

STANDARD & SPECIAL PRODUCT RANGE

• HSS, HSCO & PM Standards •

GU 500 DZ Universal Drills
 GT 500 DZ High Performance Drills
 GT 100 Parabolic Flute Deep Hole Drills
 Coolant-Through GT 100 IC Parabolic Flute Deep Hole Drills
 GT 80 Parabolic Flute Deep Hole Drills
 Coolant-Through GT 80 IC Parabolic Flute Deep Hole Drills
 GT 50 Parabolic Flute Deep Hole Drills
 General Purpose Drills
 Heavy Duty Drills
 Heavy Duty Split Point Drills
 Low Helix Drills
 High Helix Drills
 Micro-Precision Drills
 NC Spot Drills
 Drill-Countersinks
 High Performance HSS-E Taps
 High Performance PM HSS-E Taps

• HSS & HSCO Specials •

Drills
 Step Drills
 Step Drill Reamers
 Step Core Drills
 Step Core Drill Reamers
 Reamers
 Step Reamers
 Subland Drills
 Subland Drill Reamers
 Subland Core Drills
 Taps

• Carbide Standards •

RT 100 U/F High Penetration Drills
 RT 100 X High Penetration Drills
 RT 100 R High Penetration Drills
 RT 100 T Deep Hole Drills
 RT 100 VA Drills for Stainless Steels
 Coolant-Through RT 100 U/F/C High Penetration Drills
 Coolant-Through RT 150 GG Straight-Flute High Penetration Drills
 Coolant-Through HT/RT 800 WP Interchangeable Insert Drills
 GS 200 U/G Three-Flute High Precision Drills
 GT 100 Parabolic Flute Deep Hole Drills
 Exclusive Line® Small-Diameter Drills
 EB 100 Small-Diameter Single-Flute Gun Drills
 General Purpose Drills
 NC Spot Drills
 PRO-Line Universal End Mills
 TECH-Line High Performance End Mills

• Carbide Specials •

Drills
 RT High Performance Drills
 G Drills
 Gun Drills
 Three- & Four-Flute Drills
 Step Drills
 Step Drill Reamers
 Step Core Drills
 Step Core Drill Reamers
 Reamers
 Step Reamers
 Subland Drills
 Subland Drill Reamers
 Subland Core Drills
 Taps
 End Mills

• PCD Specials •

• Coating Services •

Titanium Nitride (TiN)
 Titanium Carbonitride (TiCN)
 Titanium Aluminum Nitride (TiAlN)
 FIREX® Special Multilayer Hard Coating
 Super A (AlTiN)
 MolyGlide® Lubricating Soft Coating
 Nitride/Steam Oxide
 nano-FIREX® micro thin film gradient structure
 nano-A™ micro thin film gradient structure

• Reconditioning Service •

• GM 300 Modular HSK • Toolholding System

Hydraulic/Shrink/Collet Chucks
 Adapters
 Collets

• GE 100 Modular • Tooling System

GUHRING

The Tool Company

ISO 9001:2000 CERTIFIED

Guhring, Inc.
 P.O. Box 643, Brookfield, WI 53008-0643

Shipping Address
 1445 Commerce Avenue
 Brookfield, WI 53045
 Tel (262) 784-6730 (800) 776-6170
 Fax (262) 784-9096

West Coast Distribution Center
 17902 Georgetown Lane
 Huntington Beach, CA 92647
 Tel (714) 841-3582 (800) 877-7202
 Fax (714) 841-3592

Guhring Corporation
 20 Steckle Place, Unit #14
 Kitchener, ON N2E 2C3
 Tel (519) 748-9664 (800) 463-5555
 Fax (519) 748-2954

Form 001-038 03/2011

DISTRIBUTED BY:

GUHRING

The Tool Company

2010 High Performance End Mills

GUHRING

2010 HIGH PERFORMANCE SOLID CARBIDE END MILLS

- NEW styles of Variable Helix end mills
- NEW diamond-coated routers for composites
- Expanded size ranges
- Extensive corner radius selections

The Guhring Group



Dietmar Pfränger
Production and
Technical Director

Dr. Jörg Gühring
President,
Research and Development

Oliver Gühring
Sales and Marketing
Director

Bernd Schatz
Financial and
Commercial Director

Dear customer,

Guhring is today one of the world's leading suppliers of rotary cutting tools. The current product range includes more than 1,620 different tool types and more than 44,000 different products. The reason for our success is our 4,500 employees worldwide – 350 in the USA. The leading principle of our company strategy is customer satisfaction. Herein lay our strengths.

Manufacturing expertise

With our own carbide production, coating technology, machine and equipment division as well as development departments for the core competences we have direct influence over the essential parameters for the efficiency of the tool: tool material, geometry and coating.

Product know-how

Our employees have all the knowledge and experience accumulated in the company's more than one hundred years existence. Simultaneously, our R&D center continuously provides innovations and optimizes tool performance in our testing facility with the assistance of state-of-the-art technologies.

Innovation proficiency

In 1980, Guhring was the first tool manufacturer to coat drilling tools with TiN, achieving a considerable increase in tool performance. In addition, the development of HSK shows the performance capabilities of our R&D center. Currently, Guhring is the forerunner in MQL machining and the machining of new materials such as CGI and ADI.

Global service

Guhring is represented in 56 countries, in 32 of these with Guhring subsidiaries. Here we produce tools for our worldwide customer base and ensure a constant supply of tools to our customers via refurbishment or within the scope of Tool Management Projects. All production plants apply the same materials and have identical machines and facilities at their disposal. Customers can rely on identical high quality Guhring standards anywhere in the world.

Tool Division

Rotary cutting tools are our core business. There is no other competitor who produces an equally large range of cutting tools, especially in carbide. We also produce tools in high speed steel and in the high-tech tool materials cermet, PCD/CBN and ceramic for our customers.

Machine and equipment division

To ensure the geometries, tool materials and coatings are converted into precision tools of the highest quality with an optimal cost-efficiency, Guhring's machine and equipment division designs and produces the most important manufacturing equipment for our tool production.

Service Division

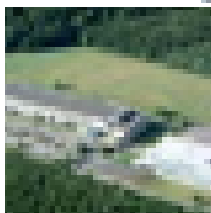
To enable customers to fully utilize the potential of their Guhring tools, we provide comprehensive services such as re-grinding and re-coating with original Guhring geometries and coatings, returning the original efficiency to the refurbished tools.

Carbide Division

Guhring's carbide development and production makes it possible to provide tools in application optimized tool materials, and to react immediately to new machining trends as well as materials. Customers benefit directly from the associated technology and cost advantages. Our carbide division and its annual carbide production of approximately 1,500 tons make Guhring one of the largest carbide producers world-wide.

We are privileged to continue to convince our customers through our efficiency!

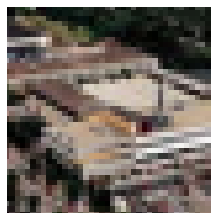
Dr. Jörg Gühring



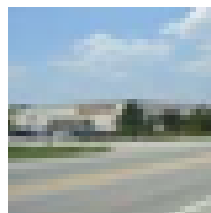
Factory
Sigmaringen-Laiz



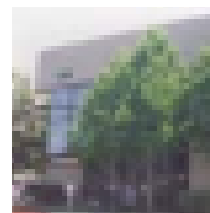
Carbide Plant Berlin



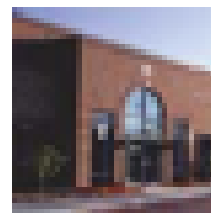
Precision Tools
Production, Berlin



Brookfield, WI



Huntington Beach, CA



Detroit, MI

Guhring Series No. Index

Series	Description	Type	Surface Finish	Page
NEW	3011 UNI PRO extra long length end mills (2-fluted), metric	N	Bright	122
NEW	3012 UNI PRO XL end mills (4-fluted), metric	N	Bright	137
NEW	3014 UNI PRO extra long length ball nose end mills (2-fluted), metric	N	Bright	143
NEW	3015 UNI PRO XL ball nose end mills (4-fluted), metric	N	Bright	148
NEW	3019 FINISH-TECH / GH 100 U standard length multi-flute end mills, metric	NH	Bright	92
NEW	3021 UNI PRO extra long length end mills (2-fluted), metric	N	FIREX®	122
	3023 UNI PRO XL end mills (4-fluted), metric	N	FIREX®	137
NEW	3024 UNI PRO standard length ball nose end mills (2-fluted), metric	N	Bright	141
	3030 UNI PRO XL ball nose end mills (2-fluted), metric	N	FIREX®	143
	3043 UNI PRO XL ball nose end mills (4-fluted), metric	N	FIREX®	148
NEW	3047 FINISH-TECH / GH 100 U standard length multi-flute end mills, metric	NH	FIREX®	92
NEW	3049 UNI PRO standard length ball nose end mills (2-fluted), metric	N	FIREX®	141
NEW	3059 ALUMI-TECH standard length end mills (2-fluted), metric	W	Bright	73
	3077 RF 100 A standard length variable helix end mills for aluminum	W	Bright	49
	3078 RF 100 F standard length variable helix end mills for materials < 30 HRC	NH	FIREX®	37
	3079 RF 100 U standard length variable helix end mills, corner radius, for materials < 54 HRC	N	FIREX®	29
	3080 RF 100 VA standard length variable helix end mills for stainless steels	N	nano-A™	39
	3081 RF 100 VA/NF standard length variable helix roughing-finishing end mills for stainless steels	NF	nano-A™	43
	3082 RF 100 U/HF standard length variable helix roughing-finishing end mills, for materials < 54 HRC	HF	FIREX®	33
NEW	3083 CR 100 carbide diamond coated routers for composite materials	n/a	Diamond	65
NEW	3084 CR 100 center cutting carbide diamond coated routers for composite materials	n/a	Diamond	64
	3086 AERO-TECH / GH 100 U stub length end mills (3-fluted)	NH	FIREX®	69
	3087 UNI PRO "R" standard length end mills (2-fluted), corner radius	N	FIREX®	124
	3088 UNI PRO "R" long length end mills (2-fluted), corner radius	N	FIREX®	126
	3089 UNI PRO "R" standard length end mills (4-fluted), corner radius	N	FIREX®	139
	3090 UNI PRO "R" XL end mills (4-fluted), corner radius	N	FIREX®	139
	3091 FINISH-TECH 50 / GH 100 U standard length multi-flute end mills, corner radius	NH	FIREX®	96
	3092 UNI PRO stub length end mills (2-fluted)	N	FIREX®	120
	3093 UNI PRO stub length end mills (4-fluted)	N	FIREX®	132
	3095 RF 50 stub length variable flute end mills (4-fluted)	N	FIREX®	57
	3096 RF 50 standard length variable flute end mills (4-fluted)	N	FIREX®	57
	3097 AERO-ROUGH 48 / RS 100 U standard length end mills	NF	FIREX®	79
	3098 AERO-ROUGH 56 / RS 100 F standard length end mills	NF	FIREX®	80
	3099 RF 100 U stub length variable helix end mills for materials < 54 HRC	N	FIREX®	25
	3100 RF 100 U standard length variable helix end mills for materials < 54 HRC	N	FIREX®	26
	3101 TRACE-TECH / GF 300 B standard length ball nose	H-HSC	FIREX®	114
NEW	3106 UNI PRO "R" standard length end mills (2-fluted), corner radius	N	Bright	125
NEW	3111 UNI PRO "R" standard length end mills (4-fluted), corner radius	N	Bright	138
NEW	3112 GH 100 U standard length multi-flute end mills, corner radius, metric	NH	Bright	97
	3113 RF 100 U stub length variable helix end mills for materials < 54 HRC	N	FIREX®	25
	3114 RF 100 U standard length variable helix end mills for materials < 54 HRC	N	FIREX®	26
	3115 RF 100 SF standard length 6-flute variable helix end mills for materials < 54 HRC	NH	FIREX®	53
NEW	3126 ALUMI-TECH standard length end mills (2-fluted), metric	W	Bright	72
	3127 ROUGH-TECH ALU / GS 100 A standard length end mills, coarse tooth, metric	WR	Bright	77
	3146 UNI PRO standard length end mills (2-fluted)	N	Bright	121
	3147 UNI PRO long length end mills (2-fluted)	N	Bright	123
	3148 UNI PRO standard length end mills (2-fluted)	N	FIREX®	121
	3149 UNI PRO long length end mills (2-fluted)	N	FIREX®	123
	3150 UNI PRO standard length end mills (4-fluted)	N	Bright	133
	3151 UNI PRO XL end mills (4-fluted)	N	Bright	136
	3152 UNI PRO long length end mills (4-fluted),	N	Bright	135
	3153 UNI PRO standard length end mills (4-fluted)	N	FIREX®	133
	3155 UNI PRO XL end mills (4-fluted)	N	FIREX®	136
	3156 UNI PRO long length end mills (4-fluted)	N	FIREX®	135
	3157 UNI PRO standard length ball nose end mills (2-fluted)	N	Bright	140
	3158 UNI PRO long length ball nose end mills (2-fluted)	N	Bright	142
	3159 UNI PRO standard length ball nose end mills (2-fluted)	N	FIREX®	140
	3160 UNI PRO long length ball nose end mills (2-fluted)	N	FIREX®	142
	3161 UNI PRO standard length ball nose end mills (4-fluted)	N	Bright	144
	3162 UNI PRO XL ball nose end mills (4-fluted)	N	Bright	147
	3164 UNI PRO long length ball nose end mills (4-fluted)	N	Bright	146

Guhring Series No. Index

Series	Description	Type	Surface Finish	Page
3165	UNI PRO standard length ball nose end mills (4-fluted)	N	FIREX®	144
3166	UNI PRO XL ball nose end mills (4-fluted)	N	FIREX®	147
3167	UNI PRO long length ball nose end mills (4-fluted)	N	FIREX®	146
3168	UNI PRO standard length end mills (3-fluted)	N	Bright	128
3169	UNI PRO XL end mills (3-fluted)	N	Bright	130
3170	UNI PRO standard length end mills (3-fluted)	N	FIREX®	128
3171	UNI PRO XL end mills (3-fluted)	N	FIREX®	130
3172	AERO-TECH / GH 100 A standard length end mills (3-fluted)	NH	Bright	70
3173	AERO-TECH / GH 100 U standard length end mills (3-fluted)	NH	FIREX®	70
3174	ALUMI-TECH standard length end mills (2-fluted)	W	Bright	73
3175	ALUMI-TECH long length end mills (2-fluted)	W	Bright	74
3177	ALUMI-TECH / GA 200 A long length end mills (3-fluted)	W	Bright	75
3178	FINISH-TECH / GH 100 U standard length multi-flute end mills	NH	Bright	91
3179	FINISH-TECH / GH 100 U standard length multi-flute end mills	NH	FIREX®	91
3180	FINISH-TECH / GH 100 U long length multi-flute end mills	NH	Bright	93
3181	FINISH-TECH / GH 100 U long length multi-flute end mills	NH	FIREX®	93
3182	FINISH-TECH / GH 100 H standard length multi-flute end mills	H	FIREX®	89
3183	FINISH-TECH / GH 100 H long length multi-flute end mills	H	FIREX®	90
3184	ROUGH-TECH ALU / GS 100 A standard length end mills, coarse tooth	WR	Bright	77
3186	ROUGH-TECH 48 / GS 100 U standard length end mills, fine tooth	NRF	Bright	83
3188	ROUGH-TECH 48 / GS 100 U standard length end mills, fine tooth	NRF	FIREX®	83
3189	ROUGH-TECH 54 / GS 100 H standard length end mills, fine tooth	HR	FIREX®	86
3190	ROUGH-TECH 54 / GS 100 H long length end mills, fine tooth	HR	FIREX®	87
3191	TRACE-TECH / GF 300 B long length ball nose	H-HSC	FIREX®	116
3192	TRACE-TECH / GF 300 T long length cutters, Torus	H-HSC	FIREX®	112
3202	RF 100 A standard length variable helix end mills for aluminum, metric	W	Bright	49
3203	AERO-TECH / GH 100 U standard length end mills (3-fluted), metric	NH	Bright	70
3204	ROUGH-TECH 48 / GS 100 U standard length end mills, fine tooth, metric	NRF	Bright	84
3303	UNI PRO standard length end mills (2-fluted)	N	Bright	122
3304	UNI PRO standard length end mills (4-fluted)	N	Bright	134
NEW 3306	UNI PRO standard length ball nose end mills (4-fluted), metric	N	Bright	145
NEW 3307	UNI PRO standard length end mills (3-fluted), metric	N	Bright	129
NEW 3308	UNI PRO standard length ball nose end mills (2-fluted), metric	N	Bright	141
3309	ALUMI-TECH standard length end mills (2-fluted), metric	W	Bright	73
NEW 3310	ALUMI-TECH standard length end mills (2-fluted), metric	W	Bright	72
3311	FINISH-TECH / GH 100 U standard length multi-flute end mills, metric	NH	Bright	92
3312	FINISH-TECH / GH 100 U XL multi-flute end mills, metric	NH	Bright	94
3313	FINISH-TECH / GH 100 U XL multi-flute end mills, metric	NH	Bright	94
NEW 3314	UNI PRO XL end mills (3-fluted), metric	N	Bright	131
NEW 3319	RF 100 A standard length variable helix end mills for aluminum, metric	W	Bright	49
NEW 3358	ALUMI-TECH long length end mills (2-fluted), metric	W	Bright	74
3359	TRACE-TECH / GF 300 B standard length ball nose, metric	H-HSC	FIREX®	115
3360	TRACE-TECH / GF 300 B XL ball nose, metric	H-HSC	FIREX®	117
3362	TRACE-TECH / GF 300 T XL hard profile cutters, Torus, metric	H-HSC	FIREX®	113
3364	ROUGH-TECH ALU / GS 100 A standard length, coolant fed end mills, coarse tooth, metric	WR	Bright	77
3365	ROUGH-TECH 48 / GS 100 U standard length, coolant fed end mills, fine tooth, metric	NRF	FIREX®	84
3366	RF 100 F standard length variable helix end mills, coolant through, for materials < 30 HRC, metric	NH	FIREX®	37
3367	ALUMI-TECH / GA 200 A standard length, coolant fed end mills (3-fluted), metric	W	Bright	75
NEW 3468	RF 100 AWF standard length variable helix rougher for aluminum, metric	WF	Bright	51
NEW 3469	RF 100 AWF standard length variable helix rougher for aluminum, metric	WF	Bright	51
NEW 3470	RF 100 AWF long length variable helix rougher for aluminum, metric	WF	Bright	51
NEW 3471	RF 100 AWF long length variable helix rougher for aluminum, metric	WF	Bright	51
NEW 3498	RF 100 Ti standard length variable helix end mills, corner radius, for titanium alloys, metric	N	Super-A™	47
NEW 3499	RF 100 Ti standard length variable helix end mills, corner radius, for titanium alloys, metric	N	Super-A™	47
NEW 3507	RF 100 U/HF standard lgth variable helix roughing-finishing end mills, for materials < 54 HRC, metric	HF	FIREX®	33
NEW 3508	RF 100 U/HF standard lgth variable helix roughing-finishing end mills, for materials < 54 HRC, metric	HF	FIREX®	33
NEW 3509	RF 100 U/HF long length variable helix roughing-finishing end mills, for materials < 54 HRC, metric	HF	FIREX®	34
NEW 3522	RF 100 U/HF long length variable helix roughing-finishing end mills, for materials < 54 HRC, metric	HF	FIREX®	34
NEW 3540	AERO-TECH / GH 100 U stub length end mills (3-fluted), metric	NH	FIREX®	69
NEW 3558	UNI PRO stub length end mills (3-fluted), metric	N	FIREX®	127

Index

Guhring Series No. Index

Series	Description	Type	Surface Finish	Page
3561	UNI PRO "R" standard length end mills (2-fluted), corner radius, metric	N	FIREX®	125
3562	UNI PRO "R" standard length end mills (4-fluted), corner radius, metric	N	FIREX®	138
3563	GH 100 U standard length multi-flute end mills, corner radius, metric	NH	FIREX®	97
NEW 3598	RF 100 U/HF extra long variable helix roughing-finishing end mills, for materials < 54 HRC, metric	HF	FIREX®	34
NEW 3600	RF 100 U/HF extra long variable helix roughing-finishing end mills, for materials < 54 HRC, metric	HF	FIREX®	34
3627	RF 100 U long length variable helix end mills for materials < 54 HRC, metric	N	FIREX®	28
3629	RF 100 F standard length variable helix end mills for materials < 30 HRC, metric	NH	FIREX®	37
3630	RF 100 F standard length variable helix end mills for materials < 30 HRC, metric	NH	FIREX®	37
NEW 3631	RF 100 SF standard length 6-flute variable helix end mills for materials < 54 HRC, metric	NH	FIREX®	53
NEW 3632	RF 100 SF standard length 6-flute variable helix end mills for materials < 54 HRC, metric	NH	FIREX®	53
NEW 3633	UNI PRO stub length end mills (2-fluted), metric	N	FIREX®	120
NEW 3634	UNI PRO stub length end mills (2-fluted), metric	N	FIREX®	120
NEW 3637	UNI PRO stub length end mills (4-fluted), metric	N	FIREX®	132
3676	UNI PRO standard length end mills (2-fluted), metric	N	FIREX®	122
3677	UNI PRO standard length end mills (3-fluted), metric	N	FIREX®	129
3678	UNI PRO standard length end mills (4-fluted), metric	N	FIREX®	134
3679	UNI PRO standard length ball nose end mills (2-fluted), metric	N	FIREX®	141
3680	UNI PRO XL end mills (3-fluted), metric	N	FIREX®	131
3682	ROUGH-TECH 54 / GS 100 H standard length end mills, fine tooth, metric	HR	FIREX®	87
3689	FINISH-TECH / GH 100 U standard length multi-flute end mills, metric	NH	FIREX®	92
3691	FINISH-TECH / GH 100 U XL multi-flute end mills, metric	NH	FIREX®	94
3693	FINISH-TECH / GH 100 U XL multi-flute end mills, metric	NH	FIREX®	94
NEW 3696	RF 100 VA/NF standard lgth variable helix roughing/finishing end mills for stainless steels, metric	NF	nano-A™	43
3715	FINISH-TECH / GH 100 H standard length multi-flute end mills, metric	H	FIREX®	89
NEW 3716	FINISH-TECH / GH 100 H long length multi-flute end mills, metric	H	FIREX®	90
NEW 3718	RF 100 VA/NF standard lgth variable helix roughing/finishing end mills for stainless steels, metric	NF	nano-A™	43
NEW 3719	UNI PRO stub length end mills (3-fluted), metric	N	FIREX®	127
NEW 3721	UNI PRO stub length end mills (4-fluted), metric	N	FIREX®	132
3723	ROUGH-TECH 48 / GS 100 U standard length end mills, fine tooth, metric	NRF	FIREX®	84
3727	UNI PRO standard length ball nose end mills (4-fluted), metric	N	FIREX®	145
NEW 3729	AERO-TECH / GH 100 U stub length end mills (3-fluted), metric	NH	FIREX®	69
3731	RF 100 U stub length variable helix end mills for materials < 54 HRC, metric	N	FIREX®	25
3732	RF 100 U standard length variable helix end mills for materials < 54 HRC, metric	N	FIREX®	26
NEW 3733	RF 100 VA/NF long length variable helix roughing/finishing end mills for stainless steels, metric	NF	nano-A™	44
3736	RF 100 U standard length variable helix end mills for materials < 54 HRC, metric	N	FIREX®	26
3741	AERO-TECH / GH 100 U standard length end mills (3-fluted), metric	NH	FIREX®	70
NEW 3800	RF 100 VA standard length variable helix end mills for stainless steels, metric	N	nano-A™	40
NEW 3803	RF 100 VA standard length variable helix end mills for stainless steels, metric	N	nano-A™	40
NEW 3804	RF 100 VA stub length variable helix end mills for stainless steels, metric	N	nano-A™	39
NEW 3805	RF 100 VA stub length variable helix end mills for stainless steels, metric	N	nano-A™	39
NEW 3806	RF 100 VA long length variable helix end mills for stainless steels, metric	N	nano-A™	40
NEW 3807	RF 100 VA long length variable helix end mills for stainless steels, metric	N	nano-A™	40
NEW 3837	RF 100 U long length variable helix end mills w/reduced neck for materials < 54 HRC, metric	N	FIREX®	27
NEW 3838	RF 100 U long length variable helix end mills w/reduced neck for materials < 54 HRC, metric	N	FIREX®	27
NEW 3839	RF 100 U long length variable helix end mills for materials < 54 HRC, metric	N	FIREX®	27
3846	UNI PRO standard length end mills (2-fluted)	N	Super-A™	121
3847	UNI PRO long length end mills (2-fluted)	N	Super-A™	123
3848	GF 500 B HSC standard length ball nose profile cutters, metric	N-HSC	TiAIN	105
3849	GF 500 B HSC XL ball nose profile cutters, metric	N-HSC	TiAIN	106
3850	UNI PRO standard length end mills (4-fluted)	N	Super-A™	133
3851	UNI PRO XL end mills (4-fluted)	N	Super-A™	136
3852	UNI PRO end mills (4-fluted), long length	N	Super-A™	135
3853	GF 500 B HSC XL ball nose profile cutters, metric	N-HSC	TiAIN	107
3854	GF 500 B HSC standard length ball nose profile cutters, metric	N-HSC	TiAIN	109
3855	GF 500 B HSC long length ball nose profile cutters, metric	N-HSC	TiAIN	108
3856	GF 500 T HSC standard length profile cutters with Torus form, metric	N-HSC	TiAIN	100
3857	UNI PRO standard length ball nose end mills (2-fluted)	N	Super-A™	140
3858	UNI PRO long length ball nose end mills (2-fluted)	N	Super-A™	142
3859	GF 500 T HSC XL profile cutters with Torus form, metric	N-HSC	TiAIN	101
3860	GF 500 T HSC XL profile cutters with Torus form, metric	N-HSC	TiAIN	102

Index

Series	Description	Type	Surface Finish	Page
3861	UNI PRO standard length ball nose end mills (4-fluted)	N	Super-A™	144
3862	UNI PRO XL ball nose end mills (4-fluted)	N	Super-A™	147
3863	GF 500 T HSC long length profile cutters with Torus form, metric	N-HSC	TiAlN	104
3864	UNI PRO long length ball nose end mills (4-fluted)	N	Super-A™	146
3865	GF 500 T HSC long length profile cutters with Torus form, metric	N-HSC	TiAlN	103
3866	GF 500 B HSC long length ball nose profile cutters, metric	N-HSC	TiAlN	110
3867	DL 100 X2 standard length PCD high performance end mill	n/a	Bright	61
3868	UNI PRO standard length end mills (3-fluted)	N	Super-A™	128
3869	UNI PRO XL end mills (3-fluted)	N	Super-A™	130
3870	DL 100 X2 standard length PCD high performance end mill	n/a	Bright	61
NEW 3871	RF 100 U long length variable helix end mills for materials < 54 HRC, metric	N	FIREX®	27
NEW 3872	RF 100 U standard length variable helix end mills w/corner radius for materials < 54 HRC, metric	N	FIREX®	29
NEW 3873	RF 100 U standard length variable helix end mills w/corner radius for materials < 54 HRC, metric	N	FIREX®	29
3874	ALUMI-TECH standard length end mills (2-fluted)	W	Super-A™	73
3875	ALUMI-TECH long length end mills (2-fluted)	W	Super-A™	74
3876	RF 100 Ti standard length variable helix end mills, corner radius, for titanium alloys	N	Super-A™	46
NEW 3877	ALUMI-TECH / GA 200 A standard length end mills (3-fluted)	W	Super-A™	75
3884	ROUGH-TECH ALU / GS 100 A standard length end mills, coarse tooth	WR	Super-A™	77
NEW 3885	RF 100 VA/NF long length variable helix roughing/finishing end mills for stainless steels, metric	NF	nano-A™	44
3886	ROUGH-TECH 48 / GS 100 U standard length end mills, fine tooth	NRF	Super-A™	83
NEW 3887	AERO-ROUGH 48 / RS 100 U standard length end mills, metric	NF	FIREX®	79
NEW 3888	AERO-ROUGH 56 / RS 100 F standard length end mills, metric	NF	FIREX®	79
NEW 3889	AERO-ROUGH 56 / RS 100 F standard length end mills, metric	NF	FIREX®	80
NEW 3890	AERO-ROUGH 56 / RS 100 F standard length end mills, metric	NF	FIREX®	80
NEW 3891	RF 100 U 3-flute standard length variable helix end mills for materials < 54 HRC, metric	N	FIREX®	31
NEW 3892	RF 100 U 3-flute standard length variable helix end mills for materials < 54 HRC, metric	N	FIREX®	31
NEW 3893	RF 100 U 3-flute standard OAL/stub flute lgth variable helix end mills for materials < 54 HRC, metric	N	FIREX®	31
NEW 3894	RF 100 U 3-flute standard OAL/stub flute lgth variable helix end mills for materials < 54 HRC, metric	N	FIREX®	31
NEW 3895	RF 100 H standard length variable helix end mills for hardened steels up to 60 HRC, metric	H	TiAlN	55
NEW 3896	RF 100 H standard length variable helix end mills for hardened steels up to 60 HRC, metric	H	TiAlN	55
NEW 3897	RF 100 SF long length 5-flute variable helix end mills for materials < 54 HRC, metric	NH	FIREX®	54
NEW 3898	RF 100 SF long length 5-flute variable helix end mills for materials < 54 HRC, metric	NH	FIREX®	54
NEW 5492	Coolant fed high performance PCD end mill for aluminum and composites	N/A	Bright	62
NEW 5493	Coolant fed high performance PCD end mill for aluminum and composites	N/A	Bright	63

Index

Index



For well over 100 years, the name Guhring has been associated with cutting tool innovation and quality. High-production facilities on every continent rely on Guhring technology to elevate their productivity, and manufacturers of high-precision parts know that Guhring provides consistent quality and performance.

Now smaller machine shops can also enjoy the benefits of Guhring's well-known cutting tool expertise with **GUHRING Select**, a new category of stocked standard carbide

drills, taps and variable helix carbide end mills. This category is comprised of existing cutting tool series; current products which are already favorites in many machine shops across the United States.

Each **GUHRING Select** series has been chosen because of its versatility in a wide range of materials and machining operations, to provide you with a full compliment of quality drill, tap and end mill options at an economical price. These top-quality carbide tools will increase your productivity, and because they're **GUHRING Select**, you can *save 22% - 40%* over similar style tools by purchasing them. For the 3-man shop or the high-production facility, Guhring has a **GUHRING Select** tool which can help increase profitability.

Look for the **Guhring Select** logo to quickly identify these economical cutting tool choices.

QUICK FINDER

page 8

RF-LINE

- High Performance End Mills with Variable Helix designs

page 24

DIAMOND-TECH

- PCD-tipped End Mills
- Diamond Coated Routers

page 60
page 64

TECH-LINE

- High Performance End Mills
- HSCTrace Mills and Profile Cutters

page 68
page 98

PRO-LINE

- General Purpose End Mills
- General Purpose Corner Radius & Ball Nose End Mills

page 120
page 138

TECHNICAL SECTION

page 152









FEEDS AND SPEEDS

page 160

QUICK-FINDER - RF 100 Variable Helix end mill selection guide

Application			Slot drilling  1 x d	Roughing  0.3-0.8 x d	Finishing  > 0.1 x d	Super finishing  0.1 x d	
Material/ Application group	Hardness tensile strength	Example material	Rigid conditions:  - good cooling - sufficient performance - short-chipping	Unstable conditions:  - standard cooling - average performance - medium- to long-chipping	Finishing: 		
Steel 	up to 28 HRc	1045 / 5115	RF 100 F Series #3078	RF 100 VA/NF Series #3081	RF 100 S/F Series #3115		
	above 28 HRc	4140	RF 100 U Series #3114	RF 100 U/HF Series #3082			
Stainless steel 	up to 28 HRc	304 / 303	RF 100 VA Series #3080	RF 100 VA/NF Series #3081			
	above 28 HRc	316Ti	RF 100 F Series #3078	RF 100 VA/NF Series #3081			
Cast iron 	up to 180 HB 30	Gray Cast	RF 100 F Series #3078	RF 100 U/HF Series #3082			
	above 180 HB 30	GGG / GGT / GGv ductile	RF 100 U Series #3114	RF 100 U/HF Series #3082			
Aluminium 	up to 3% Si	Wrought Alloys	RF 100 A Series #3077	RF 100 A/WF Series #3469		RF 100 A Series #3077	
	above 3% Si	Cast Alloys	RF 100 F Series #3078	RF 100 A/WF Series #3469		RF 100 F Series #3078	
Ti- special alloys 	Ti-basis	TiAl6V4 Inconel 625	RF 100 Ti Series #3876	RF 100 U/HF Series #3082		RF 100 S/F Series #3115	
	Ni-basis	Inconel 728	RF 100 F Series #3078	RF 100 VA/NF Series #3081			
Hardened steel H	up to 52 HRC	H11	RF 100 U Series #3114	RF 100 U/HF Series #3082			
	above 52 HRC	D2	RF 100 H Series #3896	-	RF 100 H Series #3895		





































QUICK-FINDER - TECH-LINE and PRO-LINE end mill selection guide

Application			Slot drilling  1 x d	Roughing  0.3-0.8 x d	Finishing  > 0.1 x d	Super finishing  0.1 x d	
Material/ Application group	Hardness tensile strength	Example material	Rigid conditions:  - good cooling - short-chipping	Unstable conditions:  - standard cooling - medium- to long-chipping	Finishing: 		
Steel 	up to 28 HRc	1045 / 5115	Uni-Pro Series #3153	Rough-Tech 48 Series #3188	Finish-Tech 50 Series #3179		
	above 28 HRc	4140	Aero-Tech Series #3173	Aero-Rough 48 Series #3097			
Stainless steel 	up to 28 HRc	304 / 303	Uni-Pro Series #3153	Aero-Rough 48 Series #3097			
	above 28 HRc	316Ti	Aero-Tech Series #3173	Aero-Rough 48 Series #3097			
Cast iron 	up to 180 HB 30	Gray Cast	Uni-Pro Series #3153	Aero-Rough 48 Series #3097			
	above 180 HB 30	GGG / GGT / GGv ductile	Aero-Tech Series #3173	Aero-Rough 56 Series #3098			
Aluminium 	up to 3% Si	Wrought Alloys	Alumi-Tech Series #3174	Rough-Tech ALU Series #3184		Alumi-Tech Series #3177	
	above 3% Si	Cast Alloys	Aero-Tech Series #3173	Rough-Tech ALU Series #3184		Uni-Pro Series #3153	
Ti- special alloys 	Ti-basis	TiAl6V4 Inconel 625	Aero-Tech Series #3173	Aero-Rough 56 Series #3098		Finish-Tech 50 Series #3179	
	Ni-basis	Inconel 728	Uni-Pro Series #3153	Aero-Rough 48 Series #3097			
Hardened steel H	up to 52 HRC	H11	Aero-Tech Series #3173	Aero-Rough 56 Series #3098			
	above 52 HRC	D2	—	Rough-Tech 56 Series #3189	Finish-Tech 62 Series #3182		

Types of milling cutters and their basic application range to DIN 1836

	Type N	Standard teeth with 30° spiral, suitable for finishing operations of structural, case hardened and heat-treatable steels as well as short-chipping non-ferrous metals or materials up to a hardness of 48 HRC.
	Type W	Quick spiral (45°), suitable for finishing operations of soft materials such as aluminum, aluminum alloys and non-ferrous metals up to a hardness of approximately 180 HB 30.
	Type NH	Extremely quick spiral (45°), suitable for finishing operations of high-alloyed materials and cast iron up to a hardness of approximately 52 HRC.
	Type H	Extremely quick spiral (55°), suitable for finishing operations as well as HSC of all hardened materials and chilled cast iron up to a hardness of approximately 62 HRC.
	Type NR (round coarse tooth)	Round knuckle-type teeth, short-chipping with excellent chip evacuation. Suitable for roughing of materials up to a hardness of approximately 38 HRC.
	Type WR (round extra coarse tooth)	Coarse knuckle-type teeth, short-chipping with excellent chip evacuation. Suitable for roughing of aluminum, non-ferrous metals as well as soft steels up to a hardness of approximately 180 HB 30.
	Type NRf (round fine tooth)	Fine knuckle-type teeth, short-chipping with excellent chip evacuation. Higher feed rates in comparison to type NR. Suitable for roughing of materials with high hardness up to approx. 48 HRC.
	Type HR (round extra fine tooth)	Fine knuckle-type teeth, short-chipping with excellent chip evacuation. Suitable for roughing of hardened materials such as grey and chilled cast iron up to a hardness with of approx. 52 up to 56 HRC.
	Type NF (flat/truncated profile)	Flat knuckle-type teeth, short-chipping with improved, smoother Surface finish quality in comparison to type NR or NRf. Suitable for roughing of materials up to a hardness of approximately 56 HRC.
	Type HF	Flat fine knuckle-type teeth, short-chipping with improved, smoother surface finish quality compared to type HR. Suitable for roughing of materials up to a hardness of approximately 56 HRC.
	Type WF	Flat extra course knuckle-type teeth, short-chipping with improved, smoother surface finish quality when compared to type WR. Suitable for roughing of aluminum and non-ferrous materials up to 182 HB 30.

Pictograms

Tool material	Solid carbide	PCD									
	Ultra-fine grain carbide	Polycrystalline Diamond									
Standard	fract.	metric									
	fractional (inch)	metric (mm)									
Type (see below)	W	N	NH	H	HF	NF	WF				
	Application range to DIN 1835										
Shank form	HA	HB									
	to DIN 6535										
Helix angle											
	Size of helix angle / number of different helix angles										
No. of flutes											
	Number of flutes										
Length											
	stubby	standard	long	extra long							
Corner chamfer/ radius											
	Size of corner chamfer or radius, dependent on diameter										

RF-LINE

Standard	Tooth profile	Helix angle	No. of Flutes	Length	Tool illustration	Tool material / Surface finish	Series		Page
							HA	HB	
RF 100 U variable helix end mills (4 flute)							Carbide		
fract.	N	35° 38°	4			FIREX®	3113	3099	25
metric	N	35° 38°	4			FIREX®		3731	25
fract.	N	35° 38°	4			FIREX®	3114	3100	26
metric	N	35° 38°	4			FIREX®	3736	3732	26
metric	N	35° 38°	4			FIREX®	3839	3871	27
metric	N	35° 38°	4			FIREX®	3837	3838	27
metric	N	35° 38°	4			FIREX®	3627		28
fract.	N	35° 38°	4			FIREX®	3079		29
metric	N	35° 38°	4			FIREX®	3872	3873	29
RF 100 U variable helix end mills (3 flute)							Carbide		
metric	N	41° 43° 45°	3			FIREX®	3891	3892	31
metric	N	41° 43° 45°	3			FIREX®	3893	3894	31
RF 100 U/HF variable helix end mills with roughing/finishing profile							Carbide		
fract.	HF	30° 32°	4			FIREX®	3082 / 3082		33
metric	HF	30° 32°	4			FIREX®	3507	3508	33
metric	HF	30° 32°	4			FIREX®	3509	3522	34
metric	HF	30° 32°	4			FIREX®	3598	3600	34

Index

RF-LINE

Standard	Tooth profile	Helix angle	No. of Flutes	Length	Tool illustration	Tool material / Surface finish	Series		Page
							HA	HB	
RF 100 F variable helix end mills for free-cutting materials							Carbide		
fract.	NH	40° 42°	4			FIREX®	3078 / 3078		37
metric	NH	40° 42°	4			FIREX®	3629	3630	37
metric	NH	40° 42°	4			FIREX®		3366	37
RF 100 VA variable helix end mills for stainless steels							Carbide		
fract.	N	36° 38°	4			nano-A™	3080 / 3080		39
metric	N	36° 38°	4			nano-A™	3804	3805	39
metric	N	36° 38°	4			nano-A™	3800	3803	40
metric	N	36° 38°	4			nano-A™	3806	3807	40
RF 100 VA/NF variable helix rough/finishing end mills for stainless steels							Carbide		
fract.	NF	36° 38°	4			nano-A™	3081 / 3081		43
metric	NF	36° 38°	4			nano-A™	3696	3718	43
metric	NF	36° 38°	4			nano-A™	3733	3885	44
RF 100 Ti variable helix end mills for titanium and nickel alloys							Carbide		
fract.	N	35° 38°	4			Super-A™	3876 / 3876		46
metric	N	35° 38°	4			Super-A™	3498	3499	47
RF 100 A variable helix end mills for aluminum and cast aluminum							Carbide		
fract.	W	40° 42°	4			Bright	3077 / 3077		49
metric	W	40° 42°	4			Bright	3202	3319	49

Index

RF-LINE

Standard	Tooth profile	Helix angle	No. of Flutes	Length	Tool illustration	Tool material / Surface finish	Series		Page
							HA	HB	
RF 100 A/WF variable helix roughing end mills for aluminum & Al-alloys							Carbide		
metric	WF	29° 30° 31°	3			Bright	3468	3469	51
metric	WF	29° 30° 31°	3			Bright	3470	3471	51
RF 100 SF 6-flute "Super Finish" variable helix end mills							Carbide		
fract.	NH	45°	6			FIREX®	3115		53
metric	NH	45°	6			FIREX®	3631	3632	53
RF 100 SF 5-flute "Super Finish" variable helix end mills							Carbide		
metric	NH	45°	5			FIREX®	3897	3898	54
RF 100 H variable helix end mills for hardened steels up to 60 HRC							Carbide		
metric	H	40° 42°	4			TiAlN	3895	3896	55
RF 50 variable flute end mills							Carbide		
fract.	N	40°	4			FIREX®	3095 / 3095		57
fract.	N	40°	4			FIREX®	3096 / 3096		57

DIAMOND-TECH

Standard	Tooth profile	Helix angle	No. of Flutes	Length	Tool illustration	Tool material / Surface finish	Series		Page
							HA	HB	
DL 100 X2 - High performance PCD end mill for aluminum and composites							PCD		
fract.	--	0°	2			Bright	3867		61
fract.	--	0°	3			Bright	3870		61
Coolant fed high performance PCD end mill for aluminum and composites							PCD		
metric	--	0°	2			Bright	5492		62
metric	--	0°	3			Bright	5493		63
CR 100 Carbide Routers - diamond coated, for composite materials							Carbide		
fract.	--	0°	10-15			Diamond	3083		65
fract.	--	0°	10-15			Diamond	3084		64
fract.	--	0°	10-15			Diamond	3085		65

TECH-LINE

Standard	Tooth profile	Helix angle	No. of Flutes	Length	Tool illustration	Tool material / Surface finish	Series		Page
							HA	HB	
GH 100 U / AERO-TECH end mills (3-fluted)							Carbide		
fract.	NH	45°	3			FIREX®	3086		69
metric	NH	45°	3			FIREX®	3540	3729	69
fract.	NH	45°	3			Bright	3172		70
fract.	NH	45°	3			FIREX®	3173		70
metric	NH	45°	3			Bright	3203		70
metric	NH	45°	3			FIREX®	3741		70
ALUMI-TECH end mills (2-fluted) for aluminum							Carbide		
metric	W	45°	2			Bright	3310	3126	72
fract.	W	45°	2			Bright	3174		73
metric	W	45°	2			Bright	3309	3059	73
fract.	W	45°	2			Super-A™	3874		73
fract.	W	45°	2			Bright	3175		74
metric	W	45°	2			Bright	3358		74
fract.	W	45°	2			Super-A™	3875		74
GA 200 A / ALUMI-TECH LR end mills (3-fluted) with corner radius							Carbide		
fract.	W	45°	3			Bright	3177		75
fract.	W	45°	3			Super-A™	3877		75
metric	W	45°	3			Bright	3367		75
GS 100 A / ROUGH-TECH ALU end mills, coarse tooth							Carbide		
fract.	WR	30°	3			Bright	3184		77
fract.	WR	30°	3			Super-A™	3884		77
metric	WR	30°	3			Bright	3127		77
metric	WR	30°	3			Bright	3364		77

TECH-LINE

Standard	Tooth profile	Helix angle	No. of Flutes	Length	Tool illustration	Tool material / Surface finish	Series HA	Series HB	Page
RS 100 U / AERO-ROUGH 48 end mills						Carbide			
fract.	NF	30°	4/5			FIREX®	3097		79
metric	NF	30°	4/5			FIREX®	3887 3888		79
RS 100 F / AERO-ROUGH 56 end mills						Carbide			
fract.	NF	45°	5/6			FIREX®	3098		80
metric	NF	45°	5/6			FIREX®	3889 3890		80
GS 100 U / ROUGH-TECH 48 end mills, fine tooth						Carbide			
fract.	NRf	30°	4			Bright	3186		83
fract.	NRf	30°	4			FIREX®	3188		83
fract.	NRf	30°	4			Super-A™	3886		83
metric	NRf	30°	4			Bright	3204		84
metric	NRf	30°	4			FIREX®	3723		84
metric	NRf	30°	4			FIREX®	3365		84
GS 100 H / ROUGH-TECH 56 end mills, fine tooth						Carbide			
fract.	HR	20°	4			FIREX®	3189		86
metric	HR	20°	4			FIREX®	3682		87
fract.	HR	20°	4			FIREX®	3190		87

