Revised

EN

KORLOY

SOLID TOOLS SOLUTION

Endmill

Drill

Reamer

Chamfer

Thread

KORLOY

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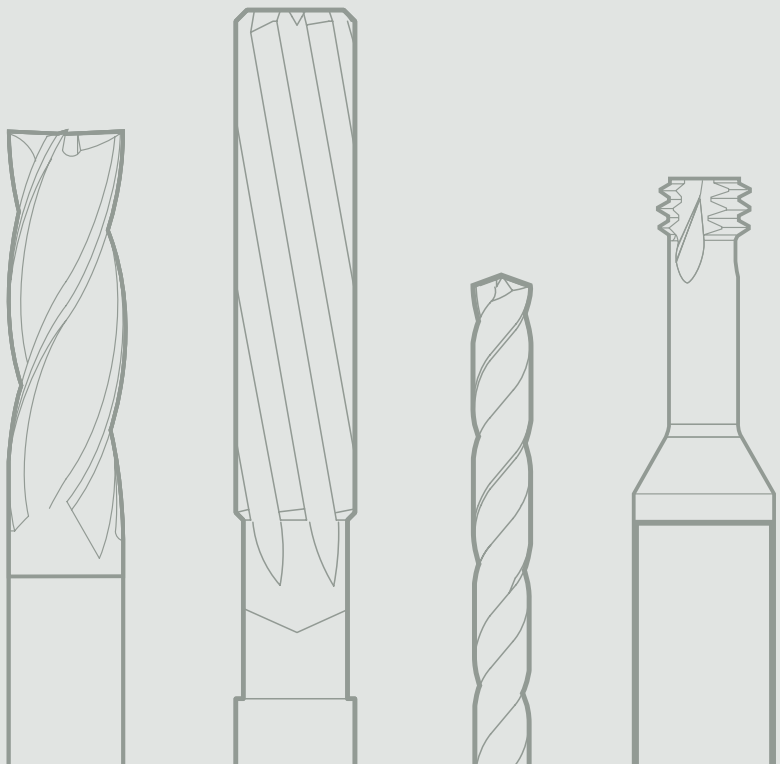
ENDMILL



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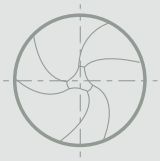
DRILL

REAMER

CHAMFER



THREAD


Super Endmill
Optimal endmill for Ni Based super alloy HRSA : Inconel718, Hastelloy, waspalloy and etc.
Endmill for HRSA Machining
Super Endmill
new
– Aerospace and generating industries
– Endmill for parts such as engines and turbines made into hard-to-cut materials.
See page 26.


H Endmill
High speed Endmill for machining high hardness workpieces up to HRC70
Improved wear resistance and machinability / Boosted productivity
High Speed Endmill Series for High Hardness Machining
H Endmill
– Exceptional wear resistance due to the advanced coating technology
- Improved machinability due to the brand-new design
- Boosted productivity due to high speed capability in high precision machining
See page 30.

H⁺ Endmill

Suitable for high speed machining of hardened workpieces(HRC50~70).

