	16	66,7	12	425605	MS-1595	C0-5018	TK-01694
–	CP-4160L	160	63	40	28	16	66,7	12	425605	MS-1595	C0-5018	TK-01694
CP-4200R	–	200	63	60	38	25	101,6	16	425605	MS-1595	C0-5018	TK-01921
–	CP-4200L	200	63	60	38	25	101,6	16	425605	MS-1595	C0-5018	TK-01921
CP-4250R	–	250	63	60	38	25	101,6	20	425605	MS-1595	C0-5018	TK-01962
–	CP-4250L	250	63	60	38	25	101,6	20	425605	MS-1595	C0-5018	TK-01962
CP-4315R	–	315	80	60	38	25	101,6 177,8	24	425605	MS-1595	C0-5018	TK-01976
–	CP-4315L	315	80	60	38	25	101,6 177,8	24	425605	MS-1595	C0-5018	TK-01976

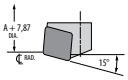
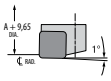
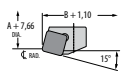
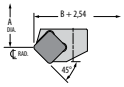
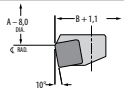
** Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.*

NOTE: For information on screw torque settings, please refer to the chart on page M38.

NOTE: Cutters are supplied less insert and nest. Nest must be purchased separately. Insert shape, size and quantity must be determined after choosing cutter and nest. Left-hand cutters can be built to order.

CP4 Series

Nests

Nests	Nest Part Number		Gage Insert
	Right Hand	Left Hand	
	NPC043R	—	CPGN-120412
	—	NPC043L	
	NPC1543R	—	CPGN-120412
	—	NPC1543L	
	NPR043R	—	RPGN-120400
	—	NPR043L	
	NPS143R	—	SPGN-120416
	—	NPS143L	
	NPS1543R		SPGN-120416
	—	NPS1543L	
	NPS4543R	—	SPGN-120416
	—	NPS4543L	
	XFNPS8043R	—	SPGN-120412
	—	XFNPS8043L	

NOTE: For applications which will not require the maximum number of inserts, 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.

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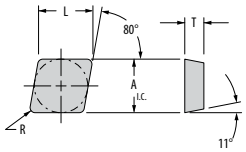
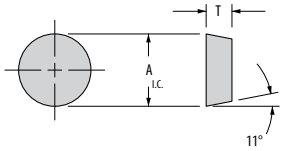
CP4 Inserts

CPGN, RPGN and SPGN

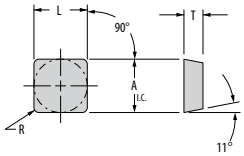
CPGN

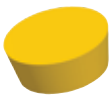


RPGN



SPGN



Inserts	Part Number ISO	Steel P			Stainless Steel M			Cast Iron K				Heat-Resistant Super Alloys S					Hardened Steel H			Part Number ANSI	Dimensions (mm)			
		GA5036	G-915	G-9120	G-915	G-9230	WG-600®	G-9230	G-915	GSN100™	XSYTIN®-1	G-915	G-9230	WG-600®	WG-300®	XSYTIN®-1	WG-300®	WG-600®	XSYTIN®-1		A	T	F	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

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated

First Choice ◆ Second Choice ● Alternative ▲

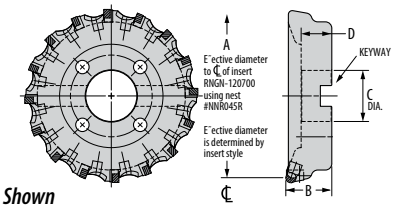
Grade descriptions — pages M 36–37

CERAMIC CLASSIFICATION: Whisker Ceramic | Phase-Toughened | Silicon Nitride | Alumina TiC

NOTE: For additional nose radii and available edge preps, please contact Greenleaf Tech Team.

C4 Series

Negative Rake Face Mill



Right-Hand End Mill Shown

Part Number		Dimensions (mm)				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	C0-5018	TK-01604
–	C-4080L	80	50	27	22	12	–	6	425605	MS-1595	C0-5018	TK-01604
C-4100R	–	100	50	32	25	14	–	8	425605	MS-1595	C0-5018	TK-01963
–	C-4100L	100	50	32	25	14	–	8	425605	MS-1595	C0-5018	TK-01963
C-4125R	–	125	63	40	28	16	–	10	425605	MS-1595	C0-5018	TK-01593
–	C-4125L	125	63	40	28	16	–	10	425605	MS-1595	C0-5018	TK-01593
C-4160R	–	160	63	40	28	16	66,7	12	425605	MS-1595	C0-5018	TK-01694
–	C-4160L	160	63	40	28	16	66,7	12	425605	MS-1595	C0-5018	TK-01694
C-4200R	–	200	63	60	32	25	101,6	16	425605	MS-1595	C0-5018	TK-01921
–	C-4200L	200	63	60	32	25	101,6	16	425605	MS-1595	C0-5018	TK-01921
C-4250R	–	250	63	60	32	25	101,6	20	425605	MS-1595	C0-5018	TK-01962
–	C-4250L	250	63	60	32	25	101,6	20	425605	MS-1595	C0-5018	TK-01962
C-4315R	–	315	80	60	32	25	101,6 177,8	24	425605	MS-1595	C0-5018	TK-01976
–	C-4315L	315	80	60	32	25	101,6 177,8	24	425605	MS-1595	C0-5018	TK-01976

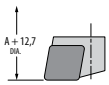
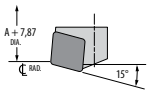
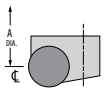
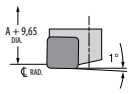
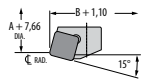
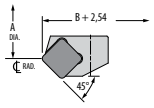
** Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.*

NOTE: For information on screw torque settings, please refer to the chart on page M38.

NOTE: Cutters are supplied less insert and nest. Nest must be purchased separately. Insert shape, size and quantity must be determined after choosing cutter and nest. Left-hand cutters can be built to order.

C4 Series

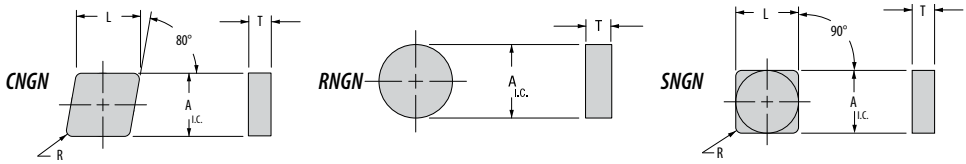
Nests

Nests	Nest Part Number		Gage Insert
	Right Hand	Left Hand	
	NNC043R	—	CNGN-120412
	—	NNC043L	
	NNC045R	—	CNGN-120712
	—	NNC045L	
	NNC1543R	—	CNGN-120412
	—	NNC1543L	
	NNC1545R	—	CNGN-120712
	—	NNC1545L	
	NNR043R	—	RNGN-120400
	—	NNR043L	
	NNR045R	—	RNGN-120700
	—	NNR045L	
	NNS143R	—	SNGN-120416
	—	NNS143L	
	NNS145R	—	SNGN-120716
	—	NNS145L	
	NNS1543R	—	SNGN-120416
	—	NNS1543L	
	NNS1545R	—	SNGN-120716
	—	NNS1545L	
	NNS4543R	—	SNGN-120416
	—	NNS4543L	
	NNS4545R	—	SNGN-120716
	—	NNS4545L	

NOTE: 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.

C4 Inserts

CNGN, RNGN, and SNGN



Inserts	Part Number ISO	Steel P			Stainless Steel M			Cast Iron K				Heat-Resistant Super Alloys S					Hardened Steel H			Part Number ANSI	Dimensions (mm)			
		GA5036	G-915	G-9120	G-915	G-9230	WG-600®	G-9230	G-915	GSN100™	XSYTIN®-1	G-915	G-9230	WG-600®	WG-300®	XSYTIN®-1	WG-300®	WG-600®	XSYTIN®-1		A	T	F	R
	CNGN-120412	◆	▲	●	▲	◆	◆	◆	▲	◆	▲	◆	▲	●	▲	◆	●	◆	▲	CNGN-433	112,70	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

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated

First Choice ◆ Second Choice ● Alternative ▲

Grade descriptions — pages M 36–37

CERAMIC CLASSIFICATION: Whisker Ceramic | Phase-Toughened | Silicon Nitride | Alumina TiC

NOTE: For additional nose radii and available edge preps, please contact Greenleaf Tech Team.

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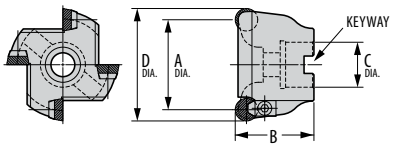
FMRP–FMRPF

Round Positive Face Mill



Right-Hand Face Mill Shown

Part Number		Gage Inserts	Dimensions (mm)				No. of Inserts	Mounting Screw	Keyway	Standard Components				*Tune-Up Kit
Right Hand	Left Hand		A	B	C	D				Anvil	Anvil Screw	Clamp	Clamp Screw	
FMRP-050R		RPGN-120400	50	40	22	62,7	4	M10	10	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01446
	FMRP-050L	RPGN-120400	50	40	22	62,7	4	M10	10	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01446
FMRP-063R		RPGN-120400	63	40	22	75,7	4	M10	10	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01446
	FMRP-063L	RPGN-120400	63	40	22	75,7	4	M10	10	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01446
FMRP-080R		RPGN-120400	80	50	27	92,7	5	M12	12	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01445
	FMRP-080L	RPGN-120400	80	50	27	92,7	5	M12	12	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01445
FMRP-100R		RPGN-120400	100	50	32	112,7	6	M16	14	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01447
	FMRP-100L	RPGN-120400	100	50	32	112,7	6	M16	14	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01447
FMRPF-038R		RPGN-120400	38	40	22	50,7	5	M10	10	–	–	3025-1	438920	TK-04734
	FMRPF-038L	RPGN-120400	38	40	22	50,7	5	M10	10	–	–	3025-1	438920	TK-04734
FMRPF-050R		RPGN-120400	50	40	22	62,7	6	M10	10	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01447
	FMRPF-050L	RPGN-120400	50	40	22	62,7	6	M10	10	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-01447
FMRPF-063R		RPGN-120400	63	40	22	75,7	7	M10	10	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-04355
	FMRPF-063L	RPGN-120400	63	40	22	75,7	7	M10	10	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-04355
FMRPF-080R		RPGN-120400	80	50	27	92,7	8	KLSS27M	12	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-04416
	FMRPF-080L	RPGN-120400	80	50	27	92,7	8	KLSS27M	12	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-04416
FMRPF-100R		RPGN-120400	100	50	32	112,7	10	KLSS32M	14	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	–
	FMRPF-100L	RPGN-120400	100	50	32	112,7	10	KLSS32M	14	308341	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	–

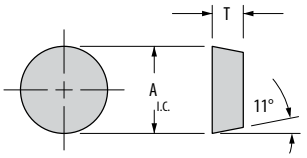
** Tune-Up Kits include all standard components and necessary wrenches to allow you to completely refurbish cutter.*

NOTE: For information on screw torque settings, please refer to the chart on page M38.

NOTE: Left-hand cutters are made to order only.