Index

TECH-LINE

Standard	Tooth profile	Helix angle	No. of Flutes	Length	Tool illustration	Tool material / Surface finish	Series HA	Series HB	Page
GH 100 H / FINISH-TECH 62 multi-flute end mills						Carbide			
fract.	H	55°	6/8			FIREX®	3182		89
metric	H	55°	6/8			FIREX®	3715		89
fract.	H	55°	6/8			FIREX®	3183		90
metric	H	55°	6/8			FIREX®	3716		90
GH 100 U / FINISH-TECH 50 multi-flute end mills						Carbide			
fract.	NH	45°	6-10			Bright	3178		91
metric	NH	45°	6-10			Bright	3311 3019		92
fract.	NH	45°	6-10			FIREX®	3179		91
metric	NH	45°	6-10			FIREX®	3689 3047		92
fract.	NH	45°	6/8			FIREX®	3091		96
metric	NH	45°	6/8			Bright	3112		97
metric	NH	45°	6/8			FIREX®	3563		97
fract.	NH	45°	6/8			Bright	3180		93
fract.	NH	45°	6/8			FIREX®	3181		93
metric	NH	45°	6/8			Bright	3312 3313		94
metric	NH	45°	6/8			FIREX®	3691 3693		94

Index

TECH-LINE

Standard	Tooth profile	Helix angle	No. of Flutes	Length	Tool illustration	Tool material / Surface finish	Series	Series	Page
							HA	HB	
GF 500 T HSC-profile cutters with Torus form							Carbide		
metric	N	30°	2			TiAlN	3856		100
metric	N	30°	2			TiAlN	3859		101
metric	N	30°	2			TiAlN	3860		102
metric	N	30°	2			TiAlN	3865		103
metric	N	30°	2			TiAlN	3863		104
GF 500 B HSC-Ball nose profile cutters							Carbide		
metric	N	30°	2			TiAlN	3848		105
metric	N	30°	2			TiAlN	3854		109
metric	N	30°	2			TiAlN	3849		106
metric	N	30°	2			TiAlN	3853		107
metric	N	30°	2			TiAlN	3855		108
metric	N	30°	2			TiAlN	3866		110
GF 300 T / TRACE-TECH hard profile cutters with Torus grind							Carbide		
fract.	H	30°	2			FIREX®	3192		112
metric	H	30°	2			FIREX®	3362		113
GF 300 B / TRACE-TECH ball nose hard profile cutters							Carbide		
fract.	H	30°	2			FIREX®	3101		114
metric	H	30°	2			FIREX®	3359		115
fract.	H	30°	2			FIREX®	3191		116
metric	H	30°	2			FIREX®	3360		117

PRO-LINE

Standard	Tooth profile	Helix angle	No. of Flutes	Length	Tool illustration	Tool material / Surface finish	Series	Series	Page
							HA	HB	
UNI PRO end mills (2-fluted)							Carbide		
fract.	N	30°	2			FIREX®	3092		120
metric	N	30°	2			FIREX®	3633	3634	120
fract.	N	30°	2			Bright	3146		121
metric	N	30°	2			Bright	3303		122
fract.	N	30°	2			FIREX®	3148		121
metric	N	30°	2			FIREX®	3676		122
fract.	N	30°	2			Super-AT™	3846		121
fract.	N	30°	2			Bright	3147		123
fract.	N	30°	2			FIREX®	3149		123
fract.	N	30°	2			Super-AT™	3847		123
metric	N	30°	2			Bright	3011		122
metric	N	30°	2			FIREX®	3021		122
UNI PRO end mills (2-fluted) with corner radius							Carbide		
fract.	N	30°	2			FIREX®	3087		124
metric	N	30°	2			Bright	3106		125
metric	N	30°	2			FIREX®	3561		125
fract.	N	30°	2			FIREX®	3088		126

PRO-LINE

Standard	Tooth profile	Helix angle	No. of Flutes	Length	Tool illustration	Tool material / Surface finish	Series		Page
							HA	HB	
UNI PRO end mills (3-fluted)						Carbide			
metric	N	30°	3			FIREX®	3558	3719	127
fract.	N	30°	3			Bright	3168		128
metric	N	30°	3			Bright	3307		129
fract.	N	30°	3			FIREX®	3170		128
fract.	N	30°	3			Super-A™	3868		128
metric	N	30°	3			FIREX®	3677		129
UNI PRO end mills (3-fluted)						Carbide			
fract.	N	30°	3			Bright	3169		130
fract.	N	30°	3			FIREX®	3171		130
fract.	N	30°	3			Super-A™	3869		130
metric	N	30°	3			Bright	3314		131
metric	N	30°	3			FIREX®	3680		131
UNI PRO end mills (4-fluted)						Carbide			
fract.	N	30°	4			FIREX®	3093		132
metric	N	30°	4			FIREX®	3637	3721	132
fract.	N	30°	4			Bright	3150		133
fract.	N	30°	4			FIREX®	3153		133
fract.	N	30°	4			Super-A™	3850		133
metric	N	30°	4			Bright	3304		134
metric	N	30°	4			FIREX®	3678		134

PRO-LINE

Standard	Tooth profile	Helix angle	No. of Flutes	Length	Tool illustration	Tool material / Surface finish	Series		Page
							HA	HB	
UNI PRO end mills (4-fluted)						Carbide			
fract.	N	30°	4			Bright	3152		135
fract.	N	30°	4			FIREX®	3156		135
fract.	N	30°	4			Super-A™	3852		135
fract.	N	30°	4			Bright	3151		136
fract.	N	30°	4			FIREX®	3155		136
fract.	N	30°	4			Super-A™	3851		136
metric	N	30°	4			Bright	3012		137
metric	N	30°	4			FIREX®	3023		137
UNI PRO "R" end mills (4-fluted) with corner radius						Carbide			
fract.	N	30°	4			FIREX®	3089		139
metric	N	30°	4			Bright	3111		138
metric	N	30°	4			FIREX®	3562		138
fract.	N	30°	4			FIREX®	3090		139
UNI PRO ball nose end mills (2-fluted)						Carbide			
fract.	N	30°	2			Bright	3157		140
fract.	N	30°	2			FIREX®	3159		140
fract.	N	30°	2			Super-A™	3857		140
metric	N	30°	2			Bright	3308	3024	141
metric	N	30°	2			FIREX®	3679	3049	141

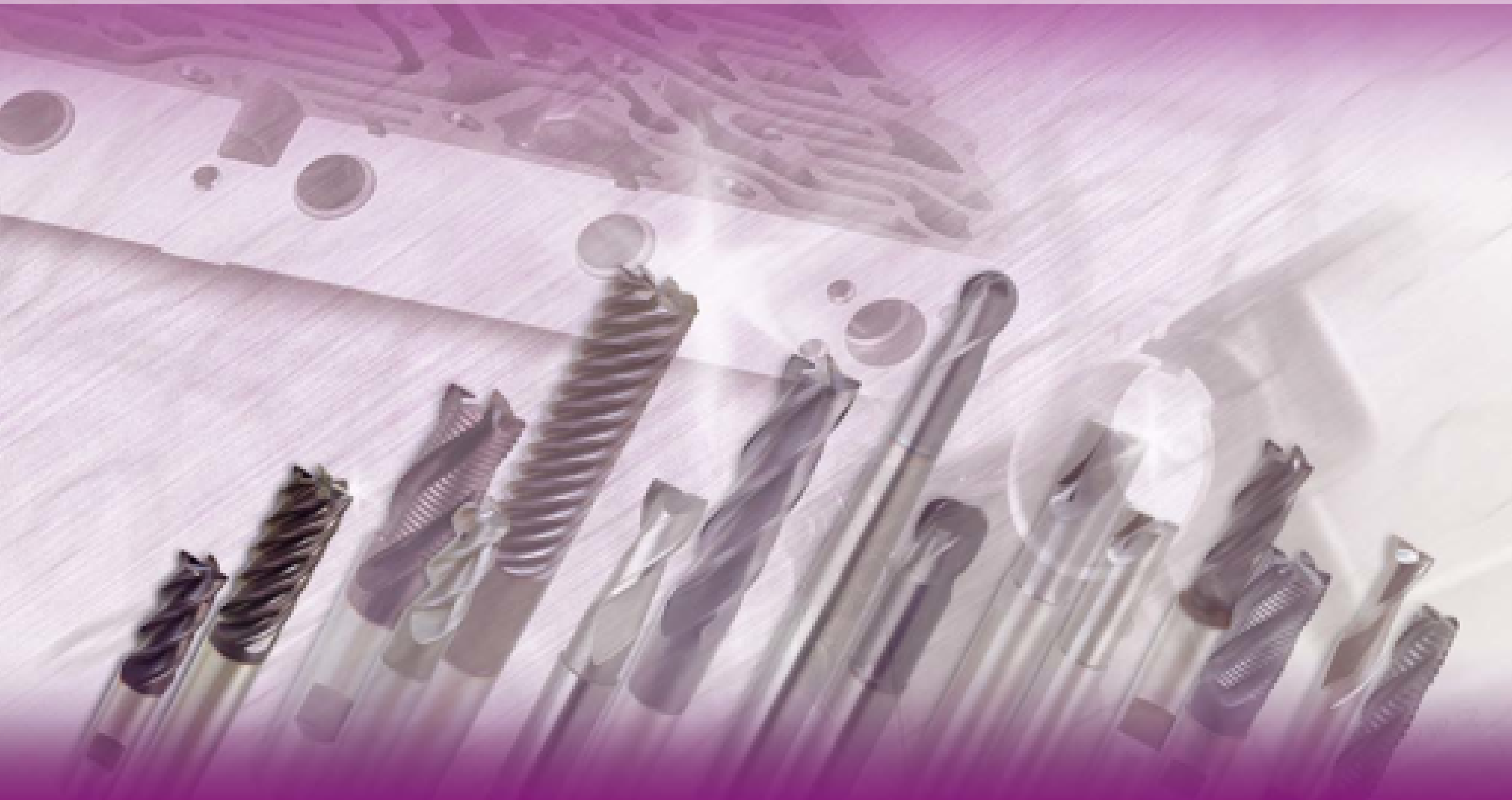
PRO-LINE

Standard	Tooth profile	Helix angle	No. of Flutes	Length	Tool illustration	Tool material / Surface finish	Series HA	Series HB	Page
UNI PRO ball nose end mills (2-fluted)						Carbide			
fract.	N	30°	2			Bright	3158		142
fract.	N	30°	2			FIREX®	3160		142
fract.	N	30°	2			Super-A™	3858		142
metric	N	30°	2			Bright	3014		143
metric	N	30°	2			FIREX®	3030		143
UNI PRO ball nose end mills (4-fluted)						Carbide			
fract.	N	30°	4			Bright	3161		144
fract.	N	30°	4			FIREX®	3165		144
fract.	N	30°	4			Super-A™	3861		144
metric	N	30°	4			Bright	3306		145
metric	N	30°	4			FIREX®	3727		145
UNI PRO ball nose end mills (4-fluted)						Carbide			
fract.	N	30°	4			Bright	3164		146
fract.	N	30°	4			FIREX®	3167		146
fract.	N	30°	4			Super-A™	3864		146
fract.	N	30°	4			Bright	3162		147
fract.	N	30°	4			FIREX®	3166		147
fract.	N	30°	4			Super-A™	3862		147
metric	N	30°	4			Bright	3015		148
metric	N	30°	4			FIREX®	3043		148
End Mill Value Packs						Carbide			
fract.					Pro-Line Universal End Mill Kit	FIREX®			149
fract.					RF 100 Variable Helix End Mill Kit	FIREX®			41

Index

Index

RF-LINE



GUHRING

RF 100 U - high-performance end mills for materials up to 48 HRc

RF 100 U high-performance end mills excel thanks to unequal helix angles which considerably reduce vibration. The uneven helix angle vastly improves surface quality with finishing operations and considerably higher feed rates with slot milling and roughing operations are also achieved.

With many applications, the complete milling process can be covered with one RF 100, which as well as increasing tool life and dimensional accuracy of the workpiece generates a considerable cost advantage.

Summary of advantages

- suitable for roughing and finishing
- up to 60% higher feed rates
- up to 4 times longer tool life
- vibration-free operation
- improved workpiece surface quality

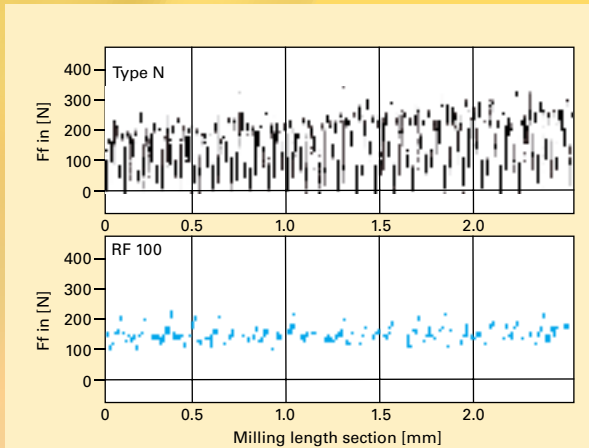


with neck clearance

35°

38°

with micro-corner protection for longer tool life



The cutting force comparison between a conventional milling cutter type N and a RF100 clearly shows the quieter, more rigid operation of the RF100.

Material	Alloyed Steel		Tool Steel		Cast iron		Stainless steel		Aluminium		Ti-special alloys		H	
	up to 28HRc	over 28 HRc	up to 180 HB 30	over 180 HB 30	up to 28 HRc	over 28 HRc	up to 3% Si	over 3% Si	Ti-based	Ni-based	up to 52 HRC	over 52 HRC		
RF 100 U	○	●	●	●					●		○			
RF 100 U/HF		●	●	●						○		○		
RF 100 F	●		○			●					●			
RF 100 VA	○				●	●					○			
RF 100 VA/NF	●				●	●					○			
RF 100 A							●	●						
RF 100 A/WF							●	●						
RF 100 Ti		○							●	○				
RF 100 H		○		○									●	●
RF 100 SF	●	●	●	●	●	●	○	○	●	●	○			

● = optimal suitability ○ = limited suitability

Hanita-style table of U end mills

(All lengths in one table)

● Alloyed Steels
 ● Tool Steels
 ● Cast materials
 ● Stainless Steels
 ● Al and Al-alloys
 ● Ti / Ni alloys
 ● H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

RF 100 U (universal) 4-flute variable helix end mills for materials < 48 HRC

Stub length

Series					3113	3099
Tool material					Solid carbide	
Surface finish					FIREX®	
Application						
d ₂ shank tolerance					h6	h6
d ₁ tolerance					h10	h10
Techn. data page					160	160
					RF100	RF100
d1	d2	l1	l2	Order	Availability	
fract.	fract.	fract.	fract.	no.		
3/16	3/16	2	3/8	4.760	●	
1/4	1/4	2	1/2	6.350	●	
5/16	5/16	2	1/2	7.940	●	
3/8	3/8	2	5/8	9.520	●	●
1/2	1/2	2 1/2	5/8	12.700	●	●
5/8	5/8	3	3/4	15.870	●	●
3/4	3/4	3	1	19.050	●	●
1	1	3	1	25.400	●	●

Stub length (Expanded Lengths)

Series							XX
Tool material							Solid carbide
Surface finish							FIREX®
Application							
d ₂ shank tolerance							h6
d ₁ tolerance							h10
Techn. data page							160
							RF100
d1	d2	d3	l1	l2	l3	Order	Availability

RF 100 U (universal) 4-flute variable helix end mills for materials < 48 HRC

Stub length (metric)

Series							3731
Tool material							Solid carbide
Surface finish							FIREX®
Application							
d ₂ shank tolerance							h6
d ₁ tolerance							h10
Techn. data page							160
							RF100
d1	d2	d3	l1	l2	l3	Order	Availability
mm	mm	mm	mm	mm	mm	no.	
6.000	6.000	5.500	54.00	10.00	18.00	6.000	○
8.000	8.000	7.500	58.00	12.00	22.00	8.000	○
10.000	10.000	9.200	66.00	14.00	26.00	10.000	○
12.000	12.000	11.200	73.00	16.00	28.00	12.000	○
14.000	14.000	13.200	75.00	18.00	30.00	14.000	○
16.000	16.000	15.000	82.00	22.00	34.00	16.000	○
18.000	18.000	17.000	84.00	24.00	36.00	18.000	○
20.000	20.000	19.000	92.00	26.00	42.00	20.000	●

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels
 Tool Steels
 Cast materials
 Stainless Steels
 Al and Al-alloys
 Ti / Ni alloys
 H Hardened Materials

RF 100 U (universal) 4-flute variable helix end mills for materials < 48 HRC

Standard length

Series					3114	3100
Tool material					Solid carbide	
Surface finish					FIREX®	
Application						
d ₂ shank tolerance					h6	h6
d ₁ tolerance					h10	h10
Techn. data page					160	160
d1	d2	l1	l2	Order	Availability	
fract.	fract.	fract.	fract.	no.		
3/16	3/16	2	5/8	4.760	●	
1/4	1/4	2 1/2	3/4	6.350	●	
5/16	5/16	2 1/2	13/16	7.940	●	
3/8	3/8	2 1/2	1	9.520	●	●
7/16	7/16	2 3/4	1	11.110	●	
1/2	1/2	3	1	12.700	●	●
5/8	5/8	3 1/2	1 1/4	15.870	●	●
3/4	3/4	4	1 1/2	19.050	●	●
1	1	4	1 1/2	25.400	●	●

Standard length (Expanded Lengths)

Series							3736
Tool material							Solid carbide
Surface finish							FIREX®
Application							
d ₂ shank tolerance							h6
d ₁ tolerance							h10
Techn. data page							160
d1	d2	d3	l1	l2	l3	Order	Availability
						no.	

RF 100 U (universal) 4-flute variable helix end mills for materials < 48 HRC

Standard length (metric)

Series							3736	3732
Tool material							Solid carbide	
Surface finish							FIREX®	
Application								
d ₂ shank tolerance							h6	h6
d ₁ tolerance							h10	h10
Techn. data page							160	160
d1	d2	d3	l1	l2	l3	Order	Availability	
mm	mm	mm	mm	mm	mm	no.		
4.000	6.000	3.700	57.00	11.00	18.00	4.000	●	○
5.000	6.000	4.700	57.00	13.00	18.00	5.000	●	○
6.000	6.000	5.500	57.00	13.00	21.00	6.000	●	○
8.000	8.000	7.500	63.00	19.00	27.00	8.000	●	○
10.000	10.000	9.200	72.00	22.00	32.00	10.000	●	○
12.000	12.000	11.200	83.00	26.00	38.00	12.000	●	○
14.000	14.000	13.200	83.00	26.00	38.00	14.000	●	○
16.000	16.000	15.000	92.00	32.00	44.00	16.000	●	○
18.000	18.000	17.000	92.00	32.00	44.00	18.000	●	○
20.000	20.000	19.000	104.00	38.00	54.00	20.000	●	○
25.000	25.000	23.500	121.00	45.00	65.00	25.000	●	○

RF-LINE

RF-LINE

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels
 Tool Steels
 Cast materials
 Stainless Steels
 Al and Al-alloys
 Ti / Ni alloys
 H Hardened Materials

RF 100 U (universal) 4-flute variable helix end mills for materials < 48 HRC

Long length w/ neck clearance (metric)

35°
38° N 4 0.1-0.6
x 45°

Series: 3837 3838
 Tool material: Solid carbide
 Surface finish: FIREX®
 Application: H
 d₂ shank tolerance: h6 h6
 d₁ tolerance: h10 h10
 Techn. data page: 160 160

GUHRING
Select

d1	d2	d3	l1	l2	l3	Order
mm	mm	mm	mm	mm	mm	no.
6.000	6.000	5.500	65.00	13.00	29.00	6.000
8.000	8.000	7.500	75.00	19.00	39.00	8.000
10.000	10.000	9.200	80.00	22.00	40.00	10.000
12.000	12.000	11.200	93.00	26.00	48.00	12.000
16.000	16.000	15.000	108.00	32.00	60.00	16.000
20.000	20.000	19.000	126.00	38.00	76.00	20.000

HA HB

Series: 3837 3838
 Tool material: Solid carbide
 Surface finish: FIREX®
 Application: H
 d₂ shank tolerance: h6 h6
 d₁ tolerance: h10 h10
 Techn. data page: 160 160

RF100 RF100

NEW NEW

Availability

HA	HB
●	○
●	○
●	○
●	○
●	○
●	○

Long length (metric)

35°
38° N 4 0.1-0.6
x 45°

Series: 3839 3871
 Tool material: Solid carbide
 Surface finish: FIREX®
 Application: H
 d₂ shank tolerance: h6 h6
 d₁ tolerance: h10 h10
 Techn. data page: 160 160

GUHRING
Select

d1	d2	d3	l1	l2	l3	Order
mm	mm	mm	mm	mm	mm	no.
6.000	6.000	5.500	65.00	18.00	29.00	6.000
8.000	8.000	7.500	75.00	24.00	39.00	8.000
10.000	10.000	9.200	80.00	30.00	40.00	10.000
12.000	12.000	11.200	93.00	36.00	48.00	12.000
16.000	16.000	15.000	108.00	48.00	60.00	16.000
20.000	20.000	19.000	126.00	60.00	76.00	20.000

HA HB

Series: 3839 3871
 Tool material: Solid carbide
 Surface finish: FIREX®
 Application: H
 d₂ shank tolerance: h6 h6
 d₁ tolerance: h10 h10
 Techn. data page: 160 160

RF100 RF100

NEW NEW

Availability

HA	HB
●	○
●	○
●	○
●	○
●	○
●	○

RF 100 U (universal) 4-flute variable helix end mills for materials < 48 HRC

Extra long length

N 35°
38° 4 0.1-0.6
x 45°

Series: 3627
 Tool material: Solid carbide
 Surface finish: FIREX®
 Application: H
 d₂ shank tolerance: h6
 d₁ tolerance: h10
 Techn. data page: 160

GUHRING
Select

d1	d2	d3	l1	l2	l3	Order
mm	mm	mm	mm	mm	mm	no.
10.000	10.000	9.200	100.00	40.00	50.00	10.000
12.000	12.000	11.200	150.00	45.00	60.00	12.000
14.000	14.000	13.200	150.00	45.00	60.00	14.000
16.000	16.000	15.000	150.00	65.00	80.00	16.000
18.000	18.000	19.000	150.00	65.00	80.00	18.000
20.000	20.000	19.000	150.00	65.00	80.00	20.000
25.000	25.000	23.500	150.00	75.00	94.00	25.000

HA

Series: 3627
 Tool material: Solid carbide
 Surface finish: FIREX®
 Application: H
 d₂ shank tolerance: h6
 d₁ tolerance: h10
 Techn. data page: 160

RF100

Availability


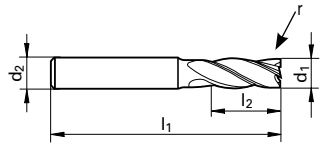
HA
●
●
●
●
●
●

● USA Stock ○ International Stock (0-2 wks)


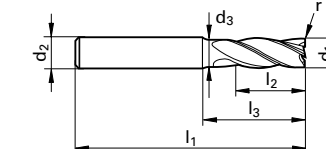
● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

RF 100 U (universal) 4-flute variable helix end mills for materials < 48 HRC

Standard length with corner radius

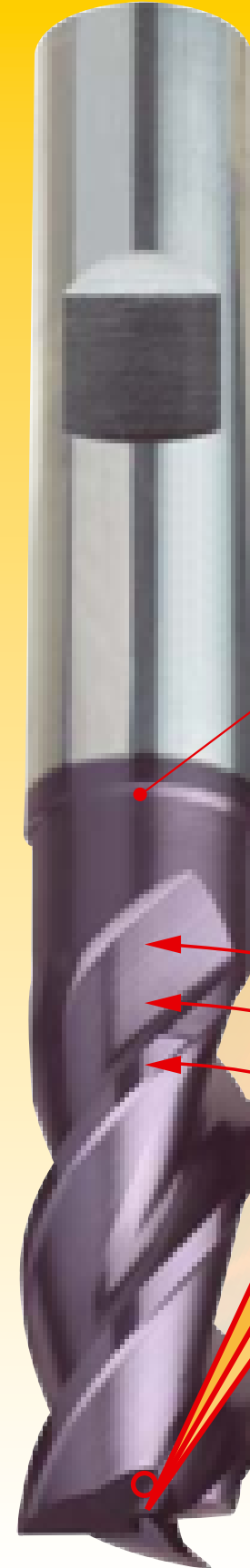
N	35° 38°	4	R	
Series Tool material Surface finish Application d ₂ shank tolerance d ₁ tolerance Techn. data page				
				
All tools come with NAS-Style corner radius				
				
d1=d2	l1	l2	r	Order
fract.	fract.	fract.	inch	no.
1/4	2 1/2	3/4	0.015	6.352
1/4	2 1/2	3/4	0.031	6.354
5/16	2 1/2	13/16	0.031	7.944
3/8	2 1/2	1	0.031	9.524
7/16	2 3/4	1 1/4	0.031	11.114
1/2	3 1/2	1 1/4	0.031	12.704
1/2	3 1/2	1 1/4	0.040	12.705
1/2	3 1/2	1 1/4	0.062	12.706
1/2	3 1/2	1 1/4	0.090	12.707
5/8	3 1/2	1 1/4	0.031	15.874
5/8	3 1/2	1 1/4	0.062	15.876
3/4	4	1 1/2	0.062	19.056
3/4	4	1 1/2	0.090	19.057
3/4	4	1 1/2	0.125	19.059
1	4	1 1/2	0.062	25.406
1	4	1 1/2	0.090	25.407
1	4	1 1/2	0.125	25.409

Standard length with corner radius (metric)

N	35° 38°	4	R			
Series Tool material Surface finish Application d ₂ shank tolerance d ₁ tolerance Techn. data page						
						
						
d1=d2	d3	l1	l2	l3	r	Order
mm	mm	mm	mm	mm	mm	no.
6.000	5.500	57.00	13.00	21.00	0.5	6.005
6.000	5.500	57.00	13.00	21.00	1.0	6.010
6.000	5.500	57.00	13.00	21.00	2.0	6.020
8.000	7.500	63.00	19.00	27.00	0.5	8.005
8.000	7.500	63.00	19.00	27.00	1.0	8.010
8.000	7.500	63.00	19.00	27.00	2.0	8.020
10.000	9.200	72.00	22.00	32.00	0.5	10.005
10.000	9.200	72.00	22.00	32.00	1.0	10.010
10.000	9.200	72.00	22.00	32.00	2.0	10.020
12.000	11.200	83.00	26.00	38.00	0.5	12.005
12.000	11.200	83.00	26.00	38.00	1.0	12.010
12.000	11.200	83.00	26.00	38.00	2.0	12.020
16.000	15.000	92.00	32.00	44.00	0.5	16.005
16.000	15.000	92.00	32.00	44.00	1.0	16.010
16.000	15.000	92.00	32.00	44.00	2.0	16.020
16.000	15.000	92.00	32.00	44.00	3.0	16.030
20.000	19.000	104.00	38.00	54.00	0.5	20.005
20.000	19.000	104.00	38.00	54.00	1.0	20.010
20.000	19.000	104.00	38.00	54.00	2.0	20.020
20.000	19.000	104.00	38.00	54.00	3.0	20.030
25.000	23.500	121.00	45.00	65.00	2.0	25.020
25.000	23.500	121.00	45.00	65.00	3.0	25.030

● USA Stock ○ International Stock (0-2 wks)

RF 100 U - high-performance 3-flute end mills for materials up to 44 HRC

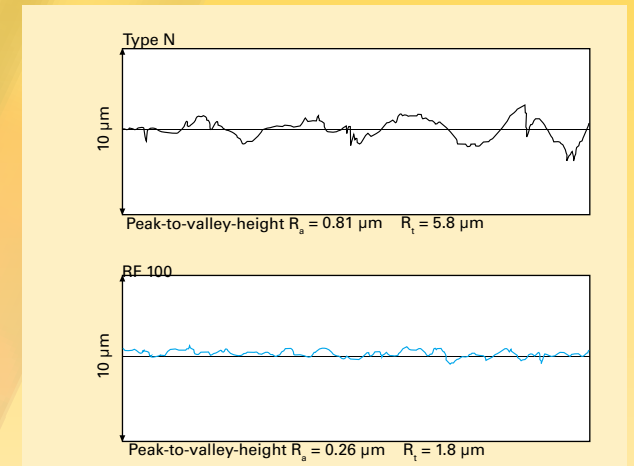


RF 100 U end mills excel thanks to unequal helix angles which considerably reduce vibration. The uneven helix angle vastly improves surface quality for finishing operations and a considerably higher feed rate for slot milling operations are also achieved. The three flute design provides additional flute space for improved chip evacuation in slot milling operations or in materials which may clog a standard four flute design.

With many applications, the complete milling process can be covered with one RF 100 U, which as well as increasing tool life and dimensional accuracy of the workpiece generates a considerable cost advantage.

Summary of advantages

- suitable for roughing and finishing
- up to 60% higher feed rates
- up to 4-times longer tool life
- vibration-free operation
- improved workpiece surface quality



The peak-to-valley height comparison between a conventional milling cutter type N and a RF 100 shows a considerable quieter, more rigid operation of the RF 100.

Material	Alloyed Steel		Tool Steel	Cast iron	Stainless steel	Aluminium		Ti-special alloys		H		
	up to 28HRC	over 28 HRC	up to 180 HB 30	over 180 HB 30	up to 28 HRC	over 28 HRC	up to 3% Si	over 3% Si	Ti-based		Ni-based	up to 52 HRC
RF 100 U	○	●	●	●					●		○	
RF 100 U/HF		●	●	●					○		○	
RF 100 F	●			○	●					●		
RF 100 VA	○				●	●				○		
RF 100 VA/NF	●				●	●				○		
RF 100 A							●	●				
RF 100 A/WF							●	●				
RF 100Ti		○							●	○		
RF 100 H		○		○							●	●
RF 100 SF	●	●	●	●	●	●	○	○	●	●	○	

● = optimal suitability ○ = limited suitability

RF 100 U (universal) 3-flute variable helix end mills for materials < 44 HRC

Standard length, stub flute length

<p>N</p> <p>41° 43° 45°</p> <p>3</p> <p>0,025-0,3 x 45°</p>			<p>Series</p> <p>XX</p>					
	<p>Tool material</p> <p>Solid carbide</p>		<p>Series</p> <p>XX</p>					
	<p>Surface finish</p> <p>FIREX®</p>		<p>Tool material</p> <p>Solid carbide</p>					
	<p>Application</p> <p> H</p>		<p>Surface finish</p> <p>FIREX®</p>					
	<p>d₂ shank tolerance</p> <p>h6</p>		<p>Application</p> <p> H</p>					
	<p>d₁ tolerance</p> <p>h10</p>		<p>d₂ shank tolerance</p> <p>h6</p>					
	<p>Techn. data page</p> <p>160</p>		<p>d₁ tolerance</p> <p>h10</p>					
			<p>NEW</p>					
d1	d2	d3	l1	l2	l3	Order	<p>Availability</p>	
fract.	fract.	dec.in.	fract.	fract.	dec.in.	no.		
1/8	1/8	0.11	1 1/2	3/16	0.40	3.170		
3/16	3/16	0.18	2	1/4	0.90	4.760		
1/4	1/4	0.23	2 1/2	3/8	1.08	6.350		
5/16	5/16	0.29	2 1/2	7/16	1.08	7.940		
3/8	3/8	0.34	3	9/16	1.44	9.520		
1/2	1/2	0.47	3	3/4	1.22	12.700		
5/8	5/8	0.59	3 1/2	7/8	1.59	15.870		
3/4	3/4	0.71	4	1	1.97	19.050		
1	1	0.94	4	1 1/4	1.72	25.400		

Standard length

<p>N</p> <p>41° 43° 45°</p> <p>3</p> <p>0,025-0,3 x 45°</p>			<p>Series</p> <p>XX</p>					
	<p>Tool material</p> <p>Solid carbide</p>		<p>Series</p> <p>XX</p>					
	<p>Surface finish</p> <p>FIREX®</p>		<p>Tool material</p> <p>Solid carbide</p>					
	<p>Application</p> <p> H</p>		<p>Surface finish</p> <p>FIREX®</p>					
	<p>d₂ shank tolerance</p> <p>h6</p>		<p>Application</p> <p> H</p>					
	<p>d₁ tolerance</p> <p>h10</p>		<p>d₂ shank tolerance</p> <p>h6</p>					
	<p>Techn. data page</p> <p>160</p>		<p>d₁ tolerance</p> <p>h10</p>					
			<p>NEW</p>					
d1	d2	d3	l1	l2	l3	Order	<p>Availability</p>	
fract.	fract.		fract.	fract.		no.		
1/8	1/8		1 1/2	3/8		3.170		
3/16	3/16		2	5/8		4.760		
1/4	1/4		2 1/2	3/4		6.350		
5/16	5/16		2 1/2	13/16		7.940		
3/8	3/8		3	1		9.520		
1/2	1/2		3	1		12.700		
5/8	5/8		3 1/2	1 1/4		15.870		
3/4	3/4		4	1 1/2		19.050		
1	1		4	1 1/2		25.400		

RF 100 U (universal) 3-flute variable helix end mills for materials < 44 HRC

Standard length, stub flute length (metric)

<p>N</p> <p>41° 43° 45°</p> <p>3</p> <p>0,025-0,3 x 45°</p>			<p>Series</p> <p>3893</p>					
	<p>Tool material</p> <p>Solid carbide</p>		<p>Series</p> <p>3894</p>					
	<p>Surface finish</p> <p>FIREX®</p>		<p>Tool material</p> <p>Solid carbide</p>					
	<p>Application</p> <p> H</p>		<p>Surface finish</p> <p>FIREX®</p>					
	<p>d₂ shank tolerance</p> <p>h6</p>		<p>Application</p> <p> H</p>					
	<p>d₁ tolerance</p> <p>h10</p>		<p>d₂ shank tolerance</p> <p>h6</p>					
	<p>Techn. data page</p> <p>160</p>		<p>d₁ tolerance</p> <p>h10</p>					
			<p>NEW</p>					
d1	d2	d3	l1	l2	l3	Order	<p>Availability</p>	
mm	mm	mm	mm	mm	mm	no.		
3.000	6.000	2.700	57.00	4.00	15.00	3.000	●	○
4.000	6.000	3.700	57.00	5.00	18.00	4.000	●	○
5.000	6.000	4.500	57.00	6.00	18.00	5.000	●	○
6.000	6.000	5.500	57.00	7.00	21.00	6.000	●	○
8.000	8.000	7.500	63.00	9.00	27.00	8.000	●	○
10.000	10.000	9.200	72.00	11.00	32.00	10.000	●	○
12.000	12.000	11.200	83.00	12.00	38.00	12.000	●	○
16.000	16.000	15.000	92.00	16.00	44.00	16.000	●	○

Standard length (metric)

<p>N</p> <p>41° 43° 45°</p> <p>3</p> <p>0,025-0,3 x 45°</p>			<p>Series</p> <p>3891</p>					
	<p>Tool material</p> <p>Solid carbide</p>		<p>Series</p> <p>3892</p>					
	<p>Surface finish</p> <p>FIREX®</p>		<p>Tool material</p> <p>Solid carbide</p>					
	<p>Application</p> <p> H</p>		<p>Surface finish</p> <p>FIREX®</p>					
	<p>d₂ shank tolerance</p> <p>h6</p>		<p>Application</p> <p> H</p>					
	<p>d₁ tolerance</p> <p>h10</p>		<p>d₂ shank tolerance</p> <p>h6</p>					
	<p>Techn. data page</p> <p>160</p>		<p>d₁ tolerance</p> <p>h10</p>					
			<p>NEW</p>					
d1	d2	d3	l1	l2	l3	Order	<p>Availability</p>	
mm	mm	mm	mm	mm	mm	no.		
3.000	6.000	2.700	57.00	8.00	15.00	3.000	●	○
4.000	6.000	3.700	57.00	11.00	18.00	4.000	●	○
5.000	6.000	4.700	57.00	13.00	18.00	5.000	●	○
6.000	6.000	5.500	57.00	13.00	21.00	6.000	●	○
8.000	8.000	7.500	63.00	19.00	27.00	8.000	●	○
10.000	10.000	9.200	72.00	22.00	32.00	10.000	●	○
12.000	12.000	11.200	83.00	26.00	38.00	12.000	●	○
16.000	16.000	15.000	92.00	32.00	44.00	16.000	●	○
20.000	20.000	19.000	104.00	38.00	54.00	20.000	●	○

● USA Stock ○ International Stock (0-2 wks)

● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

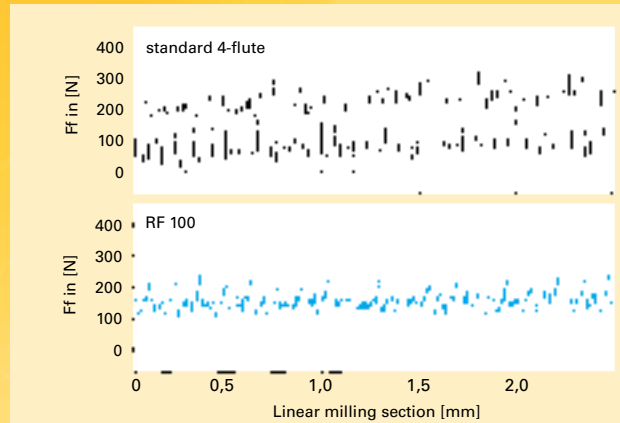
RF 100 U/HF variable helix roughing / finishing end mills for materials < 48 HRC

Based on our standard RF 100 end mills, we have developed a new series of variable-helix end mills with a completely new designed roughing profile.

The result is a drastic increase in tool life compared to conventional knuckle-type geometries and an improvement in surface finish-quality of the workpiece, so that in many applications finishing operations are unnecessary.

- up to 70% higher in feed rates
- vibration-free machining
- increased surface finish quality (Ra = 2-3 µm)
- small easy removable chips
- less cutting pressure
- vastly reduced horsepower consumption

Surface finish quality of 2-3 µm, requires no additional finishing operation in many cases



30°
32°



Micro edge protection for longer tool life

Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H
Hardness tensile strength	up to 28HRC	over 28 HRC	up to 180 HB 30 over 180 HB 30	up to 28 HRC over 28 HRC	up to 3% Si over 3% Si	Ti-based Ni-based	up to 52 HRC over 52 HRC
RF 100 U	○	●	●	●		●	○
RF 100 U/HF		●	●	●		○	○
RF 100 F	●		○	●		●	
RF 100 VA	○			●	●		○
RF 100 VA/NF	●			●	●		○
RF 100 A					●	●	
RF 100 AWF					●	●	
RF 100 Ti		○				●	○
RF 100 H		○	○				● ●
RF 100 SF	●	●	●	●	○	●	○

● = optimal suitability ○ = limited suitability

RF 100 U/HF (universal) 4-flute variable helix end mills with roughing-finishing profile

Standard length

Standard length (metric)

HF 30°/32° 4 0,3-0,6 x 45°

Series: 3082
 Tool material: Solid carbide
 Surface finish: FIREX®
 Application: H
 d₂ shank tolerance: h6
 d₁ tolerance: h10
 Techn. data page: 161

d1	d2	l1	l2	Order	Availability
fract.	fract.	fract.	fract.	no.	
1/4	1/4	2 1/2	3/4	6.350	●
5/16	5/16	2 1/2	13/16	7.940	●
3/8	3/8	2 1/2	1	9.520	●
1/2	1/2	3 1/2	1 1/4	12.700	●
5/8	5/8	3 1/2	1 1/4	15.870	●
3/4	3/4	4	1 1/2	19.050	●
1	1	4	1 1/2	25.400	●

HA HB

Series: 3507 3508
 Tool material: Solid carbide
 Surface finish: FIREX®
 Application: H
 d₂ shank tolerance: h6
 d₁ tolerance: h10
 Techn. data page: 161

d1	d2	d3	l1	l2	l3	Order	Availability
mm	mm	mm	mm	mm	mm	no.	
6.000	6.000	5.500	57.00	13.00	21.00	6.000	○
8.000	8.000	7.500	63.00	19.00	27.00	8.000	○
10.000	10.000	9.200	72.00	22.00	32.00	10.000	○
12.000	12.000	11.200	83.00	26.00	38.00	12.000	○
16.000	16.000	15.000	92.00	32.00	44.00	16.000	○
20.000	20.000	19.000	104.00	38.00	54.00	20.000	○
25.000	25.000	24.000	121.00	45.00	65.00	25.000	○

Alloyed Steels Tool Steels Cast materials Stainless Steels Al and Al-alloys Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

RF 100 U/HF (universal) 4-flute variable helix end mills with roughing-finishing profile

Long length

HF		HA					
Series		XX					
Tool material		Solid carbide					
Surface finish		FIREX®					
Application							
d ₂ shank tolerance		h6					
d ₁ tolerance		h10					
Techn. data page		161					
		RF100					
		NEW					
d1	d2	d3	l1	l2	l3	Order	Availability
fract.	fract.		fract.	fract.		no.	
1/4	1/4		3 1/4	1 1/4		6.350	
5/16	5/16		3 1/4	1 1/4		7.940	
3/8	3/8		4	1 1/2		9.520	
1/2	1/2		4 1/2	2		12.700	
5/8	5/8		5	2 1/4		15.870	
3/4	3/4		5	2 1/4		19.050	
1	1		5	2 1/4		25.400	

Extra long length

HF		HA					
Series		XX					
Tool material		Solid carbide					
Surface finish		FIREX®					
Application							
d ₂ shank tolerance		h6					
d ₁ tolerance		h10					
Techn. data page		161					
		RF100					
		NEW					
d1	d2	d3	l1	l2	l3	Order	Availability
fract.	fract.	dec. in.	fract.	fract.	dec. in.	no.	
1/4	1/4	0.23	4	3/4	2.58	6.350	
5/16	5/16	0.29	4	13/16	2.58	7.940	
3/8	3/8	0.34	4	1	2.44	9.520	
1/2	1/2	0.47	5	1	3.22	12.700	
5/8	5/8	0.59	5 1/4	1 1/4	3.34	15.870	
3/4	3/4	0.71	6	1 1/2	3.97	19.050	
1	1	0.94	6	1 1/2	3.72	25.400	

RF 100 U/HF (universal) 4-flute variable helix end mills with roughing-finishing profile

Long length (metric)

HF		HA	HB					
Series		3509	3522					
Tool material		Solid carbide						
Surface finish		FIREX®						
Application								
d ₂ shank tolerance		h6						
d ₁ tolerance		h10						
Techn. data page		161						
		RF100	RF100					
		NEW	NEW					
d1	d2	d3	l1	l2	l3	Order	Availability	
mm	mm	mm	mm	mm	mm	no.	<input type="radio"/>	<input type="radio"/>
6.000	6.000	5.500	65.00	18.00	29.00	6.000	<input type="radio"/>	<input type="radio"/>
8.000	8.000	7.500	75.00	24.00	39.00	8.000	<input type="radio"/>	<input type="radio"/>
10.000	10.000	9.200	80.00	30.00	40.00	10.000	<input type="radio"/>	<input type="radio"/>
12.000	12.000	11.200	93.00	36.00	48.00	12.000	<input type="radio"/>	<input type="radio"/>
16.000	16.000	15.000	108.00	48.00	60.00	16.000	<input type="radio"/>	<input type="radio"/>
20.000	20.000	19.000	126.00	60.00	76.00	20.000	<input type="radio"/>	<input type="radio"/>

Extra long length (metric)

HF		HA	HB					
Series		3598	3600					
Tool material		Solid carbide						
Surface finish		FIREX®						
Application								
d ₂ shank tolerance		h6						
d ₁ tolerance		h10						
Techn. data page		161						
		RF100	RF100					
		NEW	NEW					
d1	d2	d3	l1	l2	l3	Order	Availability	
mm	mm	mm	mm	mm	mm	no.	<input type="radio"/>	<input type="radio"/>
6.000	6.000	5.500	80.00	13.00	40.00	6.000	<input type="radio"/>	<input type="radio"/>
8.000	8.000	7.500	100.00	19.00	50.00	8.000	<input type="radio"/>	<input type="radio"/>
10.000	10.000	9.200	100.00	22.00	50.00	10.000	<input type="radio"/>	<input type="radio"/>
12.000	12.000	11.200	150.00	26.00	80.00	12.000	<input type="radio"/>	<input type="radio"/>
16.000	16.000	15.000	150.00	32.00	80.00	16.000	<input type="radio"/>	<input type="radio"/>
20.000	20.000	19.000	150.00	38.00	80.00	20.000	<input type="radio"/>	<input type="radio"/>

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels Tool Steels Cast materials Stainless Steels Al and Al-alloys Ti / Ni alloys Hardened Materials

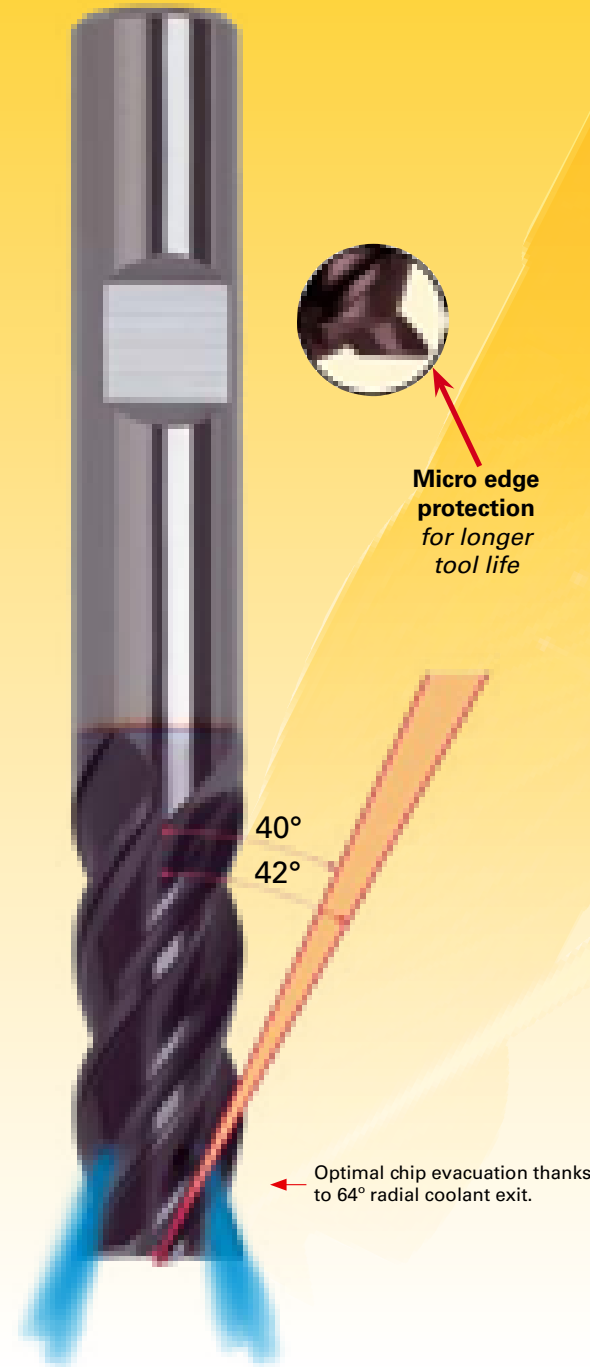
RF 100 F variable helix end mills for free-cutting materials < 30 HRC

We have developed the RF 100 end mill with variable spiral angle primarily to prevent chattering and the so-called corkscrew effect (as found when withdrawing tools having a large spiral angle)

Milling cutters with coolant through offer a considerably longer tool life and higher feed rates compared to conventional tools. Guhring has designed the milling cutter's radial coolant exit at an angle of 64°, offering considerable protection to the sensitive cutting edge corner. This coolant exit design also helps to prevent any built-up edge.