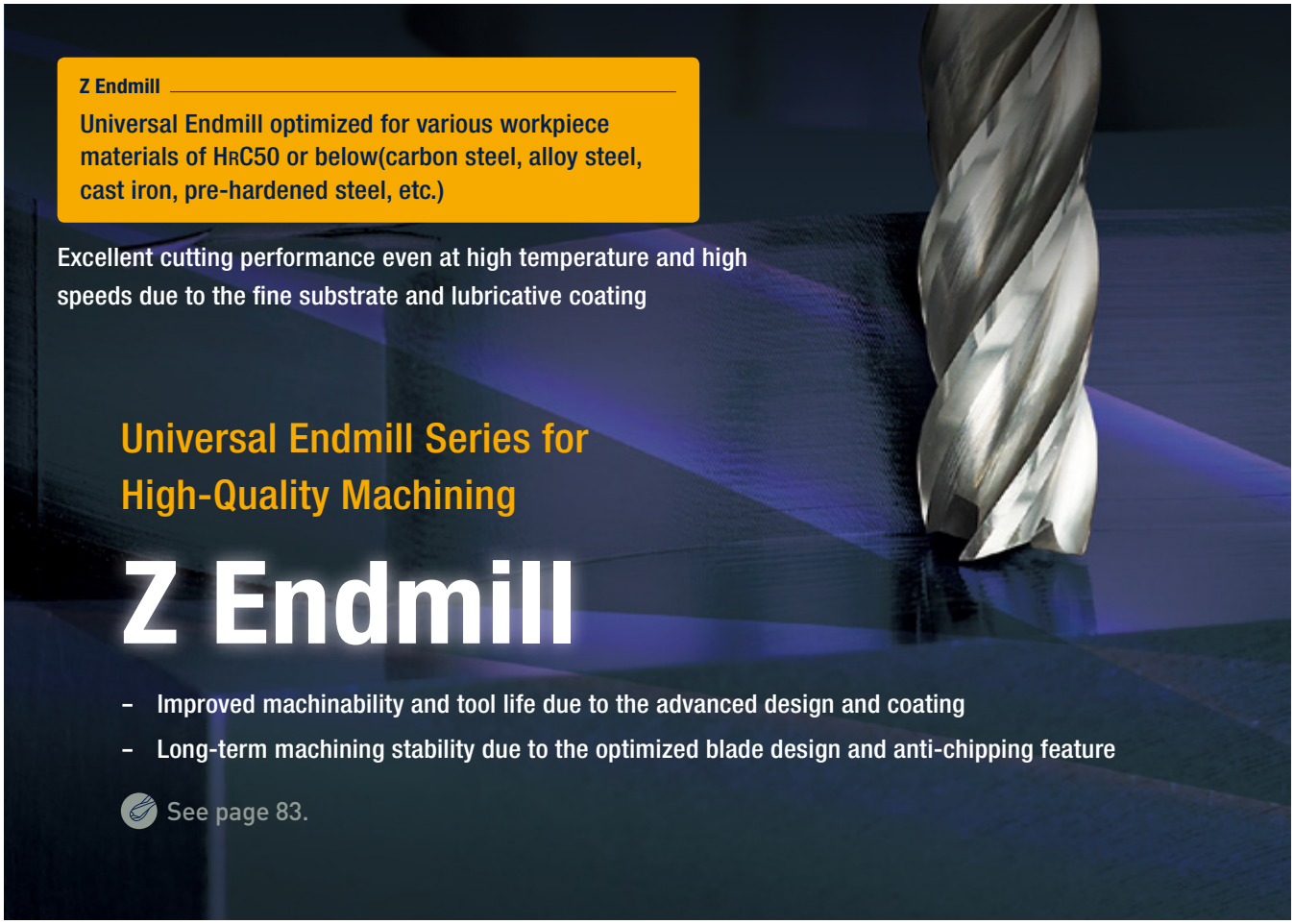
The line-up of long neck, rib, taper neck, etc. is available for using in machining with various shapes.

H⁺ Endmill

new

- Ultra-fine substrate increases cutting edge strength of tools.
- The new coating layer applied provides hardness and a high temperature oxidation resistance of cutting edge in high speed machining
- Optimally designed cutting edge for high speed machining ensures stable machinability.

See page 34.



Z Endmill

Universal Endmill optimized for various workpiece materials of HRC50 or below(carbon steel, alloy steel, cast iron, pre-hardened steel, etc.)

Excellent cutting performance even at high temperature and high speeds due to the fine substrate and lubricative coating

Universal Endmill Series for High-Quality Machining

Z Endmill

- Improved machinability and tool life due to the advanced design and coating
- Long-term machining stability due to the optimized blade design and anti-chipping feature

See page 83.

U+ Endmill

U+ Endmill is suitable for machining medium hardness workpieces (HRC30~55) made of alloy steel, carbon steel, die steel, etc.

Full line-up available with various shapes like miniature type, taper neck, ball type, etc.

U+ Endmill new

- U+ Endmill is available for a wide cutting range: roughing, medium cutting and finishing of molds and dies, and for various cutting methods of curved and inclined surfaces, special shapes, etc.
- High toughness substrate actualizes chipping resistance and hardness in machining.
- The new coating technology ensures oxidation resistance and high cutting edge strength.

See page 89.