FMRP–FMRPF Inserts

RPGN



Inserts	Part Number ISO	Steel P			Stainless Steel M			Cast Iron K				Heat-Resistant Super Alloys S					Hardened Steel H			Part Number ANSI	Dimensions (mm)	
		GA5036	G-915	G-9120	G-915	G-9230	WG-600®	G-9230	G-915	GSN100™	XSYTIN®-1	G-915	G-9230	WG-600®	WG-300®	XSYTIN®-1	WG-300®	WG-600®	XSYTIN®-1		A	T
	RPGN-120400	◆	▲	●	▲	◆	◆	◆	▲	◆	▲	◆	▲	●	▲	◆	●	◆	▲	RPGN-43	12,70	4,76

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated

CERAMIC CLASSIFICATION: Whisker Ceramic | Phase-Toughened | Silicon Nitride | Alumina TiC

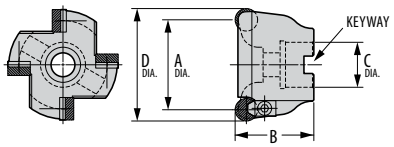
First Choice ◆ Second Choice ● Alternative ▲

Grade descriptions — pages M 36–37

NOTE: For additional nose radii and available edge preps, please contact Greenleaf Tech Team.

FMRN–FMRNF

Round Negative Face Mill



Right-Hand Face Mill Shown

Part Number		Gage Inserts	Dimensions (mm)				No. of Inserts	Mounting Screw	Keyway	Standard Components				*Tune-Up Kit
Right Hand	Left Hand		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
FMRNF-038R		RPGN-120400	38	40	22	50,7	5	M10	10	–	–	3025-1	438920	TK-04734
	FMRNF-038L	RPGN-120400	38	40	22	50,7	5	M10	10	–	–	3025-1	438920	TK-04734
FMRNF-050R		RPGN-120400	50	40	22	62,7	6	M10	10	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-04422
	FMRNF-050L	RPGN-120400	50	40	22	62,7	6	M10	10	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-04422
FMRNF-063R		RPGN-120400	63	40	22	75,7	7	M10	10	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-04277
	FMRNF-063L	RPGN-120400	63	40	22	75,7	7	M10	10	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-04277
FMRNF-080R		RPGN-120400	80	50	27	92,7	8	KLSS27M	12	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-04382
	FMRNF-080L	RPGN-120400	80	50	27	92,7	8	KLSS27M	12	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-04382
FMRNF-100R		RPGN-120400	100	50	32	112,7	10	KLSS32M	14	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-04786
	FMRNF-100L	RPGN-120400	100	50	32	112,7	10	KLSS32M	14	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-04786

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

† FMRNF-038 will not accept RNGN-120300 or RNGN-120700.

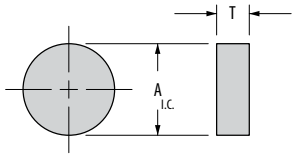
†† For Insert RNGN-120300, use anvil 312780. For insert RNGN-120700, use no anvil.

NOTE: For information on screw torque settings, please refer to the chart on page M38.

NOTE: Left-hand cutters are made to order only.

FMRN–FMRNF Inserts

RNGN



Inserts	Part Number ISO	Steel P			Stainless Steel M			Cast Iron K				Heat-Resistant Super Alloys S					Hardened Steel H			Part Number ANSI	Dimensions (mm)	
		GA5036	G-915	G-9120	G-915	G-9230	WG-600®	G-9230	G-915	GSN100™	XSYTIN®-1	G-915	G-9230	WG-600®	WG-300®	XSYTIN®-1	WG-300®	WG-600®	XSYTIN®-1		A	T
	RNGN-120300	◆	▲	●	▲	◆	◆	◆	▲	◆	▲	◆	▲	●	▲	◆	●	◆	▲	RNGN-42	12,70	3,18
	RNGN-120400	◆	▲	●	▲	◆	◆	◆	▲	◆	▲	◆	▲	●	▲	◆	●	◆	▲	RNGN-43	12,70	4,76
	RNGN-120700	◆	▲	●	▲	◆	◆	◆	▲	◆	▲	◆	▲	●	▲	◆	●	◆	▲	RNGN-45	12,70	7,94

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated

First Choice ◆ Second Choice ● Alternative ▲

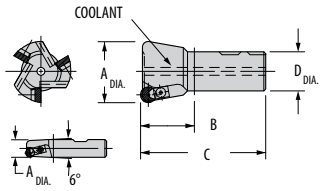
Grade descriptions — pages M 36–37

CERAMIC CLASSIFICATION: Whisker Ceramic | Phase-Toughened | Silicon Nitride | Alumina TiC

NOTE: For additional nose radii and available edge preps, please contact Greenleaf Tech Team.

WSRP-WSRPF

Round Positive End Mill



Right-Hand Cutter Shown

Part Number		Gage Inserts	Dimensions (mm)				No. of Inserts	Standard Components				*Tune-Up Kit
Right Hand	Left Hand**		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 M 3-0.5x6mm	3025-1	438920	TK-01360
	WSRP-5040L	RPGN-120400	50	45	115	40	3	308341	FHCS M 3-0.5x6mm	3025-1	438920	TK-01360
WSRP-6340R		RPGN-120400	63	45	115	40	4	308341	FHCS M 3-0.5x6mm	3025-1	438920	TK-01357
	WSRP-6340L	RPGN-120400	63	45	115	40	4	308341	FHCS M 3-0.5x6mm	3025-1	438920	TK-01357
WSRPF-2020R		RPGN-060200	20	32	82	20	3	–	–	430879	SHCS M2.5-.45x6mm	TK-04373
	WSRPF-2020L †	RPGN-060200	20	32	82	20	3	–	–	430879	SHCS M2.5-.45x6mm	TK-04373
WSRPF-2520RA		RPGN-070300	25	32	82	20	4	–	–	429323	PT-488T	TK-04396
	WSRPF-2520LA	RPGN-070300	25	32	82	20	4	–	–	429323	PT-488T	TK-04396
WSRPF-2520R		RPGN-090300	25	32	82	20	4	–	–	425716	C03508	TK-04395
	WSRPF-2520L	RPGN-090300	25	32	82	20	4	–	–	425716	C03508	TK-04395
WSRPF-3225R		RPGN-090300	32	32	88	25	5	–	–	425716	C03508	TK-04423
	WSRPF-3225L	RPGN-090300	32	32	88	25	5	–	–	425716	C03508	TK-04423
WSRPF-4032R		RPGN-120400	40	45	105	32	4	–	–	3025	438920	TK-04424
	WSRPF-4032L	RPGN-120400	40	45	105	32	4	–	–	3025	438920	TK-04424
WSRPF-5040R		RPGN-120400	50	45	115	40	4	308341	FHCS M 3-0.5x6mm	3025	438920	TK-04276
	WSRPF-5040L	RPGN-120400	50	45	115	40	4	308341	FHCS M 3-0.5x6mm	3025	438920	TK-04276
WSRPF-6340R		RPGN-120400	63	45	115	40	5	308341	FHCS M 3-0.5x6mm	3025	438920	TK-04276
	WSRPF-6340L	RPGN-120400	63	45	115	40	5	308341	FHCS M 3-0.5x6mm	3025	438920	TK-04276

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

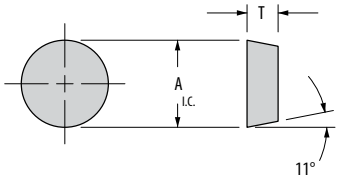
*** Left-Hand cutters are made to order only.*

† No thru-tool coolant available

NOTE: For information on screw torque settings, please refer to the chart on page M38.

WSRP-WSRPF Inserts

RPGN



Inserts	Part Number ISO	Steel P			Stainless Steel M			Cast Iron K				Heat-Resistant Super Alloys S					Hardened Steel H			Part Number ANSI	Dimensions (mm)	
		GA5036	G-915	G-9120	G-915	G-9230	WG-600®	G-9230	G-915	GSN100™	XSYTIN®-1	G-915	G-9230	WG-600®	WG-300®	XSYTIN®-1	WG-300®	WG-600®	XSYTIN®-1		A	T
	RPGN-060200	◆	▲	●	▲	◆	◆	◆	▲	◆	▲	◆	▲	●	▲	◆	●	◆	▲	RPGN-21.5	6,35	2,38
	RPGN-070300	◆	▲	●	▲	◆	◆	◆	▲	◆	▲	◆	▲	●	▲	◆	●	◆	▲	RPGN-2.52	7,94	3,18
	RPGN-090300	◆	▲	●	▲	◆	◆	◆	▲	◆	▲	◆	▲	●	▲	◆	●	◆	▲	RPGN-32	9,53	3,18
	RPGN-120400	◆	▲	●	▲	◆	◆	◆	▲	◆	▲	◆	▲	●	▲	◆	●	◆	▲	RPGN-43	12,70	4,76

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated

CERAMIC CLASSIFICATION: Whisker Ceramic | Phase-Toughened | Silicon Nitride | Alumina TiC

First Choice ◆ Second Choice ● Alternative ▲

Grade descriptions — pages M 36–37

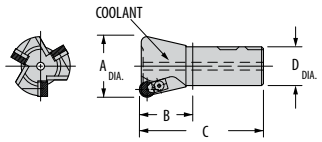
NOTE: For additional nose radii and available edge preps, please contact the Greenleaf Tech Team.

Maximum RPM

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

WSRN-WSRNF

Round Negative End Mill



Right-Hand Cutter Shown

Part Number		Gage Inserts	Dimensions (mm)				Inserts	Standard Components				*Tune-Up Kit
Right Hand	Left Hand**		A	B	C	No. of D		Anvil	Anvil Screw	Clamp	Clamp Screw	
†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
	††WSRN-5040L	RNGN-120400	50	45	115	40	3	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02702
††WSRN-6340R		RNGN-120400	63	45	115	40	4	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02699
	††WSRN-6340L	RNGN-120400	63	45	115	40	4	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02699
†WSRNF-2520R		RNGN-090300	25	30	80	20	3	–	–	425716	MS-1156	TK-01325
	†WSRNF-2520L	RNGN-090300	25	30	80	20	3	–	–	425716	MS-1156	TK-01325
WSRNF-3225R		RNGN-090300	32	30	86	25	4	–	–	425716	MS-1156	TK-04371
	WSRNF-3225L	RNGN-090300	32	30	86	25	4	–	–	425716	MS-1156	TK-04371
WSRNF-4032R		RNGN-120400	40	45	105	32	4	–	–	3025-1	438920	TK-04419
	WSRNF-4032L	RNGN-120400	40	45	105	32	4	–	–	3025-1	438920	TK-04419
††WSRNF-5040R		RNGN-120400	50	45	115	40	5	313572	FHCS M3-0.5x6mm	3025-1	438920	TK-02700
	††WSRNF-5040L	RNGN-120400	50	45	115	40	5	313572	FHCS M3-0.5x6mm	3025-1	438920	TK-02700
††WSRNF-6340R		RNGN-120400	63	45	115	40	6	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02701
	††WSRNF-6340L	RNGN-120400	63	45	115	40	6	313572	FHCS M3-0.5x6mm	3025-1	SHCS M5-0.8x12mm	TK-02701

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

† This shank does not have any flats.

†† For Insert RNGN-120700, remove the anvil and anvil screw.

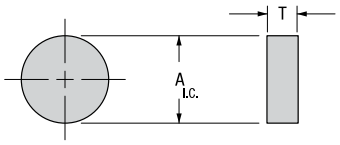
NOTE: For information on screw torque settings, please refer to the chart on page M38.