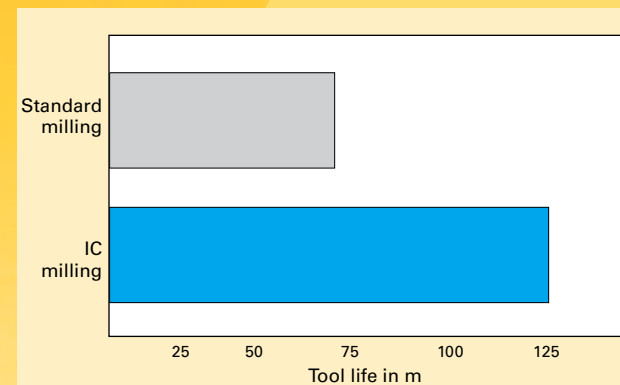
Therefore, Guhring's RF 100 F variable helix end mills offer the following advantages:

- up to 60% higher in feed rates
- longer tool life
- vibration-free machining
- suitable for roughing and finishing
- increased surface finish quality



Micro edge protection for longer tool life

Optimal chip evacuation thanks to 64° radial coolant exit.



Milling cutters with internal cooling achieve a 2/3 longer tool life in comparison with conventional milling cutters.

Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H
	up to 28HRC	over 28 HRC	up to 180 HB 30 over 180 HB 30	up to 28 HRC over 28 HRC	up to 3% Si over 3% Si	Ti-based Ni-based	
RF 100 U	○	●	●	●		●	○
RF 100 U/HF		●	●	●		○	○
RF 100 F	●		○	●		●	
RF 100 VA	○			●	●	○	
RF 100 VA/NF	●			●	●	○	
RF 100 A					●	●	
RF 100 A/WF					●	●	
RF 100 Ti		○				●	○
RF 100 H		○	○				● ●
RF 100 SF	●	●	●	●	○	●	○

● = optimal suitability ○ = limited suitability

● USA Stock ○ International Stock (0-2 wks)

RF 100 F 4-flute variable helix end mills for free-cutting materials < 30 HRC

Standard length

NH	40°/42°	4	0.1-0.6 x 45°
HA	HB		
Series	3078		
Tool material	Solid carbide		
Surface finish	FIREX®		
Application			
d ₂ shank tolerance	h6		
d ₁ tolerance	h10		
Techn. data page	160		

d1	d2	l1	l2	Order
fract.	fract.	fract.	fract.	no.
3/16	3/16	2	5/8	4.760
1/4	1/4	2 1/2	3/4	6.350
5/16	5/16	2 1/2	13/16	7.940
3/8	3/8	2 1/2	1	9.520
1/2	1/2	3 1/2	1 1/4	12.700
5/8	5/8	3 1/2	1 1/4	15.870
3/4	3/4	4	1 1/2	19.050

HA	HB	HB
Series	3629	
Tool material	Solid carbide	
Surface finish	FIREX®	
Application		
d ₂ shank tolerance	h6	
d ₁ tolerance	h10	
Techn. data page	160	

d1	d2	d3	l1	l2	l3	Order
mm	mm	mm	mm	mm	mm	no.
4.000	6.000	3.700	57.00	11.00	18.00	4.000
5.000	6.000	4.700	57.00	13.00	18.00	5.000
6.000	6.000	5.500	57.00	13.00	21.00	6.000
8.000	8.000	7.500	63.00	19.00	27.00	8.000
10.000	10.000	9.200	72.00	22.00	32.00	10.000
12.000	12.000	11.200	83.00	26.00	38.00	12.000
16.000	16.000	15.000	92.00	32.00	44.00	16.000
20.000	20.000	19.000	104.00	38.00	54.00	20.000

Standard length (metric)

NH	40°/42°	4	0.1-0.6 x 45°
HA	HB	HB	
Series	3629		
Tool material	Solid carbide		
Surface finish	FIREX®		
Application			
d ₂ shank tolerance	h6		
d ₁ tolerance	h10		
Techn. data page	160		

d1	d2	d3	l1	l2	l3	Order
mm	mm	mm	mm	mm	mm	no.
4.000	6.000	3.700	57.00	11.00	18.00	4.000
5.000	6.000	4.700	57.00	13.00	18.00	5.000
6.000	6.000	5.500	57.00	13.00	21.00	6.000
8.000	8.000	7.500	63.00	19.00	27.00	8.000
10.000	10.000	9.200	72.00	22.00	32.00	10.000
12.000	12.000	11.200	83.00	26.00	38.00	12.000
16.000	16.000	15.000	92.00	32.00	44.00	16.000
20.000	20.000	19.000	104.00	38.00	54.00	20.000

HA	HB	HB
Series	3629	
Tool material	Solid carbide	
Surface finish	FIREX®	
Application		
d ₂ shank tolerance	h6	
d ₁ tolerance	h10	
Techn. data page	160	

d1	d2	d3	l1	l2	l3	Order
mm	mm	mm	mm	mm	mm	no.
4.000	6.000	3.700	57.00	11.00	18.00	4.000
5.000	6.000	4.700	57.00	13.00	18.00	5.000
6.000	6.000	5.500	57.00	13.00	21.00	6.000
8.000	8.000	7.500	63.00	19.00	27.00	8.000
10.000	10.000	9.200	72.00	22.00	32.00	10.000
12.000	12.000	11.200	83.00	26.00	38.00	12.000
16.000	16.000	15.000	92.00	32.00	44.00	16.000
20.000	20.000	19.000	104.00	38.00	54.00	20.000

● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

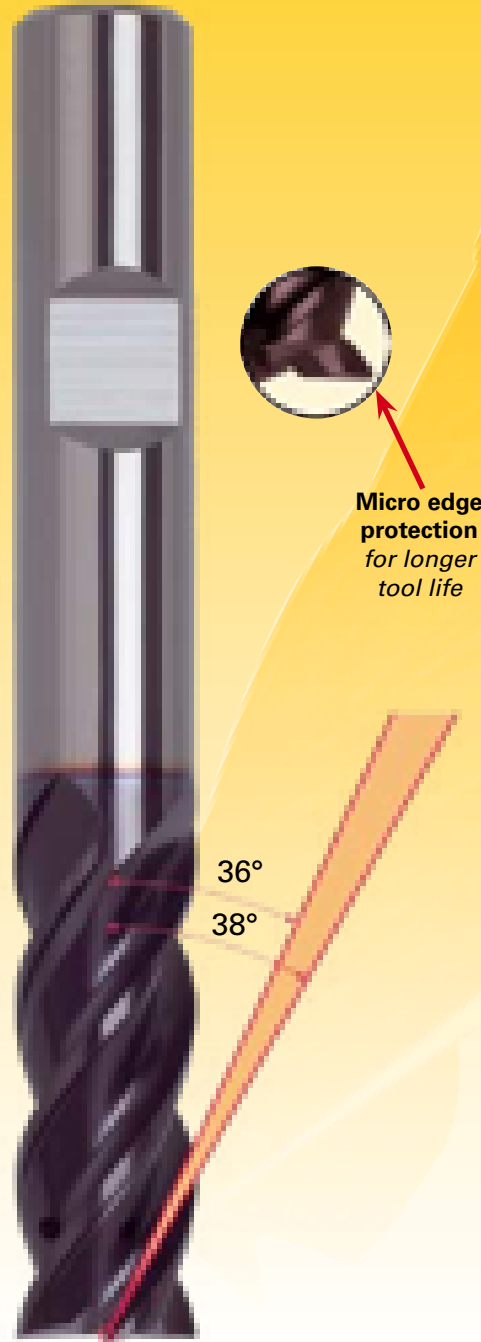
RF 100 VA variable helix end mills for stainless steels

Milling stainless steel presents some unique challenges. Guhring developed the RF 100 VA style variable helix end mill to have greater tool life and performance in stainless steels.

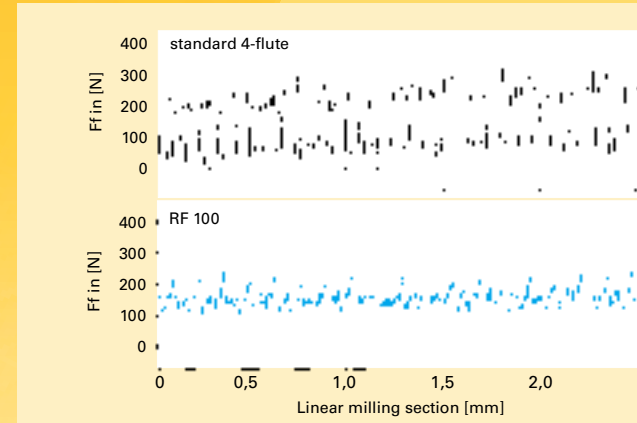
RF 100 VA style end mills feature Guhring's newest high-performance coating, nano-A™. This micro-layer coating has the superior heat and wear resistance that is needed when milling stainless steels.

This end mill design also allows these benefits:

- up to 60% higher feed rates
- longer tool life
- increased drilling depths
- vibration-free machining
- suitable for roughing and finishing
- increased surface finish quality
- reduced cutter wandering



Micro edge protection for longer tool life



A cutting force comparison between a conventional type N and a RF 100 variable helix end mill clearly shows the RF 100 end mill's quieter and more stable machining characteristics

Material	Alloyed Steel		Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys		H
	up to 28HRC	over 28 HRC	up to 180 HB 30	over 180 HB 30	up to 28 HRC	over 28 HRC	up to 3% Si	over 3% Si	
RF 100 U	○	●	●	●			●	○	
RF 100 U/HF		●	●	●			○	○	
RF 100 F	●		○		●			●	
RF 100 VA	○				●	●		○	
RF 100 VA/NF	●				●	●		○	
RF 100 A						●	●		
RF 100 A/WF						●	●		
RF 100Ti		○					●	○	
RF 100 H		○	○					●	●
RF 100 SF	●	●	●	●	●	○	○	●	○

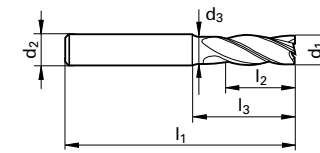
● = optimal suitability ○ = limited suitability

● USA Stock ○ International Stock (0-2 wks)

RF 100 VA 4-flute variable helix end mills for stainless steels

Stub length

N	36°/38°	4	0,15-0,70 x 45°
Series			
XX			
Tool material			
Solid carbide			
Surface finish			
nano-A™			
Application			
[Icons]			
d ₂ shank tolerance			
h6			
d ₁ tolerance			
h10			
Techn. data page			
160			
RF 100			
NEW			

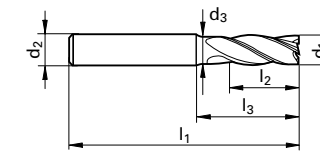


d1	d2	d3	l1	l2	l3	Order
fract.	fract.		fract.	fract.		no.
3/16	3/16		2	3/8		4.760
1/4	1/4		2	1/2		6.350
5/16	5/16		2	1/2		7.940
3/8	3/8		2	5/8		9.520
1/2	1/2		2 1/2	5/8		12.700
5/8	5/8		3	3/4		15.870
3/4	3/4		3	1		19.050
1	1		3	1		25.400

Availability

Stub length (metric)

N	36°/38°	4	0,15-0,70 x 45°
Series			
XX			
Tool material			
Solid carbide			
Surface finish			
nano-A™			
Application			
[Icons]			
d ₂ shank tolerance			
h6			
d ₁ tolerance			
h10			
Techn. data page			
160			
RF 100			
NEW			



d1	d2	d3	l1	l2	l3	Order
mm	mm	mm	mm	mm	mm	no.
4.000	6.000	3.700	54.00	8.00	15.00	4.000
5.000	6.000	4.700	54.00	9.00	15.00	5.000
6.000	6.000	5.500	54.00	10.00	18.00	6.000
8.000	8.000	7.500	58.00	12.00	22.00	8.000
10.000	10.000	9.200	66.00	14.00	26.00	10.000
12.000	12.000	11.200	73.00	16.00	28.00	12.000
16.000	16.000	15.000	82.00	22.00	34.00	16.000
20.000	20.000	19.000	92.00	26.00	42.00	20.000

Availability

RF 100	RF 100
○	○
○	○
○	○
○	○
○	○
○	○
○	○
○	○
○	○
○	○

● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

RF 100 VA 4-flute variable helix end mills for stainless steels

Standard length

 N	 36°/38°	 4	 0,15-0,70 x 45°	Series	3080
				Tool material	Solid carbide
				Surface finish	nano-A™
				Application	
				d ₂ shank tolerance	h6
				d ₁ tolerance	h10
				Techn. data page	160
d1	d2	l1	l2	Order	Availability
fract.	fract.	fract.	fract.	no.	
3/16	3/16	2	5/8	4.760	<input checked="" type="radio"/> <input type="radio"/>
1/4	1/4	2 1/2	3/4	6.350	
5/16	5/16	2 1/2	13/16	7.940	
3/8	3/8	2 1/2	1	9.520	
1/2	1/2	3 1/2	1 1/4	12.700	
5/8	5/8	3 1/2	1 1/4	15.870	
3/4	3/4	4	1 1/2	19.050	
1	1	4	1 1/2	25.400	

Standard length (metric)

 N	 36°/38°	 4	 0,15-0,70 x 45°	Series	3080		
				Tool material	Solid carbide		
				Surface finish	nano-A™		
				Application			
				d ₂ shank tolerance	h6		
				d ₁ tolerance	h10		
				Techn. data page	160		
d1	d2	d3	l1	l2	l3	Order	Availability
mm	mm	mm	mm	mm	mm	no.	
6.000	6.000	5.500	57.00	13.00	21.00	6.000	<input type="radio"/> <input type="radio"/>
8.000	8.000	7.500	63.00	19.00	27.00	8.000	
10.000	10.000	9.200	72.00	22.00	32.00	10.000	
12.000	12.000	11.200	83.00	26.00	38.00	12.000	
16.000	16.000	15.000	92.00	32.00	44.00	16.000	
20.000	20.000	19.000	104.00	38.00	54.00	20.000	
25.000	25.000	23.500	121.00	45.00	65.00	25.000	

 HA	 HB	Series	3800	3803
		Tool material	Solid carbide	
		Surface finish	nano-A™	
		Application		
		d ₂ shank tolerance	h6	h6
		d ₁ tolerance	h10	h10
		Techn. data page	160	160
RF100		RF100		
NEW		NEW		
Availability				
<input type="radio"/> <input type="radio"/>				

RF 100 VA 4-flute variable helix end mills for stainless steels

Long length

 N	 36°/38°	 4	 0,15-0,70 x 45°	Series	XX		
				Tool material	Solid carbide		
				Surface finish	nano-A™		
				Application			
				d ₂ shank tolerance	h6		
				d ₁ tolerance	h10		
				Techn. data page	160		
d1	d2	d3	l1	l2	l3	Order	Availability
fract.	fract.	dec. in.	fract.	fract.	dec. in.	no.	
3/16	3/16	0.18	2 1/2	5/8	1.40	4.760	<input type="radio"/> <input type="radio"/>
1/4	1/4	0.23	3 1/4	3/4	1.83	6.350	
5/16	5/16	0.29	3 1/4	13/16	1.83	7.940	
3/8	3/8	0.34	4	1	2.44	9.520	
1/2	1/2	0.47	4 1/2	1 1/4	2.72	12.700	
5/8	5/8	0.59	5	1 1/4	3.09	15.870	
3/4	3/4	0.71	5	1 1/2	2.97	19.050	
1	1	0.94	5	1 1/2	2.72	25.400	

 HA	 HB	Series	XX
		Tool material	Solid carbide
		Surface finish	nano-A™
		Application	
		d ₂ shank tolerance	h6
		d ₁ tolerance	h10
		Techn. data page	160
RF100			
NEW			
Availability			
<input type="radio"/> <input type="radio"/>			

Long length (metric)

 N	 36°/38°	 4	 0,15-0,70 x 45°	Series	3806	3807	
				Tool material	Solid carbide		
				Surface finish	nano-A™		
				Application			
				d ₂ shank tolerance	h6	h6	
				d ₁ tolerance	h10	h10	
				Techn. data page	160	160	
d1	d2	d3	l1	l2	l3	Order	Availability
mm	mm	mm	mm	mm	mm	no.	
6.000	6.000	5.500	65.00	10.00	29.00	6.000	<input type="radio"/> <input type="radio"/>
8.000	8.000	7.500	75.00	12.00	39.00	8.000	
10.000	10.000	9.200	80.00	14.00	40.00	10.000	
12.000	12.000	11.200	93.00	16.00	48.00	12.000	
16.000	16.000	15.000	108.00	22.00	60.00	16.000	
20.000	20.000	19.000	126.00	26.00	76.00	20.000	

 HA	 HB	Series	3806	3807
		Tool material	Solid carbide	
		Surface finish	nano-A™	
		Application		
		d ₂ shank tolerance	h6	h6
		d ₁ tolerance	h10	h10
		Techn. data page	160	160
RF100		RF100		
NEW		NEW		
Availability				
<input type="radio"/> <input type="radio"/>				

● USA Stock ○ International Stock (0-2 wks)

● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys ● H Hardened Materials

RF 100 VA/NF variable helix roughing / finishing end mills for stainless steels

Based on our standard RF 100 end mills, we have developed a new series of variable-helix end mills with a completely new designed roughing profile for stainless steel.

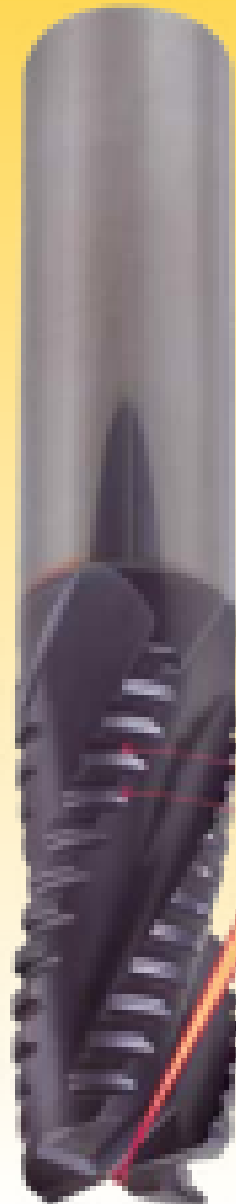
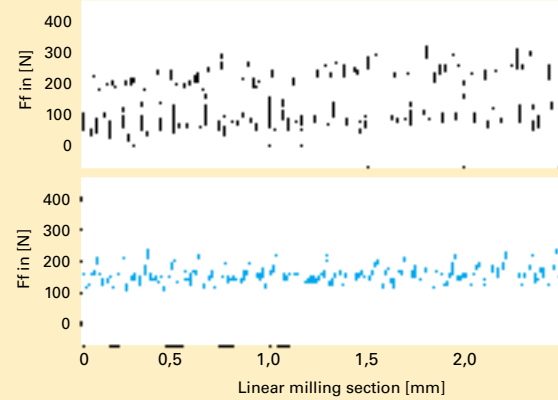
The result is a drastic increase in tool life compared to conventional knuckle-type geometries and an improvement in surface finish-quality of the workpiece, so that in many applications finishing operations are unnecessary.

RF 100 VA style end mills feature Guhring's newest high-performance coating, nano-A™. This micro-layer coating has the superior heat and wear resistance that is needed when milling stainless steels.

This end mill design also allows these benefits:

- up to 60% higher in feed rates
- vibration-free machining
- increased surface finish quality
- small easy removable chips
- less cutting pressure
- vastly reduced horsepower consumption

Surface finish quality of 2-3 μm, requires no additional finishing operation in many cases



36°
38°

Micro edge protection for longer tool life

Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H
Hardness tensile strength	up to 28Hrc	over 28 HRC	up to 180 HB 30 over 180 HB 30	up to 28 HRC over 28 HRC	up to 3% Si over 3% Si	Ti-based Ni-based	up to 52 HRC over 52 HRC
RF 100 U	○	●	●			●	○
RF 100 U/HF		●	●			○	○
RF 100 F	●		○	●		●	
RF 100 VA	○			●	●	○	
RF 100 VA/NF	●			●	●	○	
RF 100 A					●	●	
RF 100 A/WF					●	●	
RF 100Ti		○				●	○
RF 100 H		○	○				● ●
RF 100 SF	●	●	●	●	○	●	○

● = optimal suitability ○ = limited suitability

● USA Stock ○ International Stock (0-2 wks)

RF 100 VA/NF 4-flute variable helix end mills with roughing profile for stainless steel

Standard length

NF	36° 38°	4	0,3-0,6 x 45°
HA	HB		
Series	3081		
Tool material	Solid carbide		
Surface finish	nano-A™		
Application			
d ₂ shank tolerance	h6		
d ₁ tolerance	h10		
Techn. data page	161		
RF100	RF100		

d1	d2	l1	l2	Order	Availability
fract.	fract.	fract.	fract.	no.	
1/4	1/4	2 1/2	3/4	6.350	●
5/16	5/16	2 1/2	13/16	7.940	●
3/8	3/8	2 1/2	1	9.520	●
1/2	1/2	3 1/2	1 1/4	12.700	
5/8	5/8	3 1/2	1 1/4	15.870	●
3/4	3/4	4	1 1/2	19.050	●
1	1	4	1 1/2	25.400	●

Standard length (metric)

NF	36° 38°	4	0,3-0,6 x 45°
HA	HB	3696	3718
Series	3081		
Tool material	Solid carbide		
Surface finish	nano-A™		
Application			
d ₂ shank tolerance	h6	h6	
d ₁ tolerance	h10	h10	
Techn. data page	161	161	
RF100	RF100		

d1	d2	d3	l1	l2	l3	Order	Availability
mm	mm	mm	mm	mm	mm	no.	
6.000	6.000	5.500	57.00	13.00	21.00	6.000	○
8.000	8.000	7.500	63.00	19.00	27.00	8.000	○
10.000	10.000	9.200	72.00	22.00	32.00	10.000	○
12.000	12.000	11.200	83.00	26.00	38.00	12.000	○
16.000	16.000	15.000	92.00	32.00	44.00	16.000	○
20.000	20.000	19.000	104.00	38.00	54.00	20.000	○
25.000	25.000	24.000	121.00	45.00	65.00	25.000	○

● Alloyed Steels ● Tool Steels ○ Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

RF-LINE

RF 100 VA/NF variable helix end mills with roughing / finishing profile for stainless steel

Long length

NF

Series
Tool material
Surface finish
Application
d₂ shank tolerance
d₁ tolerance
Techn. data page

d1	d2	d3	l1	l2	l3	Order
fract.	fract.	dec. in.	fract.	fract.	dec. in.	no.
3/16	3/16	0.18	2 1/2	5/8	1.40	4.760
1/4	1/4	0.23	3 1/4	3/4	1.83	6.350
5/16	5/16	0.29	3 1/4	13/16	1.83	7.940
3/8	3/8	0.34	4	1	2.44	9.520
1/2	1/2	0.47	4 1/2	1 1/4	2.72	12.700
5/8	5/8	0.59	5	1 1/4	3.09	15.870
3/4	3/4	0.71	5	1 1/2	2.97	19.050
1	1	0.94	5	1 1/2	2.72	25.400

HA

XX

Solid carbide

nano-A™

h6

h10

161

RF100

NEW

Availability

● USA Stock ○ International Stock (0-2 wks)

RF-LINE

RF 100 VA/NF variable helix end mills with roughing / finishing profile for stainless steel

Long length (metric)

NF

Series
Tool material
Surface finish
Application
d₂ shank tolerance
d₁ tolerance
Techn. data page

d1	d2	d3	l1	l2	l3	Order
mm	mm	mm	mm	mm	mm	no.
6.000	6.000	5.500	65.00	10.00	29.00	6.000
8.000	8.000	7.500	75.00	12.00	39.00	8.000
10.000	10.000	9.200	80.00	14.00	40.00	10.000
12.000	12.000	11.200	93.00	16.00	48.00	12.000
16.000	16.000	15.000	108.00	22.00	60.00	16.000
20.000	20.000	19.000	126.00	26.00	76.00	20.000

HA **HB**

3733 **3885**

Solid carbide

nano-A™

h6 **h6**

h10 **h10**

161 **161**

RF100 **RF100**

NEW **NEW**

Availability

○	○
○	○
○	○
○	○
○	○
○	○

Alloyed Steels
 Tool Steels
 Cast materials
 Stainless Steels
 Al and Al-alloys
 Ti / Ni alloys
 H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

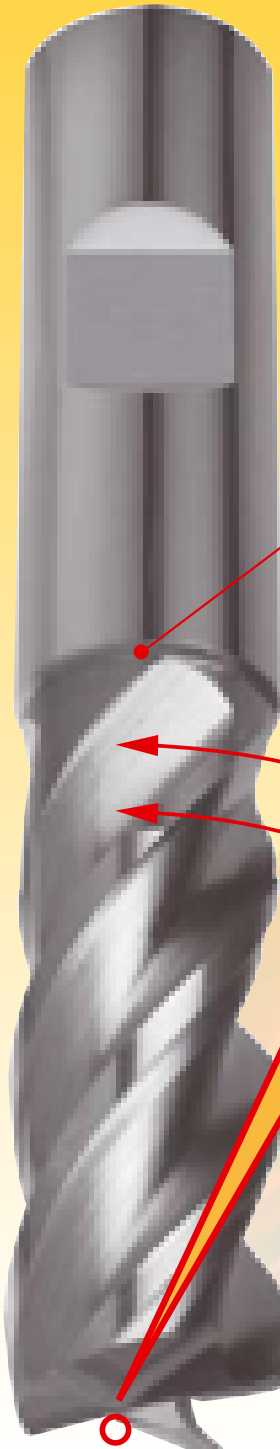
RF 100 A - high-performance roughing end mills for aluminium and Al-alloys

RF 100 high-performance end mills excel thanks to unequal helix angles which considerably reduce vibration. The uneven helix angle vastly improves surface quality for finishing operations and a considerably higher feed rate for slot drilling and roughing operations are also achieved.

With many applications, the complete milling process can be covered with one RF 100, which as well as increasing tool life and dimensional accuracy of the workpiece generates a considerable cost advantage.

Summary of advantages

- suitable for roughing and finishing
- up to 60% higher feed rates
- up to 4-times longer tool life
- vibration-free operation
- improved workpiece surface quality

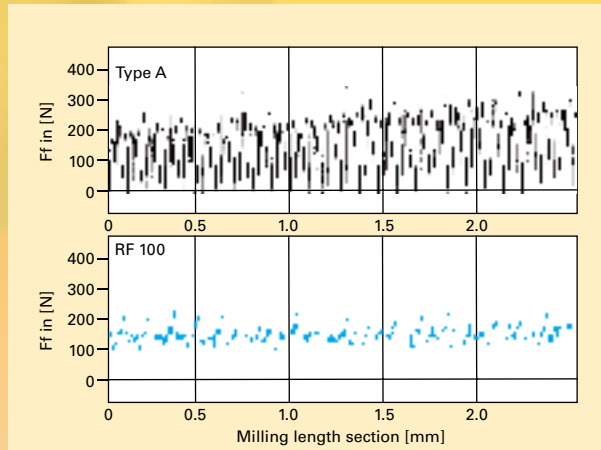


with neck clearance

40°
42°



micro-corner protection for longer tool life



The cutting force comparison between a conventional milling cutter type N and the RF 100 shows a clearly quieter, more rigid operation of the RF 100.

Material	Alloyed Steel		Tool Steel		Cast iron		Stainless steel		Aluminium		Ti-special alloys		H
	up to 28Hrc	over 28 Hrc	up to 180 HB 30	over 180 HB 30	up to 28 Hrc	over 28 Hrc	up to 3% Si	over 3% Si	Ti-based	Ni-based	up to 52 HRC	over 52 HRC	
RF 100 U	○	●	●	●					●		○		
RF 100 U/HF		●	●	●							○		
RF 100 F	●		○			●					●		
RF 100 VA	○				●	●					○		
RF 100 VA/NF	●				●	●					○		
RF 100 A									●	●			
RF 100 A/WF									●	●			
RF 100Ti		○									●	○	
RF 100 H		○	○										●
RF 100 SF	●	●	●	●	●	●	○	○	●	●	○		

● = optimal suitability ○ = limited suitability

RF 100 A 4-flute variable helix end mills for aluminum and cast aluminum < 22 HRC

Standard length

W	40° 42°	4	0.1-0.6 x 45°
Series	3077		
Tool material	Solid carbide		
Surface finish	Bright		
Application			
d ₂ shank tolerance	h6		
d ₁ tolerance	h10		
Techn. data page	160		

d1	d2	l1	l2	Order	Availability
fract.	fract.	fract.	fract.	no.	
3/16	3/16	2	5/8	4.760	●
1/4	1/4	2 1/2	3/4	6.350	●
5/16	5/16	2 1/2	13/16	7.940	●
3/8	3/8	2 1/2	1	9.520	●
1/2	1/2	3 1/2	1 1/4	12.700	●
5/8	5/8	3 1/2	1 1/4	15.870	●
3/4	3/4	4	1 1/2	19.050	●

Standard length (metric)

W	40° 42°	4	0.1-0.6 x 45°
Series	3202		
Tool material	Solid carbide		
Surface finish	Bright		
Application			
d ₂ shank tolerance	h6		
d ₁ tolerance	h10		
Techn. data page	160		

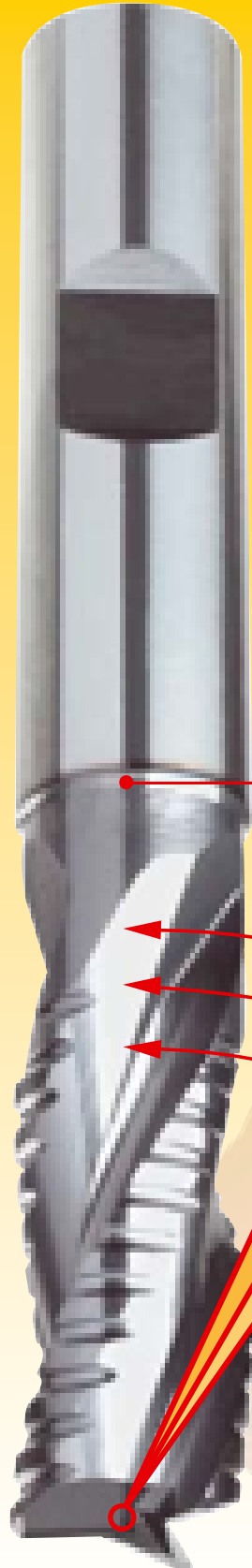
d1	d2	l1	l2	Order	Availability
mm	mm	mm	mm	no.	
4.000	6.000	57.00	11.00	4.000	○
5.000	6.000	57.00	13.00	5.000	○
6.000	6.000	57.00	13.00	6.000	●
8.000	8.000	63.00	19.00	8.000	●
10.000	10.000	72.00	22.00	10.000	○
12.000	12.000	83.00	26.00	12.000	○
16.000	16.000	92.00	32.00	16.000	○
20.000	20.000	104.00	38.00	20.000	○

d1	d2	l1	l2	Order	Availability
fract.	fract.	fract.	fract.	no.	
3/16	3/16	2	5/8	4.760	○
1/4	1/4	2 1/2	3/4	6.350	○
5/16	5/16	2 1/2	13/16	7.940	○
3/8	3/8	2 1/2	1	9.520	○
1/2	1/2	3 1/2	1 1/4	12.700	○
5/8	5/8	3 1/2	1 1/4	15.870	○
3/4	3/4	4	1 1/2	19.050	○

● Alloyed Steels ● Tool Steels ○ Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

RF 100 A/WF - high-performance roughing end mills for aluminium and Al-alloys

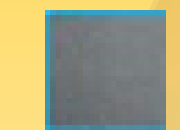


Based on our RF 100 end mill with unequal helix angles in combination with a newly developed roughing geometry. The result is a dramatic increase in tool life in comparison to conventional rough milling cutters with round or flat knuckle-type teeth. At the same time, the surface quality of the workpiece is improved to a peak-to-valley height of appr. $R_a = 2-3 \mu m$, making in many cases finishing operations unnecessary.

Simultaneously, the innovative design reduces power consumption in comparison to conventional RF 100 end mills allowing the application in unstable conditions and on less powerful machines

Summary of advantages

- low cutting pressure and power consumption
- vibration-free operation
- increased feed rates possible
- increased surface qualities ($R_a = 2-3 \mu m$)
- longer tool life



Workpiece surface $R_a = 2-3 \mu m$

with neck clearance

29°
30°
31°



micro-corner protection for longer tool life

Type	Roughing end mill	RF 100 A/WF
Performance index	100%	140%
Workpiece surface	$R_a = 9-10 \mu m$	$R_a = 2-3 \mu m$
Tool life index	100%	180%
Power consumption	100%	130%
Cutting pressure	100%	125%

Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H					
Hardness tensile strength	up to 28HRC	over 28 HRC	up to 180 HB 30	over 180 HB 30	up to 28 HRC	over 28 HRC	up to 3% Si	over 3% Si	Ti-based	Ni-based	up to 52 HRC	over 52 HRC
RF 100 U	○	●	●	●				●	○			
RF 100 U/HF		●	●	●					○			
RF 100 F	●		○		●					●		
RF 100 VA	○				●	●				○		
RF 100 VA/NF	●				●	●				○		
RF 100 A						●	●					
RF 100 A/WF						●	●					
RF 100Ti		○						●	○			
RF 100 H		○		○							●	●
RF 100 SF	●	●	●	●	●	○	○	●	●	○		

● = optimal suitability ○ = limited suitability

RF 100 A/WF variable helix roughing end mills for aluminum and aluminum alloys

Standard length

WF	29° 30° 31°	3	0,3-0,6 x 45°
Series			
Tool material			
Surface finish			
Application			
d_2 shank tolerance			
d_1 tolerance			
Techn. data page			

d1	d2	d3	l1	l2	l3	Order
fract.	fract.		fract.	fract.		no.
3/16	3/16		2	5/8		4.760
1/4	1/4		2 1/2	3/4		6.350
5/16	5/16		2 1/2	13/16		7.940
3/8	3/8		2 1/2	1		9.520
1/2	1/2		3 1/2	1 1/4		12.700
5/8	5/8		3 1/2	1 1/4		15.870
3/4	3/4		4	1 1/2		19.050
1	1		4	1 1/2		25.400

Standard length (metric)

WF	29° 30° 31°	3	0,3-0,6 x 45°
Series			
Tool material			
Surface finish			
Application			
d_2 shank tolerance			
d_1 tolerance			
Techn. data page			

d1	d2	d3	l1	l2	l3	Order
mm	mm	mm	mm	mm	mm	no.
6.000	6.000	5.500	65.00	13.00	29.00	6.000
8.000	8.000	7.500	75.00	19.00	39.00	8.000
10.000	10.000	9.200	80.00	22.00	40.00	10.000
12.000	12.000	11.200	93.00	26.00	48.00	12.000
16.000	16.000	15.000	108.00	32.00	60.00	16.000
20.000	20.000	19.000	126.00	38.00	76.00	20.000

Alloyed Steels Tool Steels Cast materials Stainless Steels Al and Al-alloys Ti / Ni alloys H Hardened Materials

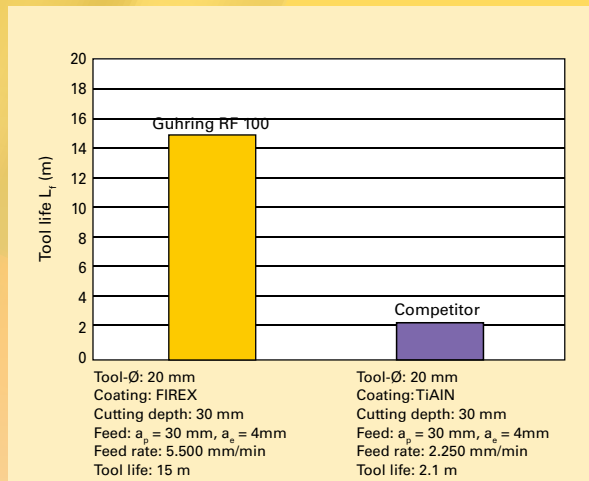
When ordering: EDP no. = Series + Order no., example: 3867 12.700

RF 100 S/F - "Super Finish" variable helix end mills for materials up to 48 HRC

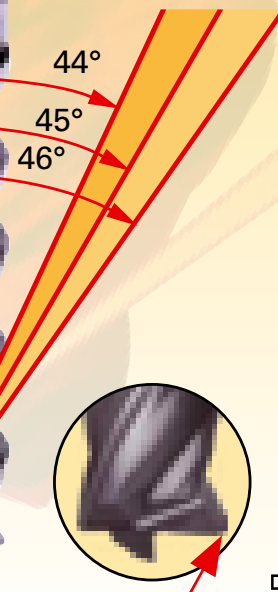
Based on our 4-flute RF 100 U the RF 100 S/F has a higher, more rigid web paired with 5 or 6 cutting edges. In addition, its innovative flute geometry ensures optimal chip evacuation. The range of application includes super finishing and HSC finishing as well as semi-roughing operations, i.e. feed widths (a_e) up to $0.3 \times D$ with close to complete cutting length.

Summary of advantages

- suitable for semi-roughing and HSC-finishing
- extremely high form accuracy
- vibration-free operation
- optimised flute geometry
- high feed rates possible
- optimal surface quality
- increased tool life



with neck clearance



micro-corner protection for longer tool life

Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H
Hardness tensile strength	up to 28HRC	over 28 HRC	up to 180 HB 30 over 180 HB 30	up to 28 HRC over 28 HRC	up to 3% Si over 3% Si	Ti-based Ni-based	up to 52 HRC over 52 HRC
RF 100 U	○	●	●			●	○
RF 100 U/HF		●	●			○	○
RF 100 F	●		○	●		●	
RF 100 VA	○			●	●		○
RF 100 VA/NF	●			●	●		○
RF 100 A					●	●	
RF 100 A/WF					●	●	
RF 100 Ti		○				●	○
RF 100 H		○	○				● ●
RF 100 SF	●	●	●	●	○	●	○

● = optimal suitability ○ = limited suitability

RF 100 SF 6-flute variable helix end mills for materials < 54 HRC

Standard length

Standard length (metric)

NH	44° 45° 46°	6	0,025- 0,3 x 45°
Series	3115		
Tool material	Solid carbide		
Surface finish	FIREX®		
Application	H		
d ₂ shank tolerance	h6		
d ₁ tolerance	h10		
Techn. data page	160		

HA	
Series	3115
Tool material	Solid carbide
Surface finish	FIREX®
Application	H
d ₂ shank tolerance	h6
d ₁ tolerance	h10
Techn. data page	160

d1	d2	l1	l2	Order	Availability
fract.	fract.	fract.	fract.	no.	
5/16	5/16	2 1/2	13/16	7.940	●
3/8	3/8	2 1/2	1	9.520	●
1/2	1/2	3	1	12.700	●
5/8	5/8	3 1/2	1 1/4	15.870	●
3/4	3/4	4	1 1/2	19.050	●
1	1	4	1 1/2	25.400	●

NH	44° 45° 46°	6	0,025- 0,3 x 45°
Series	3631 3632		
Tool material	Solid carbide		
Surface finish	FIREX®		
Application	H		
d ₂ shank tolerance	h6		
d ₁ tolerance	h10		
Techn. data page	160		

d1	d2	d3	l1	l2	l3	Order	Availability
mm	mm	mm	mm	mm	mm	no.	
8.000	8.000	7.500	63.00	19.00	27.00	8.000	○
10.000	10.000	9.500	72.00	22.00	32.00	10.000	○
12.000	12.000	11.200	83.00	26.00	38.00	12.000	○
16.000	16.000	15.000	92.00	32.00	44.00	16.000	●
20.000	20.000	19.000	104.00	38.00	54.00	20.000	○
25.000	25.000	23.500	121.00	45.00	65.00	25.000	○

● Alloyed Steels ● Tool Steels ○ Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

RF 100 SF **5-flute** variable flute spaced end mills for materials < 54 HRC

Standard length

NH		5		0,025-0,3 x 45°	HA
Series XX Tool material Solid carbide Surface finish FIREX® Application H d ₂ shank tolerance h6 d ₁ tolerance h10 Techn. data page 160					RF100
					NEW
d1	d2	l1	l2	Order	Availability
fract.	fract.	fract.	fract.	no.	
3/16	3/16	2	5/8	4.760	
1/4	1/4	2 1/2	3/4	6.350	
5/16	5/16	2 1/2	13/16	7.940	
3/8	3/8	2 1/2	1	9.520	
1/2	1/2	3 1/2	1 1/4	12.700	
5/8	5/8	3 1/2	1 1/4	15.870	
3/4	3/4	4	1 1/2	19.050	
1	1	4	1 1/2	25.400	

Long length

NH		5		0,025-0,3 x 45°	HA
Series XX Tool material Solid carbide Surface finish FIREX® Application H d ₂ shank tolerance h6 d ₁ tolerance h10 Techn. data page 160					RF100
					NEW
d1	d2	l1	l2	Order	Availability
fract.	fract.	fract.	fract.	no.	
3/16	3/16	2 1/2	3/4	4.760	
1/4	1/4	3 1/4	1 1/4	6.350	
5/16	5/16	3 1/4	1 1/4	7.940	
3/8	3/8	4	1 1/2	9.520	
1/2	1/2	4 1/2	2	12.700	
5/8	5/8	5	2 1/4	15.870	
3/4	3/4	5	2 1/4	19.050	
1	1	5	2 1/4	25.400	

RF 100 SF **5-flute** variable flute spaced end mills for materials < 54 HRC

Long length (metric)

NH		5		0,025-0,3 x 45°	HA	HB	
Series 3897 Tool material Solid carbide Surface finish FIREX® Application H d ₂ shank tolerance h6 d ₁ tolerance h10 Techn. data page 160					3897	3898	
					RF100	RF100	
					NEW	NEW	
d1	d2	d3	l1	l2	l3	Order	Availability
mm	mm	mm	mm	mm	mm	no.	
4.000	6.000	3.700	65.00	12.00	23.00	4.000	
5.000	6.000	5.700	65.00	15.00	26.00	5.000	
6.000	6.000	5.500	65.00	18.00	29.00	6.000	
8.000	8.000	7.500	75.00	24.00	39.00	8.000	
10.000	10.000	9.200	80.00	30.00	40.00	10.000	
12.000	12.000	11.200	93.00	36.00	48.00	12.000	
16.000	16.000	15.000	108.00	48.00	60.00	16.000	
20.000	20.000	19.000	126.00	60.00	76.00	20.000	

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels
 Tool Steels
 Cast materials
 Stainless Steels
 Al and Al-alloys
 Ti / Ni alloys
 H Hardened Materials

RF 100 H - high-performance roughing end mills for hardened steels up to 60 HRC

Innovative design with core stability enables roughing operations up to 1xD in materials up to 60 HRC as well as finishing operations over the entire cutting edge length (up to 2.5xD) in materials up to 60 HRC. Also applicable with HPC strategy for roughing materials over 60 HRC.