I⁺ Endmill

The highly tough substrate and wear-resistant coating

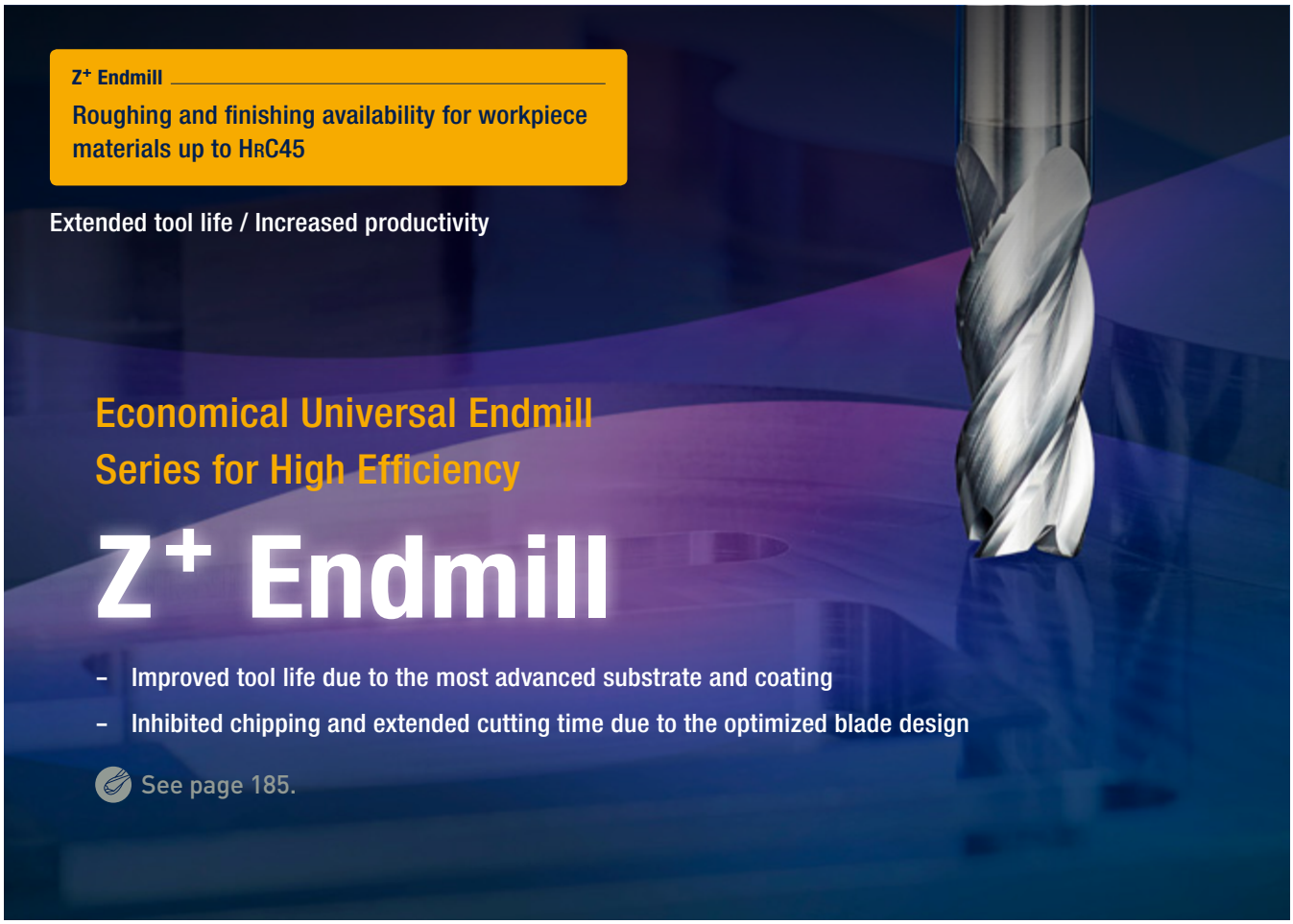
Improved tool life due to the coating with excellent resistance to chipping and wear

Universal Endmill Series for a Wide Range of Applications from Roughing to Finishing

I⁺ Endmill

- Applicable to workpiece materials up to HRC45
- Cost reduction due to excellent machinability and the reasonable price

See page 172.