NOTE: Left-hand cutters are made to order only.

Phone: 814-763-2915 • 800-458-1850 • Fax: 814-763-4423 • sales@greenleafcorporation.com • www. greenleafcorporation.com

WSRN-WSRNF Inserts

RNGN



Inserts	Part Number ISO	Steel P			Stainless Steel M			Cast Iron K				Heat-Resistant Super Alloys S					Hardened Steel H			Part Number ANSI	Dimensions (mm)	
		GA5036	G-915	G-9120	G-915	G-9230	WG-600®	G-9230	G-915	GSN100™	XSYTIN®-1	G-915	G-9230	WG-600®	WG-300®	XSYTIN®-1	WG-300®	WG-600®	XSYTIN®-1		A	T
	RNGN-090300	◆	▲	●	▲	◆	◆	◆	▲	◆	▲	◆	▲	●	▲	◆	●	◆	▲	RNGN-32	9,53	3,18
	RNGN-120300	◆	▲	●	▲	◆	◆	◆	▲	◆	▲	◆	▲	●	▲	◆	●	◆	▲	RNGN-42	12,70	3,18
	RNGN-120400	◆	▲	●	▲	◆	◆	◆	▲	◆	▲	◆	▲	●	▲	◆	●	◆	▲	RNGN-43	12,70	4,76
	RNGN-120700	◆	▲	●	▲	◆	◆	◆	▲	◆	▲	◆	▲	●	▲	◆	●	◆	▲	RNGN-45	12,70	7,94

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated

First Choice ◆ Second Choice ● Alternative ▲

Grade descriptions — pages M 36–37

CERAMIC CLASSIFICATION: Whisker Ceramic | Phase-Toughened | Silicon Nitride | Alumina TiC

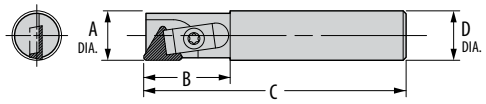
NOTE: For additional nose radii and available edge preps, please contact Greenleaf Tech Team.

Maximum RPM

Cutter Part Number	Max RPM Carbide	Max RPM Ceramic
WSRN-2520	9,500	26,000
WSRN-3225	7,500	21,000
WSRN-4032	6,200	19,500
WSRN-5040	4,600	13,000
WSRN-6340	3,800	10,000
WSRNF-2520	9,500	26,000
WSRNF-3225	7,500	21,000
WSRNF-4032	6,200	19,500
WSRNF-5040	4,600	13,000
WSRNF-6340	3,800	10,000

WSTP

Triangle Positive End Mill



Right-Hand Cutter Shown

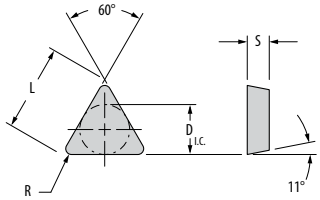
Part Number		Gage Inserts	Dimensions (mm)				No. of Inserts	Standard Components		*Tune-Up Kit
Right Hand	Left Hand		A	B	C	D		Clamp	Clamp Screw	
WSTP-1212R		TPGN-110308	12	22	67	12	1	429871	PT-317T	TK-00897
	WSTP-1212L	TPGN-110308	12	22	67	12	1	429871	PT-317T	TK-00897
WSTP-1412R		TPGN-110308	14	25	70	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.*

NOTE: For information on screw torque settings, please refer to the chart on page M38.

WSTP Inserts

TPGN



Inserts	Part Number ISO	Steel			Stainless Steel			Cast Iron				Heat-Resistant Super Alloys					Hardened Steel			Part Number ANSI	Dimensions (mm)			
		P			M			K				S					H				L	D	S	R
		GA5036	G-915	G-9120	G-915	G-9230	WG-600®	GA5023	G-915	GSN100™	XSYTIN®-1	G-915	G-9230	WG-600®	WG-300®	XSYTIN®-1	WG-300®	WG-600®	XSYTIN®-1					
	TPGN-110308	◆	▲	●	▲	◆	◆	◆	▲	◆	▲	◆	▲	●	▲	◆	●	◆	▲	TPGN-222	11,0	6,35	3,18	0,80

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated

First Choice ◆ Second Choice ● Alternative ▲

Grade descriptions — pages M 36–37

CERAMIC CLASSIFICATION: Whisker Ceramic | Phase-Toughened | Silicon Nitride | Alumina TiC

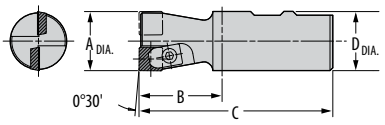
NOTE: For additional nose radii and available edge preps, please contact Greenleaf Tech Team.

Maximum RPM

Cutter Part Number	Max RPM Carbide	Max RPM Ceramic
WSTP-1212R/L	19,000	35,000
WSTP-1412R/L	17,000	35,000
WSTP-1616R/L	15,000	35,000

WSSP

Square Positive End Mill



Right-Hand Cutter Shown

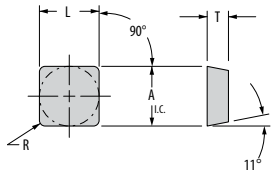
Part Number		Gage Inserts	Dimensions (mm)				No. of Inserts	Standard Components		*Tune-Up Kit
Right Hand	Left Hand		A	B	C	D		Clamp	Screw	
WSSP-1010R		SPGN-060208	10	12	52	10	1	429871	PT-317T	TK-00897
	WSSP-1010L	SPGN-060208	10	12	52	10	1	429871	PT-317T	TK-00897
WSSP-1212R		SPGN-060208	12	22	67	12	1	429871	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	SHCSM2.5-0.45x6mm	TK-01335
	WSSP-1616L	SPGN-060308	16	25	73	16	2	430879	SHCSM2.5-0.45x6mm	TK-01335
WSSP-2020R		SPGN-060308	20	25	75	20	2	430879	SHCSM2.5-0.45x6mm	TK-01335
	WSSP-2020L	SPGN-060308	20	25	75	20	2	430879	SHCSM2.5-0.45x6mm	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	SHCSM5-0.8x12mm	TK-01338
	WSSP-4032L	SPGN-120408	40	45	105	32	3	3127-C	SHCSM5-0.8x12mm	TK-01338

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

NOTE: For information on screw torque settings, please refer to the chart on page M38.

WSSP Inserts

SPGN



Inserts	Part Number ISO	Steel P			Stainless Steel M			Cast Iron K				Heat-Resistant Super Alloys S					Hardened Steel H			Part Number ANSI	Dimensions (mmm)			
		GA5036	G-915	G-9120	G-915	G-9230	WG-600®	GA5023	G-915	GSN100™	XSYTIN®-1	G-915	G-9230	WG-600®	WG-300®	XSYTIN®-1	WG-300®	WG-600®	XSYTIN®-1		A	L	T	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

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated

CERAMIC CLASSIFICATION: Whisker Ceramic | Phase-Toughened | Silicon Nitride | Alumina TiC

First Choice ◆ Second Choice ● Alternative ▲

Grade descriptions — pages M 36–37

NOTE: For additional nose radii and available edge preps, please contact Greenleaf Tech Team.

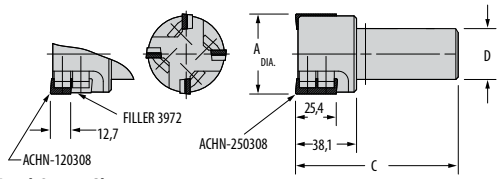
Maximum RPM

Cutter Part Number	Max RPM Carbide	Max RPM Ceramic
WSSP-1010R/L	25,000	40,000
WSSP-1212R/L	19,000	40,000
WSSP-1616R/L	15,000	40,000
WSSP-2020R/L	12,500	35,000
WSSP-2520R/L	9,500	26,000
WSSP-3225R/L	7,500	21,000
WSSP-4032R/L	6,200	16,500

NOTE: For information on screw torque settings, please refer to the chart on page M38.

WSAN

Parallelogram Positive End Mill



Right-Hand Cutter Shown

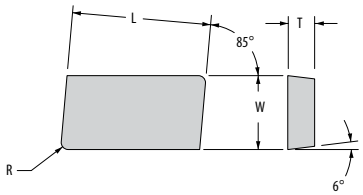
Part Number		Gage Inserts	Dimensions (mm)			No. of Inserts	Standard Components				*Tune-Up Kit	Optional Components	
Right Hand	Left Hand		A	B	C		Anvil	Anvil Screw	Clamp	Clamp Screw		Max. 1/2" D.O.C. Insert	Filler
WSAN-2520R		ACHN-250308	25	95	20	2	–	–	410756	BHCSM4-0.7x0mm	TK-01351	ACHN-120308	3972
	WSAN-2520L	ACHN-250308-LH	25	95	20	2	–	–	410756	BHCSM4-0.7x0mm	TK-01351	ACHN-120308-LH	3972
WSAN-2525R		ACHN-250308	25	101	25	2	–	–	410756	BHCSM4-0.7x0mm	TK-01351	ACHN-120308	3972
	WSAN-2525L	ACHN-250308-LH	25	101	25	2	–	–	410756	BHCSM4-0.7x0mm	TK-01351	ACHN-120308-LH	3972
WSAN-3225R		ACHN-250308	32	101	25	2	–	–	410756	BHCSM4-0.7x0mm	TK-01351	ACHN-120308	3972
	WSAN-3225L	ACHN-250308-LH	32	101	25	2	–	–	410756	BHCSM4-0.7x0mm	TK-01351	ACHN-120308-LH	3972
WSAN-4032R		ACHN-250308	40	105	32	3	AAP-3224	FHCSM3-0.5x6mm	410756	BHCSM4-0.7x0mm	TK-01617	ACHN-120308	3972
	WSAN-4032L	ACHN-250308-LH	40	105	32	3	AAP-3224-LH	FHCSM3-0.5x6mm	410756	BHCSM4-0.7x0mm	TK-02229	ACHN-120308-LH	3972
WSAN-5040R		ACHN-250308	50	115	40	4	AAP-3224	FHCSM3-0.5x6mm	410756	BHCSM4-0.7x0mm	TK-01616	ACHN-120308	3972
	WSAN-5040L	ACHN-250308-LH	50	115	40	4	AAP-3224-LH	FHCSM3-0.5x6mm	410756	BHCSM4-0.7x0mm	TK-02230	ACHN-120308-LH	3972
WSAN-6340R		ACHN-250308	63	115	40	4	AAP-3224	FHCSM3-0.5x6mm	410756	BHCSM4-0.7x0mm	TK-01616	ACHN-120308	3972
	WSAN-6340L	ACHN-250308-LH	63	115	40	4	AAP-3224-LH	FHCSM3-0.5x6mm	410756	BHCSM4-0.7x0mm	TK-02230	ACHN-120308-LH	3972

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

NOTE: For information on screw torque settings, please refer to the chart on page M38.

WSAN Inserts

ACHN



Inserts	Part Number ISO	Steel P			Stainless Steel M			Cast Iron K				Heat-Resistant Super Alloys S					Hardened Steel H			Part Number ANSI	Dimensions (mm)			
		GA5036	G-915	G-9120	G-915	G-9230	WG-600®	GA5023	G-915	GSN100™	XSYTIN®-1	G-915	G-9230	WG-600®	WG-300®	XSYTIN®-1	WG-300®	WG-600®	XSYTIN®-1		T	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

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated

CERAMIC CLASSIFICATION: Whisker Ceramic | Phase-Toughened | Silicon Nitride | Alumina TiC

First Choice ◆ Second Choice ● Alternative ▲ *Grade descriptions — pages M 36–37*

NOTE: For additional nose radii and available edge preps, please contact Greenleaf Tech Team.