Summary of advantages

- for roughing & finishing
- up to 60% higher feed rates
- up to 4-times longer tool life
- vibration-free operation
- improved surface finish

Standard length

H	40° 42°	4	0.1-0.6 x 45°	HA		
Series XX						
Tool material Solid carbide						
Surface finish TiAlN						
Application H						
d ₂ shank tolerance h6						
d ₁ tolerance h10						
Techn. data page 160						
RF100						
NEW						
Availability						
d1	d2	d3	l1	l2	l3	Order no.
fract.	fract.		fract.	fract.		
3/16	3/16		2	5/8		4.760
1/4	1/4		2 1/2	3/4		6.350
5/16	5/16		2 1/2	13/16		7.940
3/8	3/8		2 1/2	1		9.520
1/2	1/2		3 1/2	1 1/4		12.700
5/8	5/8		3 1/2	1 1/4		15.870
3/4	3/4		4	1 1/2		19.050
1	1		4	1 1/2		25.400

Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H
Hardness tensile strength	up to 28HRC	over 28 HRC	up to 180 HB 30 over 180 HB 30	up to 28 HRC over 28 HRC	up to 3% Si over 3% Si	Ti-based Ni-based	up to 52 HRC over 52 HRC
RF 100 H		○	○				● ●

● = optimal suitability ○ = limited suitability

● USA Stock ○ International Stock (0-2 wks)

Standard length (metric)

H	40° 42°	4	0.1-0.6 x 45°	HA	HB	
Series 3895 3896						
Tool material Solid carbide						
Surface finish TiAlN						
Application H						
d ₂ shank tolerance h6 h6						
d ₁ tolerance h10 h10						
Techn. data page 160 160						
RF100		RF100				
NEW		NEW				
Availability						
d1	d2	d3	l1	l2	l3	Order no.
mm	mm	mm	mm	mm	mm	
6.000	6.000	5.500	57.00	13.00	21.00	6.000
8.000	8.000	7.500	63.00	19.00	27.00	8.000
10.000	10.000	9.200	72.00	22.00	32.00	10.000
12.000	12.000	11.200	83.00	26.00	38.00	12.000
16.000	16.000	15.000	92.00	32.00	44.00	16.000
20.000	20.000	19.000	104.00	38.00	54.00	20.000

● Alloyed Steels ● Tool Steels ○ Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys ● Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

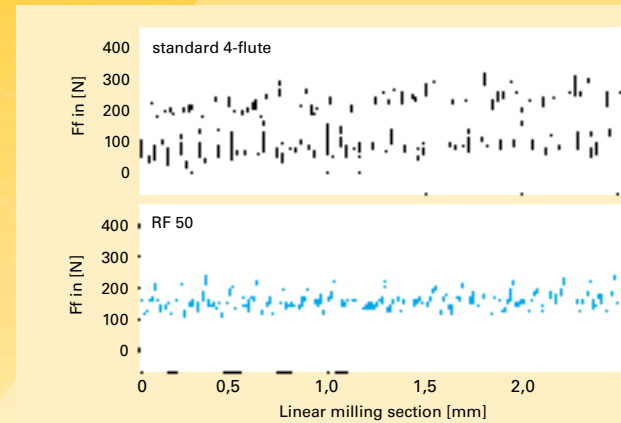
Guhring RF 50 variable flute end mills for materials < 54 HRC



We have developed the RF 50 end mill with variable flute spacing primarily to prevent chatter and the so-called cork-screw effect (as found when withdrawing tools having a large spiral angle)

However, the variable flute spacing does not only combat these two unwanted effects but offers the following additional advantages:

- Higher feed rates
- longer tool life
- increased milling depths
- vibration-free machining
- suitable for roughing and finishing
- increased surface finish quality
- straighter cutting



A cutting force comparison between a conventional type N and a RF 50 variable helix end mill clearly shows the RF 50 end mill's quieter and more stable machining characteristics.

Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H
Hardness tensile strength	up to 28HRC	over 28 HRC	up to 180 HB 30 over 180 HB 30	up to 28 HRC over 28 HRC	up to 3% Si over 3% Si	Ti-based Ni-based	up to 52 HRC over 52 HRC
RF 100 U	○	●	●	●	●	●	○

● = optimal suitability ○ = limited suitability

● USA Stock ○ International Stock (0-2 wks)

RF 50 variable flute end mills for materials < 54 HRC

Stub length

Series: 3095
 Tool material: Solid carbide
 Surface finish: FIREX®
 Application: H
 d₂ Shank tolerance: h6
 d₁ Tolerance: h10
 Tech. data page: 160

d1	d2	l1	l2	No.	Order	Availability
fract.	dec.	dec.	dec.	flutes	no.	
3/16	0.188	2.000	0.375	4	4.760	●
1/4	0.250	2.000	0.500	4	6.350	●
5/16	0.313	2.000	0.500	4	7.940	●
3/8	0.375	2.000	0.625	4	9.520	●
1/2	0.500	2.500	0.625	4	12.700	●
5/8	0.625	3.000	0.750	4	15.870	●
3/4	0.750	3.000	1.000	4	19.050	●
1	1.000	3.000	1.000	4	25.400	●

Standard length

Series: 3096
 Tool material: Solid carbide
 Surface finish: FIREX®
 Application: H
 d₂ Shank tolerance: h6
 d₁ Tolerance: h10
 Tech. data page: 160

d1	d2	l1	l2	No.	Order	Availability
fract.	dec.	dec.	dec.	flutes	no.	
3/16	0.188	2.000	0.625	4	4.760	●
1/4	0.250	2.500	0.750	4	6.350	●
5/16	0.313	2.500	0.813	4	7.940	●
3/8	0.375	2.500	1.000	4	9.520	●
7/16	0.438	2.750	1.000	4	11.110	●
1/2	0.500	3.000	1.000	4	12.700	●
5/8	0.625	3.500	1.250	4	15.870	●
3/4	0.750	4.000	1.500	4	19.050	●
1	1.000	4.000	1.500	4	25.400	●

● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

(Ad for ballnose EM)

RF 50 variable flute ballnose end mills for materials < 54 HRC

Standard length

							HA							
Series							XX							
Tool material							Solid carbide							
Surface finish														
Application														
d ₂ shank tolerance														
d ₁ tolerance														
Techn. data page														
								d1	d2	d3	l1	l2	l3	Order
								fract.	fract.		fract.	fract.		no.
								3/16	3/16		2	5/8		4.760
								1/4	1/4		2 1/2	3/4		6.350
								5/16	5/16		2 1/2	13/16		7.940
								3/8	3/8		2 1/2	1		9.520
								1/2	1/2		3 1/2	1 1/4		12.700
								5/8	5/8		3 1/2	1 1/4		15.870
								3/4	3/4		4	1 1/2		19.050
1	1		4	1 1/2		25.400								
Availability														

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels
 Tool Steels
 Cast materials
 Stainless Steels
 Al and Al-alloys
 Ti / Ni alloys
 H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

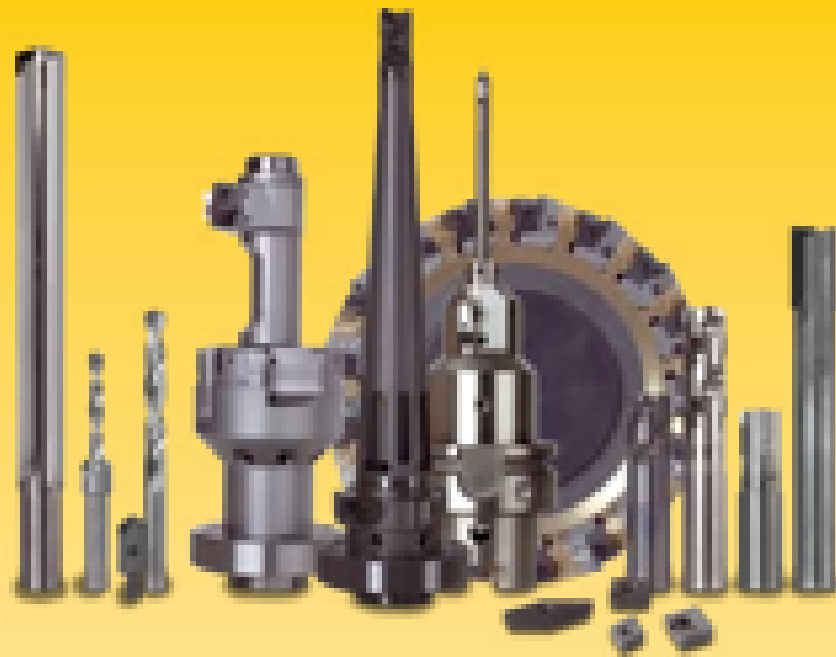
DIAMOND-TECH



The PCD and CBN tool range

Standard and highly complex PCD special tools

Guhring's PCD tool range includes drills, milling cutters and reamers, as well as tools with interchangeable inserts. Additionally, Guhring develops, designs and produces customer specific special tools for highly complex machining tasks. Some examples are PCD-tipped finishing reamers for the machining of valve seats in the automotive industry, or combination tools enabling different machining operations with one single tool.



Standard and highly complex CBN special tools

Guhring's CBN tool range includes, dependent on the range of application, drills, milling cutters, reamers and interchangeable inserts. These tools are applied in the automotive and medical industry as well as other specific applications. For example, CBN tools from Guhring are successfully and economically applied in the production of wheels, pumps and shafts.



Small but extremely accurate
CBN reaming tools with small diameters offer highest precision.



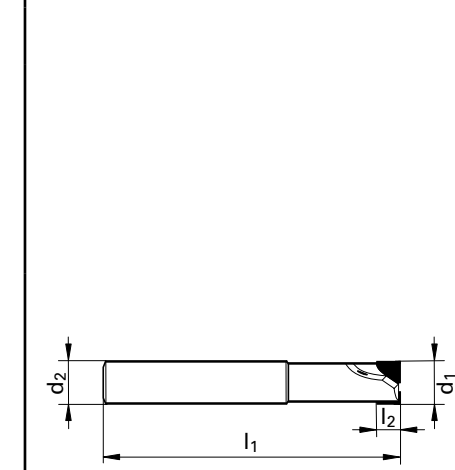
DIAMOND-TECH

DIAMOND-TECH

DL 100 X2 High performance end mills, for aluminum and composites

2-flute, center cutting

Series	3867
Tool material	PCD
Surface finish	
Application	
d ₂ Shank tolerance	h6
d ₁ Tolerance	h10
Tech. data page	call tech support

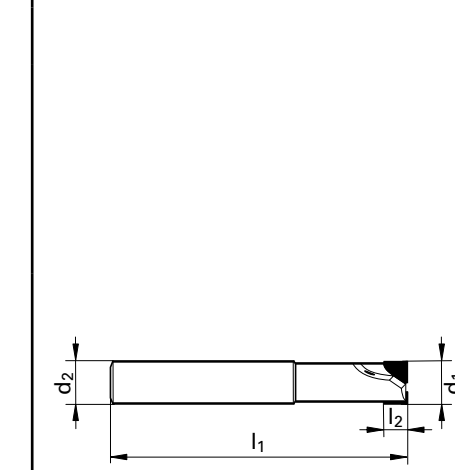


d1	d2	l1	l2	No.	Order
fract.	dec.	dec.	dec.	flutes	no.
1/4	0.250	2.500	0.750	2	6.350
3/8	0.375	3.000	0.750	2	9.520
1/2	0.500	3.000	1.000	2	12.700
3/4	0.750	4.000	1.000	2	19.050

Availability
●
●
●
●

3-flute, non-center cutting

Series	3870
Tool material	PCD
Surface finish	
Application	
d ₂ Shank tolerance	h6
d ₁ Tolerance	h10
Tech. data page	call tech support






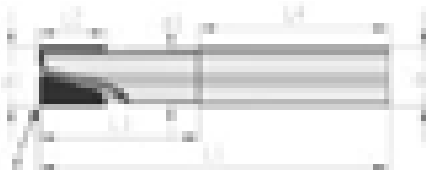



d1	d2	l1	l2	No.	Order
fract.	dec.	dec.	dec.	flutes	no.
3/8	0.375	3.000	0.500	3	9.520
1/2	0.500	3.000	0.500	3	12.700
3/4	0.750	3.000	0.500	3	19.050
1	1.000	4.000	1.000	3	25.400

Availability
●
●
●
●

Alloyed Steels Tool Steels Cast materials Stainless Steels Al and Al-alloys Ti / Ni alloys Hardened Materials








When ordering: EDP no. = Series + Order no., example: 3867 12.700

2-flute, center cutting, coolant fed

 										Series 5492	
										Tool material PCD	
										Surface finish ○	
										Application 	
										d₂ Shank tolerance h6	
										d₁ Tolerance h10	
										Tech. data page call tech support	
											
											
											
d1	d2	d3	l1	l2	l3	l4	r	No.	Order	Availability	
mm	mm	mm	mm	mm	mm	mm	mm	flutes	no.		
6.000	6.000	5.700	57.0	8.00	21.00	36.00	0.1	2	6.000	○	
8.000	8.000	7.400	63.0	8.00	27.00	36.00	0.1	2	8.000	○	
8.000	8.000	7.400	63.0	12.00	27.00	36.00	0.1	2	8.001	○	
10.000	10.000	9.400	72.0	8.00	32.00	40.00	0.1	2	10.000	○	
10.000	10.000	9.400	72.0	16.00	32.00	40.00	0.1	2	10.001	○	
12.000	12.000	11.200	83.0	8.00	38.00	45.00	0.1	2	12.000	○	
12.000	12.000	11.200	83.0	16.00	38.00	45.00	0.1	2	12.001	○	
14.000	14.000	13.000	83.0	8.00	38.00	45.00	0.1	2	14.000	○	
14.000	14.000	13.000	83.0	16.00	38.00	45.00	0.1	2	14.001	○	
16.000	16.000	15.000	100.0	12.00	52.00	48.00	0.1	2	16.000	○	
16.000	16.000	15.000	100.0	20.00	52.00	48.00	0.1	2	16.001	○	
18.000	18.000	17.000	100.0	12.00	52.00	48.00	0.1	2	18.000	○	
18.000	18.000	17.000	100.0	20.00	52.00	48.00	0.1	2	18.001	○	
20.000	20.000	19.000	100.0	12.00	50.00	50.00	0.1	2	20.000	○	
20.000	20.000	19.000	100.0	20.00	50.00	50.00	0.1	2	20.001	○	

DIAMOND-TECH

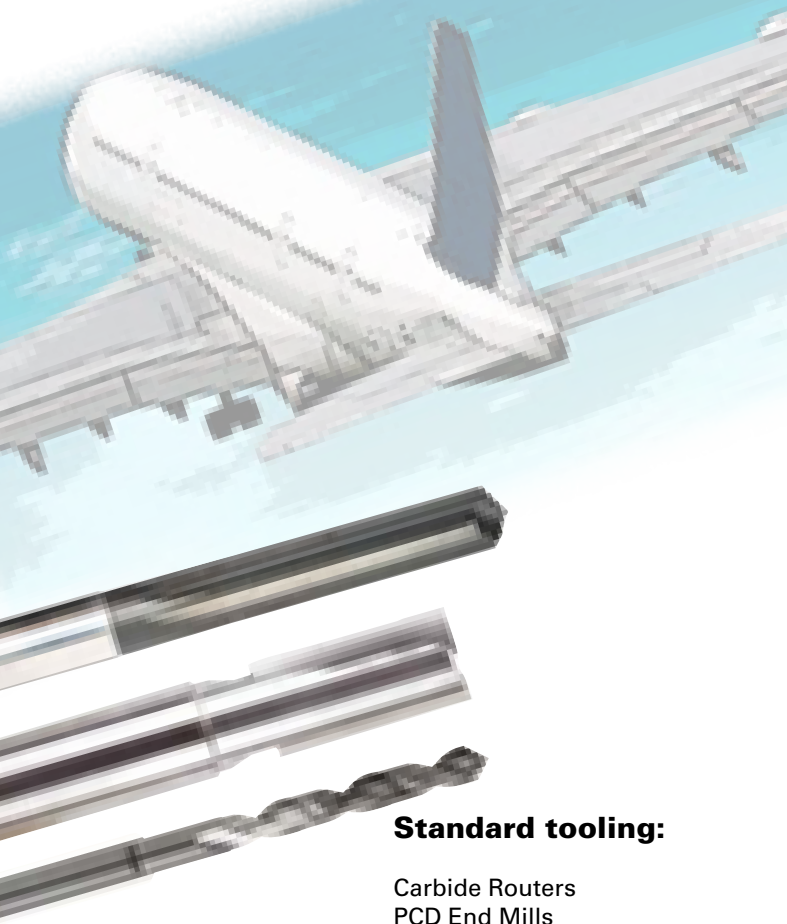
2-flute, long length, center cutting, coolant fed

 										Series 5493	
										Tool material PCD	
										Surface finish ○	
										Application 	
										d₂ Shank tolerance h6	
										d₁ Tolerance h10	
										Tech. data page call tech support	
											
											
											
d1	d2	d3	l1	l2	l3	l4	r	No.	Order	Availability	
mm	mm	mm	mm	mm	mm	mm	mm	flutes	no.		
6.000	6.000	5.700	75.00	8.00	21.00	54.00	0.1	2	6.000	○	
8.000	8.000	7.400	100.00	8.00	27.00	73.00	0.1	2	8.000	○	
8.000	8.000	7.400	100.00	12.00	27.00	73.00	0.1	2	8.001	○	
10.000	10.000	9.400	100.00	8.00	32.00	68.00	0.1	2	10.000	○	
10.000	10.000	9.400	100.00	16.00	32.00	68.00	0.1	2	10.001	○	
12.000	12.000	11.200	100.00	8.00	38.00	62.00	0.1	2	12.000	○	
12.000	12.000	11.200	100.00	16.00	38.00	62.00	0.1	2	12.001	○	
14.000	14.000	13.000	100.00	8.00	38.00	62.00	0.1	2	14.000	○	
14.000	14.000	13.000	100.00	16.00	38.00	62.00	0.1	2	14.001	○	
16.000	16.000	15.000	150.00	12.00	52.00	98.00	0.1	2	16.000	○	
16.000	16.000	15.000	150.00	20.00	52.00	98.00	0.1	2	16.001	○	
18.000	18.000	17.000	125.00	12.00	52.00	73.00	0.1	2	18.000	○	
18.000	18.000	17.000	125.00	20.00	52.00	73.00	0.1	2	18.001	○	
20.000	20.000	19.000	150.00	12.00	50.00	100.00	0.1	2	20.000	○	
20.000	20.000	19.000	150.00	20.00	50.00	100.00	0.1	2	20.001	○	

DIAMOND-TECH

GUHRING

High-Performance Cutting Tools
for Composite and Aerospace Materials



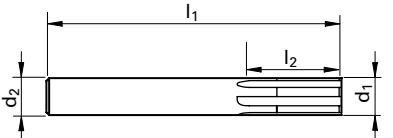


Standard tooling:

- Carbide Routers
- PCD End Mills
- 90° Diamond Coated Drills

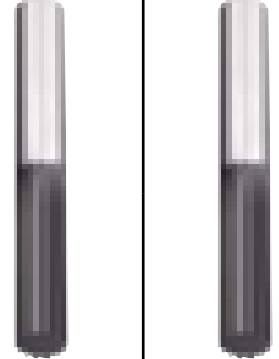
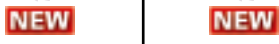
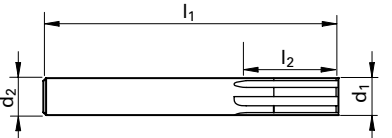
CR 100 carbide routers for composite materials

Multi-flute plunging router

Series	3084					
Tool material	PCD					
Surface finish	Diamond					
Application	Composites					
d ₂ Shank tolerance	h6					
d ₁ Tolerance	h10					
Tech. data page	call tech support					
 <p>Plunging</p>						
						
						
d1	d2	l1	l2	No.	Order	Availability
mm	mm	mm	mm	flutes	no.	
1/4	1/4	2.500	0.750	10	6.350	
3/8	3/8	3.000	1.000	14	9.520	
1/2	1/2	3.500	1.250	15	12.700	
5/8	5/8	4.000	1.625	15	15.870	

CR 100 carbide routers for composite materials

Multi-flute slotting router

Series	3083		3085			
Tool material	PCD		PCD			
Surface finish	Diamond		Diamond			
Application	Composites		Composites			
d ₂ Shank tolerance	h6		h6			
d ₁ Tolerance	h10		h10			
Tech. data page	call tech support		call tech support			
 <p>End Cutting</p>						
						
						
d1	d2	l1	l2	No.	Order	Availability
mm	mm	mm	mm	flutes	no.	
1/4	1/4	2.500	0.750	10	6.350	
3/8	3/8	3.000	1.000	14	9.520	
1/2	1/2	3.500	1.250	15	12.700	
5/8	5/8	4.000	1.625	15	15.870	

PCD Special Tooling Capabilities:

Please see www.guhring.com/PS/PCD.htm

● Alloyed Steels
 ● Tool Steels
 ● Cast materials
 ● Stainless Steels
 ● Al and Al-alloys
 ● Ti / Ni alloys
 H Hardened Materials

TECH-LINE



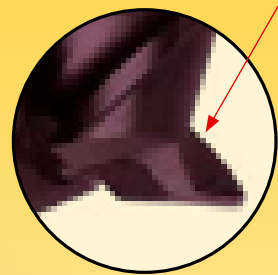
GUHRING

AERO-TECH / GH 100 U high performance 3-flute end mills

The new design Guhring GH 100 U end mills offer the ultimate pre-requisite for a cost-efficient, optimal machining of general steels, high-alloyed steels, CrNi steels as well as stainless steels and titanium-alloys up to 50 HRC.

All GH 100 U end mills excel thanks to their micro-corner protection combined with a reinforced and corrected minor cutting edge. This design considerably reduces the wear at the cutting edges allowing a higher feed rate as well as improved tool life.

Micro-corner protection and corrected reinforced cutting edge = optimal stability



GH 100 U end mills (3-fluted) excel further thanks to their optimized flute geometry, achieving ultimate machining efficiency especially for slot milling and roughing operations. Paired with a very high spiral, optimal chip evacuation is achieved while reducing vibration. The advantages:

- reduced wear
- high feed rates possible
- optimal chip evacuation
- can be applied for roughing and finishing



Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys		H				
						Ti-based	Ni-based					
Hardness tensile strength	up to 28HRC	over 28 HRC	up to 180 HB 30	over 180 HB 30	up to 28 HRC	over 28 HRC	up to 3% Si	over 3% Si	Ti-based	Ni-based	up to 52 HRC	over 52 HRC
Aero-Tech	○	●	○	●	○	○	○	○	○	○	○	○
Alumi-Tech	○					●	●					
Rough-Tech ALU	○					●	●					
Aero-Rough 48	●	●	●	●	○	○	○	○	●	●		
Aero-Rough 56	○	●	●	●	○	○	○	○	○	○	●	○
Rough-Tech 48	●	●	●	●	○	○	○	○	●	●		
Rough-Tech 56	○	●	●	●	○	○			○	○	●	○
Finish-Tech 50	○	●	●	●	○	○	○	○	○	○	○	○
Finish-Tech 62			○	○							○	○
GF 500	○	●	●	○	○		○	○	○	○	○	
GF 300			○	○							○	○
Uni-Pro (all)	●	○	○	○	○	○	○	○	○	○		

● = optimal suitability ○ = limited suitability

● USA Stock ○ International Stock (0-2 wks)

GH 100 U / AERO-TECH end mills (3-fluted) for material < 50 HRC

Stub length

NH .001 - .006 x 45°

HA

Series 3086

Tool material Solid carbide

Surface finish FIREX®

Application

d2 Shank Tolerance h6

d1 Tolerance h10

Tech. data page 162

d1	d2	l1	l2	No.	Order
fract.	fract.	fract.	fract.	flutes	no.
1/16	1/16	2	1/8	3	1.590
1/8	1/8	2	1/4	3	3.170
3/16	3/16	2	3/8	3	4.760
1/4	1/4	2	1/2	3	6.350
5/16	5/16	2	1/2	3	7.940
3/8	3/8	2	5/8	3	9.520
7/16	7/16	2 1/2	5/8	3	11.110
1/2	1/2	2 1/2	5/8	3	12.700

HA

HB

Series 3540 3729

Tool material Solid carbide

Surface finish FIREX® FIREX®

Application

d2 Shank Tolerance h6 h6

d1 Tolerance h10 h10

Tech. data page 162 162

d1	d2	l1	l2	No.	Order
mm	mm	mm	mm	flutes	no.
3.000	6.000	50.00	4.00	3	3.000
4.000	6.000	54.00	5.00	3	4.000
5.000	6.000	54.00	6.00	3	5.000
6.000	6.000	54.00	7.00	3	6.000
7.000	8.000	58.00	8.00	3	7.000
8.000	8.000	58.00	9.00	3	8.000
9.000	10.000	66.00	10.00	3	9.000
10.000	10.000	66.00	11.00	3	10.000
12.000	12.000	73.00	12.00	3	12.000
14.000	14.000	75.00	14.00	3	14.000
16.000	16.000	82.00	16.00	3	16.000
18.000	18.000	84.00	18.00	3	18.000
20.000	20.000	92.00	20.00	3	20.000

Availability

● Available ○ Not available

Availability

● Available ○ Not available

Alloyed Steels Tool Steels Cast materials Stainless Steels Al and Al-alloys Ti / Ni alloys **H** Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

TECH-LINE

GH 100 U / AERO-TECH end mills (3-fluted) for material < 50 HRC

Standard length

Series 3172 3173							Series 3203 3741						
Tool material: Solid carbide							Tool material: Solid carbide						
Surface finish: Bright FIREX®							Surface finish: Bright FIREX®						
Application: [Icons]							Application: [Icons]						
d2 Shank Tolerance: h6							d2 Shank Tolerance: h6						
d1 Tolerance: h10							d1 Tolerance: h10						
Tech. data page: 162							Tech. data page: 162						
d1	d2	l1	l2	No.	Order	Availability	d1	d2	l1	l2	No.	Order	Availability
fract.	fract.	fract.	fract.	flutes	no.		mm	mm	mm	mm	flutes	no.	
1/8	1/8	1 1/2	3/8	3	3.170	●●	2.00	2.00	32.00	6.00	3	2.000	●●
3/16	3/16	2	5/8	3	4.760	●●	2.50	2.50	32.00	7.00	3	2.500	●●
1/4	1/4	2 1/2	3/4	3	6.350	●●	3.00	3.00	38.00	7.00	3	3.000	●●
5/16	5/16	2 1/2	13/16	3	7.940	●●	3.50	3.50	50.00	7.00	3	3.500	●●
3/8	3/8	3	1	3	9.520	●●	4.00	4.00	50.00	8.00	3	4.000	●●
1/2	1/2	3	1	3	12.700	●●	4.50	4.50	50.00	8.00	3	4.500	●●
5/8	5/8	3 1/2	1 1/4	3	15.870	●●	5.00	5.00	50.00	10.00	3	5.000	●●
3/4	3/4	4	1 1/2	3	19.050	●●	5.50	5.50	57.00	10.00	3	5.500	●○
1	1	4	1 1/2	3	25.400	●●	6.00	6.00	57.00	10.00	3	6.000	●○
							6.50	6.50	60.00	13.00	3	6.500	●○
							7.00	7.00	60.00	13.00	3	7.000	●○
							7.50	7.50	63.00	16.00	3	7.500	○●
							8.00	8.00	63.00	16.00	3	8.000	●●
							8.50	8.50	67.00	16.00	3	8.500	●●
							9.00	9.00	67.00	16.00	3	9.000	●●
							9.50	9.50	72.00	19.00	3	9.500	●○
							10.00	10.00	72.00	19.00	3	10.000	●○
							11.00	11.00	83.00	22.00	3	11.000	●○
							12.00	12.00	83.00	22.00	3	12.000	●●
							13.00	13.00	83.00	22.00	3	13.000	○●
							14.00	14.00	83.00	22.00	3	14.000	●●
							15.00	15.00	92.00	26.00	3	15.000	●○
							16.00	16.00	92.00	26.00	3	16.000	●●
							18.00	18.00	92.00	26.00	3	18.000	●●
							20.00	20.00	104.00	32.00	3	20.000	●●

● USA Stock ○ International Stock (0-2 wks)

GUHRING Reconditioning Services

Restore your standard and special carbide or PCD tooling to its original factory quality, condition and performance. High precision remanufacturing delivers longer reground tool life and often more regrinds per tool, resulting in significant cost savings in terms of both tooling and machining expenses.

Guhring is able to provide factory reconditioning for our own drills, step drills, carbide end mills and reamers, and we can provide the same high-quality service for most competitors' tooling as well.

Two convenient locations offer in-house regrinds plus recoat service: Brookfield, WI and New Hudson, MI. Daily UPS shipments can return reconditioned tools to your facility within a few days; expedited services are also available.

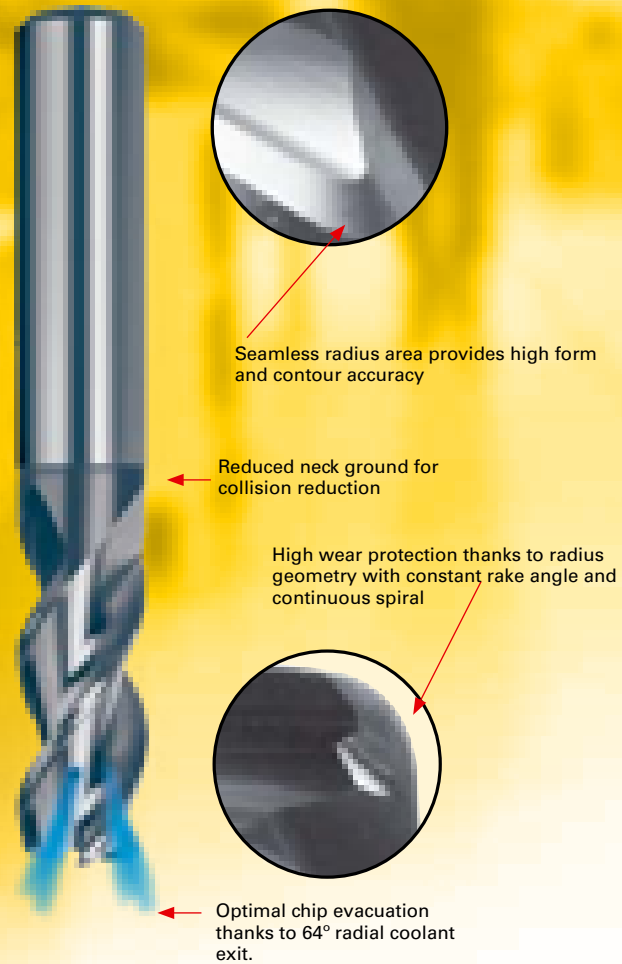
Extend the life of your carbide and PCD tooling - trust Guhring Reconditioning Services to restore your tools to like-new condition.



High metal removal end mills ALUMI-TECH / GA 200 A: The aluminum specialist

This innovative tool was developed specifically for the machining of integrated aluminum components and is suitable for roughing and slot milling as well as finishing operations.

- Special features:**
- radial coolant exit (64° angle) for optimal chip evacuation
 - radius geometry with continuous helix-radius-correction
 - reduced neck ground for collision reduction



Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H
Hardness tensile strength	up to 28HRC	over 28 HRC	up to 180 HB 30	over 180 HB 30	up to 28 HRC	over 28 HRC	up to 3% Si
					over 3% Si	Ti-based	over 3% Si
						Ni-based	up to 52 HRC
Alumi-Tech	○				●	●	

● = optimal suitability ○ = limited suitability

Stub length (metric)

W	45°	2	0.03 -0.1 x 45°	Series		Tool material		Surface finish		Application		d ₂ Shank Tolerance		d ₁ Tolerance		Tech. data page	
				HA	HB	3310	3126	Bright	Bright	HA	HB	h6	h6	h10	h10	168	168
NEW NEW																	
Availability																	
d1	d2	l1	l2	No.	Order	Availability											
mm	mm	mm	mm	flutes	no.	○	○										
3.000	6.000	50.00	4.00	2	3.000	○	○										
4.000	6.000	54.00	5.00	2	4.000	○	○										
5.000	6.000	54.00	6.00	2	5.000	○	○										
6.000	6.000	54.00	7.00	2	6.000	○	○										
8.000	8.000	58.00	9.00	2	8.000	○	○										
10.000	10.000	66.00	11.00	2	10.000	○	○										
12.000	12.000	73.00	12.00	2	12.000	○	○										
14.000	14.000	75.00	14.00	2	14.000	○	○										
16.000	16.000	82.00	16.00	2	16.000	○	○										
18.000	18.000	84.00	18.00	2	18.000	○	○										
20.000	20.000	92.00	20.00	2	20.000	○	○										

● USA Stock ○ International Stock (0-2 wks)

GA 200 A / ALUMI-TECH end mills (2-fluted) for aluminum

Standard length

W	45°	2	.001 -.004 x 45°	Series		Tool material		Surface finish		Application		d ₂ Shank Tolerance		d ₁ Tolerance		Tech. data page	
				HA	HA	3174	3874	Bright	Super-A	HA	HA	h6	h6	h10	h10	168	168
Availability																	
d1	d2	l1	l2	No.	Order	Availability											
fract.	fract.	fract.	fract.	flutes	no.	●	●										
1/8	1/8	1 1/2	7/16	2	3.170	●	●										
3/16	3/16	2	9/16	2	4.760	●	●										
1/4	1/4	2 1/2	3/4	2	6.350	●	●										
5/16	5/16	2 1/2	13/16	2	7.940	●	●										
3/8	3/8	2 1/2	7/8	2	9.520	●	●										
7/16	7/16	2 3/4	1	2	11.110	●	●										
1/2	1/2	3	1	2	12.700	●	●										
9/16	9/16	3 1/2	1 1/8	2	14.290	●	●										
5/8	5/8	3 1/2	1 1/4	2	15.870	●	●										
3/4	3/4	4	1 1/2	2	19.050	●	●										
1	1	4	1 1/2	2	25.400	●	●										

● Alloyed Steels ● Tool Steels ○ Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

Standard length (metric)

W	45°	2	0.03 -0.1 x 45°	Series		Tool material		Surface finish		Application		d ₂ Shank Tolerance		d ₁ Tolerance		Tech. data page	
				HA	HB	3309	3059	Bright	Bright	HA	HB	h6	h6	h10	h10	168	168
Availability																	
d1	d2	l1	l2	No.	Order	Availability											
mm	mm	mm	mm	flutes	no.	○	○										
3.000	6.000	57.00	7.00	2	3.000	○	○										
4.000	6.000	57.00	8.00	2	4.000	○	○										
5.000	6.000	57.00	10.00	2	5.000	○	○										
6.000	6.000	57.00	10.00	2	6.000	○	○										
8.000	8.000	63.00	16.00	2	8.000	○	○										
10.000	10.000	72.00	19.00	2	10.000	○	○										
12.000	12.000	83.00	22.00	2	12.000	○	○										
14.000	14.000	83.00	22.00	2	14.000	○	○										
16.000	16.000	92.00	26.00	2	16.000	○	○										
18.000	18.000	92.00	26.00	2	18.000	○	○										
20.000	20.000	104.00	32.00	2	20.000	○	○										

GA 200 A / ALUMI-TECH end mills (2-flute) for aluminum

Long length

Series: 3175, 3875
 Tool material: Solid carbide
 Surface finish: Bright, Super-A
 Application:
 d₂ Shank Tolerance: h6, h6
 d₁ Tolerance: h10, h10
 Tech. data page: 168, 168

HA HA

d1	d2	l1	l2	No.	Order
fract.	fract.	fract.	fract.	flutes	no.
1/4	1/4	3	1 1/8	2	6.350
3/8	3/8	3	1 1/8	2	9.520
1/2	1/2	4 1/2	2	2	12.700
5/8	5/8	5	2 1/4	2	15.870

Availability	
●	●
●	●
●	●
●	●

Extra long length (metric)

Series: 3358
 Tool material: Solid carbide
 Surface finish: Bright
 Application:
 d₂ Shank Tolerance: h6
 d₁ Tolerance: h10
 Tech. data page: 168

HA

NEW

d1	d2	l1	l2	No.	Order
mm	mm	mm	mm	flutes	no.
5.000	5.000	75.00	30.00	2	5.000
6.000	6.000	75.00	30.00	2	6.000
8.000	8.000	100.00	40.00	2	8.000
10.000	10.000	100.00	40.00	2	10.000
12.000	12.000	150.00	45.00	2	12.000
16.000	16.000	150.00	65.00	2	16.000

Availability	
○	○
○	○
○	○
○	○
○	○

GA 200 A / ALUMI-TECH end mills (3-fluted) with corner radius for aluminum

Long length

Series: 3177, 3877
 Tool material: Solid carbide
 Surface finish: Bright, Super-A
 Application:
 d₂ Shank Tolerance: h6, h6
 d₁ Tolerance: h10, h10
 Tech. data page: 168, 168

HA HA

NEW

d1=d2	d3	l1	l2	l3	r	Order
fract.	fract.	fract.	fract.	dec.	dec.	no.
1/4	1/4	3	3/8	1.500	0.0100	6.350
5/16	5/16	3	7/16	1.500	0.0125	7.940
3/8	3/8	3	9/16	1.500	0.0150	9.520
1/2	1/2	4 1/2	3/4	2.750	0.0200	12.700
5/8	5/8	5	7/8	3.000	0.0250	15.870
3/4	3/4	5	1	3.000	0.0300	19.050

Availability	
●	●
●	●
●	●
●	●
●	●
●	●

Standard length (metric)

Series: 3367
 Tool material: Solid carbide
 Surface finish: Bright
 Application:
 d₂ Shank Tolerance: h6
 d₁ Tolerance: h10
 Tech. data page: 168

* coolant fed

HA

d1=d2	d3	l1	l2	l3	r	Order
mm	mm	mm	mm	mm	mm	no.
6.000	5.700	57.00	10.00	21.00	1.0	6.000
8.000	7.700	63.00	16.00	27.00	1.0	8.000
10.000	9.500	72.00	19.00	32.00	1.5	10.000
12.000	11.500	83.00	22.00	38.00	1.5	12.000
16.000	15.500	92.00	26.00	44.00	2.0	16.000
20.000	19.500	104.00	32.00	54.00	2.5	20.000

Availability	
●	●
●	●
●	●
●	●
●	●

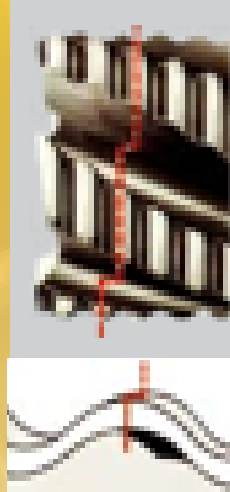
● USA Stock ○ International Stock (0-2 wks)

● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

ROUGH-TECH ALU / GS 100 A roughing cutters for aluminum, alloys and soft steel

GS 100 roughing cutters excel primarily thanks to their general purpose application possibilities enabling almost any combination of cutting depth (DOC) and cutting width (WOC). In comparison to roughing/finishing cutters with a flat knuckle-type geometry, the considerably lower power requirement ensures a reliable and economical machining process especially with less powerful machines.

Thanks to its round knuckle-type geometry with a staggered pitch angle (see illustration) the feed engagement is spread across the full length of the cutting edge even with less rigid workpiece clamping conditions or long tool neck lengths. In spite of a lower tooth feed rate compared to flat knuckle-types a high rate of metal removal is achieved.



GS 100 A: special geometry for aluminum:

- The 3-flute, 30° RH helix GS 100 A is suitable for the machining of aluminum, aluminum-alloys and other soft materials up to 700 N/mm².

Advantages at a glance:

- reduced power requirement and cutting pressure
- suitable for less powerful and less stable machines
- suitable for less favorable workpiece and tool clamping conditions
- high metal removal rate thanks to the utilization of the complete cutting edge length

In comparison with conventional tools, GS 100 A roughing cutters with internal cooling excel with considerably longer tool life and higher feed rates as well as increased feed engagement widths and depths. Guhring milling cutters with radial coolant exits at 64° provide particular protection to the sensitive corners. The specifically aimed coolant exits completely prevent built-up edges and ensure complete chip evacuation, especially with deep pockets and channels.



Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H
Hardness tensile strength	up to 28HRC	over 28 HRC	up to 180 HB 30 over 180 HB 30	up to 28 HRC over 28 HRC	up to 3% Si over 3% Si	Ti-based Ni-based	up to 52 HRC over 52 HRC
Rough-Tech ALU	○				● ●		

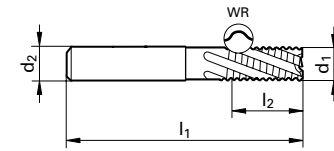
● = optimal suitability ○ = limited suitability

● USA Stock ○ International Stock (0-2 wks)

GS 100 A / ROUGH-TEC ALU end mills, coarse tooth for aluminum

Standard length

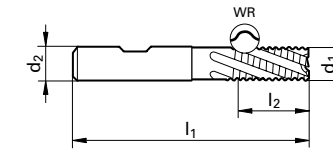
WR	30°	3	.008 -.024 x 45°
HA	HA	Series	
Bright		Super-A	
h6		h6	
h10		h10	
164		164	



d1	d2	l1	l2	No.	Order	Availability
fract.	fract.	fract.	fract.	flutes	no.	
1/4	1/4	2 1/2	3/4	3	6.350	● ●
5/16	5/16	2 1/2	3/4	3	7.940	● ●
3/8	3/8	2 1/2	7/8	3	9.520	● ●
1/2	1/2	3	1	3	12.700	● ●
5/8	5/8	3 1/2	1 1/4	3	15.870	● ●
3/4	3/4	4	1 5/8	3	19.050	● ●
1	1	4	1 3/4	3	25.400	● ●

Standard length (metric)

WR	30°	3	0,3-0,6 x 45°
HB	HB	Series	
Bright		Bright	
h6		h6	
h10		h10	
164		164	



d1	d2	l1	l2	No.	Order	Availability
mm	mm	mm	mm	flutes	no.	
6.000	6.000	57.00	10.00	3	6.000	○ ○
8.000	8.000	63.00	16.00	3	8.000	● ●
10.000	10.000	72.00	19.00	3	10.000	○ ●
12.000	12.000	83.00	22.00	3	12.000	○ ●
14.000	14.000	83.00	22.00	3	14.000	○ ●
16.000	16.000	92.00	26.00	3	16.000	○ ●
18.000	18.000	92.00	26.00	3	18.000	○ ●
20.000	20.000	104.00	32.00	3	20.000	○ ○
25.000	25.000	121.00	45.00	3	25.000	○ ○

● Alloyed Steels ● Tool Steels ○ Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

AERO-ROUGH / RS 100 U/F - Roughing geometry for optimal efficiency



RS 100 high-performance roughing cutters benefit from a completely new roughing geometry, considerably reducing surface finish wear thanks to its unequal spacing. The result is a drastic increase in tool life compared to conventional round knuckle-type geometries and an improvement in the surface finish quality of the workpiece, so that in many applications finishing operations are unnecessary and the machining cost per workpiece is vastly reduced. In addition, the tool excels with a much reduced power requirement in comparison to tools without chip breaking geometry.

Two types of RS 100 high-performance roughing cutters are available: The 4-flute, 30° RH spiral RS 100 U is suitable for the machining of all standard steels. With a new 5 to 6 flute geometry and a spiral angle increased to 45°, RS 100 F possesses a considerably increased core diameter and is suitable for roughing/finishing operations with a width of cut up to 0.25 x D in all general purpose steels and tough materials.