Z⁺ Endmill

Roughing and finishing availability for workpiece materials up to HRC45

Extended tool life / Increased productivity

Economical Universal Endmill Series for High Efficiency

Z⁺ Endmill

- Improved tool life due to the most advanced substrate and coating
- Inhibited chipping and extended cutting time due to the optimized blade design

See page 185.

R+ Endmill

Blade design ideal for roughing

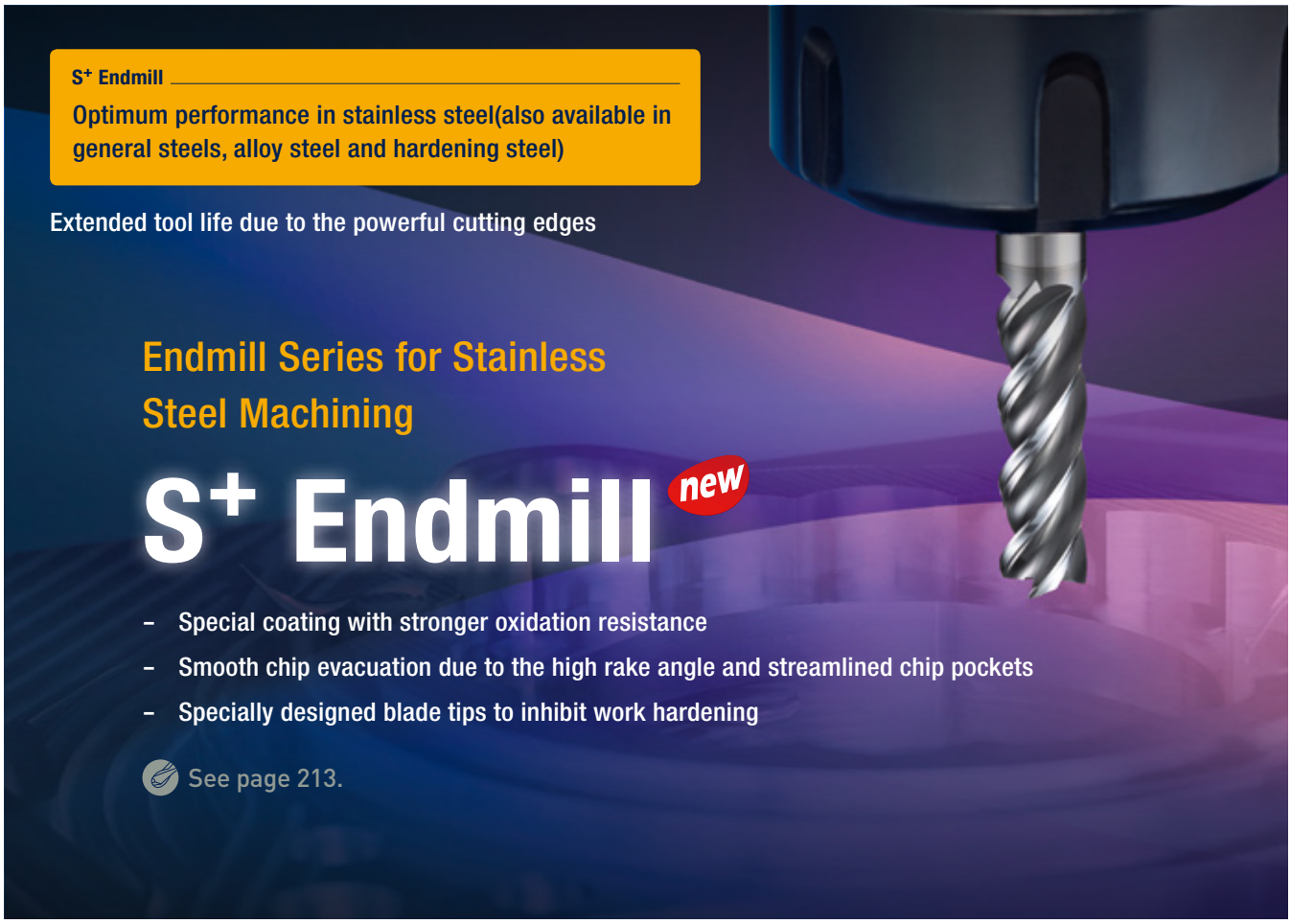
High machining efficiency due to the special design for medium to rough cutting

Highly Efficient Roughing Endmill Series

R+ Endmill

- Cost-saving cutting edge design for highly efficient roughing applications
- Reduced cutting load due to both differential pitch and unequal helix formation

See page 203.