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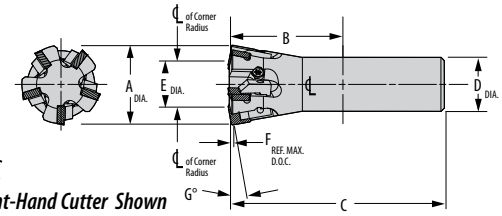
Excelerator® XF

Positive High-Feed Mills

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



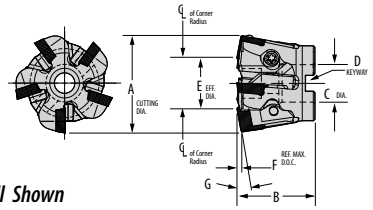
Right-Hand Cutter Shown

Cutter Order Number	Insert	Dimensions (mm)							No. of Inserts	Standard Components		*Tune-Up Kit	Max RPM Carbide	Max RPM Ceramic
		A	B	C	D	E	F	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	9,500	26,000
XFSP-4032-EM	SPGN-090308	40	45	105	32	22,8	1,32	10°	5	313256	SE02-01	TK-01905	6,200	16,500

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

NOTE: For information on screw torque settings, please refer to the chart on page M38.

55mm High-Feed Face Mill / Square Positive Inserts



Right-Hand Face Mill Shown

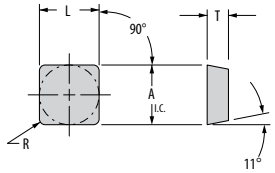
Cutter Order Number	Insert	Dimensions (mm)							No. of Inserts	Standard Components			*Tune-Up Kit	Max RPM Carbide	Max RPM Ceramic
		A	B	C	D	E	F	G		Clamp	Clamp Screw	Mount Screw			
XFSP-055-FM	SPGN-120408	55	40	22	31,52	1,93	10°	10,4	5	431628	SE03-72	SHCSM10-1.5	TK-02228	4,600	13,300

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

NOTE: For information on screw torque settings, please refer to the chart on page M38.

Excelerator XF Inserts

SPGN



Inserts	Part Number ISO	Steel P			Stainless Steel M			Cast Iron K				Heat-Resistant Super Alloys S					Hardened Steel H			Part Number ANSI	Dimensions (mm)			
		GA5036	G-915	G-9120	G-915	G-9230	WG-600®	GA5023	G-915	GSN100™	XSYTIN®-1	G-915	G-9230	WG-600®	WG-300®	XSYTIN®-1	WG-300®	WG-600®	XSYTIN®-1		A	L	T	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

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated

First Choice ◆ Second Choice ● Alternative ▲ *Grade descriptions — pages M 36–37*

CERAMIC CLASSIFICATION: Whisker Ceramic | Phase-Toughened | Silicon Nitride | Alumina TiC

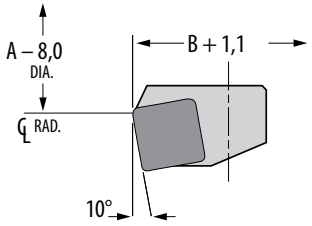
NOTE: For additional nose radii and available edge preps, please contact Greenleaf Tech Team.

XFNPS

Nest for CP4 Series

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

NOTE: For information on CP4-series nests, please refer to the chart on page M14.



Performance Calculations

Starting Speeds and Feeds for Excelerator XF®

Material	Hardness	Insert Grades	Cutting Speed (m/min)	Target Chip Thickness (mm)	Recommended Feed per Tooth (mm/tooth) Width of Cut (%) of Effective Diameter		
					15%	30%	45%+
Steel	60-65 HRC	WG-600®	150	0,038	0,307	0,239	0,221
	50-59 HRC	WG-600®	240	0,051	0,411	0,320	0,295
	40-49 HRC	WG-600®	400	0,069	0,554	0,432	0,396
	40-49 HRC	GA5036	120	0,043	0,348	0,272	0,249
	30-39 HRC	GA5036	180	0,076	0,615	0,480	0,442
	≤30 HRC	GA5036	240	0,104	0,838	0,660	0,610

DOC vs. Effective Diameter for Excelerator® XF

Depth of Cut	XFSP-2520-EM	XFSP-4032-EM	XFSP-055-FM	CP4 Series Face Mills: XFNPS8043 Nest						
	25mm	40mm	55mm	80mm	100mm	125mm	160mm	200mm	250mm	315mm
0,25	16,97	25,77	34,49	75,00	95,00	120,00	155,00	195,00	245,00	310,00
0,5	19,81	28,61	37,33	77,89	97,89	122,89	157,89	197,89	247,89	312,89
0,75	22,65	31,45	40,17	80,72	100,72	125,72	160,72	200,72	250,72	315,72
1,0	X	34,28	43,00	83,55	103,55	128,55	163,55	203,55	253,55	318,55
1,27	X	37,34	46,06	86,61	106,61	131,61	166,61	206,61	256,61	321,61
1,5	X	X	48,67	89,22	109,22	134,22	169,22	209,46	259,22	324,22
1,77	X	X	X	92,28	112,28	137,28	172,28	212,28	262,28	327,28
2,0	X	X	X	93,68	113,68	138,68	173,68	213,68	263,68	328,68
DIA OVER INSERT	25,00	40,00	55,00	100,50	120,50	145,50	180,50	220,50	270,50	335,50

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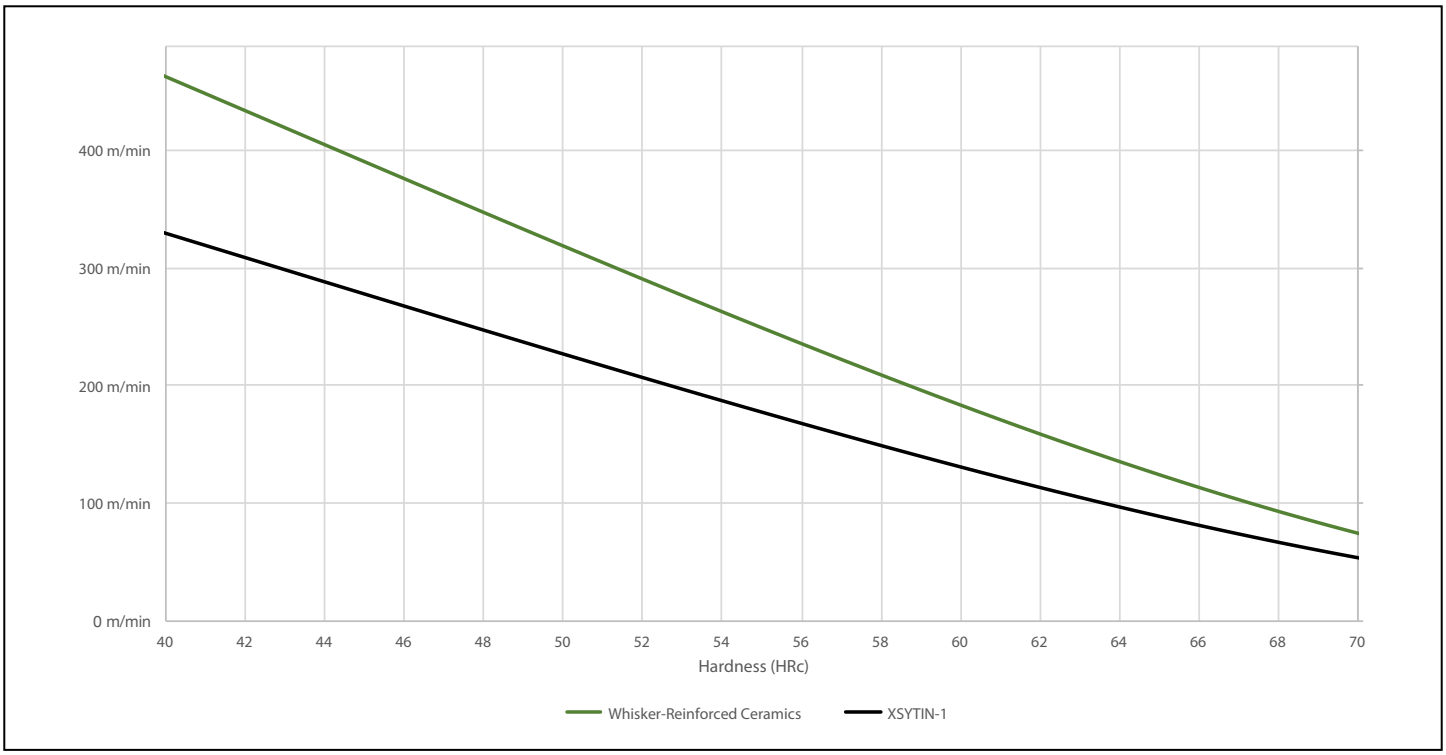
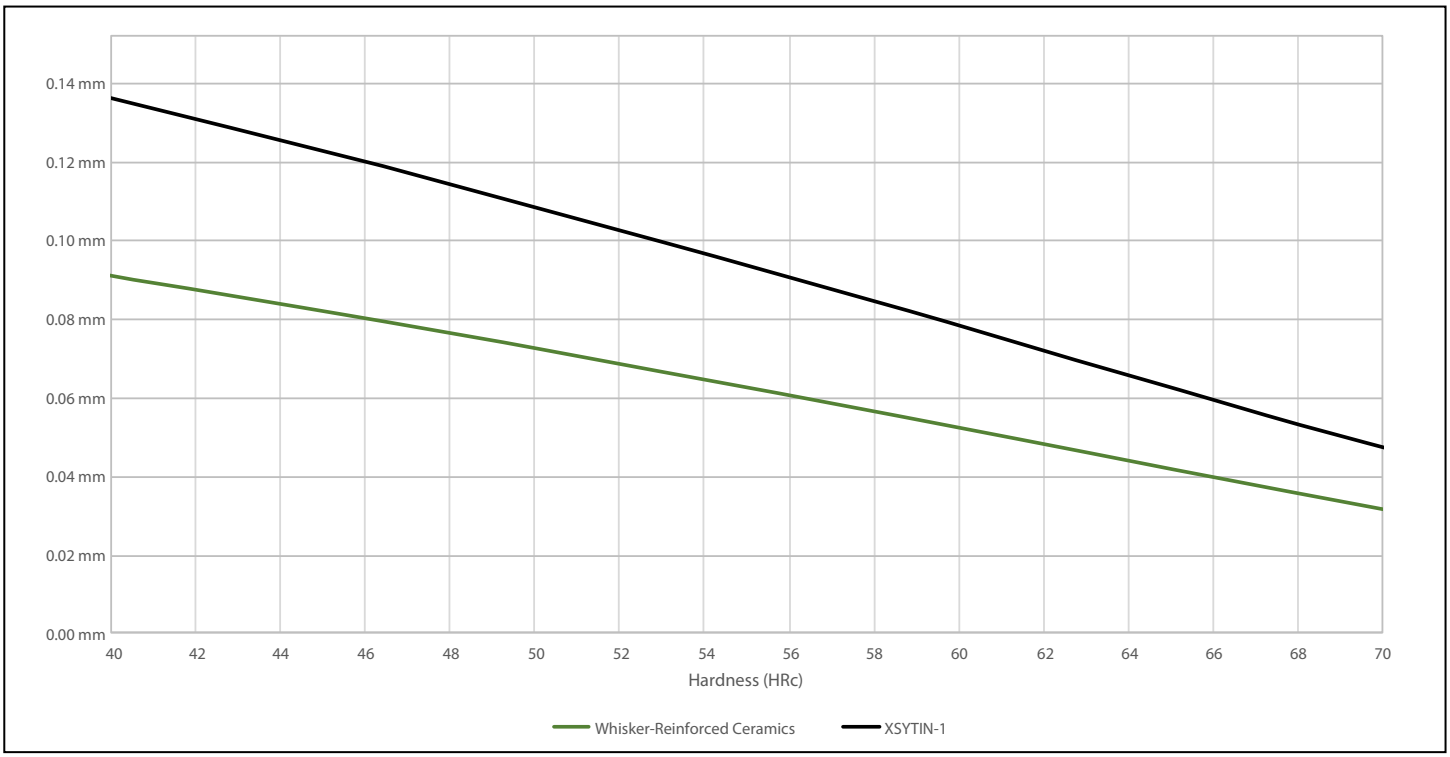
Milling Hardened Steel, Cutting Speed (Vc)