Advantages at a glance:

- increased tool life in comparison to milling cutters with round knuckle-type teeth
- increased feed rate thanks to new edge wear protection
- improved workpiece surface finish
- reduced power requirement compared to smooth cutting milling cutters

Comparison overview:

Type	NR round knuckle-type	NF flat knuckle-type (old)	RS 100 U&F (new)
Perform. index	100%	65%	120%
Workpiece Surface finish	Ra = 9-10 µm	Ra = 6-7 µm	Ra = 2-3 µm
Tool life index	100%	100%	140%

Material	Alloyed Steel		Tool Steel		Cast iron		Stainless steel		Aluminium		Ti-special alloys		H
	Alloyed Steel	Tool Steel	Cast iron	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	Aluminium	Ti-special alloys			
Hardness tensile strength	up to 28HRC	over 28 HRC	up to 180 HB 30	over 180 HB 30	up to 28 HRC	over 28 HRC	up to 3% Si	over 3% Si	Ti-based	Ni-based	up to 52 HRC	over 52 HRC	
Aero-Rough 48	●	●	●	●	●	○	○	○	●	●	○	○	
Aero-Rough 56	○	●	●	●	○	○	○	○	○	○	●	○	○

● = optimal suitability ○ = limited suitability

● USA Stock ○ International Stock (0-2 wks)

RS 100 U / AERO-ROUGH 48 end mills

for materials < 48 HRC, standard length

NF	30°	4/5	.012 -.024 x 45°	HA		
Series				3097		
Tool material				Solid carbide		
Surface finish				FIREX®		
Application						
d ₂ Shank Tolerance				h6		
d ₁ Tolerance				h10		
Tech. data page				163		
d1	d2	l1	l2	No.	Order	Availability
fract.	fract.	fract.	fract.	flutes	no.	
1/4	1/4	2 1/2	3/4	4	6.350	●
5/16	5/16	2 1/2	13/16	4	7.940	●
3/8	3/8	2 1/2	7/8	4	9.520	●
1/2	1/2	3	1	4	12.700	●
5/8	5/8	3 1/2	1 1/4	4	15.870	●
3/4	3/4	4	1 5/8	4	19.050	●
1	1	4	1 3/4	5	25.400	●

Alloyed Steels Tool Steels Cast materials Stainless Steels Al and Al-alloys Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

Standard length (metric)

NF	30°	4/5	0,3-0,6 x 45°	HA	HB	
Series				3887	3888	
Tool material				Solid carbide		
Surface finish				FIREX®		
Application						
d ₂ Shank Tolerance				h6		
d ₁ Tolerance				h10		
Tech. data page				163		
d1	d2	l1	l2	No.	Order	Availability
mm	mm	mm	mm	flutes	no.	
6.000	6.000	57.00	13.00	4	6.000	○
8.000	8.000	63.00	19.00	4	8.000	○
10.000	10.000	72.00	22.00	4	10.000	○
12.000	12.000	83.00	26.00	4	12.000	○
14.000	14.000	83.00	26.00	4	14.000	○
16.000	16.000	92.00	32.00	4	16.000	○
18.000	18.000	92.00	32.00	4	18.000	○
20.000	20.000	104.00	38.00	4	20.000	○
25.000	25.000	121.00	45.00	5	25.000	○

RS 100 F / AERO-ROUGH 56 end mills for materials < 56 HRC

Standard length

NF	45°	5/6	.012 .024 x 45°			
Series						
Tool material						
Surface finish						
Application						
d ₂ Shank Tolerance						
d ₁ Tolerance						
Tech. data page						
d1	d2	l1	l2	No.	Order	
fract.	fract.	fract.	fract.	flutes	no.	
1/4	1/4	2 1/2	3/4	5	6.350	
5/16	5/16	2 1/2	13/16	5	7.940	
3/8	3/8	2 1/2	7/8	5	9.520	
1/2	1/2	3	1	5	12.700	
5/8	5/8	3 1/2	1 1/4	6	15.870	
3/4	3/4	4	1 5/8	6	19.050	
1	1	4	1 3/4	6	25.400	

Standard length (metric)

NF	45°	5/6	0,3-0,6 x 45°			
Series						
Tool material						
Surface finish						
Application						
d ₂ Shank Tolerance						
d ₁ Tolerance						
Tech. data page						
d1	d2	l1	l2	No.	Order	
mm	mm	mm	mm	flutes	no.	
6.000	6.000	57.00	13.00	5	6.000	
8.000	8.000	63.00	19.00	5	8.000	
10.000	10.000	72.00	22.00	5	10.000	
12.000	12.000	83.00	26.00	5	12.000	
14.000	14.000	83.00	26.00	5	14.000	
16.000	16.000	92.00	32.00	6	16.000	
18.000	18.000	92.00	32.00	6	18.000	
20.000	20.000	104.00	38.00	6	20.000	
25.000	25.000	121.00	45.00	6	25.000	

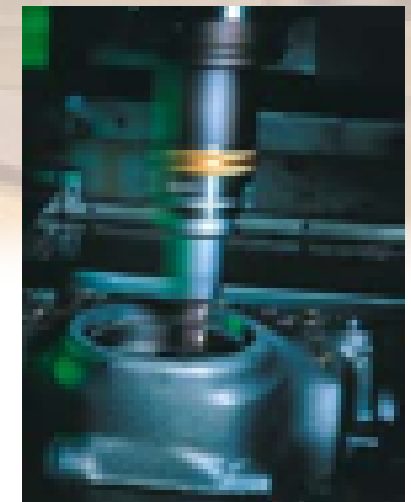
HA	Series	3098
	Tool material	Solid carbide
	Surface finish	FIREX®
	Application	
	d ₂ Shank Tolerance	h6
	d ₁ Tolerance	h10
	Tech. data page	163
Availability		
●		

HA	HB	Series	3889	3890
		Tool material	Solid carbide	
		Surface finish	FIREX®	
		Application		
		d ₂ Shank Tolerance	h6	
		d ₁ Tolerance	h10	
		Tech. data page	163	
NEW NEW				
Availability				
○ ○				

TECH-LINE

● USA Stock ○ International Stock (0-2 wks)

GUHRING Coating Services



Cutting tools and wear parts substrates have benefitted from enormous engineering advances over recent decades. Thin film coatings, when properly applied, improve tool and part characteristics and functionality. They increase surface hardness, lower the friction coefficient and thermal conductivity, and provide a chemically inert surface. As a cutting tool manufacturer, Guhring offers a level of coating expertise without equal in the industry. Our coating services features include:

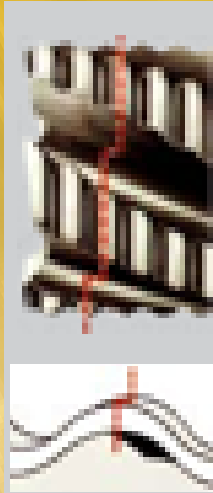
- **High-performance PVD (physical vapor deposition) coatings from the first manufacturer to apply TiN coating to cutting tools**
- **Coatings developed for specific applications and workpiece materials**
- **In-house coating chambers at two U.S. locations; for cut and wear parts**
- **Proprietary Guhring coatings such as FIREX® and Super-ATM for exceptional heat and wear resistance**

ROUGH-TECH 48 GS 100 U roughing cutters for materials < 48 HRC

GS 100 roughing cutters offer extensive general purpose application possibilities. These roughers have a unique round knuckle-type tooth profile which requires less HP than traditional flat knuckle-type end mills. The unique geometry also has a staggered pitch angle (see illustration), spreading the feed engagement across the full length of the cutting edge and allowing for a high rate of metal removal.

GS 100 U: special geometry for materials < 48 HRC

- The 4-flute GS 100 U with its 30° RH spiral and fine knuckle-type teeth is suitable for the machining of all general steels up to 48 HRC, high-alloyed steels as well as titanium or chrome nickel alloys.



GS 100 H: special geometry for materials < 56 HRC

- The GS 100 F 5- and 6-flute end mill has a 45° right hand spiral with the NF style knuckle design suitable for machining high tensile steels up to 56 HRC hardness.

Advantages at a glance:

- reduced power requirement and cutting pressure
- suitable for less powerful and less stable machines
- suitable for less favorable workpiece and tool clamping conditions
- high metal removal rate thanks to the utilization of the complete cutting edge length

Guhring milling cutters with radial coolant exits at 64° (series #3365) provide particular protection to the sensitive corners. The specifically aimed coolant exits completely prevent built-up edges and ensure complete chip evacuation, especially with deep pockets and channels.

Material	Alloyed Steel			Tool Steel		Cast iron		Stainless steel		Aluminium		Ti-special alloys		H
	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H							
Hardness tensile strength	up to 28Hrc	over 28 Hrc	up to 180 HB 30 over 180 HB 30	up to 28 HRC	over 28 HRC	up to 3% Si	over 3% Si	Ti-based	Ni-based	up to 52 HRC	over 52 HRC			
Aero-Tech	○	●	○	○	○	○	○	○	○	○	○	○	○	
Alumi-Tech	○					●	●							
Rough-Tech ALU	○					●	●							
Aero-Rough 48	●	●	●	○	○	○	○	○	○	○	○	○	○	
Aero-Rough 56	○	●	●	○	○	○	○	○	○	○	○	○	○	
Rough-Tech 48	●	●	●	○	○	○	○	○	○	○	○	○	○	
Rough-Tech 56	○	●	●	○	○			○	○	○	○	○	○	
Finish-Tech 50	○	●	●	●	○	○	○	○	○	○	○	○	○	
Finish-Tech 62			○	○								○	○	
GF 500	○	●	●	○	○	○	○	○	○	○	○	○	○	
GF 300			○	○				○				○	○	
Uni-Pro (all)	●	○	○	○	○	○	○	○	○	○	○	○	○	

● = optimal suitability ○ = limited suitability

● USA Stock ○ International Stock (0-2 wks)

GS 100 U / ROUGH-TECH 48 roughing cutters for materials <48 HRC

Standard length

Series	HA	HA	HA
3186	3188	3886	
Solid carbide			
Bright	FIREX®	Super-A	
Application			
d2 Shank Tolerance			
d1 Tolerance			
Tech. data page			

d1	d2	l1	l2	No.	Order
fract.	fract.	fract.	fract.	flutes	no.
1/4	1/4	2 1/2	3/4	4	6.350
5/16	5/16	2 1/2	3/4	4	7.940
3/8	3/8	2 1/2	7/8	4	9.520
1/2	1/2	3	1	4	12.700
5/8	5/8	3 1/2	1 1/4	4	15.870
3/4	3/4	4	1 5/8	4	19.050
1	1	4	1 3/4	4	25.400

Availability		
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●

● Alloyed Steels ● Tool Steels ○ Cast materials ● Stainless Steels ● Al and Al-alloys ○ Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

GS 100 U / ROUGH-TECH 48 end mills, fine tooth for materials < 48 HRC

Standard length (metric)

						HB	HB	HB
Series						3204	3723	3365
Tool material						Solid carbide		
Surface finish						Bright	FIREX®	FIREX®
Application								
d ₂ Shank Tolerance						h6	h6	h6
d ₁ Tolerance						h10	h10	h10
Tech. data page						164	164	164
d1	d2	l1	l2	No.	Order	Availability		
mm	mm	mm	mm	flutes	no.			
6.000	6.000	57.00	13.00	4	6.000	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
8.000	8.000	63.00	19.00	4	8.000	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
10.000	10.000	72.00	22.00	4	10.000	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
12.000	12.000	83.00	26.00	4	12.000	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
14.000	14.000	83.00	26.00	4	14.000	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
16.000	16.000	92.00	32.00	4	16.000	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
18.000	18.000	92.00	32.00	4	18.000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20.000	20.000	104.00	38.00	4	20.000	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
25.000	25.000	121.00	45.00	4	25.000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

● USA Stock ○ International Stock (0-2 wks)

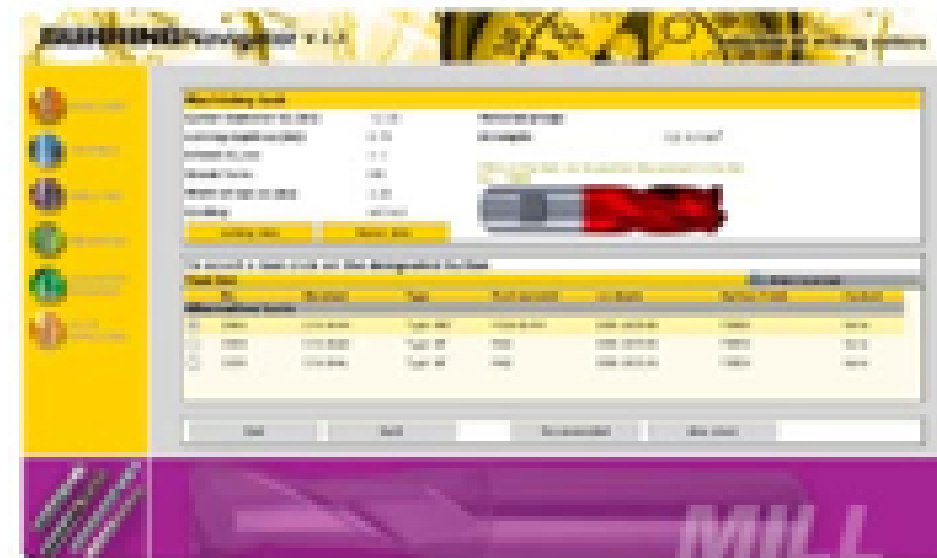
Need information in a hurry? Or at 11 pm on a Saturday?

Check out www.guhring.com and quickly and easily find detailed information about all of our standard drills, taps and end mills.

Our newly updated technical library provides common milling formulas, a competitor's cross-reference utility, DIN standard information, tool application tips, and much more.

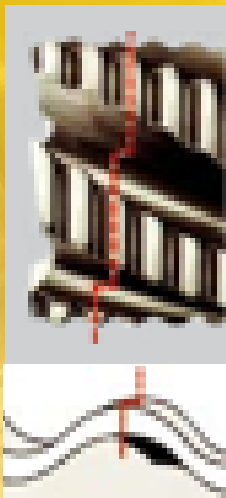
Authorized Guhring distributors can also log into our system and check inventory, track open and closed orders, and download valuable information.

Click on the Guhring Navigator button and utilize our free software to guide you toward the optimal drill, tap or end mill for your application, plus determine various machining parameters such as torque requirements and speed/feed rates.



GS 100 H roughing cutters for materials < 54 HRC

GS 100 roughing cutters excel primarily thanks to their general purpose application possibilities enabling almost any combination of cutting depth (DOC) and cutting width (WOC). In comparison to roughing/finishing cutters with a flat knuckle-type geometry, the considerably lower power requirement ensures a reliable and economical machining process especially with less powerful machines.



GS 100 H: special geometry for materials < 54 HRC:

- GS 100 H excels in the machining of difficult-to-machine materials over 1000 N/mm², cast iron and grey cast iron as well as hardened materials up to approximately 52 to 54 HRC thanks to its 20° helix and its small rake angle.

Advantages at a glance:

- reduced power requirement and cutting pressure
- suitable for less powerful and less stable machines
- suitable for less favourable workpiece and tool clamping conditions
- high metal removal rate thanks to the utilisation of the complete cutting edge length

Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H					
	up to 28HRC	over 28 HRC	up to 180 HB 30	over 180 HB 30	up to 28 HRC	over 28 HRC		up to 3% Si	over 3% Si	Ti-based	Ni-based	up to 52 HRC
Rough-Tech 48	●	●	●	●	○	○	○	○	○	○	○	○
Rough-Tech 56	○	●	●	●	○	○	○	○	○	○	○	○

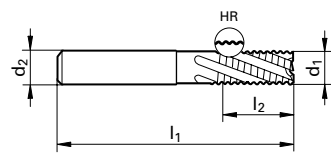
● = optimal suitability ○ = limited suitability

Standard length

HR	20°	4	.012 -.024 x 45°
Series			
Tool material			
Surface finish			
Application			
d ₂ Shank Tolerance			
d ₁ Tolerance			
Tech. data page			

HA
3189
Solid carbide
FIREX®
h6
h10
164

54HRC



d1	d2	l1	l2	No.	Order
fract.	fract.	fract.	fract.	flutes	no.
1/4	1/4	2 1/2	3/4	4	6.350
5/16	5/16	2 1/2	3/4	4	7.940
3/8	3/8	2 1/2	7/8	4	9.520
1/2	1/2	3	1	4	12.700
5/8	5/8	3 1/2	1 1/4	4	15.870
3/4	3/4	4	1 5/8	4	19.050

Availability

●
●
●
●
●
●

● USA Stock ○ International Stock (0-2 wks)

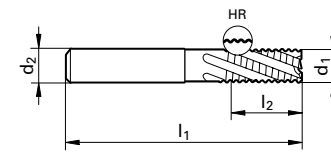
GS 100 H / ROUGH-TECH 56 end mills, fine tooth for materials < 54 HRC

Standard length (metric)

HR	20°	4	0,3-0,6 x 45°
Series			
Tool material			
Surface finish			
Application			
d ₂ Shank Tolerance			
d ₁ Tolerance			
Tech. data page			

HB
3682
Solid carbide
FIREX®
h6
h10
164

54HRC



d1	d2	l1	l2	No.	Order
mm	mm	mm	mm	flutes	no.
6.000	6.000	57.00	13.00	4	6.000
8.000	8.000	63.00	19.00	4	8.000
10.000	10.000	72.00	22.00	4	10.000
12.000	12.000	83.00	26.00	4	12.000
16.000	16.000	92.00	32.00	4	16.000
20.000	20.000	104.00	38.00	4	20.000

Availability

●
●
●
●
●
●

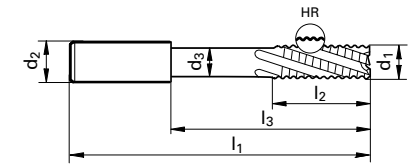
● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys ● Hardened Materials

Long length

HR	20°	4	.012 -.024 x 45°
Series			
Tool material			
Surface finish			
Application			
d ₂ Shank Tolerance			
d ₁ Tolerance			
Tech. data page			

HA
3190
Solid carbide
FIREX®
h6
h10
164

54HRC



d1=d2	d3	l1	l2	l3	No.	Order
fract.	fract.	fract.	fract.	dec.	flutes	no.
1/4	1/4	3	3/4	1.500	4	6.350
5/16	5/16	3	7/8	1.500	4	7.940
3/8	3/8	3	7/8	1.500	4	9.520
1/2	1/2	4 1/2	1	2.750	4	12.700
5/8	5/8	5	1 1/4	3.000	4	15.870
3/4	3/4	5	1 1/2	3.000	4	19.050

Availability

●
●
●
●
●
●

GH 100 H high performance end mills for hard milling and superfine finishing

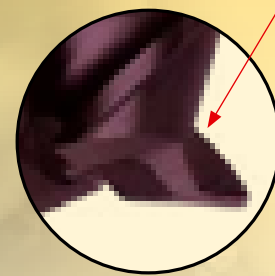
Guhring's hard milling cutters optimally satisfy the requirements for time- and cost-saving machining of hardened workpieces. Different geometries as well as the carbide grade with its high hardness and toughness are optimally adapted for the various milling operations.

Subsequently, Guhring's hard milling cutters achieve highest contour accuracy for cutting depths up to 4xD. Furthermore, milling cutters with full or corner radii are especially suitable for roughing or finishing operations in 3D HSC machining of forms and forging dies.

Advantages:

- application up to 62 HRC
- superior tool rigidity
- high contour accuracy of radii
- excellent surface finish

Micro-corner protection and corrected reinforced cutting edge = optimal stability



Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H
Hardness	up to 28HRC	over 28 HRC	up to 180 HB 30	over 180 HB 30	up to 28 HRC	over 28 HRC	up to 3% Si
tensile strength	over 28 HRC	up to 180 HB 30	over 180 HB 30	up to 28 HRC	over 28 HRC	up to 3% Si	over 3% Si
Finish-Tech 62			○	●			●

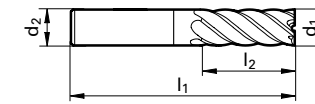
● = optimal suitability ○ = limited suitability

● USA Stock ○ International Stock (0-2 wks)

GH 100 H / FINISH-TECH 62 multi-flute end mills for superfine finishing of materials < 62 HRC

Standard length

H	55°	6/8	0.002 -0.008 x 45°
Series	3182		
Tool material	Solid carbide		
Surface finish	FIREX®		
Application			
d2 Shank Tolerance	h6		
d1 Tolerance	h10		
Tech. data page	162		



d1	d2	l1	l2	No.	Order
fract.	fract.	fract.	fract.	flutes	no.
1/4	1/4	2 1/2	3/4	6	6.350
5/16	5/16	2 1/2	7/8	6	7.940
3/8	3/8	2 1/2	7/8	6	9.520
1/2	1/2	3	1	6	12.700
5/8	5/8	3 1/2	1 1/4	6	15.870
3/4	3/4	4	1 1/2	8	19.050

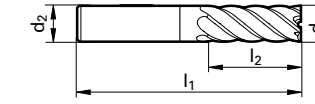
HA	
Series	3182
Tool material	Solid carbide
Surface finish	FIREX®
Application	
d2 Shank Tolerance	h6
d1 Tolerance	h10
Tech. data page	162



Availability
●
●
●
●
●

Standard length (metric)

H	55°	6/8	0.05 -0.2 x 45°
Series	3715		
Tool material	Solid carbide		
Surface finish	FIREX®		
Application			
d2 Shank Tolerance	h6		
d1 Tolerance	h10		
Tech. data page	162		



d1	d2	l1	l2	No.	Order
mm	mm	mm	mm	flutes	no.
3.000	6.000	57.00	8.00	6	3.000
4.000	6.000	57.00	11.00	6	4.000
5.000	6.000	57.00	13.00	6	5.000
6.000	6.000	57.00	13.00	6	6.000
8.000	8.000	63.00	19.00	6	8.000
10.000	10.000	72.00	22.00	6	10.000
12.000	12.000	83.00	26.00	6	12.000
14.000	14.000	83.00	26.00	6	14.000
16.000	16.000	92.00	32.00	6	16.000
18.000	18.000	92.00	32.00	8	18.000
20.000	20.000	104.00	38.00	8	20.000

HA	
Series	3715
Tool material	Solid carbide
Surface finish	FIREX®
Application	
d2 Shank Tolerance	h6
d1 Tolerance	h10
Tech. data page	162



Availability
○
○
○
○
●
○
○
○
○
○
○

● Alloyed Steels ● Tool Steels ○ Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

GH 100 H / FINISH-TECH 62 multi-flute end mills for superfine finishing of materials < 62 HRC

Long length

H	55°	6/8	0.002 - .008 x 45°			
Series						
Tool material						
Surface finish						
Application						
d ₂ Shank Tolerance						
d ₁ Tolerance						
Tech. data page						
d1=d2	d3	l1	l2	l3	No.	Order
fract.	fract.	fract.	fract.	dec.	flutes	no.
1/4	1/4	3	3/4	1.500	6	6.350
5/16	5/16	3	7/8	1.500	6	7.940
3/8	3/8	3	7/8	1.500	6	9.520
1/2	1/2	4	1 1/2	2.750	6	12.700
5/8	5/8	5	1 1/4	3.000	6	15.870
3/4	3/4	5	1 1/2	3.000	8	19.050

HA
Series
3183
Tool material
Solid carbide
Surface finish
FIREX®
Application
h6
d ₂ Shank Tolerance
h10
d ₁ Tolerance
162
62HRC
Availability
●
●
●
●
●
●

Long length (metric)

H	55°	6/8	0.05 - 0.2 x 45°		
Series					
Tool material					
Surface finish					
Application					
d ₂ Shank Tolerance					
d ₁ Tolerance					
Tech. data page					
d1	d2	l1	l2	No.	Order
mm	mm	mm	mm	flutes	no.
6.000	6.000	75.00	30.00	6	6.000
8.000	8.000	100.00	40.00	6	8.000
10.000	10.000	150.00	40.00	6	10.000
12.000	12.000	150.00	45.00	6	12.000
16.000	16.000	150.00	65.00	6	16.000
20.000	20.000	150.00	65.00	8	20.000

HA
Series
3716
Tool material
Solid carbide
Surface finish
FIREX®
Application
h6
d ₂ Shank Tolerance
h10
d ₁ Tolerance
162
62HRC
Availability
○
○
○
○
○
○

NEW

● USA Stock ○ International Stock (0-2 wks)

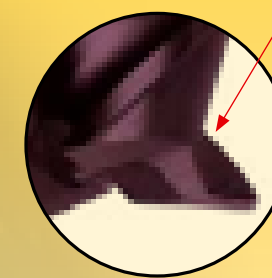
Finish-Tech 50 / GH 100 U high performance end mills

The new design Guhring GH 100 U end mills offer the ultimate pre-requisite for a cost-efficient, optimal machining of general steels, high-alloyed steels, CrNi steels as well as stainless steels and titanium-alloys up to 50 HRC.

All GH 100 U end mills excel thanks to their micro-corner protection combined with a reinforced and corrected minor cutting edge. This design considerably reduces the wear at the cutting edges allowing a higher feed rate as well as improving tool life.



Micro-corner protection and corrected reinforced cutting edge = optimal stability



GH 100 U multi-tooth end mills excel thanks to a reinforced core, providing high stability and enabling the production of optimal workpiece surfaces. Together with the reduced machining time wear is drastically reduced. The advantages:

- reduced wear
- high feed rates possible
- high contour accuracy
- reduced machining time
- suitable for HSC (High Speed Cutting)

Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H
Hardness tensile strength	up to 28HRC	over 28 HRC	up to 180 HB 30	over 180 HB 30	up to 28 HRC	over 28 HRC	up to 3% Si
Finish-Tech 50	○	●	●	●	●	○	○

● = optimal suitability ○ = limited suitability

Alloyed Steels Tool Steels Cast materials Stainless Steels Al and Al-alloys Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

Standard length

NH	45°	6-10	0.002 - .008 x 45°		
Series					
Tool material					
Surface finish					
Application					
d ₂ Shank Tolerance					
d ₁ Tolerance					
Tech. data page					
d1	d2	l1	l2	No.	Order
fract.	fract.	fract.	fract.	flutes	no.
1/4	1/4	2 1/2	3/4	6	6.350
5/16	5/16	2 1/2	7/8	6	7.940
3/8	3/8	2 1/2	7/8	6	9.520
1/2	1/2	3	1	6	12.700
5/8	5/8	3 1/2	1 1/4	6	15.870
3/4	3/4	4	1 1/2	8	19.050
1	1	4	1 1/2	10	25.400

HA	HA
Series	Series
3178	3179
Tool material	Tool material
Solid carbide	Solid carbide
Surface finish	Surface finish
Bright	FIREX®
Application	Application
h6	h6
d ₂ Shank Tolerance	d ₂ Shank Tolerance
h10	h10
d ₁ Tolerance	d ₁ Tolerance
162	162
Availability	Availability
●	●
●	●
●	●
●	●
●	●
●	●

TECH-LINE

GH 100 H / FINISH-TECH 50 multi-tooth end mills for superfine finishing of materials < 50 HRC

Standard length (metric)

						HA	HA	HB	HB
Series						3311	3689	3019	3047
Tool material						Solid carbide			
Surface finish						Bright	FIREX®	Bright	FIREX®
Application									
d ₂ Shank Tolerance						h6	h6	h6	h6
d ₁ Tolerance						h10	h10	h10	h10
Tech. data page						162	162	162	162
d1	d2	l1	l2	No.	Order				
mm	mm	mm	mm	flutes	no.				
3.000	6.000	57.00	8.00	6	3.000	○	●		
4.000	6.000	57.00	11.00	6	4.000	○	●		
5.000	6.000	57.00	13.00	6	5.000	○	●		
6.000	6.000	57.00	13.00	6	6.000	○	●		○
8.000	8.000	63.00	19.00	6	8.000	○	●		○
10.000	10.000	72.00	22.00	6	10.000	○	●		○
12.000	12.000	83.00	26.00	6	12.000	○	●		○
14.000	14.000	83.00	26.00	6	14.000	○	●		○
16.000	16.000	92.00	32.00	6	16.000	○	●		○
18.000	18.000	92.00	32.00	8	18.000	○	●		○
20.000	20.000	104.00	38.00	8	20.000	○	●		○
25.000	25.000	121.00	45.00	10	25.000	○	○		○

● USA Stock ○ International Stock (0-2 wks)

TECH-LINE

GH 100 H / FINISH-TECH 50 multi-tooth end mills for superfine finishing of materials < 50 HRC

Long length

						HA	HA
Series						3180	3181
Tool material						Solid carbide	
Surface finish						Bright	FIREX®
Application							
d ₂ Shank Tolerance						h6	h6
d ₁ Tolerance						h10	h10
Tech. data page						162	162
d1	d2	l1	l2	No.	Order		
fract.	fract.	fract.	fract.	flutes	no.		
1/4	1/4	3	1 1/8	6	6.350	●	●
5/16	5/16	3	1 1/8	6	7.940	●	●
3/8	3/8	3	1 1/8	6	9.520	●	●
1/2	1/2	4 1/2	2	6	12.700	●	●
5/8	5/8	5	2 1/4	6	15.870	●	●
3/4	3/4	5	2 1/4	8	19.050	●	●

● Alloyed Steels ● Tool Steels ○ Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

Extra Long length (metric)

NH		45°		6/8		0.05 -0.2 x 45°	
Series							
Tool material							
Surface finish							
Application							
d ₂ Shank Tolerance							
d ₁ Tolerance							
Tech. data page							
d1	d2	l1	l2	No.	Order		
mm	mm	mm	mm	flutes	no.		
6.00	6.00	75.00	30.00	6	6.000		
8.00	8.00	100.00	40.00	6	8.000		
10.00	10.00	100.00	40.00	6	10.000		
12.00	12.00	150.00	45.00	6	12.000		
16.00	16.00	150.00	65.00	6	16.000		
20.00	20.00	150.00	65.00	8	20.000		

HA	HB	HA	HB
3312	3313	3691	3693
Solid carbide			
Bright		FIREX®	
h6	h6	h6	h6
h10	h10	h10	h10
162	162	162	162
Availability			
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

● USA Stock ○ International Stock (0-2 wks)

Looking for the next level in finish milling?

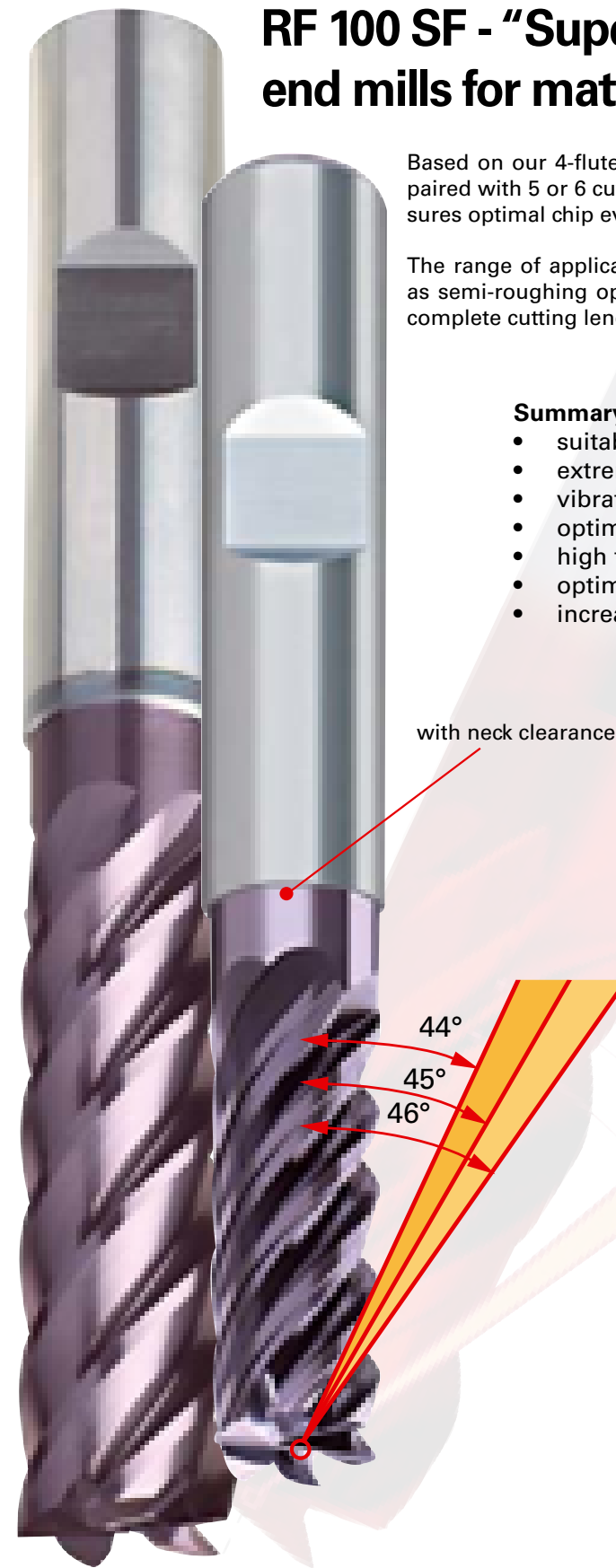
RF 100 SF - "Super Finish" variable helix end mills for materials up to 48 HRC

Based on our 4-flute RF 100 U the RF 100 S/F has a higher, more rigid web paired with 5 or 6 cutting edges. In addition, its innovative flute geometry ensures optimal chip evacuation.

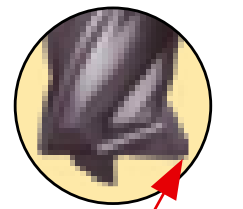
The range of application includes super finishing and HSC finishing as well as semi-roughing operations, i.e. feed widths (a_e) up to 0.3xD with close to complete cutting length.

Summary of advantages

- suitable for semi-roughing and HSC-finishing
- extremely high form accuracy
- vibration-free operation
- optimised flute geometry
- high feed rates possible
- optimal surface quality
- increased tool life



with neck clearance



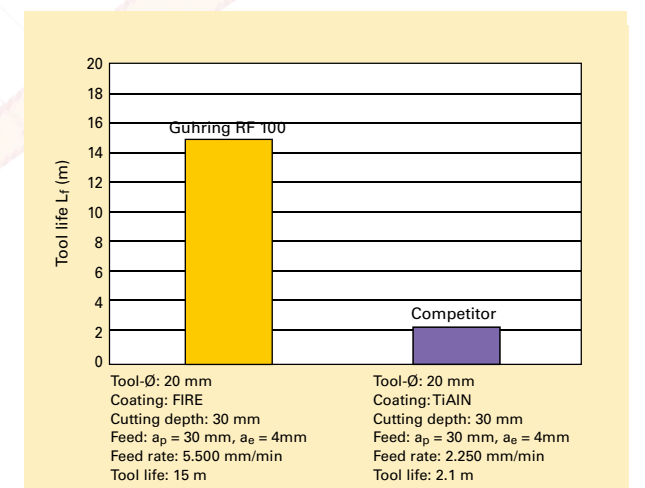
micro-corner protection for longer tool life

44°

45°

46°

* See page 53 for more information



Tool life comparison: Semi-roughing in 48 HRC the RF 100 S/F achieves more than 7 times the tool life in comparison to conventional end mills.

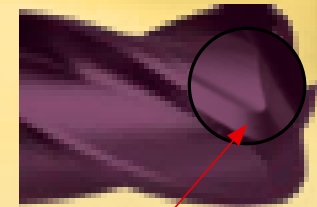
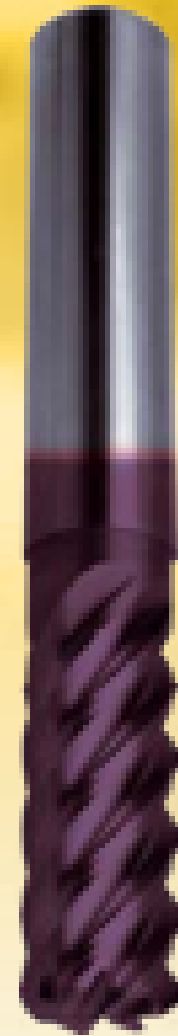
Finish-Tech 50 / GH 100 U high performance end mills with radius

The new design Guhring GH 100 U end mills offer the ultimate pre-requisite for a cost-efficient, optimal machining of general steels, high-alloyed steels, CrNi steels as well as stainless steels and titanium-alloys up to 50 HRC.

All GH 100 U end mills excel thanks to their micro-corner protection combined with a reinforced and corrected minor cutting edge. This design considerably reduces the wear at the cutting edges allowing a higher feed rate as well as improving tool life.

GH 100 U multi-tooth end mills excel thanks to a reinforced core, providing high stability and optimal workpiece surfaces. Along with reduced machining time, wear is drastically reduced. The advantages:

- reduced wear
- high feed rates possible
- high contour accuracy
- reduced machining time
- suitable for HSC (High Speed Cutting)



Seamless radius area provides high form and contour accuracy.



High wear protection thanks to radius geometry with constant rake angle and continuous spiral.

Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H
	up to 28HRC	over 28 HRC	up to 180 HB 30	over 180 HB 30	up to 28 HRC	over 28 HRC	up to 3% Si
						Ti-based	Ni-based
						up to 52 HRC	over 52 HRC
Finish-Tech 50	○	●	●	●	●	○	○

● = optimal suitability ○ = limited suitability

Standard length

NH	45°	6/8	R	HA		
Series						
3091						
Tool material						
Solid carbide						
Surface finish						
FIREX®						
Application						
d ₂ Shank Tolerance						
h6						
d ₁ Tolerance						
h10						
Tech. data page						
162						
Availability						
d1=d2	l1	l2	r	No.	Code	
fract.	fract.	fract.	dec.	flutes	No.	
1/4	2 1/2	3/4	0.015	6	6.352	●
1/4	2 1/2	3/4	0.031	6	6.354	●
1/4	2 1/2	3/4	0.062	6	6.356	●
5/16	2 1/2	13/16	0.015	6	7.942	●
5/16	2 1/2	13/16	0.031	6	7.944	●
5/16	2 1/2	13/16	0.062	6	7.946	●
3/8	2 1/2	1	0.015	6	9.522	●
3/8	2 1/2	1	0.031	6	9.524	●
3/8	2 1/2	1	0.062	6	9.526	●
1/2	3	1	0.015	6	12.702	●
1/2	3	1	0.031	6	12.704	●
1/2	3	1	0.062	6	12.706	●
1/2	3	1	0.090	6	12.707	●
5/8	3 1/2	1/14	0.031	6	15.874	●
5/8	3 1/2	1/14	0.062	6	15.876	●
5/8	3 1/2	1/14	0.090	6	15.877	●
3/4	4	1 1/2	0.031	8	19.054	●
3/4	4	1 1/2	0.062	8	19.056	●
3/4	4	1 1/2	0.090	8	19.057	●
3/4	4	1 1/2	0.125	8	19.059	●

● USA Stock ○ International Stock (0-2 wks)

GH 100 U / FINISH-TECH 50 multi-flute end mills with corner radius

Standard length (metric)

NH	45°	6/8	R	HA	HA			
Series								
3112								
3563								
Tool material								
Solid carbide								
Surface finish								
Bright								
FIREX®								
Application								
d ₂ Shank Tolerance								
h6								
d ₁ Tolerance								
h10								
Tech. data page								
162								
Availability								
d1=d2	d3	l1	l2	l3	r	No.	Code	
mm	mm	mm	mm	mm	mm	fl.	No.	
6.000	5.700	57.00	13.00	21.00	0.50	6	6.005	○
6.000	5.700	57.00	13.00	21.00	1.00	6	6.010	○
8.000	7.700	63.00	19.00	27.00	0.50	6	8.005	○
8.000	7.700	63.00	19.00	27.00	1.00	6	8.010	○
8.000	7.700	63.00	19.00	27.00	1.50	6	8.015	○
8.000	7.700	63.00	19.00	27.00	2.00	6	8.020	○
10.000	9.500	72.00	22.00	32.00	0.50	6	10.005	○
10.000	9.500	72.00	22.00	32.00	1.00	6	10.010	○
10.000	9.500	72.00	22.00	32.00	1.50	6	10.015	○
10.000	9.500	72.00	22.00	32.00	2.00	6	10.020	○
12.000	11.500	83.00	26.00	38.00	0.50	6	12.005	○
12.000	11.500	83.00	26.00	38.00	1.00	6	12.010	○
12.000	11.500	83.00	26.00	38.00	1.50	6	12.015	○
12.000	11.500	83.00	26.00	38.00	2.00	6	12.020	○
16.000	15.500	92.00	32.00	44.00	1.00	6	16.010	○
16.000	15.500	92.00	32.00	44.00	1.50	6	16.015	○
16.000	15.500	92.00	32.00	44.00	2.00	6	16.020	○
20.000	19.500	104.00	38.00	54.00	1.00	8	20.010	○
20.000	19.500	104.00	38.00	54.00	1.50	8	20.015	○
20.000	19.500	104.00	38.00	54.00	2.00	8	20.020	○

● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

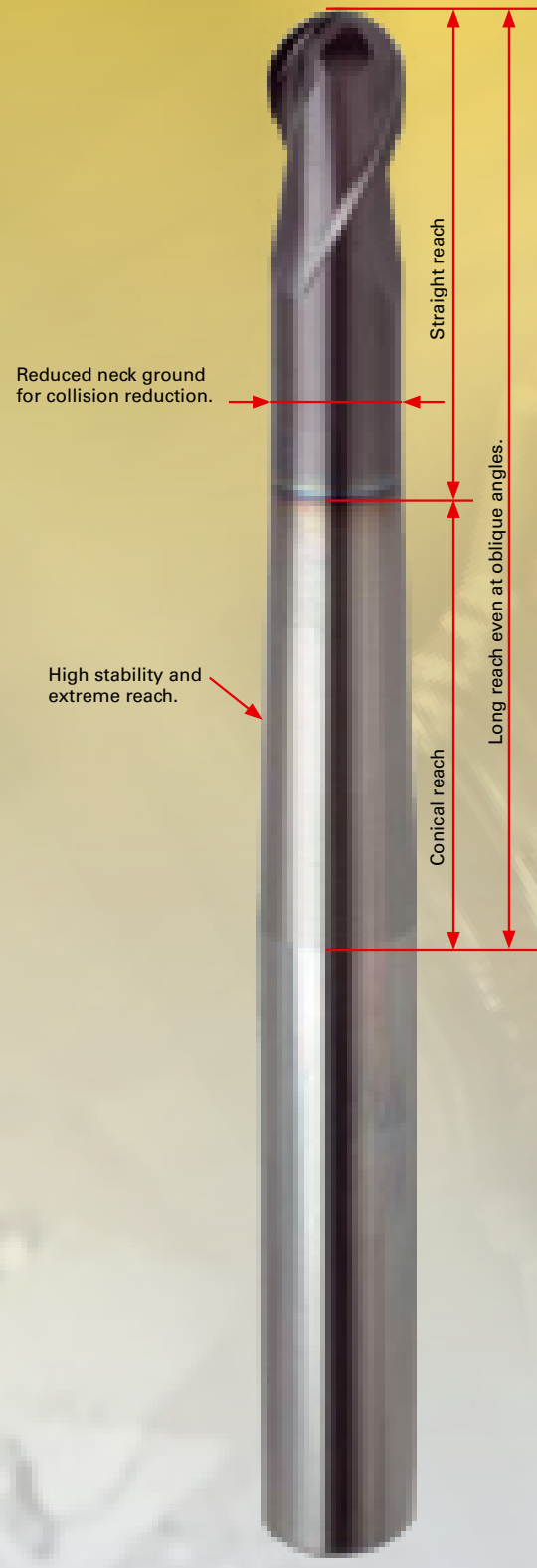
GF 500 HSC Trace Milling Cutters with ball nose or Torus form -

GF 500 HSC (High Speed Cutting) trace milling cutters are suitable for all roughing, finishing as well as fine finishing operations under HSC conditions in the mould and die industry. The range of application includes all general steels as well as high-alloyed steels but also hardened materials from 40 to 54 HRC.

The new web thinning form provides optimal chip evacuation as well as stability. In addition, the extremely close tolerances on radius and diameter ensure a very high contour accuracy on the workpiece, improving tool life considerably. A completely new grinding process produces considerably smoother cutting edges and flutes and also results in a clear increase in tool life. GF 500 B HSC ball nose trace milling cutters and GF 500T HSC-trace milling cutters with Torus form are both available with different lengths. The combination of the new geometries with reinforced shanks as well as reduced neck diameters allows extremely high feed rates and also provides high rigidity and optimal collision protection even for increased cutting depths.

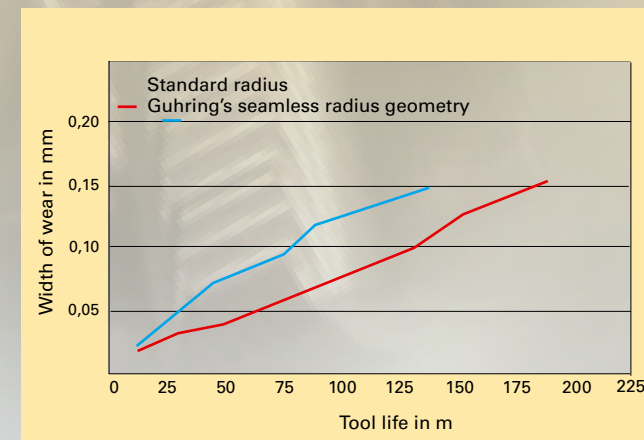
Advantages at a glance:

- accurate tolerances on diameter
- close radius tolerances
- radius grind with constant helix correction
- straight and radius areas ground in one pass
- grinding process for highest Surface finish finishes



Optimal wear protection thanks to radius grind with constant rake angle and continuous helix.

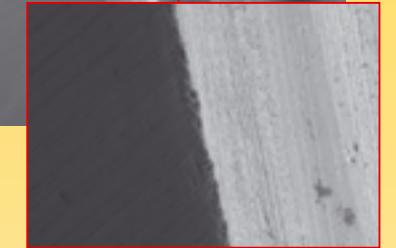
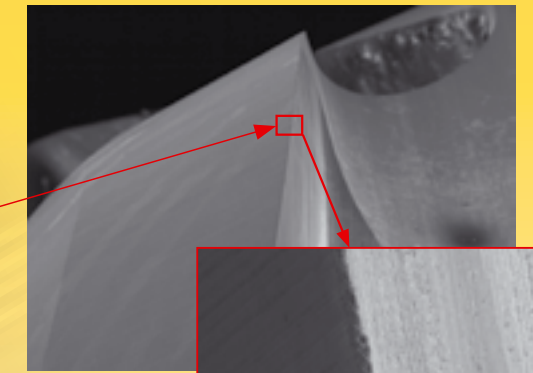
Seamless radius area provides high form and contour accuracy.



Pic. 1: Wear comparison
Guhring's seamless radius geometry reduces wear and provides a considerably longer tool life in comparison with tools ground with conventional full radius.

for highest accuracy in the mold and die industry

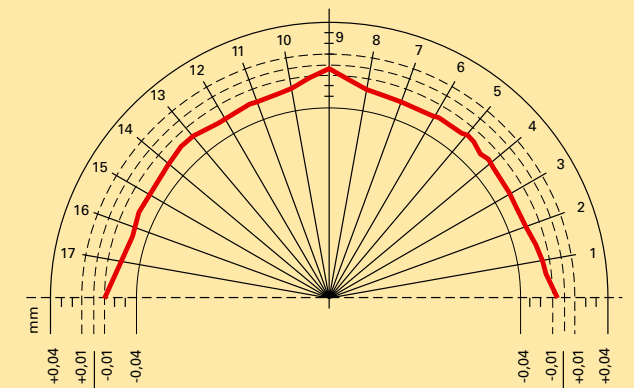
GF 500 milling cutters benefit from considerably smoother cutting edges and flutes produced by a completely new grinding process. It results in a reduction in crumbling of the cutting edges and therefore increases tool life. In addition, wear is extremely even, allowing more economical and frequent regrinding of the tools and providing further cost advantages.