S+ Endmill

Optimum performance in stainless steel(also available in general steels, alloy steel and hardening steel)

Extended tool life due to the powerful cutting edges

Endmill Series for Stainless Steel Machining

S+ Endmill new

- Special coating with stronger oxidation resistance
- Smooth chip evacuation due to the high rake angle and streamlined chip pockets
- Specially designed blade tips to inhibit work hardening

See page 213.

A+ Endmill

The proprietary U-type flute design

Smooth chip evacuation at high feeds

Endmill Series for Aluminum Machining

A+ Endmill

- Double relief angle for improved edge rigidity and boosted productivity
- Sharp edges for both roughing and finishing

See page 216.

Smooth Chip Flow and the Reliable Welding-Proof Feature

Solid Endmill for Aluminum

DLC coated

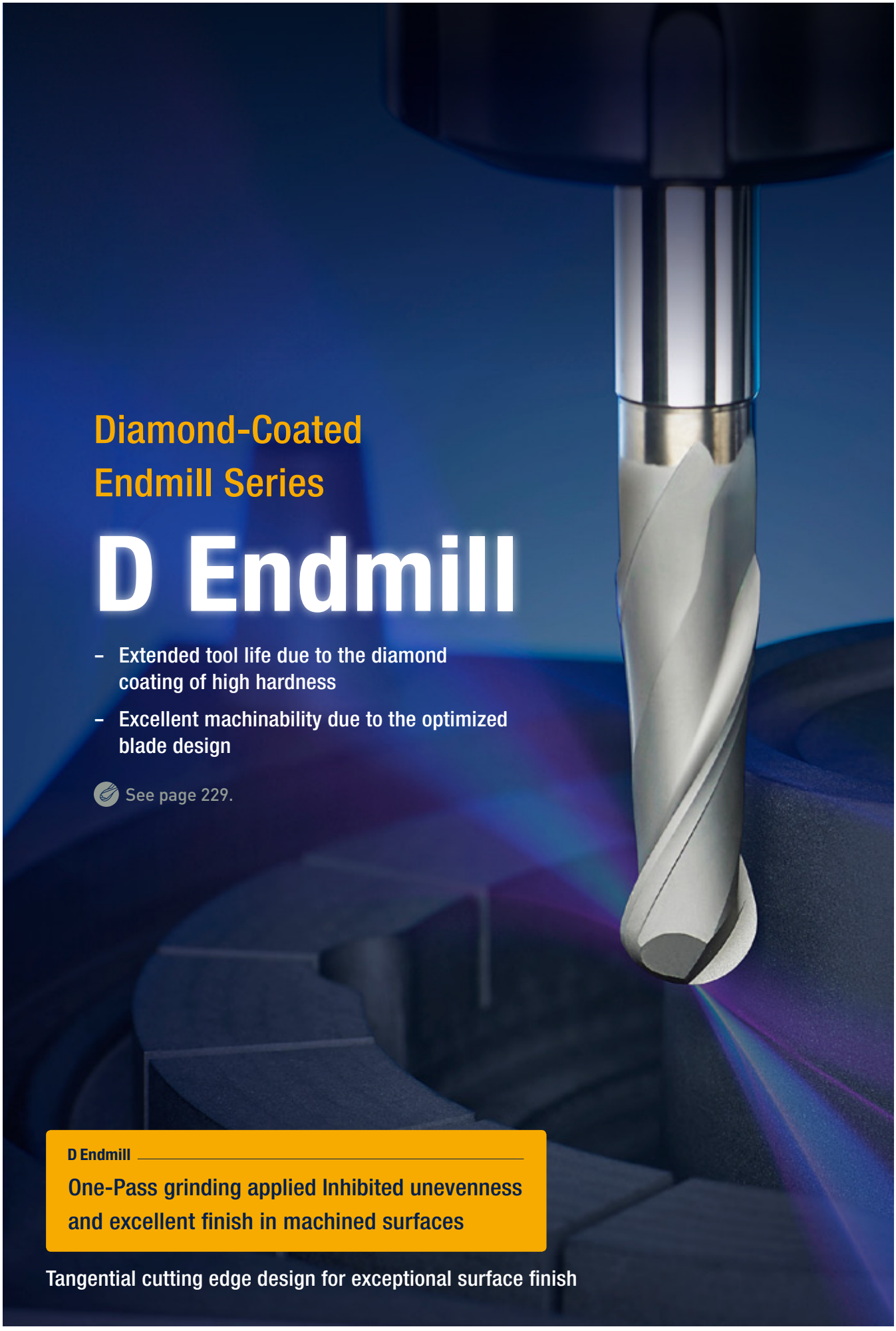
- Three to six times higher tool life with high hardness(Hv 3000~7000) compared to uncoated Endmill
- Excellent surface finish due to lubrication resulting from the low friction coefficient($\mu < 0.1$)