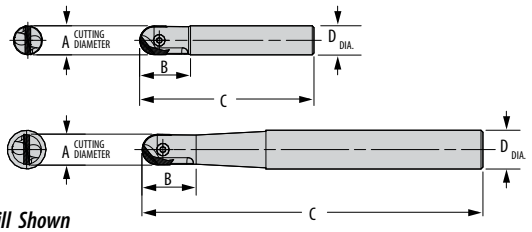
Milling Hardened Steel, Average Chip Thickness (Hm)



Ball Nose

End Mill

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



Right-Hand End Mill Shown

Part Number		Gage Insert	Dimensions (mm)				Standard Components	*Tune-Up Kit Includes All Standard Components	Max RPM Carbide	Max RPM Ceramic
Short Series	Extended Series		A	B	C	D	Insert Screw			
SSBN-M010X		GBN-M010	10	17	100	16	SM30-083	TK-03466	40,000	40,000
	SSBN-M010EX	GBN-M010	10	17	180	16	SM30-083	TK-03466	40,000	40,000
SSBN-M012X		GBN-M012	12	19	110	16	SM40-106	TK-03461	40,000	40,000
	SSBN-M012EX	GBN-M012	12	19	200	16	SM40-106	TK-03461	40,000	40,000
SSBN-M016X		GBN-M016	16	25,4	130	20	SM50-139	TK-03175	40,000	40,000
	SSBN-M016EX	GBN-M016	16	25,4	220	20	SM50-139	TK-03175	40,000	40,000
SSBN-M020X		GBN-M020	20	32	140	25	SM60-167	TK-04138	40,000	40,000
	SSBN-M020EX	GBN-M020	20	32	250	25	SM60-167	TK-04138	40,000	40,000
SSBN-M025X		GBN-M025	25	36	150	32	SM70-210	TK-04142	40,000	40,000
	SSBN-M025EX	GBN-M025	25	36	250	32	SM70-210	TK-03462	40,000	40,000

NOTE: Add L to part number for left-hand cutter.

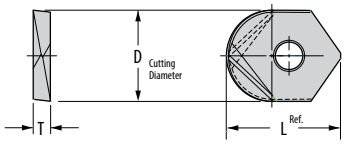
NOTE: For information on screw torque settings, please refer to the chart on page M38.

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

Ball Nose Inserts

GBN

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



Inserts	Part Number ANSI	Steel	S Steel	Cast Iron			Heat-Resistant Super Alloys			Hardened Steel			Dimensions (mm)		
		P	M	K			S			H					
		G-925	G-925	G-925	WG-600®	XSYTIN®-1	G-925	WG-600®	XSYTIN®-1	G-925	WG-600®	XSYTIN®-1	L	T	D
	GBN-M010	◆	◆	◆	▲	◆	◆	▲	◆	◆	◆	▲	12,7	3,18	10
	GBN-M012	◆	◆	◆	▲	◆	◆	▲	◆	◆	◆	▲	17,0	4,78	12
	GBN-M016	◆	◆	◆	▲	◆	◆	▲	◆	◆	◆	▲	20,3	4,78	16
	GBN-M020	◆	◆	◆	▲	◆	◆	▲	◆	◆	◆	▲	22,9	4,78	20
	GBN-M025	◆	◆	◆	▲	◆	◆	▲	◆	◆	◆	▲	31,2	4,78	25

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated

CERAMIC CLASSIFICATION: Whisker Ceramic | Phase-Toughened | Silicon Nitride | Alumina TiC

First Choice ◆ Second Choice ● Alternative ▲

Grade descriptions — pages M 36–37

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Performance Calculations

Starting Speeds and Feeds for Ball Nose

Work Material	Hardness (HRc)	Insert Grades	Cutting Speed (mm/m)	Target Chip Thickness (mm)	Recommended Feed per Tooth (mm/t) Depth of Cut to Radius Ratio (Ap/r)		
					0–13.4%	13.4–29.3%	29.3–50%
Steel	40 HRC	G-925	152	0,048	0,216	0,124	0,095
		XSYTIN®-1	320	0,080	0,365	0,206	0,159
		WG-600®	457	0,056	0,253	0,144	0,111
	50 HRC	G-925	107	0,032	0,107	0,062	0,048
		XSYTIN®-1	219	0,064	0,290	0,165	0,127
		WG-600®	311	0,048	0,216	0,124	0,095
	60 HRC	G-925	91	0,016	0,071	0,041	0,032
		XSYTIN®-1	131	0,048	0,216	0,124	0,095
		WG-600®	186	0,032	0,143	0,082	0,064
Tool Steel	65 HRC	G-925	84	0,016	0,071	0,041	0,032
		XSYTIN®-1	85	0,040	0,179	0,103	0,079
		WG-600®	122	0,024	0,107	0,062	0,048
HRSA	20-25 HRC	G-925	168	0,064	0,290	0,165	0,127
		XSYTIN®-1	914	0,064	0,290	0,165	0,127
		WG-600®	1204	0,040	0,179	0,103	0,079
	40-45 HRC	G-925	107	0,040	0,179	0,103	0,079
		XSYTIN®-1	792	0,040	0,179	0,103	0,079
		WG-600®	1052	0,024	0,107	0,062	0,048
Grapitic Cast Iron	≤40 HRC	G-925	259	0,086	0,395	0,223	0,171
		XSYTIN®-1	701	0,072	0,327	0,185	0,143
		WG-600®	899	0,048	0,216	0,124	0,095
Stainless Steel	≤40 HRC	G-925	137	0,064	0,290	0,165	0,127
		XSYTIN®-1	732	0,064	0,290	0,165	0,127
		WG-600®	1061	0,040	0,179	0,103	0,079
Titanium 6Al4V	35-40 HRC	G-925	76	0,024	0,107	0,062	0,048
Aluminum		G-925	290	0,095	0,441	0,247	0,190

* *Recommended Feed per Tooth values are for full slotting situations to maintain the target chip thickness value. When 3D/Profile milling, please use the Greenleaf Ball Nose Calculator to determine the appropriate cutting parameters to achieve the target chip thickness listed. For questions regarding applications and additional materials, please contact your local sales and service engineer or the Greenleaf Technical Service department.*

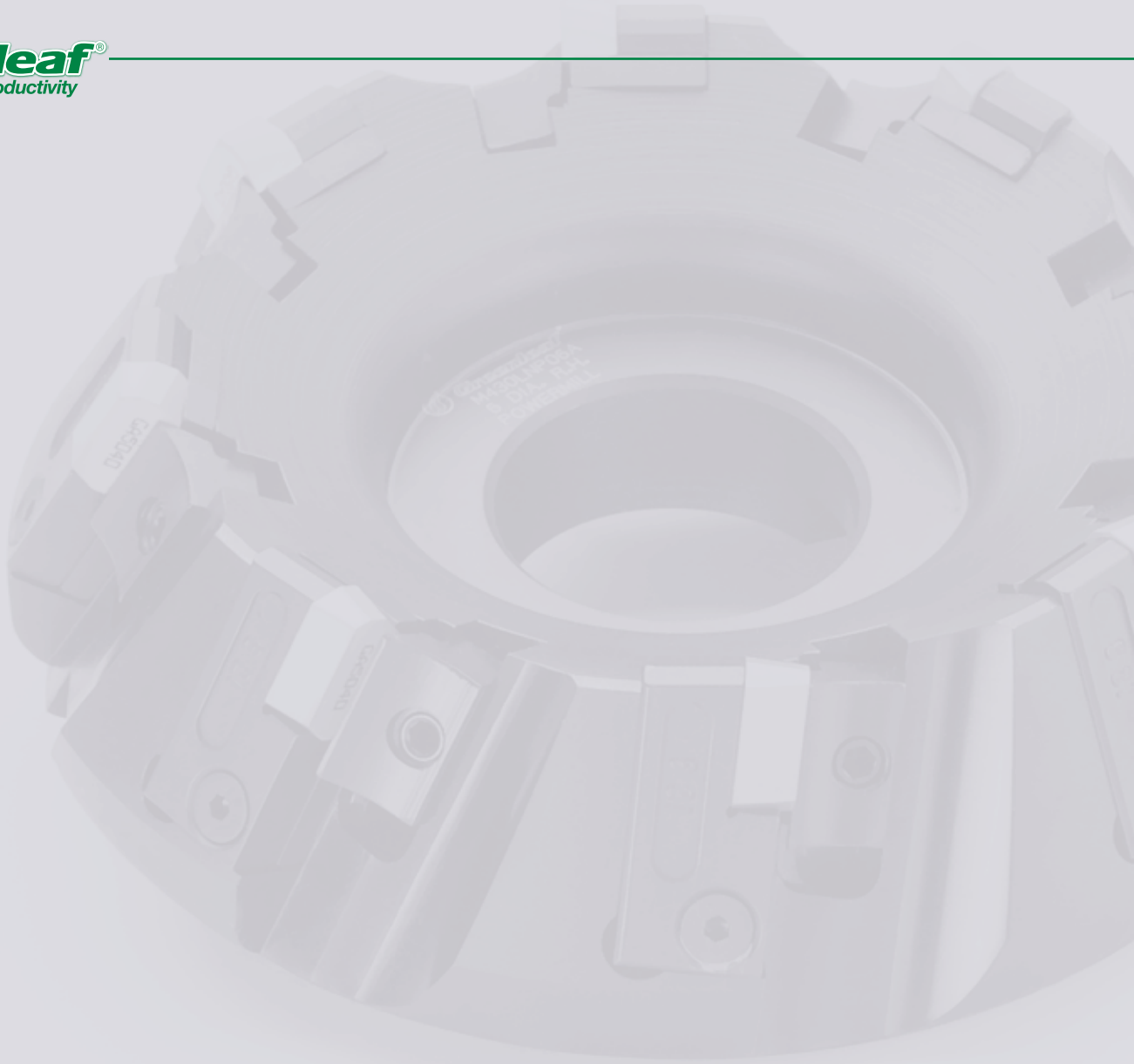
** *Maximum recommended depth of cut (DOC) when using XSYTIN-1 & G-925 is 20% of the insert diameter, and 15% of the insert diameter when using WG-600.*