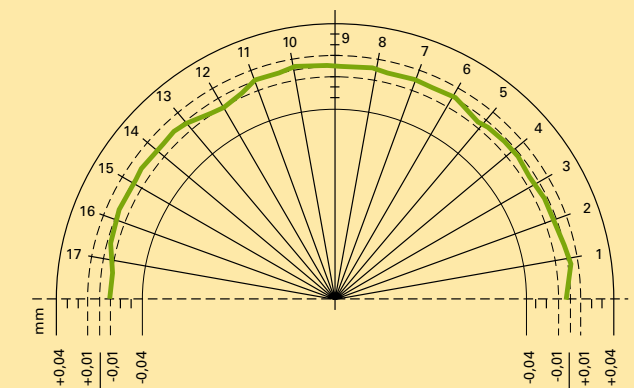
GF 500 cutting edge, produced with the new Guhring grinding process

Cutting edge of the competitor tool, produced by conventional grinding process

As well as high Surface finish qualities, close radius tolerances are achieved. Subsequently, GF 500 milling cutters offer very high form accuracy as well as considerable tool life increases up to 60 % in comparison to conventional tools.



Radius accuracy of competitor tool
(+/- 0.05 mm, +/-0.002")



GF 500 radius tolerance
(+/- 0.01 mm, +/-0.0004")

Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys	H						
	up to 28Hrc	over 28 HRC		up to 180 HB 30	over 180 HB 30	up to 28 HRC		over 28 HRC	up to 3% Si	over 3% Si	Ti-based	Ni-based	up to 52 HRC
GF 500	○	●	●	○	○	●	●	●	●	●	●	●	●

● = optimal suitability ○ = limited suitability

GF 500 T HSC-profile cutters with Torus form for materials < 54 HRC

Standard length (metric)

Series
Tool material
Surface finish
Application
d₂ Shank Tolerance
d₁ Tolerance
Tech. data page

Radius Precision ± 0.0004" (+/- 0.01mm)

d1	d2	d3	l1	l2	l3	l4	r	β	No.	Order
mm	mm	mm	mm	mm	mm	mm	mm	°	flutes	no.
2.000	6.000	1.800	57.00	3.00	6.20	20.00	0.50	5.70	2	2.000
3.000	6.000	2.800	57.00	3.50	8.40	20.00	0.50	4.30	2	3.000
4.000	6.000	3.800	57.00	4.00	9.40	20.00	1.00	2.90	2	4.000
6.000	6.000	5.600	57.00	6.00	-	20.00	2.00	-	2	6.000
8.000	8.000	7.600	63.00	7.00	-	26.00	2.00	-	2	8.000
10.000	10.000	9.600	72.00	8.00	-	30.00	3.00	-	2	10.000
12.000	12.000	11.500	83.00	10.00	-	35.00	4.00	-	2	12.000

3856

Solid carbide

TiAlN

h6

h8

167

54HRC

Availability

● USA Stock ○ International Stock (0-2 wks)

TECH-LINE

Long length (metric)

Series
Tool material
Surface finish
Application
d₂ Shank Tolerance
d₁ Tolerance
Tech. data page

Radius Precision ± 0.0004" (+/- 0.01mm)

d1	d2	d3	l1	l2	l3	l4	r	β	No.	Order
mm	mm	mm	mm	mm	mm	mm	mm	°	flutes	no.
2.000	6.000	1.800	80.00	3.00	8.00	40.00	0.50	2.90	2	2.000
3.000	6.000	2.800	80.00	3.50	12.00	40.00	0.50	2.20	2	3.000
4.000	6.000	3.800	80.00	4.00	20.00	40.00	1.00	1.40	2	4.000
6.000	8.000	5.600	100.00	6.00	25.00	60.00	2.00	1.00	2	6.000
8.000	10.000	7.600	120.00	7.00	30.00	75.00	2.00	0.80	2	8.000
10.000	12.000	9.600	120.00	8.00	30.00	70.00	3.00	0.80	2	10.000
12.000	16.000	11.500	150.00	10.00	35.00	100.00	4.00	1.20	2	12.000

3859

Solid carbide

TiAlN

h6

h8

167

54HRC

Availability

● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys ● Hardened Materials

TECH-LINE

GF 500 T HSC-profile cutters with Torus form / tapered for materials < 54 HRC

Long length (metric)

Series
Tool material
Surface finish
Application
d₂ Shank Tolerance
d₁ Tolerance
Tech. data page

Radius Precision ± 0.0004" (+/- 0.01mm)

d1	d2	d3	l1	l2	l3	l4	r	β	No.	Order
mm	mm	mm	mm	mm	mm	mm	mm	°	flutes	no.
2.000	6.000	1.800	80.00	3.00	8.00	40.00	0.50	1.00	2	2.000
3.000	6.000	2.800	80.00	3.50	12.00	40.00	0.50	1.00	2	3.000
4.000	6.000	3.800	100.00	4.00	20.00	60.00	0.50	1.00	2	4.000
6.000	8.000	5.600	120.00	6.00	25.00	80.00	1.00	1.00	2	6.000
8.000	10.000	7.600	150.00	7.00	20.00	105.00	1.00	0.60	2	8.000

3860

Solid carbide

TiAlN

h6

h8

167

54HRC

Availability

● USA Stock ○ International Stock (0-2 wks)

GF 500 T HSC-profile cutters with Torus form / reduced neck for materials < 54 HRC

Long length (metric)

Series
Tool material
Surface finish
Application
d₂ Shank Tolerance
d₁ Tolerance
Tech. data page

Radius Precision ± 0.0004" (+/- 0.01mm)

d1	d2	d3	l1	l2	l4	r	No.	Order
mm	mm	mm	mm	mm	mm	mm	flutes	no.
6.000	6.000	5.600	80.00	6.00	45.00	2.00	2	6.000
8.000	8.000	7.600	100.00	7.00	65.00	2.00	2	8.000
10.000	12.000	9.600	120.00	8.00	70.00	3.00	2	10.000
12.000	12.000	11.500	120.00	10.00	75.00	4.00	2	12.000

3865

Solid carbide

TiAlN

h6

h8

167

54HRC

Availability

● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys ● H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

GF 500 T HSC-profile cutters with Torus form for materials < 54 HRC

Long length (metric)

d1	d2	l1	l2	l4	r	No.	Order
mm	mm	mm	mm	mm	mm	flutes	no.
4.000	4.000	80.00	8.00	17.50	0.50	2	4.000
6.000	6.000	100.00	12.00	23.00	1.00	2	6.000
8.000	8.000	100.00	16.00	29.00	1.00	2	8.000
10.000	10.000	100.00	20.00	35.00	1.00	2	10.000
12.000	12.000	120.00	24.00	41.00	1.50	2	12.000

HA

3863

Solid carbide

TiAlN

d₂ Shank Tolerance: h6

d₁ Tolerance: h8

Tech. data page: 167

54HRC

Availability

● USA Stock ○ International Stock (0-2 wks)

GF 500 B HSC-ball nose profile cutters for materials < 54 HRC

Standard length (metric)

d1	d2	d3	l1	l2	l3	l4	r	β	No.	Order
mm	mm	mm	mm	mm	mm	mm	mm	°	flutes	no.
2.000	6.000	1.800	57.00	3.00	6.200	20.00	1.00	5.70	2	2.000
3.000	6.000	2.800	57.00	3.50	8.400	20.00	1.50	4.30	2	3.000
4.000	6.000	3.800	57.00	4.00	9.400	20.00	2.00	2.90	2	4.000
6.000	6.000	5.600	57.00	6.00	20.000	20.00	3.00	-	2	6.000
8.000	8.000	7.600	63.00	7.00	26.000	26.00	4.00	-	2	8.000
10.000	10.000	9.600	72.00	8.00	30.000	30.00	5.00	-	2	10.000
12.000	12.000	11.500	83.00	10.00	35.000	35.00	6.00	-	2	12.000

Availability

○

HA

3848

Solid carbide

TiAlN

d₂ Shank Tolerance: h6

d₁ Tolerance: h8

Tech. data page: 166

54HRC

Availability

○

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels Tool Steels Cast materials Stainless Steels Al and Al-alloys Ti / Ni alloys H Hardened Materials

GF 500 B HSC-ball nose profile cutters / tapered for materials < 54 HRC

Long length (metric)

Radius Precision $\pm 0.0004''$ (+/- 0.01mm)

d1	d2	d3	l1	l2	l3	l4	r	β	No.	Order
mm	mm	mm	mm	mm	mm	mm	mm	°	flutes	no.
2.000	6.000	1.800	80.00	3.00	8.00	40.00	1.00	2.90	2	2.000
3.000	6.000	2.800	80.00	3.50	12.00	40.00	1.50	2.20	2	3.000
4.000	6.000	3.800	80.00	4.00	20.00	40.00	2.00	1.40	2	4.000
5.000	6.000	4.700	80.00	5.00	25.00	40.00	2.50	0.70	2	5.000
6.000	8.000	5.600	100.00	6.00	25.00	60.00	3.00	1.00	2	6.000
8.000	10.000	7.600	120.00	7.00	30.00	75.00	4.00	0.80	2	8.000
10.000	12.000	9.600	120.00	8.00	30.00	70.00	5.00	0.80	2	10.000
12.000	16.000	11.500	150.00	10.00	35.00	100.00	6.00	1.20	2	12.000

HA

3849

Solid carbide

TiAlN

d2 Shank Tolerance: h6

d1 Tolerance: h8

Tech. data page: 166

54HRC

Availability

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

GF 500 B HSC-ball nose profile cutters / tapered for materials < 54 HRC

Long length (metric)

Radius Precision $\pm 0.0004''$ (+/- 0.01mm)

d1	d2	d3	l1	l2	l3	l4	r	β	No.	Order
mm	mm	mm	mm	mm	mm	mm	mm	°	flutes	no.
2.000	6.000	1.800	80.00	3.00	8.00	40.00	1.00	1.00	2	2.000
3.000	6.000	2.800	80.00	3.50	12.00	40.00	1.50	1.00	2	3.000
4.000	6.000	3.800	100.00	4.00	20.00	60.00	2.00	1.00	2	4.000
6.000	8.000	5.600	120.00	6.00	25.00	80.00	3.00	1.00	2	6.000
8.000	10.000	7.600	150.00	7.00	20.00	105.00	4.00	0.60	2	8.000

HA

3853

Solid carbide

TiAlN

d2 Shank Tolerance: h6

d1 Tolerance: h8

Tech. data page: 166

54HRC

Availability

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

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels Tool Steels Cast materials Stainless Steels Al and Al-alloys Ti / Ni alloys H Hardened Materials

GF 500 B HSC-ball nose profile cutters / reduced neck for materials < 54 HRC

Long length (metric)

Radius Precision $\pm 0.0004''$ (+/- 0.01mm)

d1	d2	d3	l1	l2	l4	r	No.	Order
mm	mm	mm	mm	mm	mm	mm	flutes	no.
6.000	6.000	5.600	80.00	6.00	45.00	3.00	2	6.000
8.000	8.000	7.600	100.00	7.00	65.00	4.00	2	8.000
10.000	10.000	9.600	120.00	8.00	80.00	5.00	2	10.000
12.000	12.000	11.500	120.00	10.00	75.00	6.00	2	12.000

HA

3855

Solid carbide

TiAlN

Application

d₂ Shank Tolerance h6

d₁ Tolerance h8

Tech. data page 166

54HRC

Availability

GF 500 B HSC-ball nose profile cutters for materials < 54 HRC

Standard length (metric)

Radius Precision $\pm 0.0004''$ (+/- 0.01mm)

d1	d2	l1	l2	l4	r	No.	Order
mm	mm	mm	mm	mm	mm	flutes	no.
6.000	6.000	57.00	12.00	23.00	3.00	2	6.000
8.000	8.000	63.00	16.00	29.00	4.00	2	8.000
10.000	10.000	72.00	20.00	35.00	5.00	2	10.000
12.000	12.000	83.00	24.00	41.00	6.00	2	12.000

HA

3854

Solid carbide

TiAlN

Application

d₂ Shank Tolerance h6

d₁ Tolerance h8

Tech. data page 166

54HRC

Availability

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels Tool Steels Cast materials Stainless Steels Al and Al-alloys Ti / Ni alloys H Hardened Materials

GF 500 B HSC-ball nose profile cutters for materials < 54 HRC

Long length (metric)

Series Tool material Surface finish Application d ₂ Shank Tolerance d ₁ Tolerance Tech. data page							
l ₄ = Recommended projection from chuck Radius Precision ± 0.0004" (+/- 0.01mm)							
d ₁	d ₂	l ₁	l ₂	l ₄	r	No.	Order
mm	mm	mm	mm	mm	mm	flutes	no.
4.000	4.000	80.00	8.00	17.50	2.00	2	4.000
6.000	6.000	100.00	12.00	23.00	3.00	2	6.000
8.000	8.000	100.00	16.00	29.00	4.00	2	8.000
10.000	10.000	100.00	20.00	35.00	5.00	2	10.000
12.000	12.000	120.00	24.00	41.00	6.00	2	12.000

HA
3866
Solid carbide
TiAlN
h6
h8
166
54HRC
Availability
○
○
○
○
○

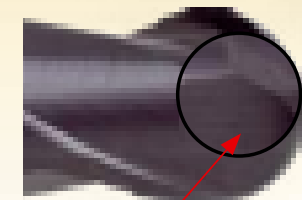
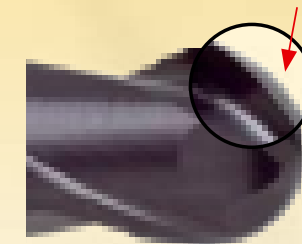
● USA Stock ○ International Stock (0-2 wks)

GF 300 B and GF 300 T: Ball nose and Torus end mills for high performance milling in materials < 62 HRC



Reduced neck ground for collision reduction

High wear protection thanks to radius geometry with constant rake angle and continuous spiral.



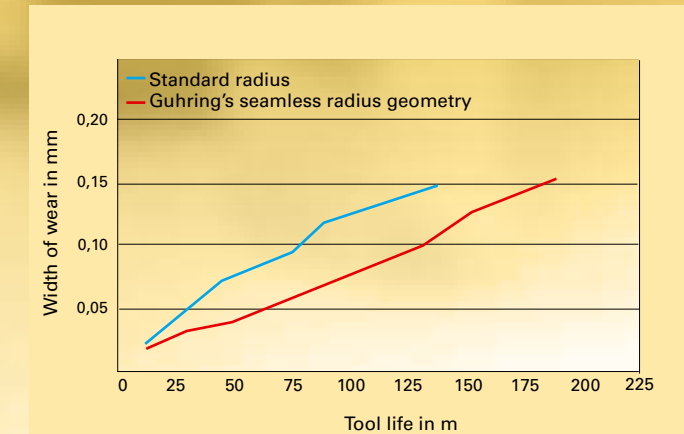
Seamless radius area provides high form and contour accuracy.

The die and mold industry places ever higher demands on milling cutters – primarily with regard to accuracy and tool life. Therefore, Guhring's cutting tool program now includes radius milling cutters that are perfectly adapted to satisfy these demands and provide optimal machining results thanks to application orientated geometries, carbide grades and coatings. The advantages are especially high form and contour accuracy of the workpiece, minimal wear and therefore excellent tool life.

The special features of Guhring's ball nose milling cutters are:

- outside diameter and the radius is ground in one-pass
- radius point geometry with constant helix-radius-correction
- reduced neck ground for collision reduction with protruding edges

(see next page)



Wear comparison: Guhring's seamless radius geometry reduces wear and provides a considerably longer tool life in comparison with tools ground with conventional full radius.

Material	Alloyed Steel	Tool Steel	Cast iron	Stainless steel	Aluminium	Ti-special alloys		H
	up to 28HRC	over 28 Hrc				Ti-based	Ni-based	
GF 500	○	●	●	○	●	●	●	●
GF 300			○	●		○	●	●

● = optimal suitability ○ = limited suitability

GF 300 T / TRACE-TECH 62 cutters with Torus grind / reduced neck for materials < 62 HRC

Extra long length

Series
 Tool material
 Surface finish
 Application
 d₂ Shank Tolerance
 d₁ Tolerance
 Tech. data page

HA

3192

Solid carbide

FIREX®

h6

h8

167

54HRC

d1	d2	d3	l1	l2	l3	l4	r	No.	Code
fract.	fract.	dec.	fract.	fract.	dec.	mm	dec.	flutes	No.
3/16	1/4	0.167	2 1/2	3/16	0.750	1.000	0.008	4	4.760
1/4	1/4	0.230	3	1/4	1.500		0.010	4	6.350
5/16	5/16	0.292	3	5/16	1.500		0.013	4	7.940
3/8	3/8	0.355	3	3/8	1.500		0.013	4	9.520
1/2	1/2	0.480	4 1/2	1/2	2.750		0.020	4	12.700
5/8	5/8	0.605	5	5/8	3.000		0.025	4	15.870

Availability

●

●

●

●

●

●

● USA Stock ○ International Stock (0-2 wks)

Extra long length (metric)

Series
 Tool material
 Surface finish
 Application
 d₂ Shank Tolerance
 d₁ Tolerance
 Tech. data page

HA

3362

Solid carbide

FIREX®

h6

h8

167

54HRC

d1	d2	d3	l1	l2	l3	r	No.	Code
mm	mm	mm	mm	mm	mm	mm	flutes	No.
6.000	6.000	5.700	75.00	9.00	39.00	1.00	4	6.000
8.000	8.000	7.700	100.00	12.00	64.00	1.00	4	8.000
10.000	10.000	9.500	100.00	15.00	60.00	1.50	4	10.000
12.000	12.000	11.500	150.00	18.00	105.00	1.50	4	12.000
16.000	16.000	15.500	150.00	24.00	102.00	2.00	4	16.000

Availability

○

○

○

○

○

● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

GF 300 B / TRACE-TECH ball nose cutters / reduced neck for materials < 62 HRC

Standard length

Series Tool material Surface finish Application d ₂ Shank Tolerance d ₁ Tolerance Tech. data page								
d1	d2	d3	l1	l2	l3	r	No.	Code
fract.	fract.	dec.	fract.	fract.	dec.	dec.	flutes	No.
1/8	1/8	0.113	2	1/8	0.500	0.063	2	3.170
3/16	3/16	0.176	2	3/16	0.500	0.094	2	4.760
1/4	1/4	0.238	2	1/4	0.688	0.125	2	6.350
5/16	5/16	0.300	2	5/16	1.197	0.156	2	7.940
3/8	3/8	0.363	2 1/2	3/8	1.197	0.188	2	9.520
1/2	1/2	0.480	3	1/2	1.447	0.250	2	12.700

HA	
3101	
Solid carbide	
FIREX®	
h6	
h8	
166	
Availability	
● ● ● ● ● ●	

● USA Stock ○ International Stock (0-2 wks)

Standard length (metric)

Series Tool material Surface finish Application d ₂ Shank Tolerance d ₁ Tolerance Tech. data page								
d1	d2	d3	l1	l2	l3	r	No.	Code
mm	mm	mm	mm	mm	mm	mm	flutes	No.
0.500	3.000	0.400	38.00	0.75	10.00	0.25	2	0.500
0.800	3.000	0.700	38.00	1.20	10.00	0.40	2	0.800
1.000	3.000	0.900	38.00	1.50	10.00	0.50	2	1.000
1.500	3.000	1.400	38.00	2.25	10.00	0.75	2	1.500
2.000	6.000	1.900	57.00	3.00	21.00	1.00	2	2.000
3.000	6.000	2.700	57.00	5.00	21.00	1.50	2	3.000
4.000	6.000	3.700	57.00	6.00	21.00	2.00	2	4.000
5.000	6.000	4.700	57.00	8.00	21.00	2.50	2	5.000
6.000	6.000	5.700	57.00	9.00	21.00	3.00	2	6.000
8.000	8.000	7.700	63.00	12.00	27.00	4.00	2	8.000
10.000	10.000	9.500	72.00	15.00	32.00	5.00	2	10.000
12.000	12.000	11.500	83.00	18.00	38.00	6.00	2	12.000
16.000	16.000	15.500	92.00	24.00	44.00	8.00	2	16.000

HA	
3359	
Solid carbide	
FIREX®	
h6	
h8	
166	
Availability	
○ ○ ○ ○ ● ● ● ● ● ● ○ ○	

Alloyed Steels
 Tool Steels
 Cast materials
 Stainless Steels
 Al and Al-alloys
 Ti / Ni alloys
 H Hardened Materials

When ordering: EDP no. = Series + Order no., example: 3867 12.700

GF 300 B / TRACE-TECH ball nose cutters / reduced neck for materials < 62 HRC

Long length

Series
Tool material
Surface finish
Application
d₂ Shank Tolerance
d₁ Tolerance
Tech. data page

HA
3191
Solid carbide
FIREX®
h6
h8
166

d1	d2	d3	l1	l2	l3	r	No.	Code
fract.	fract.	dec.	fract.	fract.	dec.	dec.	flutes	No.
1/8	1/4	0.230	2 1/2	1/8	1.000	0.063	2	3.170
3/16	1/4	0.167	2 1/2	3/16	1.000	0.094	2	4.760
1/4	1/4	0.230	3	1/4	1.500	0.125	2	6.350
5/16	5/16	0.292	3	5/16	1.500	0.156	2	7.940
3/8	3/8	0.355	3	3/8	1.500	0.188	2	9.520
1/2	1/2	0.480	4 1/2	1/2	2.750	0.250	2	12.700
5/8	5/8	0.605	5	5/8	3.000	0.313	2	15.870

Availability

●

Extra long length (metric)

Series
Tool material
Surface finish
Application
d₂ Shank Tolerance
d₁ Tolerance
Tech. data page

HA
3360
Solid carbide
FIREX®
h6
h8
166

d1	d2	d3	l1	l2	l3	r	No.	Code
mm	mm	mm	mm	mm	mm	mm	flutes	No.
3.000	6.000	2.700	75.00	5.00	39.00	1.50	2	3.000
4.000	6.000	3.700	75.00	6.00	39.00	2.00	2	4.000
5.000	6.000	4.700	75.00	8.00	39.00	2.50	2	5.000
6.000	6.000	5.700	75.00	9.00	39.00	3.00	2	6.000
8.000	8.000	7.700	100.00	12.00	64.00	4.00	2	8.000
10.000	10.000	9.500	100.00	15.00	60.00	5.00	2	10.000
12.000	12.000	11.500	150.00	18.00	105.00	6.00	2	12.000
16.000	16.000	15.500	150.00	24.00	102.00	8.00	2	16.000

Availability

○

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels Tool Steels Cast materials Stainless Steels Al and Al-alloys Ti / Ni alloys H Hardened Materials

PRO-LINE



GUHRING

UNI PRO end mills (2-fluted)

Stub length

Series: 3092 Tool material: Solid carbide Surface finish: FIREX® Application: d ₂ Shank tolerance: h6 d ₁ Tolerance: h10 Tech. data page: 165					
Availability: ●					
d1	d2	l1	l2	No.	Code
fract.	fract.	fract.	fract.	flutes	No.
1/16	1/8	2	1/8	2	1.590
1/8	1/8	2	1/4	2	3.170
3/16	3/16	2	3/8	2	4.760
1/4	1/4	2	1/2	2	6.350
5/16	5/16	2	1/2	2	7.940
3/8	3/8	2	5/8	2	9.520
7/16	7/16	2 1/2	5/8	2	11.110
1/2	1/2	2 1/2	5/8	2	12.700
5/8	5/8	3	3/4	2	15.870
3/4	3/4	3	1	2	19.050

Stub length (metric)

Series: 3633 Tool material: Solid carbide Surface finish: FIREX® Application: d ₂ Shank tolerance: h6 d ₁ Tolerance: h10 Tech. data page: 165					
Availability: ○					
d1	d2	l1	l2	No.	Code
mm	mm	mm	mm	flutes	No.
2.000	6.000	50.00	3.00	2	2.000
2.500	6.000	50.00	3.00	2	2.500
3.000	6.000	50.00	4.00	2	3.000
4.000	6.000	54.00	5.00	2	4.000
5.000	6.000	54.00	6.00	2	5.000
6.000	6.000	54.00	7.00	2	6.000
6.500	8.000	58.00	8.00	2	6.500
8.000	8.000	58.00	9.00	2	8.000
10.000	10.000	66.00	11.00	2	10.000
12.000	12.000	73.00	12.00	2	12.000
14.000	14.000	75.00	14.00	2	14.000
16.000	16.000	82.00	16.00	2	16.000
18.000	18.000	84.00	18.00	2	18.000
20.000	20.000	92.00	20.00	2	20.000

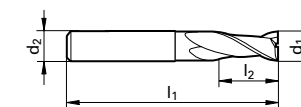
Series: 3634 Tool material: Solid carbide Surface finish: FIREX® Application: d ₂ Shank tolerance: h6 d ₁ Tolerance: h10 Tech. data page: 165	
Availability: ○	

UNI PRO end mills (2-fluted)

Standard length

Series: 3146, 3148, 3846 Tool material: Solid carbide Surface finish: Bright, FIREX®, Super-A™ Application: d ₂ Shank tolerance: h6 d ₁ Tolerance: h10 Tech. data page: 165					
Availability: ●					
d1	d2	l1	l2	No.	Code
fract.	fract.	fract.	fract.	flutes	No.
1/16	1/8	1 1/2	3/16	2	1.590
5/64	1/8	1 1/2	1/4	2	1.980
3/32	1/8	1 1/2	9/32	2	2.380
7/64	1/8	1 1/2	3/8	2	2.780
1/8	1/8	1 1/2	3/8	2	3.170
9/64	3/16	2	9/16	2	3.570
5/32	3/16	2	1/2	2	3.970
11/64	3/16	2	9/16	2	4.370
3/16	3/16	2	5/8	2	4.760
13/64	3/16	2 1/2	5/8	2	5.160
7/32	1/4	2 1/2	5/8	2	5.560
15/64	1/4	2 1/2	3/4	2	5.950
1/4	1/4	2 1/2	3/4	2	6.350
17/64	5/16	2 1/2	7/8	2	6.750
9/32	5/16	2 1/2	3/4	2	7.140
19/64	5/16	2 1/2	7/8	2	7.540
5/16	5/16	2 1/2	13/16	2	7.940
21/64	3/8	2 1/2	7/8	2	8.330
11/32	3/8	2 1/2	1	2	8.730
23/64	3/8	2 1/2	7/8	2	9.130
3/8	3/8	2 1/2	1	2	9.520
25/64	7/16	2 1/2	7/8	2	9.920
13/32	7/16	2 3/4	1	2	10.320
27/64	7/16	2 1/2	7/8	2	10.720
7/16	7/16	2 3/4	1	2	11.110
29/64	1/2	3	1	2	11.510
15/32	1/2	3	1	2	11.910
31/64	1/2	3	1	2	12.300
1/2	1/2	3	1	2	12.700
9/16	9/16	3 1/2	1 1/8	2	14.290
5/8	5/8	3 1/2	1 1/4	2	15.870
11/16	3/4	4	1 3/8	2	17.460
3/4	3/4	4	1 1/2	2	19.050
1	1	4	1 1/2	2	25.400

NEW Expanded offering!



Series: 3146, 3148, 3846 Tool material: Solid carbide Surface finish: Bright, FIREX®, Super-A™ Application: d ₂ Shank tolerance: h6 d ₁ Tolerance: h10 Tech. data page: 165		
Availability: ●		

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels
 Tool Steels
 Cast materials
 Stainless Steels
 Al and Al-alloys
 Ti / Ni alloys
 Hardened Materials

UNI PRO end mills (2-fluted)

Standard length (metric)

Series	3303 3676				
Tool material	Solid carbide				
Surface finish	Bright		FIREX®		
Application					
d ₂ Shank tolerance	h6				
d ₁ Tolerance	h10				
Tech. data page	165				
d1	d2	l1	l2	No.	Code
mm	mm	mm	mm	flutes	No.
2.000	2.000	32.00	6.00	2	2.000
2.500	2.500	32.00	7.00	2	2.500
3.000	3.000	38.00	7.00	2	3.000
3.500	3.500	50.00	7.00	2	3.500
4.000	4.000	50.00	8.00	2	4.000
4.500	4.500	50.00	8.00	2	4.500
5.000	5.000	50.00	10.00	2	5.000
5.500	5.500	57.00	10.00	2	5.500
6.000	6.000	57.00	10.00	2	6.000
6.500	6.500	60.00	13.00	2	6.500
7.000	7.000	60.00	13.00	2	7.000
7.500	7.500	63.00	16.00	2	7.500
8.000	8.000	63.00	16.00	2	8.000
8.500	8.500	67.00	16.00	2	8.500
9.000	9.000	67.00	16.00	2	9.000
9.500	9.500	72.00	19.00	2	9.500
10.000	10.000	72.00	19.00	2	10.000
11.000	11.000	83.00	22.00	2	11.000
12.000	12.000	83.00	22.00	2	12.000
13.000	13.000	83.00	22.00	2	13.000
14.000	14.000	83.00	22.00	2	14.000
15.000	15.000	92.00	26.00	2	15.000
16.000	16.000	92.00	26.00	2	16.000
18.000	18.000	92.00	26.00	2	18.000
20.000	20.000	104.00	32.00	2	20.000

Extra Long length (metric)

Series	3011 3021				
Tool material	Solid carbide				
Surface finish	Bright		FIREX®		
Application					
d ₂ Shank tolerance	h6				
d ₁ Tolerance	h10				
Tech. data page	165				
d1	d2	l1	l2	No.	Code
mm	mm	mm	mm	flutes	No.
3.000	3.000	75.00	20.00	2	3.000
4.000	4.000	75.00	25.00	2	4.000
5.000	5.000	75.00	30.00	2	5.000
6.000	6.000	75.00	30.00	2	6.000
8.000	8.000	100.00	40.00	2	8.000
10.000	10.000	100.00	40.00	2	10.000
12.000	12.000	150.00	45.00	2	12.000
14.000	14.000	150.00	45.00	2	14.000
14.000	16.000	150.00	65.00	2	14.001
16.000	16.000	150.00	65.00	2	16.000
18.000	18.000	150.00	65.00	2	18.000
18.000	20.000	150.00	65.00	2	18.001
20.000	20.000	150.00	65.00	2	20.000

UNI PRO end mills (2-fluted)

Long length

Series	3147 3149 3847				
Tool material	Solid carbide				
Surface finish	Bright		FIREX®		Super-A™
Application					
d ₂ Shank tolerance	h6				
d ₁ Tolerance	h10				
Tech. data page	165				
d1	d2	l1	l2	No.	Code
fract.	fract.	fract.	fract.	flutes	No.
1/8	1/8	2	1/2	2	3.170
3/16	3/16	2 1/2	3/4	2	4.760
1/4	1/4	3	1 1/8	2	6.350
5/16	5/16	3	1 1/8	2	7.940
3/8	3/8	3	1 1/8	2	9.520
7/16	7/16	4 1/2	2	2	11.110
1/2	1/2	4 1/2	2	2	12.700
5/8	5/8	5	2 1/4	2	15.870
3/4	3/4	5	2 1/4	2	19.050
1	1	5	2 1/4	2	25.400

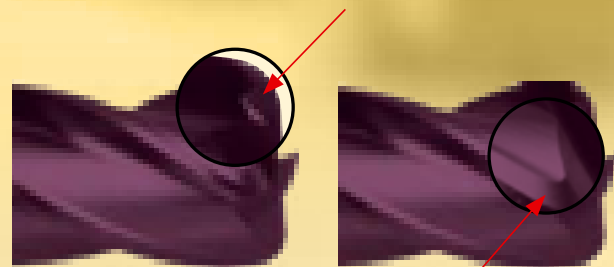
Corner radius milling cutters: Satisfying the highest demands on accuracy and tool life

Especially the die and mould industry places ever higher demands on milling cutters – primarily with regard to accuracy and tool life. Therefore, Guhring's cutting tool program now includes radius milling cutters that are perfectly adapted to satisfy these demands and provide optimal machining results thanks to application orientated geometries, carbide grades and coatings. The advantages are especially high form and contour accuracy of the workpiece, minimal wear and therefore excellent tool life.

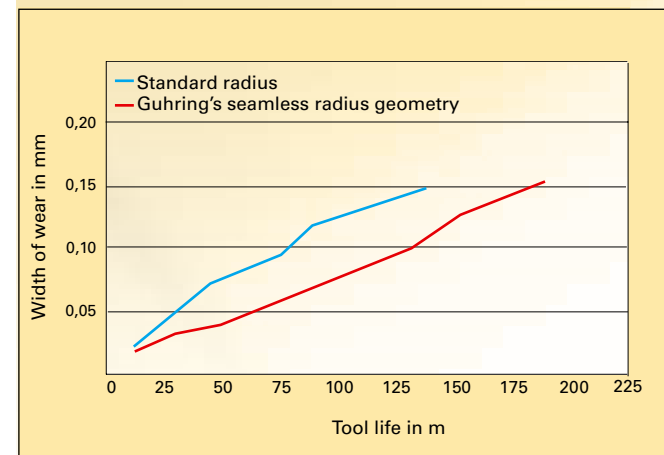
The special features of Guhring's Ball nose milling cutters are:

- outside diameter and the radius is ground in one-pass
- radius point geometry with constant helix-radius-correction
- reduced neck ground for collision reduction with protruding edges

High wear protection thanks to radius geometry with constant rake angle and continuous spiral.



Seamless radius area provides high form and contour accuracy.



Wear comparison: Guhring's seamless radius geometry reduces wear and provides a considerably longer tool life in comparison with tools ground with conventional full radius.

Standard length

N	30°	2	R	HA			
Series 3087							
Tool material Carbide							
Surface finish FIREX®							
Application							
d ₂ Shank tolerance HA							
d ₁ Tolerance h10							
Tech. data page 165							
d1	d2	l1	l2	r	No.	Code	Availability
fract.	fract.	fract.	fract.	in.	flutes	No.	
1/8	1/8	1 1/2	3/8	0.015	2	3.172	●
1/8	1/8	1 1/2	3/8	0.031	2	3.174	●
3/16	3/16	2	5/8	0.015	2	4.762	●
3/16	3/16	2	5/8	0.031	2	4.764	●
3/16	3/16	2	5/8	0.062	2	4.766	●
1/4	1/4	2 1/2	3/4	0.015	2	6.352	●
1/4	1/4	2 1/2	3/4	0.031	2	6.354	●
1/4	1/4	2 1/2	3/4	0.062	2	6.356	●
5/16	5/16	2 1/2	13/16	0.015	2	7.942	●
5/16	5/16	2 1/2	13/16	0.031	2	7.944	●
5/16	5/16	2 1/2	13/16	0.062	2	7.946	●
3/8	3/8	2 1/2	1	0.015	2	9.522	●
3/8	3/8	2 1/2	1	0.031	2	9.524	●
3/8	3/8	2 1/2	1	0.062	2	9.526	●
1/2	1/2	3	1	0.015	2	12.702	●
1/2	1/2	3	1	0.031	2	12.704	●
1/2	1/2	3	1	0.062	2	12.706	●

● USA Stock ○ International Stock (0-2 wks)

UNI PRO "R" end mills (2-fluted) with corner radius

Standard length (metric)

N	30°	2	R	HA	HA					
Series 3106 / 3561										
Tool material Solid carbide / Carbide										
Surface finish Bright / FIREX®										
Application										
d ₂ Shank tolerance h6 / h6										
d ₁ Tolerance h10 / h10										
Tech. data page 165 / 165										
d1	d2	d3	l1	l2	l3	r	No.	Code	Availability	
mm	mm	mm	mm	mm	mm	mm	flutes	No.		
6.000	6.000	5.700	57.00	10.00	21.00	0.50	2	6.005	○	○
6.000	6.000	5.700	57.00	10.00	21.00	1.00	2	6.010	○	○
8.000	8.000	7.700	63.00	16.00	27.00	0.50	2	8.005	○	○
8.000	8.000	7.700	63.00	16.00	27.00	1.00	2	8.010	○	○
8.000	8.000	7.700	63.00	16.00	27.00	1.50	2	8.015	○	○
8.000	8.000	7.700	63.00	16.00	27.00	2.00	2	8.020	○	○
10.000	10.000	9.500	72.00	19.00	32.00	0.50	2	10.005	○	○
10.000	10.000	9.500	72.00	19.00	32.00	1.00	2	10.010	○	○
10.000	10.000	9.500	72.00	19.00	32.00	1.50	2	10.015	○	○
10.000	10.000	9.500	72.00	19.00	32.00	2.00	2	10.020	○	○
12.000	12.000	11.500	83.00	22.00	38.00	0.50	2	12.005	○	○
12.000	12.000	11.500	83.00	22.00	38.00	1.00	2	12.010	○	○
12.000	12.000	11.500	83.00	22.00	38.00	1.50	2	12.015	○	○
12.000	12.000	11.500	83.00	22.00	38.00	2.00	2	12.020	○	○
16.000	16.000	15.500	92.00	26.00	44.00	1.00	2	16.010	○	○
16.000	16.000	15.500	92.00	26.00	44.00	1.50	2	16.015	○	○
16.000	16.000	15.500	92.00	26.00	44.00	2.00	2	16.020	○	○
20.000	20.000	19.500	104.00	32.00	54.00	1.00	2	20.010	○	○
20.000	20.000	19.500	104.00	32.00	54.00	1.50	2	20.015	○	○
20.000	20.000	19.500	104.00	32.00	54.00	2.00	2	20.020	○	○

● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

UNI PRO "R" end mills (2-fluted) with corner radius

Long length

							HA	
							3088	
							Solid carbide	
							FIREX®	
							h6	
							h10	
							165	
							Availability	
d1	d2	l1	l2	r	No.	Code		
fract.	fract.	fract.	fract.	in.	flutes	No.		
1/8	1/8	2	1/2	0.015	2	3.172		
1/8	1/8	2	1/2	0.031	2	3.174		
1/4	1/4	3	1 1/8	0.015	2	6.352		
1/4	1/4	3	1 1/8	0.031	2	6.354		
1/4	1/4	3	1 1/8	0.062	2	6.356		
3/8	3/8	3	1 1/8	0.015	2	9.522		
3/8	3/8	3	1 1/8	0.031	2	9.524		
3/8	3/8	3	1 1/8	0.062	2	9.526		
1/2	1/2	4 1/2	2	0.015	2	12.702		
1/2	1/2	4 1/2	2	0.031	2	12.704		
1/2	1/2	4 1/2	2	0.062	2	12.706		
							● USA Stock ○ International Stock (0-2 wks)	

PRO-LINE

UNI PRO end mills (3-fluted)

Stub length (metric)

						HA		HB	
						3558		3719	
						Carbide		Carbide	
						FIREX®		FIREX®	
						h6		h6	
						h10		h10	
						165		165	
						Availability		Availability	
d1	d2	l1	l2	No.	Code				
mm	mm	mm	mm	flutes	No.				
2.000	6.000	50.00	3.00	3	2.000			○ ○	
2.500	6.000	50.00	3.00	3	2.500			○ ○	
3.000	6.000	50.00	4.00	3	3.000			● ●	
3.500	6.000	50.00	4.00	3	3.500			○ ○	
4.000	6.000	54.00	5.00	3	4.000			○ ○	
5.000	6.000	54.00	6.00	3	5.000			○ ○	
6.000	6.000	54.00	7.00	3	6.000			○ ○	
7.000	8.000	58.00	8.00	3	7.000			○ ○	
8.000	8.000	58.00	9.00	3	8.000			○ ○	
10.000	10.000	66.00	11.00	3	10.000			● ●	
12.000	12.000	73.00	12.00	3	12.000			○ ○	
16.000	16.000	82.00	16.00	3	16.000			○ ○	
						● USA Stock ○ International Stock (0-2 wks)			
						● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys ● H Hardened Materials			

PRO-LINE

UNI PRO end mills (3-fluted)

Standard length

<p>Series</p> <p>Tool material</p> <p>Surface finish</p> <p>Application</p> <p>d₂ Shank tolerance</p> <p>d₁ Tolerance</p> <p>Tech. data page</p>					
d1	d2	l1	l2	No.	Code
fract.	fract.	fract.	fract.	flutes	No.
1/8	1/8	1 1/2	3/8	3	3.170
3/16	3/16	2	5/8	3	4.760
1/4	1/4	2 1/2	3/4	3	6.350
5/16	5/16	2 1/2	13/16	3	7.940
3/8	3/8	3	1	3	9.520
7/16	7/16	2 3/4	1	3	11.110
1/2	1/2	3	1	3	12.700
9/16	9/16	3 1/2	1 1/8	3	14.290
5/8	5/8	3 1/2	1 1/4	3	15.870
3/4	3/4	4	1 1/2	3	19.050
1	1	4	1 1/2	3	25.400

HA	HA	HA
3168	3170	3868
Solid carbide		
Bright	FIREX®	Super-A™
h6	h6	h6
h10	h10	h10
165	165	165
Availability		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

UNI PRO end mills (3-fluted)

Standard length (metric)

<p>Series</p> <p>Tool material</p> <p>Surface finish</p> <p>Application</p> <p>d₂ Shank tolerance</p> <p>d₁ Tolerance</p> <p>Tech. data page</p>					
d1	d2	l1	l2	No.	Code
mm	mm	mm	mm	flutes	No.
2.000	2.000	32.00	6.00	3	2.000
2.500	2.500	32.00	7.00	3	2.500
3.000	3.000	38.00	7.00	3	3.000
3.500	3.500	50.00	7.00	3	3.500
4.000	4.000	50.00	8.00	3	4.000
4.500	4.500	50.00	8.00	3	4.500
5.000	5.000	50.00	10.00	3	5.000
5.500	5.500	57.00	10.00	3	5.500
6.000	6.000	57.00	10.00	3	6.000
6.500	6.500	60.00	13.00	3	6.500
7.000	7.000	60.00	13.00	3	7.000
7.500	7.500	63.00	16.00	3	7.500
8.000	8.000	63.00	16.00	3	8.000
8.500	8.500	67.00	16.00	3	8.500
9.000	9.000	67.00	16.00	3	9.000
9.500	9.500	72.00	19.00	3	9.500
10.000	10.000	72.00	19.00	3	10.000
11.000	11.000	83.00	22.00	3	11.000
12.000	12.000	83.00	22.00	3	12.000
13.000	13.000	83.00	22.00	3	13.000
14.000	14.000	83.00	22.00	3	14.000
15.000	15.000	92.00	26.00	3	15.000
16.000	16.000	92.00	26.00	3	16.000
18.000	18.000	92.00	26.00	3	18.000
20.000	20.000	104.00	32.00	3	20.000

HA	HA
3307	3677
Solid Carbide	
Bright	FIREX®
h6	h6
h10	h10
165	165
Availability	
<input type="checkbox"/>	<input type="checkbox"/>

PRO-LINE

PRO-LINE

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels
 Tool Steels
 Cast materials
 Stainless Steels
 Al and Al-alloys
 Ti / Ni alloys
 Hardened Materials

UNI PRO XL end mills (3-fluted)

Extra long length

						HA	HA	HA
Series						3169	3171	3869
Tool material						Solid carbide		
Surface finish						Bright	FIREX®	Super-A™
Application								
d ₂ Shank tolerance						h6	h6	h6
d ₁ Tolerance						h10	h10	h10
Tech. data page						165	165	165
						Availability		
d1	d2	l1	l2	No.	Code			
fract.	fract.	fract.	fract.	flutes	No.			
3/16	3/16	3	1 1/4	3	4.760	●	●	●
1/4	1/4	4	1 5/8	3	6.350	●	●	●
5/16	5/16	4	1 5/8	3	7.940	●	●	●
3/8	3/8	4	1 5/8	3	9.520	●	●	●
7/16	7/16	5	2	3	11.110	●	●	●
1/2	1/2	6	3	3	12.700	●	●	●
5/8	5/8	6	3	3	15.870	●	●	●
3/4	3/4	6	3	3	19.050	●	●	●
1	1	6	3	3	25.400	●	●	●

Extra long length (metric)

						HA	HA
Series						3314	3680
Tool material						Carbide	
Surface finish						Bright	FIREX®
Application							
d ₂ Shank tolerance						h6	h6
d ₁ Tolerance						h10	h10
Tech. data page						165	165
						Availability	
d1	d2	l1	l2	No.	Code		
mm	mm	mm	mm	flutes	No.		
3.000	3.000	75.00	20.00	3	3.000	○	○
4.000	4.000	75.00	25.00	3	4.000	○	○
5.000	5.000	75.00	30.00	3	5.000	○	○
6.000	6.000	75.00	30.00	3	6.000	○	○
8.000	8.000	100.00	40.00	3	8.000	○	○
10.000	10.000	100.00	40.00	3	10.000	○	○
12.000	12.000	150.00	45.00	3	12.000	○	○
16.000	16.000	150.00	65.00	3	16.000	○	○
20.000	20.000	150.00	65.00	3	20.000	○	○

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels
 Tool Steels
 Cast materials
 Stainless Steels
 Al and Al-alloys
 Ti / Ni alloys
 Hardened Materials

UNI PRO end mills (4-fluted)

Stub length

Series: 3093 Tool material: Solid Carbide Surface finish: FIREX® Application: d ₂ Shank tolerance: h6 d ₁ Tolerance: h10 Tech. data page: 165					
Availability: ●					
d1	d2	l1	l2	No.	Code
fract.	fract.	fract.	fract.	flutes	No.
1/16	1/8	2	1/8	4	1.590
1/8	1/8	2	1/4	4	3.170
3/16	3/16	2	3/8	4	4.760
1/4	1/4	2	1/2	4	6.350
5/16	5/16	2	1/2	4	7.940
3/8	3/8	2	5/8	4	9.520
7/16	7/16	2 1/2	5/8	4	11.110
1/2	1/2	2 1/2	5/8	4	12.700
5/8	5/8	3	3/4	4	15.870
3/4	3/4	3	1	4	19.050

Stub length (metric)

Series: 3637 / 3721 Tool material: Solid Carbide Surface finish: FIREX® Application: d ₂ Shank tolerance: h6 / h6 d ₁ Tolerance: h10 / h10 Tech. data page: 165 / 165					
Availability: ●					
d1	d2	l1	l2	No.	Code
mm	mm	mm	mm	flutes	No.
2.000	6.000	50.00	4.00	4	2.000
3.000	6.000	50.00	5.00	4	3.000
4.000	6.000	54.00	8.00	4	4.000
5.000	6.000	54.00	9.00	4	5.000
6.000	6.000	54.00	10.00	4	6.000
8.000	8.000	58.00	12.00	4	8.000
10.000	10.000	66.00	14.00	4	10.000
12.000	12.000	73.00	16.00	4	12.000
14.000	14.000	75.00	18.00	4	14.000
16.000	16.000	82.00	22.00	4	16.000
18.000	18.000	84.00	24.00	4	18.000
20.000	20.000	92.00	26.00	4	20.000

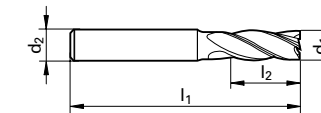
UNI PRO end mills (4-fluted)*

Standard length

Series: 3150 / 3153 / 3850 Tool material: Solid carbide Surface finish: Bright / FIREX® / Super-A™ Application: d ₂ Shank tolerance: h6 / h6 / h6 d ₁ Tolerance: h10 / h10 / h10 Tech. data page: 165 / 165 / 165					
Availability: ●					
d1	d2	l1	l2	No.	Code
fract.	fract.	fract.	fract.	flutes	No.
1/16	1/8	1 1/2	3/16	4	1.590
5/64	1/8	1 1/2	1/4	4	1.980
3/32	1/8	1 1/2	9/32	4	2.380
7/64	1/8	1 1/2	3/8	4	2.780
1/8	1/8	1 1/2	3/8	4	3.170
9/64	3/16	2	9/16	4	3.570
5/32	3/16	2	1/2	4	3.970
11/64	3/16	2	9/16	4	4.370
3/16	3/16	2	5/8	4	4.760
13/64	31/4	2 1/2	5/8	4	5.160
7/32	1/4	2 1/2	5/8	4	5.560
15/64	1/4	2 1/2	3/4	4	5.950
1/4	1/4	2 1/2	3/4	4	6.350
17/64	5/16	2 1/2	7/8	4	6.750
9/32	5/16	2 1/2	3/4	4	7.140
19/64	5/16	2 1/2	7/8	4	7.540
5/16	5/16	2 1/2	13/16	4	7.940
21/64	3/8	2 1/2	7/8	4	8.330
11/32	3/8	2 1/2	1	4	8.730
23/64	3/8	2 1/2	7/8	4	9.130
3/8	3/8	2 1/2	1	4	9.520
25/64	7/16	2 1/2	7/8	4	9.920
13/32	7/16	2 3/4	1	4	10.320
27/64	7/16	2 1/2	7/8	4	10.720
7/16	7/16	2 3/4	1	4	11.110
29/64	1/2	3	1	4	11.510
15/32	1/2	3	1	4	11.910
31/64	1/2	3	1	4	12.300
1/2	1/2	3	1	4	12.700
9/16	9/16	3 1/2	1 1/8	4	14.290
5/8	5/8	3 1/2	1 1/4	4	15.870
11/16	3/4	4	1 3/8	4	17.460
3/4	3/4	4	1 1/2	4	19.050
1	1	4	1 1/2	6	25.400

NEW Expanded size range!