See page 226.

Solid Endmill for Aluminum

Minimized cutting load and built-up edges for excellent surface finish

Available for aluminum, aluminum alloy, copper, and copper alloy



Diamond-Coated Endmill Series

D Endmill

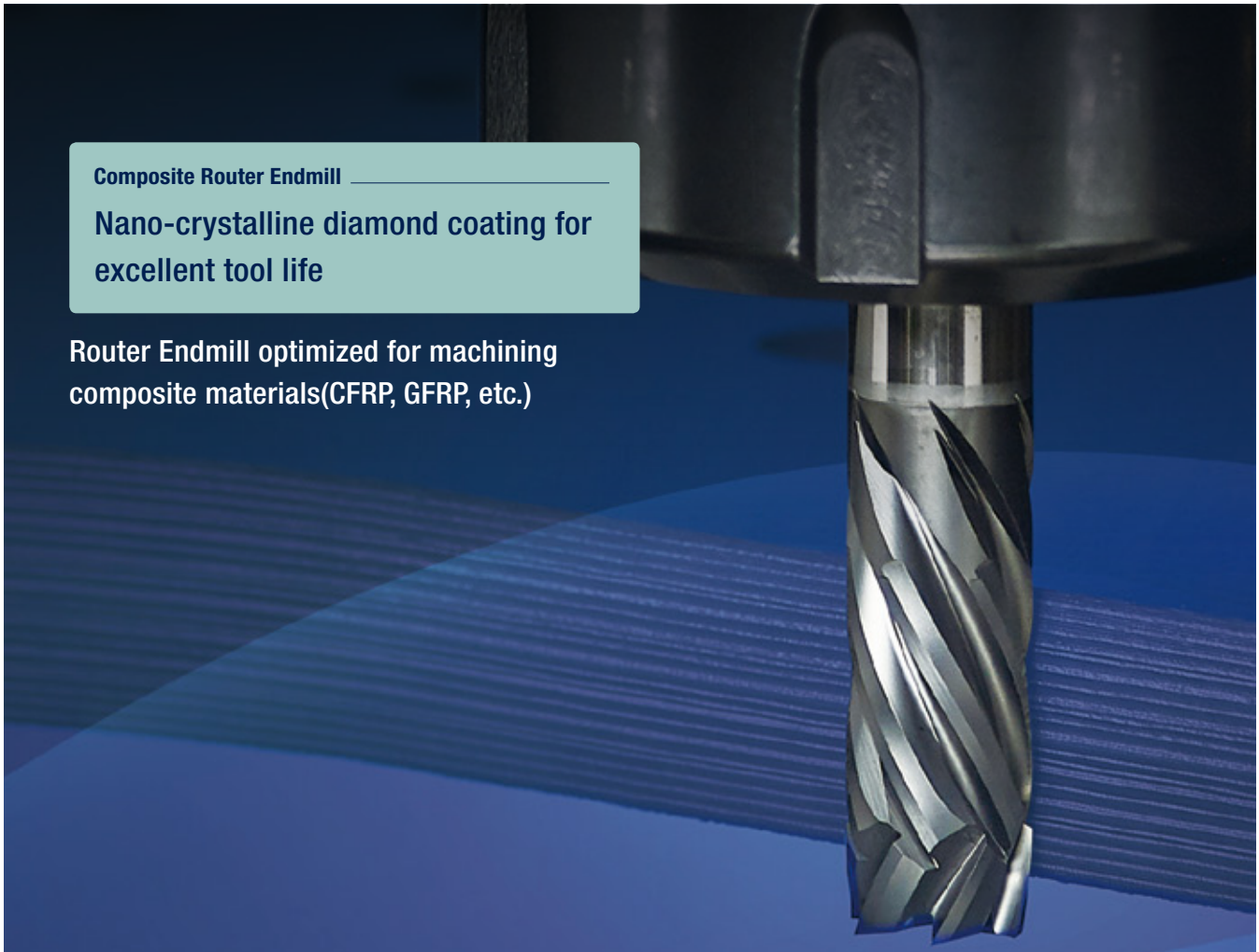
- Extended tool life due to the diamond coating of high hardness
- Excellent machinability due to the optimized blade design