Effective Cutting Diameter

		Effective Diameter D_{eff} (mm) for a given Depth of Cut												
	DOC	0,013	0,25	0,38	0,64	0,89	1,40	1,91	2,41	2,54	2,92	3,18	3,81	5,08
Insert Diameter (mm)	10	2,18	3,07	3,73	4,75	5,54	6,74	7,62	8,29	8,42	8,78	8,98	9,33	-
	12	2,53	3,56	4,33	5,54	6,48	7,95	9,07	9,96	10,16	10,69	11,00	11,64	12,44
	16	2,83	3,98	4,86	6,22	7,30	8,99	10,32	11,40	11,64	12,30	12,70	13,56	14,81
	20	3,10	4,37	5,33	6,84	8,04	9,93	11,43	12,67	12,95	13,73	14,20	15,24	16,85
	25	3,58	5,05	6,17	7,93	9,34	11,58	13,38	14,90	15,24	16,21	16,80	18,14	20,32

Maximum recommended DOC for WG-600®

Maximum recommended DOC for G-925 and XSYTIN®-1



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Powermill Milling Cutters

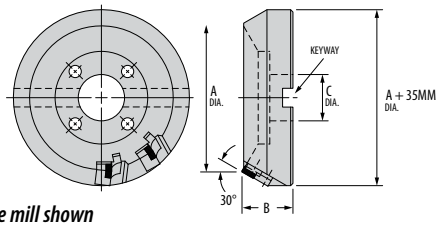
Ideal for heavy-duty cutting in severe interruptions and uneven surfaces. Replaceable components maximize cutter life while providing deep depths of cut.

Greenleaf Tune-Up Kits

A Tune-Up Kit consists of all the standard hardware to refurbish a particular toolholder, boring bar, or milling cutter. A toolholder will have a readily visible, laser-inscribed Tune-Up Kit number on it for ease in ordering. This number will prevent any confusion created by searching a catalog for hardware, and it will help reduce downtime.

Powermill M430LNP-A

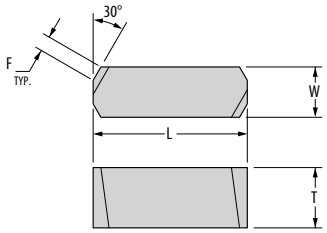
30º Lead, Neg-Pos

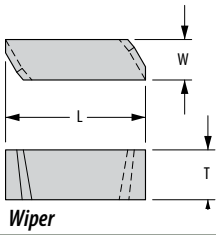


Right-hand face mill shown

Part Number		Gage Insert	No. of Inserts	Wiper Insert	Dimensions (mm)					Standard Components				*Tune-Up Kit	Optional
Right Hand	**Left Hand				A	B	C	Keyway	Bolt Circle	Anvil	Wedge Screw	Anvil	Back-Up Plate		†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	S-2M
	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	S-2M
	M430LNP160AL	LNP-335L	8	LNP-335LW	160	63	40	16	66,7	430992	STCM-8	S-21M	303414	TK-02062	S-2M
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	S-2M
M430LNP250AR		LNP-335R	12	LNP-335RW	250	63	60	25	101,6	430992	STCM-8	S-21M	303414	TK-02219	S-2M
	M430LNP250AL	LNP-335L	12	LNP-335LW	250	63	60	25	101,6	430992	STCM-8	S-21M	303414	TK-02219	S-2M
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

NOTE: Maximum depth of cut is 12.7mm.
NOTE: The Standard and Optional Anvil both use the same Anvil Screw: #10-32 x 1 FHCS.
NOTE: For information on screw torque settings, please refer to the chart on page M38.
** 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.*





Wiper

Powermill Inserts

LNP

Inserts	Part Number ISO	Steel P			Stainless Steel M		Part Number ANSI	Dimensions (mm)			
		GA5036	G-915	G-9120	G-910	G-9230		W	T	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

CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated
CERAMIC CLASSIFICATION: Whisker Ceramic | Phase-Toughened | Silicon Nitride | Alumina TiC

First Choice ◆ Second Choice ● Alternative ▲

Grade descriptions — pages M 36–37

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 a 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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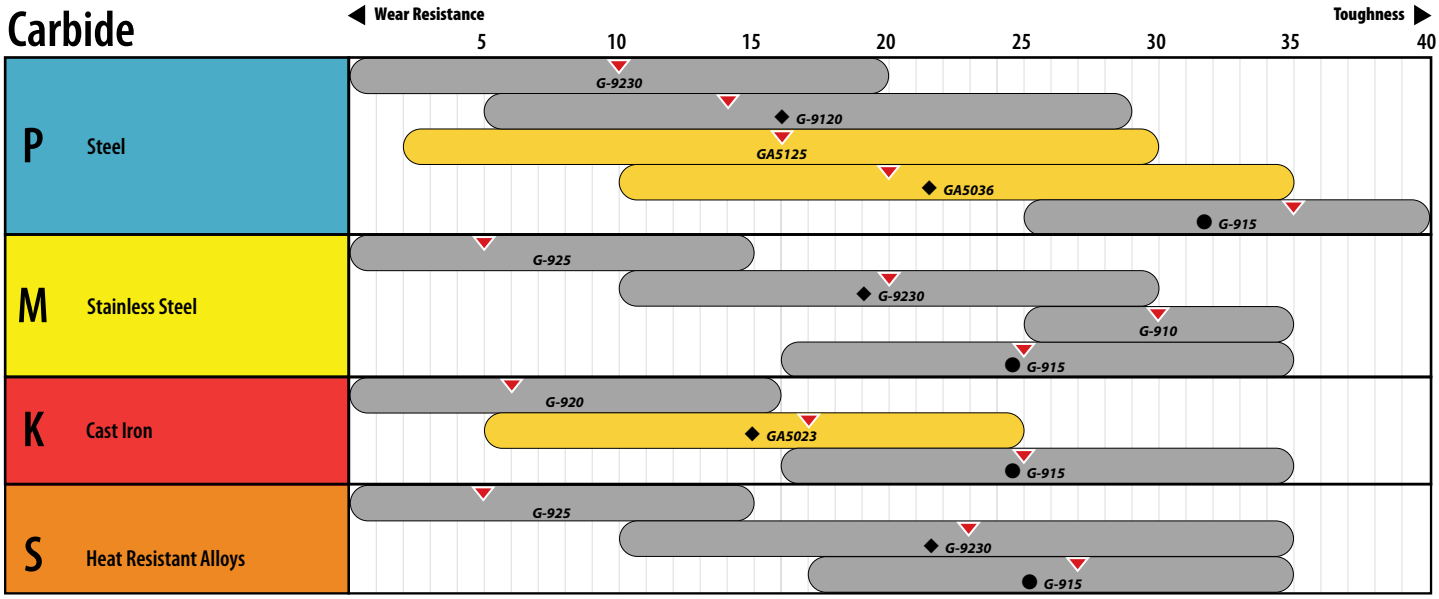
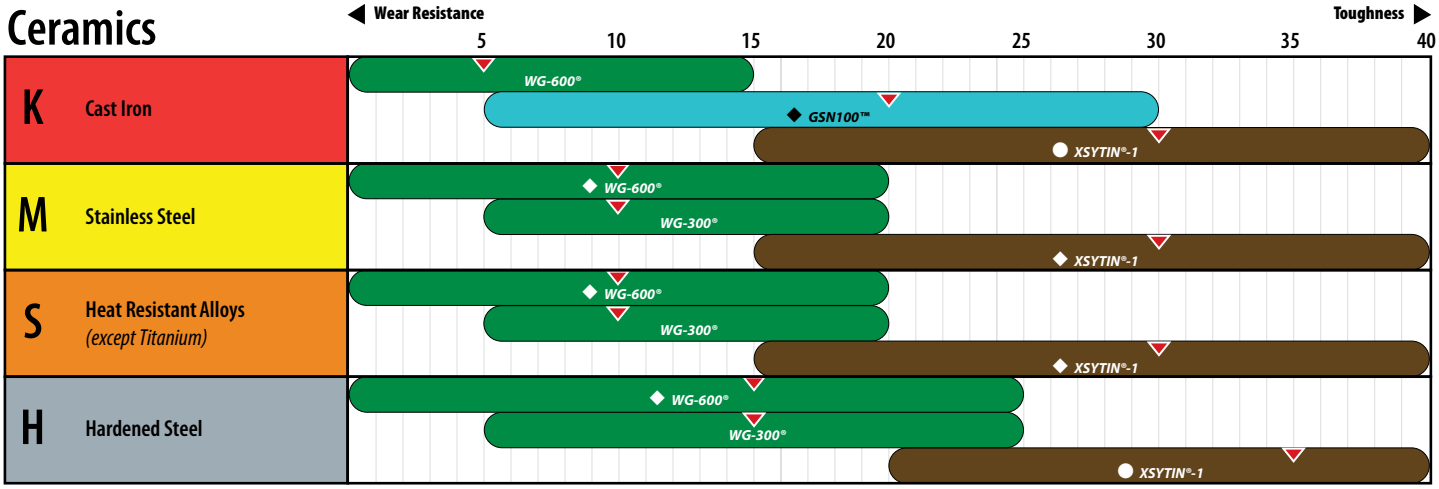
Insert Grade Reference for Milling

Carbide



CARBIDE COATINGS: MT-CVD Coated | PVD Coated | Uncoated First Choice ◆ Second Choice ●

Ceramics



CERAMIC CLASSIFICATION: Whisker Ceramic | Phase-Toughened | Silicon Nitride | Alumina TiC First Choice ◆ Second Choice ●

Insert Grades

Carbide

Greenleaf offers a comprehensive line of carbide inserts ranging from sub-micron C-1 through C-8 classifications in uncoated, MT-CVD coated and PVD coated options. Carbide inserts are available in ANSI standard geometries that support the various milling products that are offered.

CVD Coated

GA5023
A high-performance grade designed for the turning and milling of various grades of cast iron, GA5023 features an advanced MT-CVD coating specifically developed to withstand the abrasiveness of cast iron in machining. Applications range from roughing to finishing in most grades of cast iron, including gray, nodular, and others. The high wear resistance and toughness of GA5023 enable high-speed machining in a wide range of feed rates.

GA5036
A high-speed MT-CVD coated milling grade, GA5036 should be used when milling forged and cast steels and select ductile irons. GA5036 constitutes a unique combination of toughness and heat resistance, making it suitable for heavy and light-duty milling at high cutting speeds. It is a great first choice for all steel milling.

GA5125
A high-performance MT-CVD coated carbide used primarily for the milling and turning of manganese steel. GA5125 can also be applied in Cr-Mo steels, tool steels, and other alloyed steels in continuous and interrupted turning. GA5125 provides excellent resistance to abrasion, crater wear, thermal shock, deformation, and built-up edge. It performs best when applied at high speeds and moderate feed rates.

PVD Coated

G-910
A 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.

PVD Coated *continued*

G-915
A multi-layer PVD-coated grade, G-915 is exceptional for milling and interrupted turning of heat-resistant alloys, stainless steels, and low-carbon steels. The coating adds heat and abrasion resistance to the tough substrate. G-915 should be used at moderate speeds and moderate to high feeds. It is a versatile grade that performs well in a variety of materials and operations outside its primary application range, making it a great choice for general machining.