*1" dia = 6 flute



PRO-LINE

PRO-LINE

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels
 Tool Steels
 Cast materials
 Stainless Steels
 Al and Al-alloys
 Ti / Ni alloys
 H Hardened Materials

UNI PRO XL end mills (4-fluted)*

Extra long length

	Series		HA	HA	HA
	Tool material		3151	3155	3851
	Surface finish		Solid carbide		
	Application		Bright	FIREX®	Super-A™
	d ₂ Shank tolerance		h6	h6	h6
	d ₁ Tolerance		h10	h10	h10
	Tech. data page		165	165	165
			Availability		
	d1	d2	l1	l2	No.
fract.	fract.	fract.	fract.	flutes	No.
3/16	3/16	3	1 1/4	4	4.760
1/4	1/4	4	1 5/8	4	6.350
5/16	5/16	4	1 5/8	4	7.940
3/8	3/8	4	1 5/8	4	9.520
7/16	7/16	5	2	4	11.110
1/2	1/2	6	3	4	12.700
5/8	5/8	6	3	4	15.870
3/4	3/4	6	3	4	19.050
1	1	6	3	6	25.400

Extra long length (metric)

	Series		HA	HA	
	Tool material		3012	3023	
	Surface finish		Solid Carbide		
	Application		Bright	FIREX®	
	d ₂ Shank tolerance		h6	h6	
	d ₁ Tolerance		h10	h10	
	Tech. data page		165	165	
			Availability		
	d1	d2	l1	l2	No.
mm	mm	mm	mm	flutes	No.
3.000	3.000	75.00	20.00	4	3.000
4.000	4.000	75.00	25.00	4	4.000
5.000	5.000	75.00	30.00	4	5.000
6.000	6.000	75.00	30.00	4	6.000
8.000	8.000	100.00	40.00	4	8.000
10.000	10.000	100.00	40.00	4	10.000
12.000	12.000	150.00	45.00	4	12.000
14.000	14.000	150.00	45.00	4	14.000
16.000	16.000	150.00	65.00	4	16.000
18.000	18.000	150.00	65.00	4	18.000
20.000	20.000	150.00	65.00	4	20.000

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels
 Tool Steels
 Cast materials
 Stainless Steels
 Al and Al-alloys
 Ti / Ni alloys
 H Hardened Materials

UNI PRO "R" end mills (4-fluted) with corner radius

Standard length (metric)

									HA	HA
Series									3111	3562
Tool material									Bright	Solid carbide
Surface finish									Bright	FIREX®
Application										
d ₂ Shank tolerance									h6	h6
d ₁ Tolerance									h10	h10
Tech. data page									165	165
d1	d2	d3	l1	l2	l3	r	No.	Code	Availability	Availability
mm	mm	mm	mm	mm	mm	mm	flutes	No.		
6.000	6.000	5.700	57.00	13.00	21.00	0.50	4	6.005	○	●
6.000	6.000	5.700	57.00	13.00	21.00	1.00	4	6.010	○	○
8.000	8.000	7.700	63.00	19.00	27.00	0.50	4	8.005	○	●
8.000	8.000	7.700	63.00	19.00	27.00	1.00	4	8.010	○	●
8.000	8.000	7.700	63.00	19.00	27.00	1.50	4	8.015	○	○
8.000	8.000	7.700	63.00	19.00	27.00	2.00	4	8.020	○	○
10.000	10.000	9.500	72.00	22.00	32.00	0.50	4	10.005	○	●
10.000	10.000	9.500	72.00	22.00	32.00	0.80	4	10.008	○	○
10.000	10.000	9.500	72.00	22.00	32.00	1.00	4	10.010	○	○
10.000	10.000	9.500	72.00	22.00	32.00	1.50	4	10.015	○	○
10.000	10.000	9.500	72.00	22.00	32.00	2.00	4	10.020	○	○
12.000	12.000	11.500	83.00	26.00	38.00	0.50	4	12.005	○	○
12.000	12.000	11.500	83.00	26.00	38.00	0.80	4	12.008	○	○
12.000	12.000	11.500	83.00	26.00	38.00	1.00	4	12.010	○	○
12.000	12.000	11.500	83.00	26.00	38.00	1.50	4	12.015	○	○
12.000	12.000	11.500	83.00	26.00	38.00	2.00	4	12.020	○	○
16.000	16.000	15.500	92.00	32.00	44.00	1.00	4	16.010	○	○
16.000	16.000	15.500	92.00	32.00	44.00	1.50	4	16.015	○	○
16.000	16.000	15.500	92.00	32.00	44.00	2.00	4	16.020	○	○
20.000	20.000	19.500	104.00	38.00	54.00	1.00	4	20.010	○	○
20.000	20.000	19.500	104.00	38.00	54.00	1.50	4	20.015	○	○
20.000	20.000	19.500	104.00	38.00	54.00	2.00	4	20.020	○	○

● USA Stock ○ International Stock (0-2 wks)

UNI PRO "R" end mills (4-fluted) with corner radius

Standard length

								HA
Series								3089
Tool material								Carbide
Surface finish								FIREX®
Application								
d ₂ Shank tolerance								h6
d ₁ Tolerance								h10
Tech. data page								165
d1	d2	l1	l2	r	No.	Code	Availability	
fract.	fract.	fract.	fract.	in.	flutes	No.		
1/8	1/8	1 1/2	3/8	0.015	4	3.172	●	
1/8	1/8	1 1/2	3/8	0.031	4	3.174	●	
3/16	3/16	2	5/8	0.015	4	4.762	●	
3/16	3/16	2	5/8	0.031	4	4.764	●	
3/16	3/16	2	5/8	0.062	4	4.766	●	
1/4	1/4	2 1/2	3/4	0.015	4	6.352	●	
1/4	1/4	2 1/2	3/4	0.031	4	6.354	●	
1/4	1/4	2 1/2	3/4	0.062	4	6.356	●	
5/16	5/16	2 1/2	13/16	0.015	4	7.942	●	
5/16	5/16	2 1/2	13/16	0.031	4	7.944	●	
5/16	5/16	2 1/2	13/16	0.062	4	7.946	●	
3/8	3/8	2 1/2	1	0.015	4	9.522	●	
3/8	3/8	2 1/2	1	0.031	4	9.524	●	
3/8	3/8	2 1/2	1	0.062	4	9.526	●	
1/2	1/2	3	1	0.015	4	12.702	●	
1/2	1/2	3	1	0.031	4	12.704	●	
1/2	1/2	3	1	0.062	4	12.706	●	

● Alloyed Steels ● Tool Steels ○ Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys H Hardened Materials

Extra long length

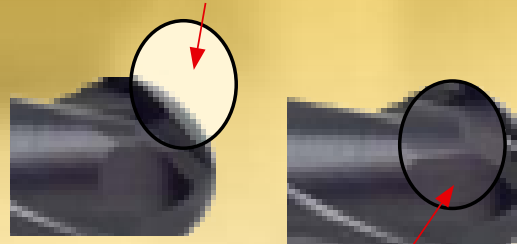
							HA
Series							3090
Tool material							Carbide
Surface finish							FIREX®
Application							
d ₂ Shank tolerance							h6
d ₁ Tolerance							h10
Tech. data page							165
d1	d2	l1	l2	r	No.	Code	Availability
fract.	fract.	fract.	fract.	in.	flutes	No.	
1/4	1/4	4	1 5/8	0.015	4	6.352	●
1/4	1/4	4	1 5/8	0.031	4	6.354	●
1/4	1/4	4	1 5/8	0.062	4	6.356	●
3/8	3/8	4	1 5/8	0.015	4	9.522	●
3/8	3/8	4	1 5/8	0.031	4	9.524	●
3/8	3/8	4	1 5/8	0.062	4	9.526	●
1/2	1/2	6	3	0.015	4	12.702	●
1/2	1/2	6	3	0.031	4	12.704	●
1/2	1/2	6	3	0.062	4	12.706	●

Ball nose milling cutters: Satisfying the highest demands on accuracy and tool life

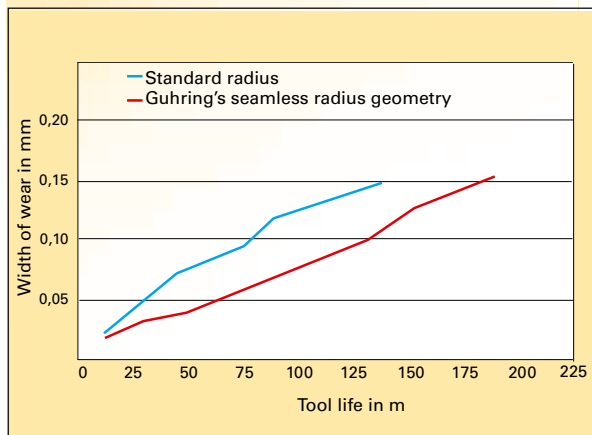
Especially the die and mould industry places ever higher demands on milling cutters – primarily with regard to accuracy and tool life. Therefore, Guhring's cutting tool program now includes radius milling cutters that are perfectly adapted to satisfy these demands and provide optimal machining results thanks to application orientated geometries, carbide grades and coatings. The advantages are especially high form and contour accuracy of the workpiece, minimal wear and therefore excellent tool life.

- Features of Guhring's Ball nose milling cutters:**
- outside diameter and radius are ground in one pass
 - radius point geometry with constant helix-radius-correction
 - reduced neck ground for collision reduction with protruding edges

High wear protection thanks to radius geometry with constant rake angle and continuous spiral.



Seamless radius area provides high form and contour accuracy.



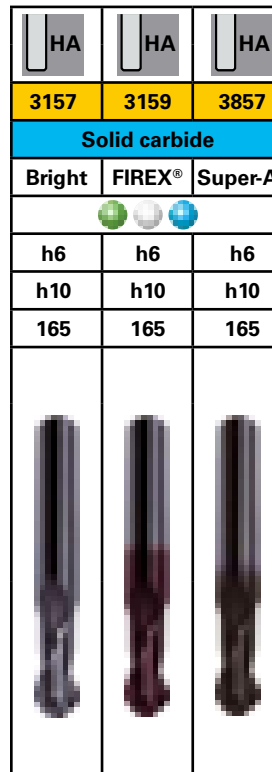
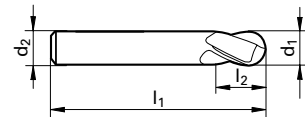
Wear comparison:
Guhring's seamless radius geometry reduces wear and provides a considerably longer tool life in comparison with tools ground with conventional full radius.

UNI PRO ball nose end mills (2-fluted)

Standard length

N	30°	2	Ball	Series		
				HA	HA	HA
				3157	3159	3857
				Solid carbide		
				Bright	FIREX®	Super-A
				Application		
				d ₂ Shank tolerance		
				d ₁ Tolerance		
				Tech. data page		
				h6	h6	h6
				h10	h10	h10
				165	165	165
				Availability		
d1	d2	l1	l2	No.	Code	
fract.	fract.	fract.	fract.	flutes	No.	
1/16	1/8	1 1/2	3/16	2	1.590	●
5/64	1/8	1 1/2	1/8	2	1.980	●
3/32	1/8	1 1/2	3/8	2	2.380	○
7/64	1/8	1 1/2	3/8	2	2.780	○
1/8	1/8	1 1/2	3/8	2	3.170	●
9/64	3/16	2	9/16	2	3.570	○
5/32	3/16	2	9/16	2	3.970	○
11/64	3/16	2	9/16	2	4.370	○
3/16	3/16	2	5/8	2	4.760	●
13/64	3/16	2	5/8	2	5.160	○
7/32	1/4	2 1/2	5/8	2	5.560	○
15/64	1/4	2 1/2	3/4	2	5.950	○
1/4	1/4	2 1/2	3/4	2	6.350	○
17/64	5/16	2 1/2	7/8	2	6.750	○
9/32	5/16	2 1/2	7/8	2	7.140	○
19/64	5/16	2 1/2	7/8	2	7.540	○
5/16	5/16	2 1/2	13/16	2	7.940	●
21/64	3/8	2 1/2	7/8	2	8.330	○
11/32	3/8	2 1/2	7/8	2	8.730	○
23/64	3/8	2 1/2	7/8	2	9.130	○
3/8	3/8	2 1/2	1	2	9.520	●
25/64	7/16	2 3/4	7/8	2	9.920	○
13/32	7/16	2 3/4	7/8	2	10.320	○
27/64	7/16	2 3/4	7/8	2	10.720	○
7/16	7/16	2 3/4	1	2	11.110	●
29/64	1/2	3	1	2	11.510	○
15/32	1/2	3	1	2	11.910	○
31/64	1/2	3	1	2	12.300	○
1/2	1/2	3	1	2	12.700	●
9/16	9/16	3 1/2	1 1/8	2	14.290	●
5/8	5/8	3 1/2	1 1/4	2	15.870	●
3/4	3/4	4	1 1/2	2	19.050	●
1	1	4	1 1/2	2	25.400	○

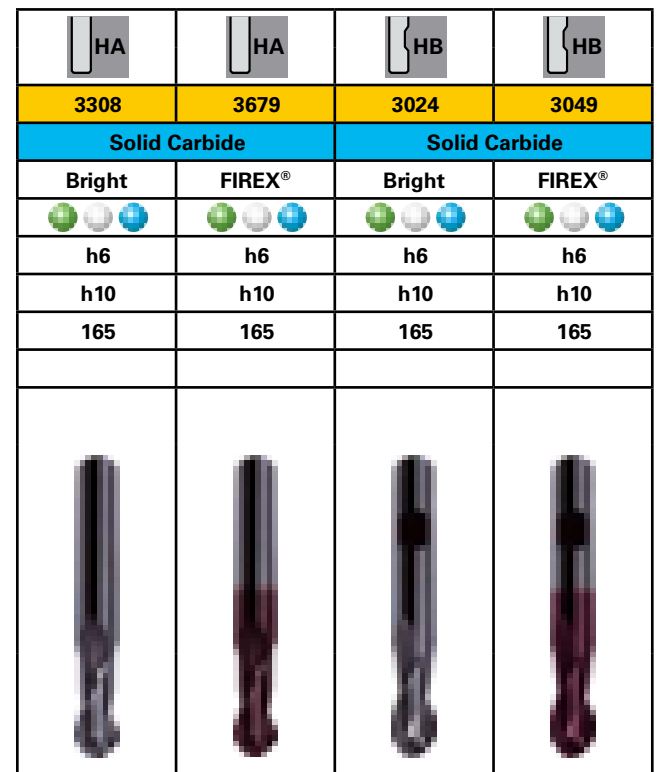
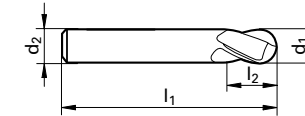
NEW Expanded size range!



UNI PRO ball nose end mills (2-fluted)

Standard length (metric)

N	30°	2	Ball	Series			
				HA	HA	HB	HB
				3308	3679	3024	3049
				Solid Carbide		Solid Carbide	
				Bright	FIREX®	Bright	FIREX®
				Application			
				d ₂ Shank tolerance			
				d ₁ Tolerance			
				Tech. data page			
				h6	h6	h6	h6
				h10	h10	h10	h10
				165	165	165	165
				Availability			
d1	d2	l1	l2	No.	Code		
mm	mm	mm	mm	flutes	No.		
0.500	3.000	38.00	1.00	2	0.500	○	○
0.800	3.000	38.00	1.00	2	0.800	○	○
1.000	3.000	38.00	2.00	2	1.000	○	○
1.500	3.000	38.00	3.00	2	1.500	○	○
2.000	6.000	57.00	6.00	2	2.000	○	○
3.000	6.000	57.00	7.00	2	3.000	○	○
4.000	6.000	57.00	8.00	2	4.000	○	○
5.000	6.000	57.00	10.00	2	5.000	○	○
6.000	6.000	57.00	10.00	2	6.000	○	○
8.000	8.000	63.00	16.00	2	8.000	○	○
10.000	10.000	72.00	19.00	2	10.000	○	○
12.000	12.000	83.00	22.00	2	12.000	○	○
14.000	14.000	83.00	22.00	2	14.000	○	○
16.000	16.000	92.00	26.00	2	16.000	○	○
18.000	18.000	92.00	26.00	2	18.000	○	○
20.000	20.000	104.00	32.00	2	20.000	○	○



● Alloyed Steels ● Tool Steels ● Cast materials ● Stainless Steels ● Al and Al-alloys ● Ti / Ni alloys ● H Hardened Materials

UNI PRO ball nose end mills (2-fluted)

Extra long length

Series					
Tool material					
Surface finish					
Application					
d_2 Shank tolerance					
d_1 Tolerance					
Tech. data page					
d1	d2	l1	l2	No.	Code
fract.	fract.	fract.	fract.	flutes	No.
1/8	1/8	2	1/2	2	3.170
3/16	3/16	2 1/2	3/4	2	4.760
1/4	1/4	3	1 1/8	2	6.350
5/16	5/16	3	1 1/8	2	7.940
3/8	3/8	3	1 1/8	2	9.520
7/16	7/16	4 1/2	2	2	11.110
1/2	1/2	4 1/2	2	2	12.700
5/8	5/8	5	2 1/4	2	15.870
3/4	3/4	5	2 1/4	2	19.050

HA	HA	HA
3158	3160	3858
Solid carbide		
Bright	FIREX®	Super-A™
h6	h6	h6
h10	h10	h10
165	165	165
Availability		
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●

Extra long length (metric)

Series					
Tool material					
Surface finish					
Application					
d_2 Shank tolerance					
d_1 Tolerance					
Tech. data page					
d1	d2	l1	l2	No.	Code
mm	mm	mm	mm	flutes	No.
3.000	3.000	75.00	20.00	2	3.000
4.000	4.000	75.00	25.00	2	4.000
5.000	5.000	75.00	30.00	2	5.000
6.000	6.000	75.00	30.00	2	6.000
8.000	8.000	100.00	40.00	2	8.000
10.000	10.000	100.00	40.00	2	10.000
12.000	12.000	150.00	45.00	2	12.000

HA	HA
3014	3030
Solid Carbide	
Bright	FIREX®
h6	h6
h10	h10
165	165
Availability	
○	○
○	○
○	○
○	●
○	○
○	●
○	○

PRO-LINE

PRO-LINE

● USA Stock ○ International Stock (0-2 wks)

Alloyed Steels Tool Steels Cast materials Stainless Steels Al and Al-alloys Ti / Ni alloys Hardened Materials

UNI PRO ball nose end mills (4-fluted)

Standard length

						HA	HA	HA
<p>Series</p> <p>Tool material</p> <p>Surface finish</p> <p>Application</p> <p>d₂ Shank tolerance</p> <p>d₁ Tolerance</p> <p>Tech. data page</p> <p>NEW Expanded size range!</p>						3161	3165	3861
						Solid carbide		
						Bright	FIREX®	Super-A™
						h6	h6	h6
						h10	h10	h10
165	165	165						
						Availability		
d1	d2	l1	l2	No.	Code			
fract.	fract.	fract.	fract.	flutes	No.			
1/16	1/8	1 1/2	3/16	4	1.590	●	●	○
5/64	1/8	1 1/2	1/8	4	1.980	●	●	○
3/32	1/8	1 1/2	3/8	4	2.380	●	●	○
7/64	1/8	1 1/2	3/8	4	2.780	●	●	○
1/8	1/8	1 1/2	3/8	4	3.170	●	●	○
9/64	3/16	2	9/16	4	3.570	●	●	○
5/32	3/16	2	9/16	4	3.970	●	●	○
11/64	3/16	2	9/16	4	4.370	●	●	○
3/16	3/16	2	5/8	4	4.760	●	●	○
13/64	3/16	2 1/2	5/8	4	5.160	●	●	○
7/32	1/4	2 1/2	5/8	4	5.560	●	●	○
15/64	1/4	2 1/2	3/4	4	5.950	●	●	○
1/4	1/4	2 1/2	3/4	4	6.350	●	●	○
17/64	5/16	2 1/2	7/8	4	6.750	●	●	○
9/32	5/16	2 1/2	7/8	4	7.140	●	●	○
19/64	5/16	2 1/2	7/8	4	7.540	●	●	○
5/16	5/16	2 1/2	13/16	4	7.940	●	●	○
21/64	3/8	2 1/2	7/8	4	8.330	●	●	○
11/32	3/8	2 1/2	7/8	4	8.730	●	●	○
23/64	3/8	2 1/2	7/8	4	9.130	●	●	○
3/8	3/8	2 1/2	1	4	9.520	●	●	○
25/64	7/16	2 3/4	7/8	4	9.920	●	●	○
13/32	7/16	2 3/4	7/8	4	10.320	●	●	○
27/64	7/16	2 3/4	7/8	4	10.720	●	●	○
7/16	7/16	2 3/4	1	4	11.110	●	●	○
29/64	1/2	3	1	4	11.510	●	●	○
15/32	1/2	3	1	4	11.910	●	●	○
31/64	1/2	3	1	4	12.300	●	●	○
1/2	1/2	3	1	4	12.700	●	●	○
9/16	9/16	3 1/2	1 1/8	4	14.290	●	●	○
5/8	5/8	3 1/2	1 1/4	4	15.870	●	●	○
3/4	3/4	4	1 1/2	4	19.050	●	●	○
1	1	4	1 1/2	4	25.400	●	●	○

● USA Stock ○ International Stock (0-2 wks)

UNI PRO ball nose end mills (4-fluted)

Standard length (metric)

						HA	HA
<p>Series</p> <p>Tool material</p> <p>Surface finish</p> <p>Application</p> <p>d₂ Shank tolerance</p> <p>d₁ Tolerance</p> <p>Tech. data page</p> 						3306	3727
						Carbide	
						Bright	FIREX®
						h6	h6
						h10	h10
165	165						
						Availability	
d1	d2	l1	l2	No.	Code		
mm	mm	mm	mm	flutes	No.		
4.000	4.000	50.00	11.00	4	4.000	○	○
5.000	5.000	50.00	13.00	4	5.000	○	○
6.000	6.000	57.00	13.00	4	6.000	○	●
8.000	8.000	63.00	19.00	4	8.000	○	○
10.000	10.000	72.00	22.00	4	10.000	○	○
12.000	12.000	83.00	26.00	4	12.000	○	○
14.000	14.000	83.00	26.00	4	14.000	○	○
16.000	16.000	92.00	32.00	4	16.000	○	○
18.000	18.000	92.00	32.00	4	18.000	○	○
20.000	20.000	104.00	38.00	4	20.000	●	●

Alloyed Steels

 Tool Steels

 Cast materials

 Stainless Steels

 Al and Al-alloys


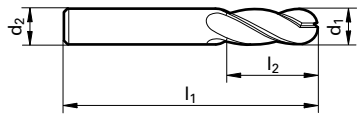
 Ti / Ni alloys

 H Hardened Materials








When ordering: EDP no. = Series + Order no., example: 3867 12.700

UNI PRO XL ball nose end mills (4-fluted)

Long length


<p>Series Tool material Surface finish Application d₂ Shank tolerance d₁ Tolerance Tech. data page</p>


d1	d2	l1	l2	No.	Code
fract.	fract.	fract.	fract.	flutes	No.
1/8	1/8	2	1/2	4	3.170
3/16	3/16	2 1/2	3/4	4	4.760
1/4	1/4	3	1 1/8	4	6.350
5/16	5/16	3	1 1/8	4	7.940
3/8	3/8	3	1 1/8	4	9.520
7/16	7/16	4 1/2	2	4	11.110
1/2	1/2	4 1/2	2	4	12.700
5/8	5/8	5	2 1/4	4	15.870
3/4	3/4	5	2 1/4	4	19.050


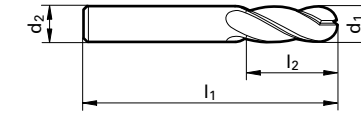
		
3164	3167	3864
Solid carbide		
Bright	FIREX®	Super-A™
		
HA	HA	HA
h10	h10	h10
165	165	165
		

Availability		
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●

● USA Stock ○ International Stock (0-2 wks)

UNI PRO XL ball nose end mills (4-fluted)

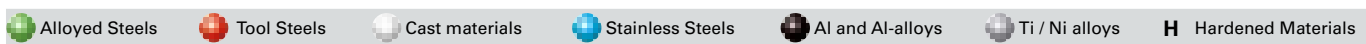
Extra long length


<p>Series Tool material Surface finish Application d₂ Shank tolerance d₁ Tolerance Tech. data page</p>


d1	d2	l1	l2	No.	Code
fract.	fract.	fract.	fract.	flutes	No.
3/16	3/16	3	1 1/4	4	4.760
1/4	1/4	4	1 5/8	4	6.350
5/16	5/16	4	1 5/8	4	7.940
3/8	3/8	4	1 5/8	4	9.520
7/16	7/16	5	2	4	11.110
1/2	1/2	6	3	4	12.700
5/8	5/8	6	3	4	15.870
3/4	3/4	6	3	4	19.050

		
3162	3166	3862
Solid carbide		
Bright	FIREX®	Super-A™
		
h6	h6	h6
h10	h10	h10
165	165	165
		

Availability		
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●



UNI PRO XL ball nose end mills (4-fluted)

Extra long length (metric)

Series Tool material Surface finish Application d_2 Shank tolerance d_1 Tolerance Tech. data page					
d1	d2	l1	l2	No.	Code
mm	mm	mm	mm	flutes	No.
3.000	3.000	75.00	20.00	4	3.000
4.000	4.000	75.00	25.00	4	4.000
5.000	5.000	75.00	30.00	4	5.000
6.000	6.000	75.00	30.00	4	6.000
8.000	8.000	100.00	40.00	4	8.000
10.000	10.000	100.00	40.00	4	10.000
12.000	12.000	150.00	45.00	4	12.000

HA	HA
3015	3043
Carbide	
Bright	FIREX®
h6	h6
h10	h10
165	165
NEW	
Availability	
<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>
<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>

● USA Stock ○ International Stock (0-2 wks)

Pro-Line Universal End Mill Kits

Here is a great way to try Guhring quality precision ground carbide end mills with heat-resistant FIREX® coating in your shop - at a great price! Our unique carbide grade and proprietary coating deliver strong performance and extended tool life.

Each Guhring Uni-Pro End Mill Kit contains:

One each
Series 3153 Uni-Pro 1/4" dia. 5/16" dia. 3/8" dia. 1/2" dia.
PLUS - a bonus: One **Series 3179** Finish-Tech 50 1/4" dia.



Kit EDP #333038728

Series 3153 Uni-Pro Features:

- Cutting geometry allows for use in a wide array of materials
- FIREX® coating provides outstanding heat and wear resistance
- Guhring's own ultra fine grain carbide for increased tool life
- 4-flute design with 30° helix produces a good surface finish
- Standard length, straight shank



Series 3179 Finish-Tech 50 Features:

- 6-flute geometry (at 1/4" dia) with free-cutting 45° helix angle produces an excellent surface finish, allows elevated feed rates
- Large core diameter for added rigidity, improving surface finish
- FIREX® coating provides outstanding heat and wear resistance
- Micro-corner protection chamfer reduces wear at corner, adds tool life
- Guhring's own ultra fine grain carbide for increased tool life

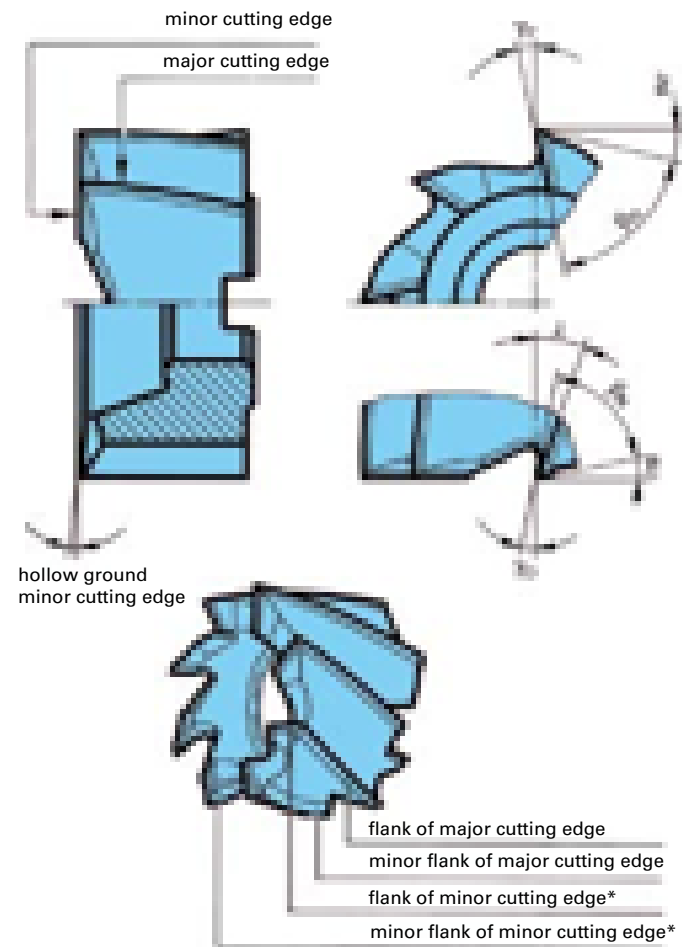


TECHNICAL SECTION



GUHRING

Definitions and angles



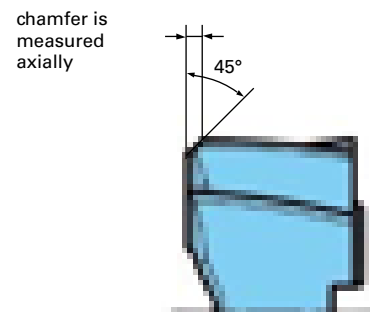
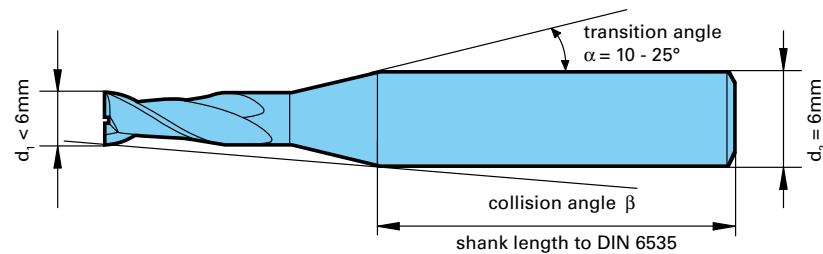
α_p = clearance angle, major cutting edge
 β_H = lip angle, major cutting edge
 γ_p = rake angle, major cutting edge

α_o = clearance angle, minor cutting edge
 β_N = lip angle, minor cutting edge
 γ_o = rake angle, minor cutting edge

λ = spiral angle

*) minor cutting edges do not cut in the direction of feed

Transition angle α and collision angle β with tools $d_1 < d_2$, tapered, dependent on flute and total length.



Formulae

Milling Formulas - INCH Values

Symbol	Description	Formula
SFM	Surface Feet / Minute	$SFM = \frac{RPM \times D}{3.82}$
RPM	Revolutions / Minute	$RPM = \frac{SFM \times 3.82}{D}$
IPT	Feed / Tooth	$IPT = \frac{IPM}{z \times RPM}$
IPM	Inches / Minute	$IPM = IPT \times RPM \times z$
$D_{(eff)}$	Effective Diameter	$D_{(eff)} = 2 \times \sqrt{R^2 - (R - D_1)^2}$

Symbol key: D = tool diameter (in.) z = no. of flutes R = radius D_1 = DOC (ap)

Milling Formulas - METRIC Values

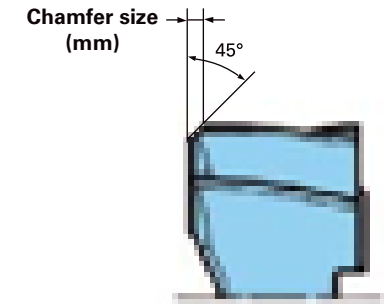
Symbol	Description	Formula
Vc	Surface Meters / Minute	$Vc = \frac{\pi \times D \times n}{1000}$
n	Revolutions / Minute	$n = \frac{Vc \times 1000}{\pi \times D}$
fz	Feed / Tooth	$fz = \frac{vf}{n \times z}$
Vf	Millimeters / Minute	$vf = (n) \times (z) \times (fz)$
D(eff)	Effective Diameter	$D_{(eff)} = 2 \times \sqrt{D \times ap - ap^2}$

Symbol key: $\pi = 3.1416$ D = tool diameter (mm) z = no. of flutes ap = depth of cut

Comparison of Hardness

Tens. strength (N/mm ²)	HRC	HB30	HV10	Tens. strength (N/mm ²)	HRC	HB30	HV10
240		71	75	940	29	278	293
255		76	80	970	30	287	302
270		81	85	995	31	295	310
285		86	90	1020	32	301	317
305		90	95	1050	33	311	327
320		95	100	1080	34	319	336
335		100	105	1110	35	328	345
350		105	110	1140	36	337	355
370		109	115	1170	37	346	364
385		114	120	1200	38	354	373
400		119	125	1230	39	363	382
415		124	130	1260	40	372	392
430		128	135	1300	41	383	403
450		133	140	1330	42	393	413
465		138	145	1360	43	402	423
480		143	150	1400	44	413	434
495		147	155	1440	45	424	446
510		152	160	1480	46	435	458
530		157	165	1530	47	449	473
545		162	170	1570	48	460	484
560		166	175	1620	49	472	497
575		171	180	1680	50	488	514
595		176	185	1730	51	501	527
610		181	190	1790	52	517	544
625		185	195	1845	53	532	560
640		190	200	1910	54	549	578
660		195	205	1980	55	567	596
675		199	210	2050	56	584	615
690		204	215	2140	57	607	639
705		209	220	2180	58	622	655
720		214	225		59		675
740		219	230		60		698
755		223	235		61		720
770		228	240		62		745
785		233	245		63		773
800	22	238	250		64		800
820	23	242	255		65		829
835	24	247	260		66		864
860	25	255	268		67		900
870	26	258	272		68		940
900	27	266	280				
920	28	273	287				

Size of micro-corner protection



Nominal diameter (mm)	Chamfer size (mm)	Product description / Product name	
< 2.00	0.025 x 45°	RF 100 U (3-fluted cutter)	Uni-Pro End Mill (2-flute)
2.00 - 6.00	0.05 x 45°	RF 100 S/F (5-fluted cutter)	Uni-Pro End Mill (3-flute)
6.10 - 10.00	0.10 x 45°	RF 100 S/F (6-fluted cutter)	Uni-Pro End Mill (4-flute)
10.01 - 20.00	0.15 x 45°	GH 100 U / Aero-Tech (3-fluted cutter)	Uni-Pro Mini End Mill (3-flute)
20.01 - 25.00	0.20 x 45°	GH 100 U / Finish-Tech 50 (6-/8-fluted cutter)	
25.01 - 32.00	0.30 x 45°	GH 100 H / Finish-Tech 62 (6-/8-fluted cutter)	

Nominal diameter (mm)	Chamfer size (mm)	Product description / Product name	
< 2.00	0.00 x 45°	Alumi-Tech (2-fluted cutter)	
2.00 - 6.00	0.03 x 45°		
6.10 - 10.00	0.05 x 45°		
10.01 - 20.00	0.10 x 45°		

Nominal diameter (mm)	Chamfer size (mm)	Product description / Product name	
4.00 - 5.00	0.10 x 45°	RF 100 U (4-fluted cutter)	
5.01 - 8.00	0.15 x 45°	RF 100 F	
8.01 - 12.00	0.20 x 45°	RF 100 A	
12.01 - 14.00	0.25 x 45°		
14.01 - 16.00	0.35 x 45°		
16.01 - 18.00	0.40 x 45°		
18.01 - 20.00	0.45 x 45°		
20.01 - 25.00	0.60 x 45°		
25.01 - 32.00	0.75 x 45°		

Nominal diameter (mm)	Chamfer size (mm)	Product description / Product name	
6.00 - 10.00	0.30 x 45°	RF 100 U/HF	RS 100 F / Aero-Rough 56
10.01 - 20.00	0.50 x 45°	RF 100 VA/NF	GS 100 U / Rough-Tech 48
20.01 - 25.00	0.60 x 45°	RF 100 A/WF	GS 100 A / Rough-Tech ALU
25.01 - 32.00	0.80 x 45°	RS 100 U / Aero-Rough 48	GS 100 H / Rough-Tech 56

Nominal diameter (mm)	Chamfer size (mm)	Product description / Product name	
4.00 - 5.00	0.15 x 45°	RF 100 VA	
5.01 - 6.00	0.20 x 45°	RF 100 H	
6.01 - 8.00	0.25 x 45°		
8.01 - 10.00	0.30 x 45°		
10.01 - 12.00	0.35 x 45°		
12.01 - 14.00	0.40 x 45°		
14.01 - 16.00	0.50 x 45°		
16.01 - 18.00	0.60 x 45°		
18.01 - 20.00	0.60 x 45°		
20.01 - 25.00	0.75 x 45°		
25.01 - 32.00	0.90 x 45°		

Tolerances to DIN ISO 286

		Nominal diameter range in µm/tolerances in µm										
		from 1 up to 3	over 3 up to 6	over 6 up to 10	over 10 up to 18	over 18 up to 30	over 30 up to 50	over 50 up to 80	over 80 up to 120	over 120 up to 180	over 180 up to 250	
Tolerances: Position and Grade	Shafts	h 6	0	0	0	0	0	0	0	0	0	
			-6	-8	-9	-11	-13	-16	-19	-22	-25	-29
		h 7	0	0	0	0	0	0	0	0	0	0
			-10	-12	-15	-18	-21	-25	-30	-35	-40	-46
		h 8	0	0	0	0	0	0	0	0	0	0
		-14	-18	-22	-27	-33	-39	-46	-54	-63	-72	
	h 9	0	0	0	0	0	0	0	0	0	0	
		-25	-30	-36	-43	-52	-62	-74	-87	-100	-115	
	h 10	0	0	0	0	0	0	0	0	0	0	
		-40	-48	-58	-70	-84	-100	-120	-140	-160	-185	
	e 8*	-14	-20	-25	-32	-40	-50	-60	-72	-85	-100	
		-28	-38	-47	-59	-73	-89	-106	-126	-148	-172	

*Milling cutters to tolerance e8 produce key slots to tolerance P9 with one cut.

General notes

All the cutting rate recommendations specified in this catalog are standard values valid exclusively for new tools or tools re-ground to Guhring specifications. Pre-requisites are stable machines, optimal cooling, optimal tool clamping and maximum concentricity of the tool and the

machine spindle. Our recommended cutting rates must be reduced if the conditions deviate. The values may also be adjusted to influence Surface finish quality, machining rate or tool life.

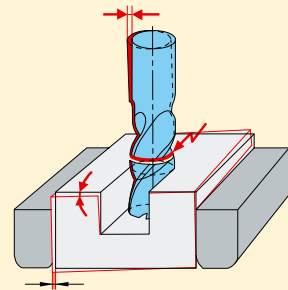
1. Workpiece clamping

Loss of tool life or tool breakage through unstable clamping

- improve workpiece clamping

Alternative:

- reduce feed
- reduce cutting width or depth



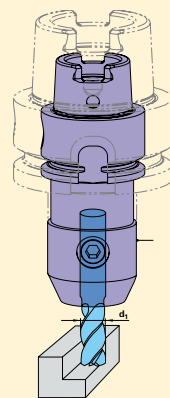
2. Tool clamping

Loss of tool life or tool breakage through unstable, worn or too small/long/thin tool holder

- apply new or larger tool holder or holder with increased clamping force and increased concentricity

Alternative:

- reduce cutting rates
- reduce clamping length
- apply tool with smaller diameter
- check clamping screws for wear



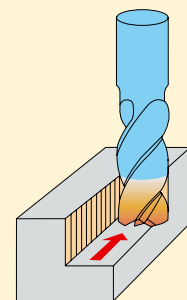
3. Surface finish quality

Excessive peak-to-valley height Ra/Rz at the tool Surface finish through excessive feed rates or vibrations

- improve workpiece clamping and tool clamping (see points 1 and 2)

Alternative:

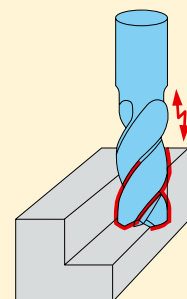
- reduce feed and feed rate
- increase cutting speed



4. Vibrations

High tool wear, insufficient workpiece Surface finish quality and insufficient dimensional accuracy through vibration

- improve workpiece and tool clamping (see points 1 and 2)
- increase tooth feed, because the chip centre thickness is too small
- modify speed
- modify milling strategy, i.e. select alternative cutting distribution
- change tool selection, i.e. reduce no. of teeth or spiral



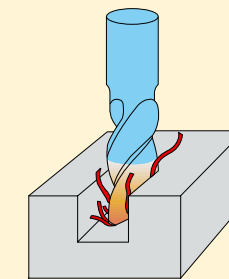
5. Chip congestion/cooling

Significant reduction in tool life, chipping on cutting edges, edge build-up of flutes through insufficient chip evacuation

- select milling cutters with internal cooling

Alternative:

- peripheral cooling via GM 300 chuck
- increase volume flow
- adjust coolant flow
- apply compressed air cooling (according to tool and material)
- reduce feed rate
- modify cutting distribution
- select end mill with fewer flutes



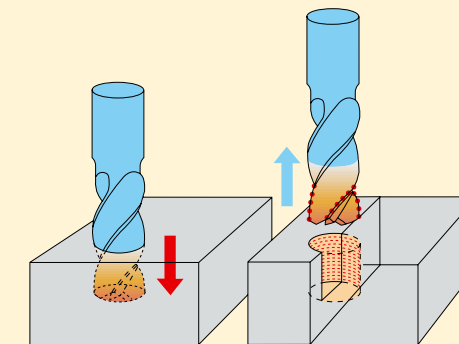
6. Pecking when drilling

Significant reduction in tool life as well as chipping of cutting edges through insufficient chip evacuation and thermal stresses

- select milling cutter with internal cooling with drilling depths > 0.5 x D pecking in stages

Alternative:

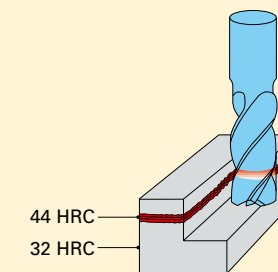
- peripheral cooling via GM 300 chuck
- increase volume flow
- adjust coolant flow
- reduce feed rate



7. Thermal influence on materials

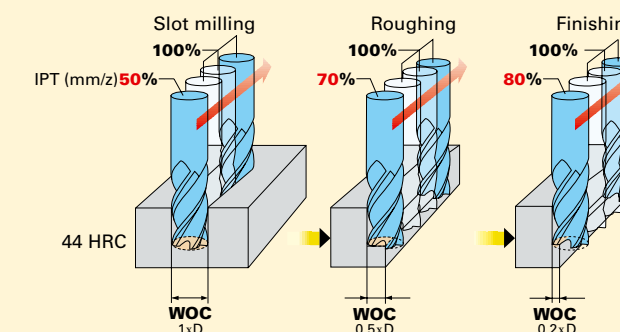
Through welding or torch cutting, the material characteristics at the parting line do not correspond with the specified material class

- reduce cutting rates
- select tool for materials with a higher tensile strength



8. Entry in hardened materials

For entering materials over 44 HRC, reduce the feed rate IPT in accordance with the illustration on the right

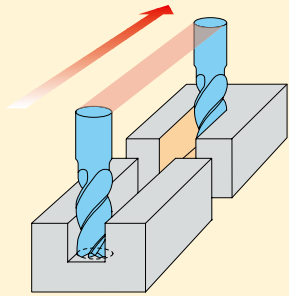


Troubleshooting

9. Loss in tool life with interrupted cutting

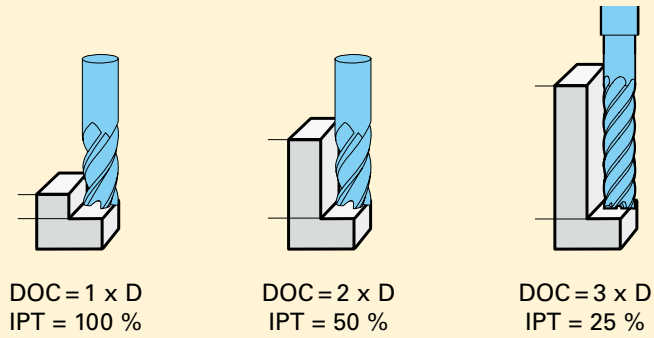
Significant loss in tool life through interrupted cutting (especially with milling angles of 90°)

- modify cutting distribution
- reduce feed rate for entry and exit
- reduce approach angle



10. Feed rate adjustment: Modifying the cutting depth

- when modifying the cutting depth DOC, the feed rate must be reduced in accordance with the illustration on the right
- cutting speed or revolutions remain unchanged up to cutting depths of 3 x D, must only be adapted over 3 x D



11. Plunging strategies

for drilling:

- reduce feed rate IPT
- additional pecking for drilling depths > 0.5 x D or transition to radial machining

Attention: Danger of breakage through abrupt load increase!

Ramping up to 15° (preferred):

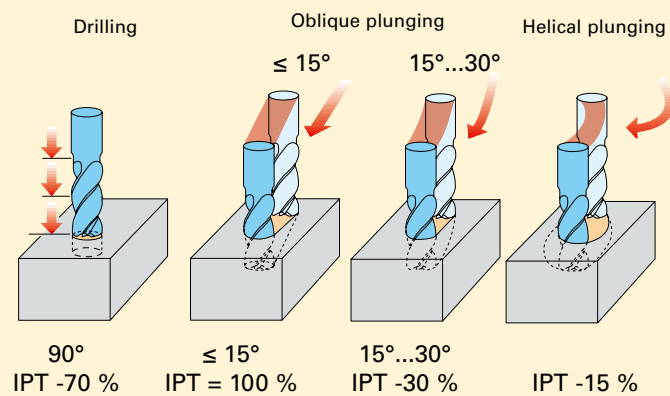
- reduction in feed rate IPT not required

Ramping between 15° and 30°:

- reduce feed rate IPT in accordance with the illustration on the right

Helical plunging:

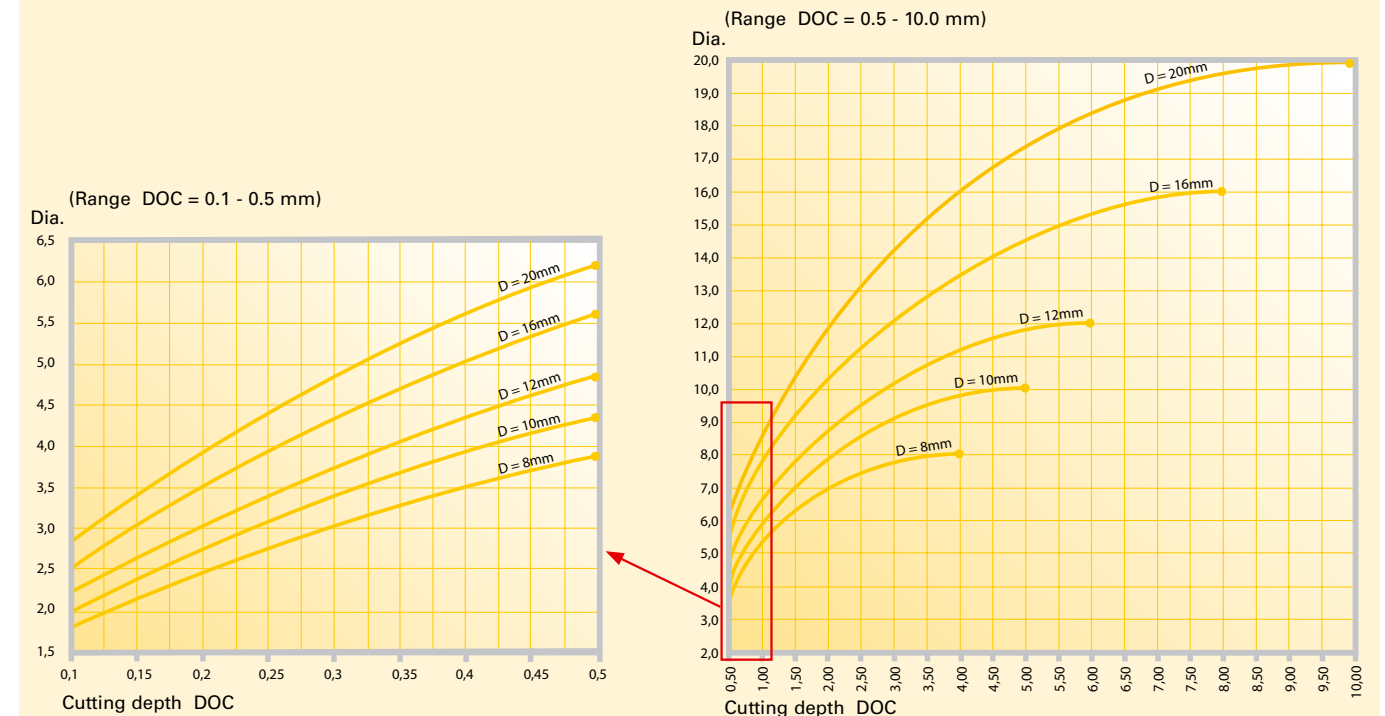
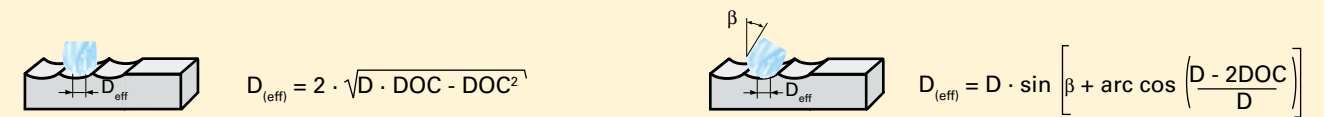
- for helical plunging on a milling cycle, we recommend a feed of 0.1 to 0.2 per cycle (0.100" - 0.200")
- reduce feed rate IPT in accordance with the illustration on the right
- select preferred hole diameter 1.8 x D



Troubleshooting

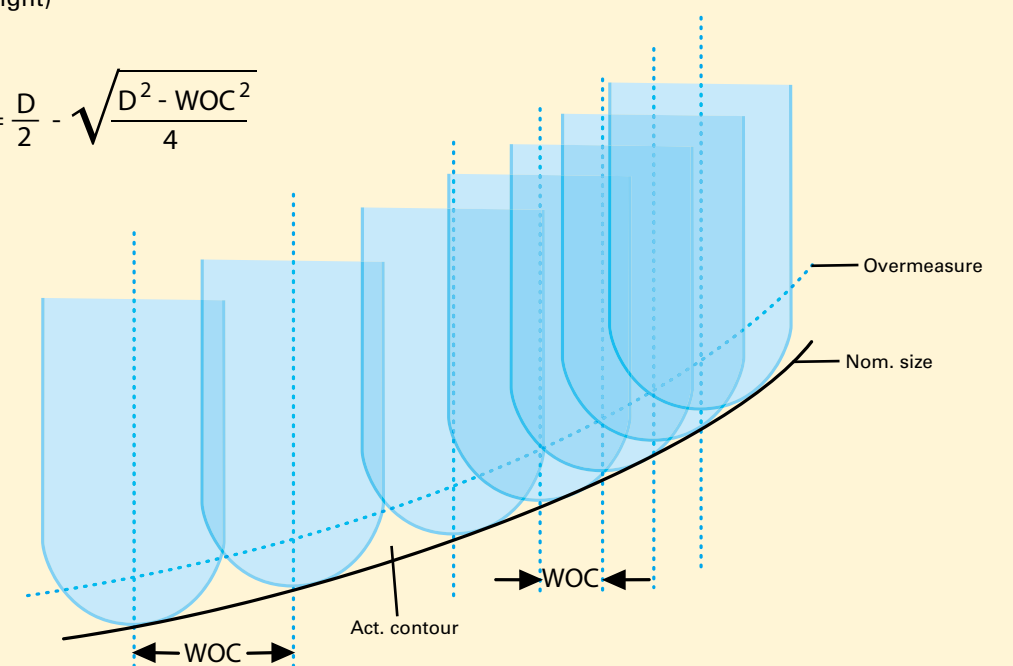
12. Copy milling

For cutting depths $DOC < 0.5 \times D$, the engaged effective diameter D_{eff} must be applied to calculate the speed. With the spindle not engaged, the effective diameter is calculated according to the illustration below. To increase tool life, we recommend machining with tilted spindle. The tilt angle must be taken into account when calculating the effective diameter D_{eff} .



Modifying the cutting width WOC results in improved Surface finish quality of the workpiece (reduced peak-to-valley height)

$$R_{th} = \frac{D}{2} - \sqrt{\frac{D^2 - WOC^2}{4}}$$



Feed and Speed Table - Finish-Tech (GH 100 U & H) & Aero-Tech (GH 100 U)

IPT - adjustment: * **HPC = High Performance Cutting = High Metal Removal Rate**
 DOC (ap) = 2 x d ; IPT -30%
 IPT - adjustment: **
 DOC (ap) = 1-2 x d ; IPT+25%
 IPT - adjustment: ***
 DOC (ap) = 1-2 x d ; IPT+60%

Application	Width of cut (ae)	Depth of cut (ap)
Slotting*	1 x d	0.5 to 1.0 x d
Roughing*	0.5 to 0.9 x d	0.5 to 1.0 x d
Finishing	0.05 to 0.1 x d	1.0 to 2.0 x d
HPC-roughing**	0.25 to 0.5 x d	1.0 to 2.0 x d
HSC-roughing***	0.05 to 0.25 x d	1.0 to 2.0 x d

Material	Color Ball	Hardness	Use Type	Type of application	SFM	Feed (inches per tooth) by diameter							
						1/8"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
						Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	Green	up to 28 HRC	Aero-Tech	Slotting	540	0.0006	0.0012
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	Green	28 to 38 HRC	Aero-Tech	Slotting	480	0.0006	0.0012	0.0016	0.0021	0.0025	0.0032	0.0035	0.0053
			Aero-Tech	Roughing	540	0.0007	0.0014	0.0019	0.0025	0.0030	0.0035	0.0043	0.0060
			Finish-Tech	Finishing	840	0.0006	0.0011	0.0014	0.0019	0.0023	0.0028	0.0034	0.0050
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	Red	28 to 44 HRC	Aero-Tech	Slotting	365	0.0005	0.0009	0.0013	0.0017	0.0020	0.0025	0.0030	0.0044
			Aero-Tech	Roughing	432	0.0006	0.0013	0.0016	0.0020	0.0025	0.0030	0.0035	0.0050
			Finish-Tech	Finishing	540	0.0005	0.0009	0.0013	0.0016	0.0019	0.0022	0.0028	0.0041
Hardened Steels Carbon and Alloy Steels, Tool & Die Steels	H	up to 54 HRC	Aero-Tech	Slotting	168	0.0003	0.0007	0.0008	0.0011	0.0012	0.0017	0.0019	0.0028
			Finish-Tech***	Roughing	264	0.0004	0.0007	0.0010	0.0012	0.0014	0.0018	0.0022	0.0033
			Finish-Tech	Finishing	360	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019	0.0025	0.0036
	H	54-60 HRC		Slotting									
				Roughing									
			Finish-Tech	Finishing	270	0.0004	0.0006	0.0010	0.0014	0.0017	0.0020	0.0031	0.0035
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	Blue	up to 28 HRC	Aero-Tech	Slotting	288	0.0005	0.0011	0.0014	0.0018	0.0021	0.0025	0.0032	0.0046
			Aero-Tech	Roughing	336	0.0006	0.0012	0.0016	0.0021	0.0025	0.0032	0.0035	0.0053
			Finish-Tech	Finishing	432	0.0006	0.0011	0.0014	0.0019	0.0023	0.0028	0.0034	0.0050
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	Blue	up to 28 HRC	Aero-Tech	Slotting	192	0.0005	0.0009	0.0012	0.0016	0.0018	0.0023	0.0028	0.0043
			Aero-Tech	Roughing	288	0.0006	0.0011	0.0014	0.0019	0.0023	0.0028	0.0034	0.0050
			Finish-Tech	Finishing	336	0.0005	0.0011	0.0014	0.0018	0.0021	0.0025	0.0032	0.0046
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8MO, Nitronic	Blue	over 28 HRC	Aero-Tech	Slotting	168	0.0004	0.0009	0.0011	0.0014	0.0016	0.0021	0.0025	0.0035
			Aero-Tech	Roughing	240	0.0005	0.0009	0.0012	0.0016	0.0018	0.0023	0.0028	0.0043
			Finish-Tech	Finishing	288	0.0005	0.0009	0.0012	0.0016	0.0018	0.0023	0.0028	0.0043
High-Temperature Alloys Nimonic, Inconel, Monel, Hastelloy	Grey	up to 42 HRC	Aero-Tech	Slotting	72	0.0004	0.0005	0.0007	0.0009	0.0011	0.0014	0.0018	0.0021
			Aero-Tech	Roughing	84	0.0004	0.0007	0.0011	0.0012	0.0014	0.0019	0.0023	0.0028
			Finish-Tech	Finishing	108	0.0005	0.0009	0.0012	0.0016	0.0018	0.0023	0.0028	0.0043
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	Grey	up to 42 HRC	Aero-Tech	Slotting	162	0.0005	0.0009	0.0012	0.0016	0.0018	0.0023	0.0028	0.0043
			Aero-Tech	Roughing	243	0.0006	0.0011	0.0014	0.0019	0.0023	0.0028	0.0034	0.0050
			Finish-Tech	Finishing	351	0.0006	0.0011	0.0014	0.0019	0.0023	0.0028	0.0034	0.0050
Cast Iron - Gray CG ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	Grey	up to 240 HB 30	Aero-Tech	Slotting	384	0.0007	0.0014	0.0018	0.0023	0.0028	0.0034	0.0039	0.0057
			Aero-Tech	Roughing	432	0.0007	0.0014	0.0019	0.0025	0.0030	0.0035	0.0043	0.0060
			Finish-Tech	Finishing	528	0.0006	0.0012	0.0016	0.0021	0.0025	0.0032	0.0035	0.0053
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	Grey	above 240 HB 30	Aero-Tech	Slotting	336	0.0006	0.0011	0.0014	0.0019	0.0023	0.0028	0.0034	0.0050
			Aero-Tech	Roughing	384	0.0007	0.0014	0.0018	0.0023	0.0028	0.0034	0.0039	0.0057
			Finish-Tech	Finishing	480	0.0006	0.0012	0.0016	0.0021	0.0025	0.0032	0.0035	0.0053
Aluminum, Al-wrought alloys, Al-alloys 2024, 6061, 7075, 1050, 6351, 5005, 2017, 7075	Black	up to 3% Si	Aero-Tech	Slotting	1200	0.0007	0.0014	0.0018	0.0023	0.0028	0.0034	0.0039	0.0057
			Aero-Tech	Roughing	1440	0.0007	0.0014	0.0019	0.0025	0.0030	0.0035	0.0043	0.0060
			Finish-Tech	Finishing	2400	0.0006	0.0012	0.0016	0.0021	0.0025	0.0032	0.0035	0.0053
Aluminum-cast alloys High Silicon - A380, A390, Castings, 3.2131 G-AISI5Cu1, 3.2153 G-AISI7Cu3, 3.2573 G-AISI9, 3.2581 G-AISI12, 3.2583 G-AISI12Cu, - G-AISI12CuNiMg	Black	above 3% Si	Aero-Tech	Slotting	552	0.0006	0.0011	0.0014	0.0019	0.0023	0.0028	0.0034	0.0050
			Aero-Tech	Roughing	672	0.0007	0.0014	0.0018	0.0023	0.0028	0.0034	0.0039	0.0057
			Finish-Tech	Finishing	840	0.0006	0.0012	0.0016	0.0021	0.0025	0.0032	0.0035	0.0053
Magnesium Alloys	-	-	Aero-Tech	Slotting	432	0.0006	0.0011	0.0014	0.0019	0.0023	0.0028	0.0034	0.0050
			Aero-Tech	Roughing	528	0.0007	0.0014	0.0018	0.0023	0.0028	0.0034	0.0039	0.0057
			Finish-Tech	Finishing	672	0.0006	0.0012	0.0016	0.0021	0.0025	0.0032	0.0035	0.0053
Non-ferrous Copper Alloys, Brass, Bronze	-	up to 28 HRC	Aero-Tech	Slotting	600	0.0005	0.0009	0.0012	0.0016	0.0018	0.0023	0.0028	0.0043
			Aero-Tech	Roughing	720	0.0006	0.0011	0.0014	0.0019	0.0023	0.0028	0.0034	0.0050
			Finish-Tech	Finishing	960	0.0006	0.0011	0.0014	0.0019	0.0023	0.0028	0.0034	0.0050

Feed and Speed Table - Aero-Rough 48 (RS 100 U) & Aero-Rough 56 (RS 100 F)

IPT - adjustment: * **HPC = High Performance Cutting = High Metal Removal Rate**
 DOC (ap) = 2 x d ; IPT -30%
 IPT - adjustment: **
 DOC (ap) = 1-2 x d ; IPT+25%
 IPT - adjustment: ***
 DOC (ap) = 1-2 x d ; IPT+60%

Application	Width of cut (ae)	Depth of cut (ap)
Slotting*	1 x d	0.5 to 1.0 x d
Roughing*	0.5 to 0.9 x d	0.5 to 1.0 x d
Finishing	0.05 to 0.1 x d	1.0 to 2.0 x d
HPC-roughing**	0.25 to 0.5 x d	1.0 to 2.0 x d
HSC-roughing***	0.05 to 0.25 x d	1.0 to 2.0 x d

Material	Color Ball	Hardness	Use Type	Type of application	SFM	Feed (inches per tooth) by diameter							
						1/8"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
						Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	Green	up to 28 HRC	Aero-Rough 48	Slotting	432	0.0005	0.0009
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	Green	28 to 38 HRC	Aero-Rough 56	Roughing	480	0.0005	0.0009	0.0013	0.0016	0.0018	0.0023	0.0028	0.0042
				Finishing									
			Aero-Rough 48	Slotting	384	0.0005	0.0009	0.0011	0.0014	0.0016	0.0022	0.0025	0.0035
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	Red	28 to 44 HRC	Aero-Rough 48	Slotting	324	0.0004	0.0005	0.0009	0.0011	0.0013	0.0016	0.0022	0.0025
			Aero-Rough 56	Roughing	384	0.0004	0.0007	0.0011	0.0013	0.0014	0.0020	0.0023	0.0028
				Finishing									
Hardened Steels Carbon and Alloy Steels, Tool & Die Steels	H	up to 54 HRC	Aero-Rough 56	Slotting	168	0.0004	0.0005	0.0007	0.0009	0.0011	0.0014	0.0018	0.0022
			Aero-Rough 56	Roughing	264	0.0005	0.0005	0.0009	0.0011	0.0013	0.0016	0.0022	0.0025
				Finishing									
	H	54-60 HRC		Slotting									
				Roughing									
			Finish-Tech	Finishing	270	0.0004	0.0006	0.0010	0.0014	0.0017	0.0020	0.0031	0.0035
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	Blue	up to 28 HRC	Aero-Rough 48	Slotting	288	0.0005	0.0009	0.0011	0.0014	0.0016	0.0022	0.0025	0.0035
			Aero-Rough 48	Roughing	336	0.0005	0.0009	0.0013	0.0016	0.0018	0.0023	0.0028	0.0042
				Finishing									
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	Blue	up to 28 HRC	Aero-Rough 48	Slotting	192	0.0004	0.0005	0.0009	0.0011	0.0013	0.0016	0.0022	0.0025
			Aero-Rough 48	Roughing	288	0.0005	0.0007	0.0011	0.0013	0.0014	0.0020	0.0023	0.0028
				Finishing									
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8MO, Nitronic	Blue	over 28 HRC	Aero-Rough 48	Slotting	168	0.0004	0.0005	0.0007	0.0009	0.0011	0.0014	0.0018	0.0022
			Aero-Rough 48	Roughing	240	0.0005	0.0005	0.0009	0.0011	0.0013	0.0016		

Feed and Speed Table - Rough-Tech 48 (GS 100 U), Rough-tech 56 (GS 100 H), Rough-Tech ALU (GS 100 A)

IPT - adjustment: * **HPC = High Performance Cutting**
 DOC (ap) = 2 x d ; IPT -30% = High Metal Removal Rate
 IPT - adjustment: **
 DOC (ap) = 1-2 x d ; IPT+25%
 IPT - adjustment: *** **HSC = High Speed Machining**
 DOC (ap) = 1-2 x d ; IPT+60% = Good Surface Quality

Application	Width of cut (ae)	Depth of cut (ap)
Slotting*	1 x d	0.5 to 1.0 x d
Roughing*	0.5 to 0.9 x d	0.5 to 1.0 x d
Finishing	0.05 to 0.1 x d	1.0 to 2.0 x d
HPC-roughing**	0.25 to 0.5 x d	1.0 to 2.0 x d
HSC-roughing***	0.05 to 0.25 x d	1.0 to 2.0 x d

Material	Color Ball	Hardness	Use Type	Type of application	SFM	Feed (inches per tooth) by diameter							
						1/8"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
						Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	up to 28 HRC	Rough-Tech 48 Slotting	432	0.0004	0.0008	0.0010	0.0013
Rough-Tech 48 Roughing	480	0.0005	0.0008	0.0011	0.0014	0.0016		0.0021	0.0025	0.0038			
Finishing													
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	28 to 38 HRC	Rough-Tech 48 Slotting	384	0.0004	0.0008	0.0010	0.0013	0.0014	0.0019	0.0022	0.0031		
		Rough-Tech 48 Roughing	432	0.0005	0.0008	0.0011	0.0014	0.0016	0.0021	0.0025	0.0038		
		Finishing											
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7,T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	28 to 44 HRC	Rough-Tech 48 Slotting	324	0.0003	0.0005	0.0008	0.0010	0.0011	0.0014	0.0019	0.0022		
		Rough-Tech 48 & 56 Roughing	384	0.0003	0.0006	0.0010	0.0011	0.0013	0.0018	0.0021	0.0025		
		Finishing											
Hardened Steels Carbon and Alloy Steels, Tool & Die Steels	H	up to 54 HRC	Rough-Tech 56 Slotting	168	0.0003	0.0005	0.0006	0.0008	0.0010	0.0013	0.0016	0.0019	
			Rough-Tech 56 Roughing	264	0.0004	0.0005	0.0008	0.0010	0.0011	0.0014	0.0019	0.0022	
			Finishing										
	H	54-60 HRC	Slotting										
			Roughing										
			Finishing										
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	up to 28 HRC	Rough-Tech 48 Slotting	288	0.0004	0.0008	0.0010	0.0013	0.0014	0.0019	0.0022	0.0031		
		Rough-Tech 48 Roughing	336	0.0005	0.0008	0.0011	0.0014	0.0016	0.0021	0.0025	0.0038		
		Finishing											
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	up to 28 HRC	Rough-Tech 48 Slotting	192	0.0003	0.0004	0.0007	0.0008	0.0010	0.0013	0.0017	0.0020		
		Rough-Tech 48 Roughing	288	0.0004	0.0006	0.0008	0.0010	0.0011	0.0015	0.0018	0.0022		
		Finishing											
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8MO, Nitronic	over 28 HRC	Rough-Tech 48 Slotting	168	0.0003	0.0004	0.0006	0.0007	0.0008	0.0011	0.0014	0.0017		
		Rough-Tech 48 Roughing	240	0.0004	0.0004	0.0007	0.0008	0.0010	0.0013	0.0017	0.0020		
		Finishing											
High-Temperature Alloys Nimonic, Inconel, Monel, Hastelloy	up to 42 HRC	Rough-Tech 48 Slotting	72	0.0002	0.0003	0.0004	0.0006	0.0007	0.0010	0.0011	0.0014		
		Rough-Tech 48 Roughing	84	0.0003	0.0004	0.0006	0.0007	0.0008	0.0011	0.0014	0.0017		
		Finishing											
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	up to 42 HRC	Rough-Tech 48 Slotting	144	0.0003	0.0004	0.0007	0.0008	0.0010	0.0013	0.0017	0.0020		
		Rough-Tech 48 Roughing	216	0.0004	0.0006	0.0008	0.0010	0.0011	0.0015	0.0018	0.0022		
		Finishing											
Cast Iron - Gray CG ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	up to 240 HB 30	Rough-Tech 48 Slotting	384	0.0004	0.0007	0.0010	0.0013	0.0014	0.0018	0.0022	0.0033		
		Rough-Tech 48 Roughing	432	0.0004	0.0008	0.0011	0.0014	0.0017	0.0020	0.0025	0.0036		
		Finishing											
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	above 240 HB 30	Rough-Tech 56 Slotting	336	0.0004	0.0007	0.0008	0.0011	0.0013	0.0017	0.0020	0.0027		
		Rough-Tech 56 Roughing	384	0.0004	0.0007	0.0010	0.0013	0.0014	0.0018	0.0022	0.0033		
		Finishing											
Aluminum, Al-wrought alloys, Al-alloys 2024, 6061, 7075, 1050, 6351, 5005, 2017, 7075	up to 3% Si	Rough-Tech ALU Slotting	1350	0.0005	0.0010	0.0013	0.0018	0.0021	0.0025	0.0030	0.0044		
		Rough-Tech ALU Roughing	1620	0.0006	0.0011	0.0014	0.0019	0.0022	0.0028	0.0031	0.0047		
		Finishing											
Aluminum-cast alloys High Silicon - A380, A390, Castings, 3.2131 G-AISI5Cu1, 3.2153 G-AISI7Cu3, 3.2573 G-AISI9, 3.2581 G-AISI12, 3.2583 G-AISI12Cu, - G-AISI12CuNiMg	above 3% Si	Rough-Tech ALU Slotting	621	0.0005	0.0008	0.0011	0.0014	0.0016	0.0021	0.0025	0.0038		
		Rough-Tech ALU Roughing	756	0.0005	0.0010	0.0013	0.0016	0.0019	0.0022	0.0028	0.0041		
		Finishing											
Magnesium Alloys	-	Rough-Tech ALU Slotting	486	0.0004	0.0008	0.0010	0.0013	0.0014	0.0019	0.0022	0.0031		
		Rough-Tech ALU Roughing	594	0.0005	0.0010	0.0013	0.0016	0.0019	0.0022	0.0028	0.0041		
		Finishing											
Non-ferrous Copper Alloys, Brass, Bronze	up to 28 HRC	Rough-Tech ALU Slotting	675	0.0004	0.0008	0.0010	0.0013	0.0014	0.0019	0.0022	0.0031		
		Rough-Tech ALU Roughing	810	0.0005	0.0010	0.0013	0.0016	0.0019	0.0022	0.0028	0.0041		
		Finishing											

Feed and Speed Table - Uni-Pro 2-3-4 flutes

IPT - adjustment: * **HPC = High Performance Cutting**
 DOC (ap) = 2 x d ; IPT -30% = High Metal Removal Rate
 IPT - adjustment: **
 DOC (ap) = 1-2 x d ; IPT+25%
 IPT - adjustment: *** **HSC = High Speed Machining**
 DOC (ap) = 1-2 x d ; IPT+60% = Good Surface Quality

Application	Width of cut (ae)	Depth of cut (ap)
Slotting*	1 x d	0.5 to 1.0 x d
Roughing*	0.5 to 0.9 x d	0.5 to 1.0 x d
Finishing	0.05 to 0.1 x d	1.0 to 2.0 x d
HPC-roughing**	0.25 to 0.5 x d	1.0 to 2.0 x d
HSC-roughing***	0.05 to 0.25 x d	1.0 to 2.0 x d

Material	Color Ball	Hardness	No. Flutes	Type of application	SFM	Feed (inches per tooth) by diameter							
						1/8"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
						Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	up to 28 HRC	2 Slotting	378	0.0005	0.0010	0.0012	0.0017
3 Roughing	420	0.0006	0.0011	0.0015	0.0019	0.0023		0.0028	0.0033	0.0047			
4 Finishing	588	0.0004	0.0008	0.0011	0.0015	0.0018		0.0022	0.0026	0.0039			
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	28 to 38 HRC	2 Slotting	336	0.0005	0.0010	0.0012	0.0017	0.0019	0.0025	0.0028	0.0041		
		3 Roughing	378	0.0006	0.0011	0.0015	0.0019	0.0023	0.0028	0.0033	0.0047		
		4 Finishing	462	0.0004	0.0008	0.0011	0.0015	0.0018	0.0022	0.0026	0.0039		
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7,T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	28 to 44 HRC	2 Slotting	283.5	0.0004	0.0008	0.0011	0.0015	0.0018	0.0022	0.0026	0.0039		
		3 Roughing	336	0.0006	0.0011	0.0014	0.0018	0.0022	0.0026	0.0030	0.0044		
		4 Finishing	420	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019	0.0025	0.0036		
Hardened Steels Carbon and Alloy Steels, Tool & Die Steels	H	up to 54 HRC	2 Slotting	147	0.0003	0.0006	0.0007	0.0009	0.0011	0.0014	0.0017	0.0024	
			3 Roughing	231	0.0004	0.0006	0.0008	0.0011	0.0012	0.0015	0.0019	0.0028	
			4 Finishing	315	0.0004	0.0007	0.0009	0.0012	0.0014	0.0017	0.0021	0.0031	
	H	54-60 HRC	Slotting										
			Roughing										
			Finishing										
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	up to 28 HRC	2 Slotting	252	0.0004	0.0007	0.0009	0.0012	0.0014	0.0017	0.0021	0.0031		
		3 Roughing	294	0.0004	0.0008	0.0011	0.0014	0.0017	0.0021	0.0024	0.0035		
		4 Finishing	378	0.0004	0.0007	0.0009	0.0013	0.0015	0.0019	0.0022	0.0033		
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	up to 28 HRC	2 Slotting	168	0.0004	0.0006	0.0008	0.0011	0.0012	0.0015	0.0019	0.0028		
		3 Roughing	252	0.0004	0.0007	0.0009	0.0013	0.0015	0.0019	0.0022	0.0033		
		4 Finishing	294	0.0004	0.0007	0.0009	0.0012	0.0014	0.0017	0.0021	0.0031		
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8MO, Nitronic	over 28 HRC	2 Slotting	147	0.0003	0.0006	0.0007	0.0009	0.0011	0.0014	0.0017	0.0024		
		3 Roughing	210	0.0004	0.0006	0.0008	0.0011	0.0012	0.0015	0.0019	0.0028		
		4 Finishing	252	0.0004	0.0006	0.0008	0.0011	0.0012	0.0015	0.0019	0.0028		
High-Temperature Alloys Nimonic, Inconel, Monel, Hastelloy	up to 42 HRC	2 Slotting	63	0.0002	0.0004	0.0005	0.0006	0.0007	0.0009	0.0012	0.0014		
		3 Roughing	73.5	0.0002	0.0005	0.0007	0.0008	0.0009	0.0013	0.0015	0.0019		
		4 Finishing	94.5	0.0004	0.0006	0.0008	0.0011	0.0012	0.0015	0.0019	0.0028		
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	up to 42 HRC	2 Slotting	126	0.0004	0.0006	0.0008	0.0011	0.0012	0.0015	0.0019			

Feed and Speed Table - GF 500 B / GF 300 B (Ball) METRIC

Tool length/ reach up to 3xD m/min (Vc) and mm/T (fz) 100%

Tool length/ reach up to 3-5xD m/min (Vc) and mm/T (fz) -20%

Tool length/ reach up to 5-10xD m/min (Vc) and mm/T (fz) -40%

Application		Drum.	(mm)	2	3	4	6	8	10	12	16
Roughing	ap	(mm)	0.10	0.15	0.20	0.40	0.60	0.75	1.00	1.20	
	ae	(mm)	0.15	0.15	0.30	0.50	0.75	1.00	1.50	1.50	
Finishing	ap	(mm)	0.05	0.07	0.10	0.14	0.16	0.18	0.20	0.30	
	ae	(mm)	0.05	0.05	0.07	0.10	0.15	0.20	0.25	0.30	

Material	Color Ball	Hardness	Use Type	Type of application	Vc m/min	fz feed (mm/Tooth) by diameter										
						2	3	4	6	8	10	12	16			
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	Green	up to 28 HRc	GF 500	Roughing	250	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 500	Finishing	350	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	Green/Red	28 to 38 HRc	GF 500	Roughing	250	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 500	Finishing	350	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	Red	28 to 44 HRc	GF 500	Roughing	200	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 500	Finishing	300	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
Hardened Steels Carbon and Alloy Steels, Tool & Die Steels	H	up to 54 HRC	GF 500	Roughing	180	0.020	0.030	0.035	0.040	0.050	0.070	0.080	0.100			
			GF 500	Finishing	280	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
	H	54-60 HRC	GF 300	Roughing	150	0.020	0.030	0.035	0.040	0.050	0.070	0.080	0.100			
			GF 300	Finishing	230	0.025	0.030	0.040	0.045	0.050	0.070	0.100	0.120			
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	Blue	up to 28 HRc	GF 500	Roughing	180	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 500	Finishing	280	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	Blue	up to 28 HRc	GF 500	Roughing	130	0.020	0.030	0.035	0.040	0.050	0.070	0.080	0.100			
			GF 500	Finishing	200	0.025	0.030	0.040	0.045	0.050	0.070	0.100	0.120			
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8MO, Nitronic	Blue	over 28 HRc	GF 500	Roughing	80	0.020	0.030	0.035	0.040	0.050	0.070	0.080	0.100			
			GF 500	Finishing	130	0.025	0.030	0.040	0.045	0.050	0.070	0.100	0.120			
High-Temperature Alloys Nimonic, Inconel, Monel, Hastelloy	Grey	up to 42 HRc	GF 500	Roughing	40	0.010	0.020	0.030	0.035	0.040	0.050	0.070	0.080			
			GF 500	Finishing	60	0.020	0.025	0.030	0.040	0.045	0.060	0.080	0.090			
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	Grey	up to 42 HRc	GF 500	Roughing	80	0.020	0.030	0.035	0.040	0.050	0.070	0.080	0.100			
			GF 500	Finishing	150	0.025	0.030	0.040	0.045	0.050	0.070	0.100	0.120			
Cast Iron - Gray CG ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	Grey	up to 240 HB 30	GF 500	Roughing	200	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 500	Finishing	300	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	Grey	above 240 HB 30	GF 500	Roughing	150	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 500	Finishing	230	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
Aluminum, Al-wrought alloys, Al-alloys 2024, 6061, 7075, 1050, 6351, 5005, 2017, 7075	Black	up to 3% Si	GF 500	Roughing	350	0.040	0.045	0.050	0.070	0.100	0.120	0.150	0.170			
			GF 500	Finishing	600	0.040	0.045	0.050	0.070	0.100	0.120	0.150	0.170			
Aluminum-cast alloys High Silicon - A380, A390, Castings, 3.2131 G-AISI5Cu1, 3.2153 G-AISI7Cu3, 3.2573 G-AISI9, 3.2581 G-AISI12, 3.2583 G-AISI12Cu, - G-AISI12CuNiMg	Black	above 3% Si	GF 500	Roughing	280	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 500	Finishing	350	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
Magnesium Alloys	-	-	GF 500	Roughing	250	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 500	Finishing	350	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
Non-ferrous Copper Alloys, Brass, Bronze	-	up to 28 HRc	GF 500	Roughing	250	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 500	Finishing	400	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			

Feed and Speed Table - GF 500 T / GF 300 T (Torus) METRIC

Tool length/ reach up to 3xD m/min (Vc) and mm/T (fz) 100%

Tool length/ reach up to 3-5xD m/min (Vc) and mm/T (fz) -20%

Tool length/ reach up to 5-10xD m/min (Vc) and mm/T (fz) -40%

Application		Drum.	(mm)	2	3	4	6	8	10	12	16
Roughing	ap	(mm)	0.15	0.20	0.30	0.40	0.60	0.75	1.00	1.50	
	ae	(mm)	1.00	1.50	2.00	3.00	4.00	5.00	6.00	8.00	
Finishing	ap	(mm)	0.08	0.11	0.13	0.15	0.20	0.30	0.40	0.50	
	ae	(mm)	0.20	0.30	0.40	0.70	1.00	1.50	2.00	3.00	

Material	Color Ball	Hardness	Use Type	Type of application	Vc m/min	fz feed (mm/Tooth) by diameter										
						2	3	4	6	8	10	12	16			
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	Green	up to 28 HRc	GF 500	Roughing	200	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 500	Finishing	300	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	Green/Red	28 to 38 HRc	GF 500	Roughing	200	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 500	Finishing	300	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	Red	28 to 44 HRc	GF 300	Roughing	180	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 300	Finishing	280	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
Hardened Steels Carbon and Alloy Steels, Tool & Die Steels	H	up to 54 HRC	GF 300	Roughing	140	0.020	0.030	0.035	0.040	0.050	0.070	0.080	0.100			
			GF 300	Finishing	200	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
	H	54-60 HRC	GF 300	Roughing	80	0.020	0.030	0.035	0.040	0.050	0.070	0.080	0.100			
			GF 300	Finishing	130	0.025	0.030	0.040	0.045	0.050	0.070	0.100	0.120			
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	Blue	up to 28 HRc	GF 500	Roughing	180	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 500	Finishing	280	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	Blue	up to 28 HRc	GF 500	Roughing	120	0.020	0.030	0.035	0.040	0.050	0.070	0.080	0.100			
			GF 500	Finishing	180	0.025	0.030	0.040	0.045	0.050	0.070	0.100	0.120			
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8MO, Nitronic	Blue	over 28 HRc	GF 500	Roughing	80	0.020	0.030	0.035	0.040	0.050	0.070	0.080	0.100			
			GF 500	Finishing	130	0.025	0.030	0.040	0.045	0.050	0.070	0.100	0.120			
High-Temperature Alloys Nimonic, Inconel, Monel, Hastelloy	Grey	up to 42 HRc	GF 500	Roughing	40	0.010	0.020	0.030	0.035	0.040	0.050	0.070	0.080			
			GF 500	Finishing	60	0.020	0.025	0.030	0.040	0.045	0.060	0.080	0.090			
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al	Grey	up to 42 HRc	GF 500	Roughing	90	0.020	0.030	0.035	0.040	0.050	0.070	0.080	0.100			
			GF 500	Finishing	150	0.025	0.030	0.040	0.045	0.050	0.070	0.100	0.120			
Cast Iron - Gray CG ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	Grey	up to 240 HB 30	GF 500	Roughing	200	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 300	Finishing	300	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	Grey	above 240 HB 30	GF 300	Roughing	150	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
			GF 300	Finishing	230	0.030	0.040	0.045	0.050	0.070	0.100	0.120	0.150			
Aluminum, Al-wrought alloys, Al-alloys 2024, 6061, 7075, 1050, 6351, 5005, 2017, 7075	Black	up to 3% Si														

Feed and Speed Table - Alumi-Tech (GA 200 A)

IPT - adjustment: *
 DOC (ap) = 2 x d ; IPT -30%
 IPT - adjustment: **
 DOC (ap) = 1-2 x d ; IPT+25%
 IPT - adjustment: ***
 DOC (ap) = 1-2 x d ; IPT+60%

HPC = High Performance Cutting
 = High Metal Removal Rate
HSC = High Speed Machining
 = Good Surface Quality

Application	Width of cut (ae)	Depth of cut (ap)
Slotting*	1 x d	.5 to 1.0 x d
Roughing*	.5 to .9 x d	.5 to 1.0 x d
Finishing	.05 to .1 x d	1.0 to 2.0 x d
HPC-roughing**	.25 to .5 x d	1.0 to 2.0 x d
HSC-roughing***	0.05 to .25 x d	1.0 to 2.0 x d

Material	Color Ball	Hardness	Use Type	Type of application	SFM	Feed (inches per tooth) by diameter								
						1/8"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"	
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330		up to 28 HRc												
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	 	28 to 38 HRc												
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7		28 to 44 HRc												
Hardened Steels Carbon and Alloy Steels, Tool & Die Steels	H	up to 54 HRC												
	H	54-60 HRC												
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F		up to 28 HRc												
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH		up to 28 HRc												
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8MO, Nitronic		over 28 HRc												
High-Temperature Alloys Nimonic, Inconel, Monel, Hastelloy		up to 42 HRc												
Titanium Alloys 6Al-4V, 5Al-2.5 Sn, 6Al-2Sn-4Zr-6Mo, 3Al-8V-6Cr4Mo-4Zr, 10V-2Fe-3Al, 13V-11Cr-3Al		up to 42 HRc												
Cast Iron - Gray CG ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40		up to 240 HB 30												
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450		above 240 HB 30												
Aluminum, Al-wrought alloys, Al-alloys 2024, 6061, 7075, 1050, 6351, 5005, 2017, 7075		up to 3% Si	Alumi-Tech	Slotting	1500	0.0008	0.0016	0.0020	0.0026	0.0031	0.0037	0.0043	0.0063	
			Alumi-Tech	Roughing	1800	0.0008	0.0016	0.0022	0.0028	0.0033	0.0039	0.0047	0.0067	
			Alumi-Tech	Finishing	3000	0.0007	0.0014	0.0018	0.0024	0.0028	0.0035	0.0039	0.0059	
Aluminum-cast alloys High Silicon - A380, A390, Castings, 3.2131 G-AISI5Cu1, 3.2153 G-AISI7Cu3, 3.2573 G-AISI9, 3.2581 G-AISI12, 3.2583 G-AISI12Cu, - G-AISI12CuNiMg		above 3% Si	Alumi-Tech	Slotting	690	0.0006	0.0012	0.0016	0.0022	0.0026	0.0031	0.0037	0.0055	
			Alumi-Tech	Roughing	840	0.0008	0.0016	0.0020	0.0026	0.0031	0.0037	0.0043	0.0063	
			Alumi-Tech	Finishing	1050	0.0007	0.0014	0.0018	0.0024	0.0028	0.0035	0.0039	0.0059	
Magnesium Alloys		-	Alumi-Tech	Slotting	540	0.0006	0.0012	0.0016	0.0022	0.0026	0.0031	0.0037	0.0055	
			Alumi-Tech	Roughing	660	0.0008	0.0016	0.0020	0.0026	0.0031	0.0037	0.0043	0.0063	
			Alumi-Tech	Finishing	840	0.0007	0.0014	0.0018	0.0024	0.0028	0.0035	0.0039	0.0059	
Non-ferrous Copper Alloys, Brass, Bronze		up to 28 HRc	Alumi-Tech	Slotting	750	0.0006	0.0010	0.0014	0.0018	0.0020	0.0026	0.0031	0.0047	
			Alumi-Tech	Roughing	900	0.0006	0.0012	0.0016	0.0022	0.0026	0.0031	0.0037	0.0055	
			Alumi-Tech	Finishing	1200	0.0006	0.0012	0.0016	0.0022	0.0026	0.0031	0.0037	0.0055	

TECHNICAL SECTION