G-9120
This multi-layer PVD-coated carbide grade excels at milling and turning steel castings and forgings. G-9120 was engineered specifically to maximize productivity at moderate to heavy feed rates and high depths of cut, making it ideal for heavy-turning applications in steel.

G-9230
A PVD-coated grade designed for the machining of heat-resistant alloys, titanium, and hardened and stainless steels. G-9230 works particularly well in stainless steel turning, interrupted turning of HRSA, and interrupted turning of titanium. G-9230 has superior wear resistance and toughness and is excellent for casting and forging scale conditions.

G-925
A high-performance multi-layer PVD-coated grade, G-925 is specifically designed for turning abrasive and difficult-to-machine materials. Typical applications include turning of HRSA, titanium and other refractory metals, stainless steels, and ductile cast irons. G-925 exhibits excellent resistance to notching and deformation. Apply at moderate to high speeds and moderate feeds.

G-935
A multi-layer PVD-coated grade for steel milling and turning applications requiring additional resistance to mechanical and thermal shock. The multi-layered PVD coating raises the speed envelope and wear resistance in tough milling, indexable drilling, and interrupted turning applications.

Uncoated

G-01
Developed for milling heat-resistant alloys, stainless steel, and low-carbon steels at low speeds and moderate to high feeds, G-01 can also be used for turning in the same range of materials with severe interruption or old machinery.

G-01M
A tough sub-micron grade, G01M is used for milling and rough turning stainless steels– even when rolling or casting skin is present. The edge strength of G-01M allows the use of sharp edges and high positive rakes in continuous or interrupted cuts.

G-02
An excellent general-purpose cast-iron grade, G-02 can be used for milling and turning cast iron at moderately high speeds and medium feeds. G-02 is also a good choice for machining aluminum with positive rakes and light roughing of some heat-resistant alloys and stainless steels.

G-53
An excellent general-purpose milling grade for steels at moderate speeds and feeds. G-53 has a good combination of toughness and wear resistance for milling, or can be used as an all-around grade for mixed-production applications.

G-60
Used for the milling of steel, steel castings, and steel forgings. Apply G-60 at moderate speeds and heavy feed rates and depths of cut. G-60 is more wear-resistant than G-50 but is lower in toughness.

Ceramic

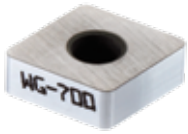
Greenleaf is the leader in the development and manufacture of ceramic and coated ceramic inserts. ANSI standard geometries are offered to fit in many of the milling lines offered.

WG-300®

A SiC whisker-reinforced Al_2O_3 ceramic that is very effective at machining nickel- and cobalt-based super alloys, alloyed cast iron, and hardened steels at metal removal rates up to 10 times higher than carbide. Excellent chemical stability and wear resistance at very high cutting speeds make WG-300® the first choice worldwide for grooving and turning difficult materials.

WG-600®

A coated SiC whisker-reinforced Al_2O_3 ceramic that offers higher tool life and speed capabilities than uncoated whisker-reinforced ceramics due to the additional barrier to heat and mechanical abrasion. Application areas for WG-600® include rough and finish turning of alloys in the M, K, S, and H ISO material classes, as well as milling of hardened steels and select stainless steels. WG-600® is particularly well-suited for finish-turning and grooving of heat-resistant super alloys and is unmatched in both turning and milling of steels with a hardness above 60 HRc.



WG-700™™

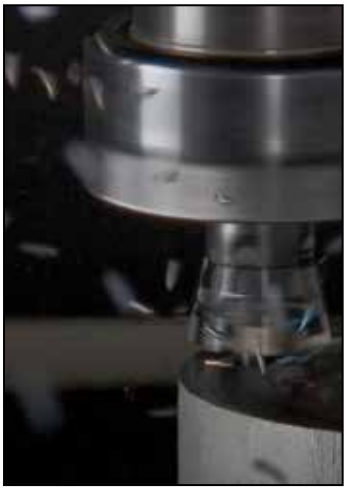
A SiC whisker-reinforced Al_2O_3 ceramic featuring improved toughness and a unique low-friction coating. WG-700™ is ideal for turning, grooving, and profiling nickel- and cobalt-based super alloys that other ceramics may struggle in. WG-700™ exhibits exceptional tool life and productivity in next-generation formulations or novel heat treatments of heat-resistant super alloys, and long-reach or thin-walled applications with lower rigidity.

XSYTIN®-1

A phase-toughened ceramic grade capable of sustaining extreme cutting forces. The unprecedented strength, impact toughness, and resistance to thermal shock of XSYTIN®-1 make it ideal for use in interrupted cuts, forging scale removal, and milling. In continuous cuts, the strength of XSYTIN®-1 allows the use of significantly higher feed rates or depths of cut. In machining environments with severe interruptions and scale, the edge strength of XSYTIN®-1 allows the use of very light edge preparations, minimizing the force of impact and making for a much smoother cut.

GSN100™

An engineered blend of hot-pressed silicon nitride and proprietary toughening agents that excels in the machining of cast iron. GSN100™ delivers superior wear and toughness for turning, grooving, and milling applications. It is available in all standard geometries and engineered specials.



Screw Torque Settings

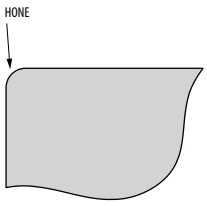
Screw Type	Part Number	Screw Torque (Nm)	Wrench
Insert Screw	PT-589T	0,9	T7
	313631	0,9	T7
	PT-542T	0,9	T7
	PT-559T	2,5	T15
	312679	2,5	T15
	PT-546T	5,0	T20
	SM30-083	2,0	T10
	SM40-106	2,9	T15
	SM50-139	4,4	T20
	SM60-167	5,8	T25
	SM70-210	10,7	T20
Wedge Screw	MS-1595	9,6	T30
	STCM-8	10,7	M4
Nest Screw	C0-5018	7,9	T20
Anvil Screw	FHCS M3-0.5x6mm	1,0	M2
	FHCS M5-0.8x20mm	6,8	M3
Clamp Screw	SHCS M5-0.8x12mm	13,6	M4
	438920	13,6	T25
	SHCS M2.5-.45x6mm	1,7	M2
	MS-1156	3,4	T15
	PT-488T	2,5	T10
	C03508	2,5	T15
	PT-317T	2,3	T10
	BHCS M4-0.7x10mm	3,4	M25
	PT-542T	1,7	T7
	SE02-01	4,0	T15
	SE03-72	7,9	T20
Back-Up Plate Screw	FHCS M3-0.5x10mm	1,5	M2

Excelerator® Mills

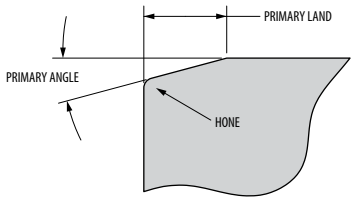
Setup and Operational Procedures

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 Greenleaf Tech Team. Contact the Greenleaf Tech Team at: 814-763-2915 or by email: techteam@greenleafcorporation.com
5. For safety purposes, do not exceed the maximum RPMs 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.

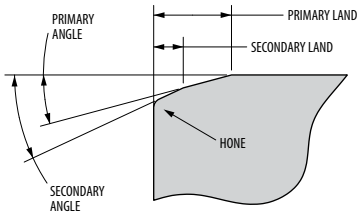
Ceramic Edge Preparations



HONE



PRIMARY ANGLE



SECONDARY ANGLE

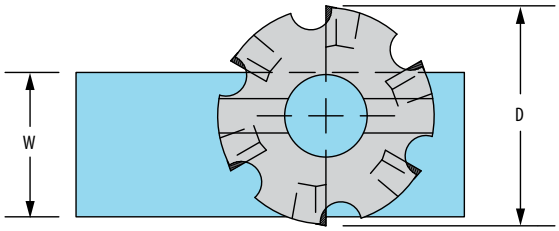
Edge Prep	Hone	Primary Land	Primary Angle	Application
A	0,015mm R.			Light hone added to designated lands and chipforms • **XSYTIN®-1** – General-purpose milling of HRSA, hardened steel, and maraging steel
T1		0,07mm	20°	• **XSYTIN®-1** – General-purpose milling of high-hardness HRSA, and hardened steel
T1A	0,015mm R.	0,07mm	20°	• **WG-300®/600/700** – Light-medium milling of hardened steel, milling HRSA, general-purpose turning and milling of stainless steel • **XSYTIN®-1** – Same applications as T1 where the interruption or hardness gradient and size of hard particles are greater - particularly in HRSA forging scale
T2		0,17mm	20°	Used in the same applications as T1 but at heavier depths of cut and/or heavier feed rates • **GSN100™** – General purpose grey, nodular, and CGI cast iron milling • **XSYTIN®-1** – General purpose grey, nodular, and CGI cast iron milling
T2A	0,015mm R.	0,17mm	20°	• **WG-300®/600/700** – Milling of grey and nodular cast iron, and hardened steel • **GSN100™** – Same applications as T2 where more edge strength and protection from irregular wear is required • **XSYTIN®-1** – General-purpose cast iron (including white cast iron, ADI, CGI) milling

Technical Data

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.

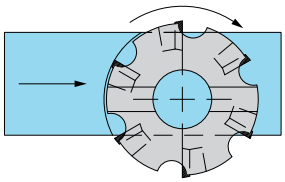
With smaller, low horsepower machines it will be better to select a smaller cutter and take two passes rather than a large diameter cutter forced to operate at low tooth loads (feed rates) to avoid stalling of the spindle.



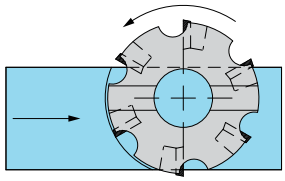
W = Width of work
D = Cutter diameter

Choose a cutter diameter approximately 1.5 times the workpiece width.

Hand of Cutters



Right-hand cutter



Left-hand cutter

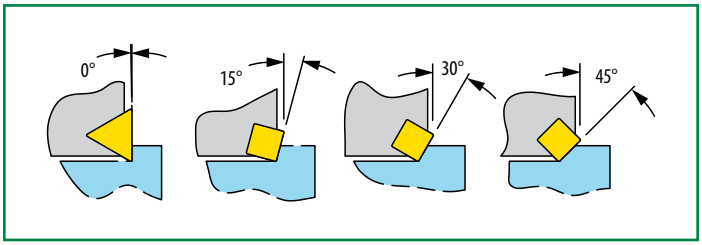
A *right-hand cutter* is one which, when viewed from above, rotates clockwise relative to the workpiece.

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

Lead Angles

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.

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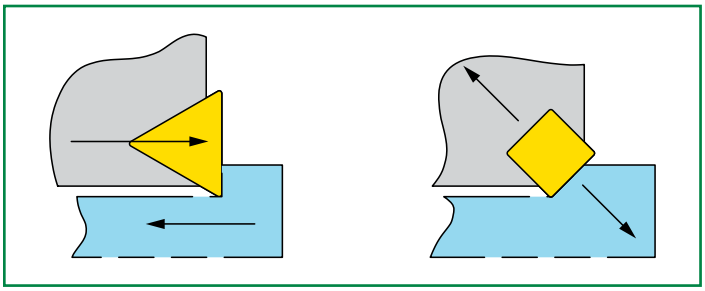
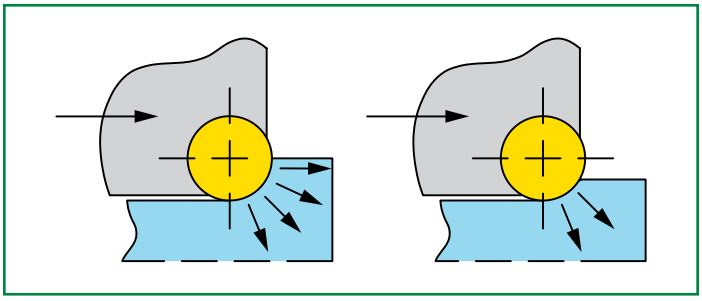


The Round Insert Cutter

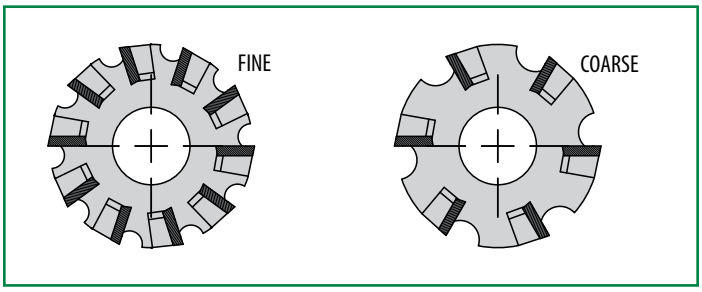
The exception to the rule in lead angle cutting forces is the round insert. With a round insert, the lead angle is entirely dependent upon the depth of cut. As the depth increases, the lead angle decreases. If cutting half the diameter deep, there is effectively 0° lead angle.



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.

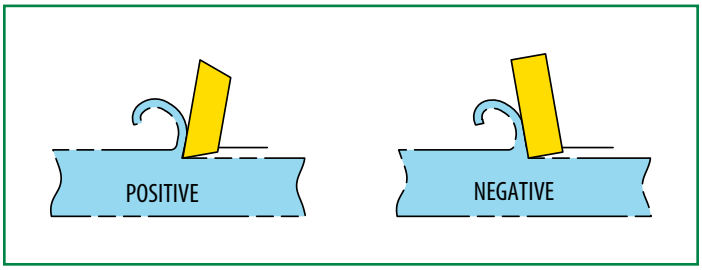
Negative Versus Positive Geometry

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.

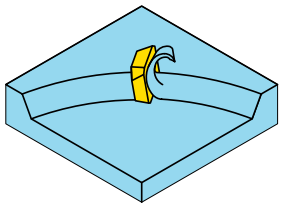
In general, use negative rakes for cast iron, interrupted cuts, and on rigid high horsepower machining for steels.

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



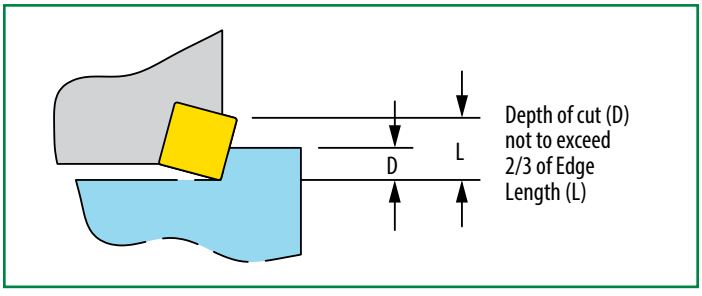
There are many milling cutters with a combination of positive and negative rakes often called shear-angle design. These cutters offer some of both worlds, although inserts are essentially like positive inserts and cannot be turned over. Shear angle cutters do provide continuous chip ejection since the 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.



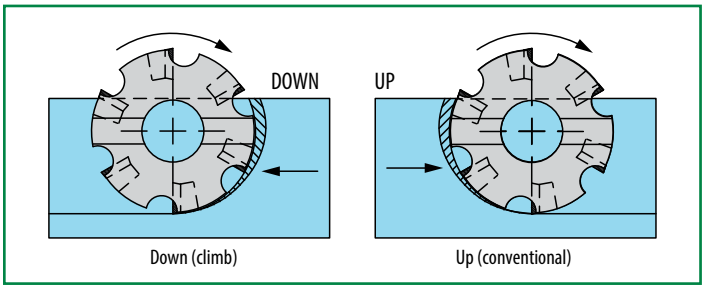
Depth of Cut

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.



Up Milling and Down Milling

This refers to direction of rotation relative to the feed.

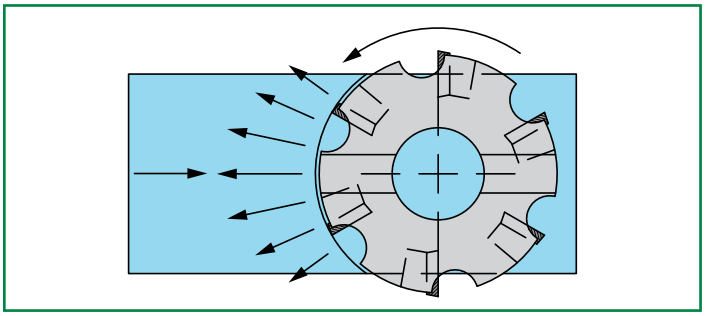


With a modern machine in good condition, down milling will give the best results. This is because the thickest section of the chip is against the insert to avoid welding, and pressure is progressively relieved towards the finished surface.

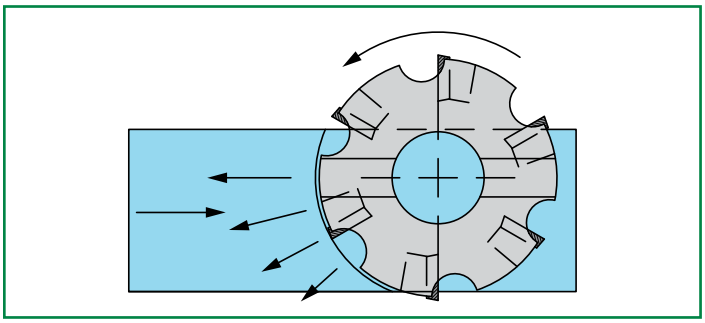
In up milling, friction and pressure build up before the chip starts to form, causing premature edge wear. It should be in rare cases that up milling is needed. This could be, for example, on an older machine with backlash in the table feed.

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.

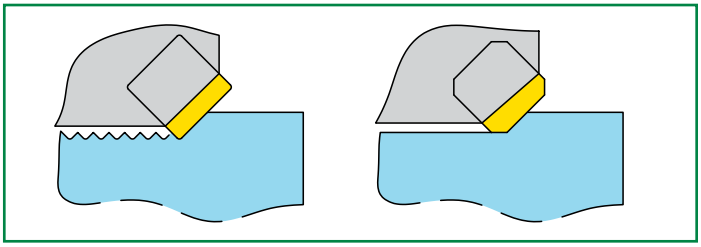


When moving off center, the path of cut is longer since each insert now sweeps a longer arc with each revolution. This may have a measureable impact on tool life, and cutting temperature will tend to increase.

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:

Vc	=	Cutting speed	m/min
D	=	Cutting diameter	mm
n	=	Spindle speed	rev/min

Cutting speed $Vc = \frac{(\pi \times D \times n)}{1000}$

Spindle speed $n = \frac{(Vc \times 1000)}{\pi \times D}$

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.

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:

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

Table feed: $Vf = fz \times n \times z$

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

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

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

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

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

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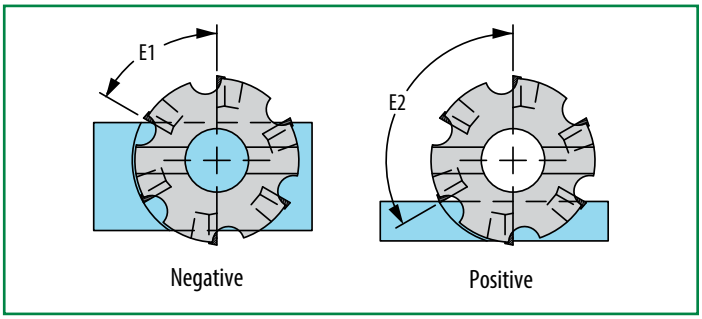
Angle of Entry

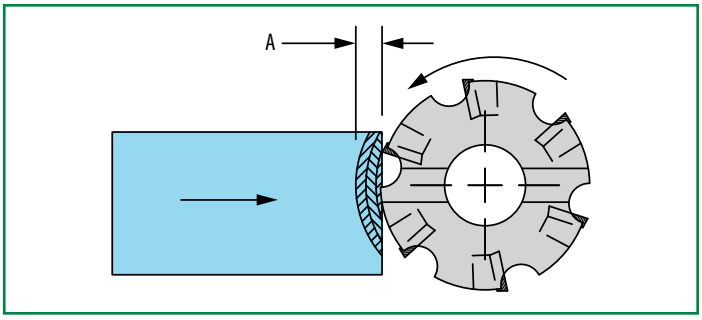
In face milling operations, the angle of entry can have a significant impact upon insert performance. A positive angle of entry can cause breakage or chipping, especially when using positive inserts. Positive angle of entry will occur when the path of cut is narrow relative to cutter diameter.



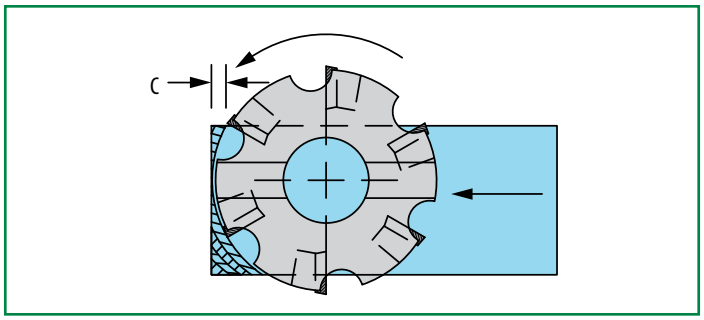
1. When the angle of entry (E1) is less than 90°, the initial impact occurs at a position behind the point of the tool. The insert has a greater section and is stronger here and better able to withstand the impacts.

2. When the angle of entry (E2) is greater than 90°, 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.

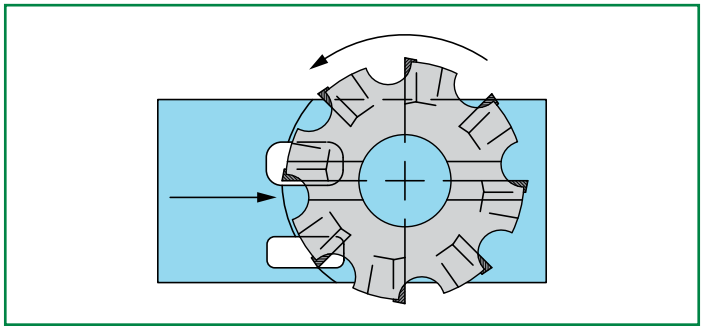
At this point, the cutter breaks through in the center, leaving two islands of material. Changes of entry angle occur which can result in insert problems. As in entry into the part, a reduction of feed rate can help alleviate chipping or breakage problems if they arise.

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:

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

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.

For Additional Information about Milling with Ceramics

For additional information about milling with ceramics, go to the Application and Technical Information (ATI) section of the catalog.