See page 229.

D Endmill

One-Pass grinding applied Inhibited unevenness and excellent finish in machined surfaces

Tangential cutting edge design for exceptional surface finish



Composite Router Endmill

Nano-crystalline diamond coating for excellent tool life

Router Endmill optimized for machining composite materials(CFRP, GFRP, etc.)

Router Endmill Series for Machining Composite Materials

Composite Router Endmill

- Blade design to inhibit delamination and burrs
- Boosted productivity due to highly efficient machining

See page 234.

T Endmill

Customized tools for various machine applications for dental prostheses

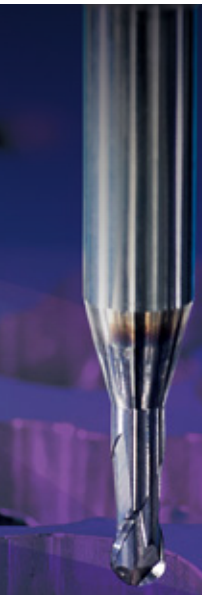
Optimized cutting performance by matching a proper grade with each type of dental prostheses

Endmill Series for Dental Prostheses Made of Zirconia, Titanium, Co-Cr, Wax, PMMA, etc.

T Endmill

- Inhibited unevenness and excellent finish in machined surfaces due to the optimized cutting edge design
- Specialized tool shape for each machine type

See page 238.



M+ Endmill

Multi-functional endmill for machining with various applications such as holemaking, milling etc.

Multi-functional Endmill, Highly Efficient

M+ Endmill new

- Endmill with various applications
  Drilling, ramping, slotting, side milling
- Enhanced surface roughness and reduced cutting load due to excellent tool rigidity
- Strengthened machinability due to Cr-based coating layer application

See page 240.


MSD Plus
Improved wear resistance by the new grade PC325U
Highly Efficient Hole Machining for Various Workpieces Including Automotive Components
MSD Plus
– Highly efficient hole machining for various workpiece types such as automotive components
– Wider chip pockets for smooth chip evacuation
See page 254.


MLD Plus
Improved wear resistance by the new grade PC315G
The Hole Machining Tool for High Precision and High Quality
MLD Plus
– Additional guide margins for stable machinability
See page 265.

MSD Plus-S

Specialized for heat-resistant alloys used in aerospace, energy, power generation and automotive industries

Improved productivity and wear resistance due to stable machinability

For Hole Machining of Inconel and Titanium

MSD Plus-S

- Stable machinability with the optimized blade design and chip pockets
- Extended tool life due to excellent high temp resistance to chipping

See page 260.

The Hole Machining Tool Optimized for CFRP

MSD Plus CFRP

– Reduced burrs and excellent hole quality in CFRP machining by the high rake cutting edges

See page 269.

MSD Plus CFRP

Strong wear resistance by the new diamond-coated grade ND2100

MSFD

Improved resistance to chipping and welding, and reduced burrs by edge honing and chamfering

The Hole Machining Tool for Wide Applications Including Ramped, Curved and Flat Surfaces

MSFD

- High-quality drilling availability in ramped surfaces by 180° point angle

See page 270.

HSD Plus

Universal drill applied with DIN standard

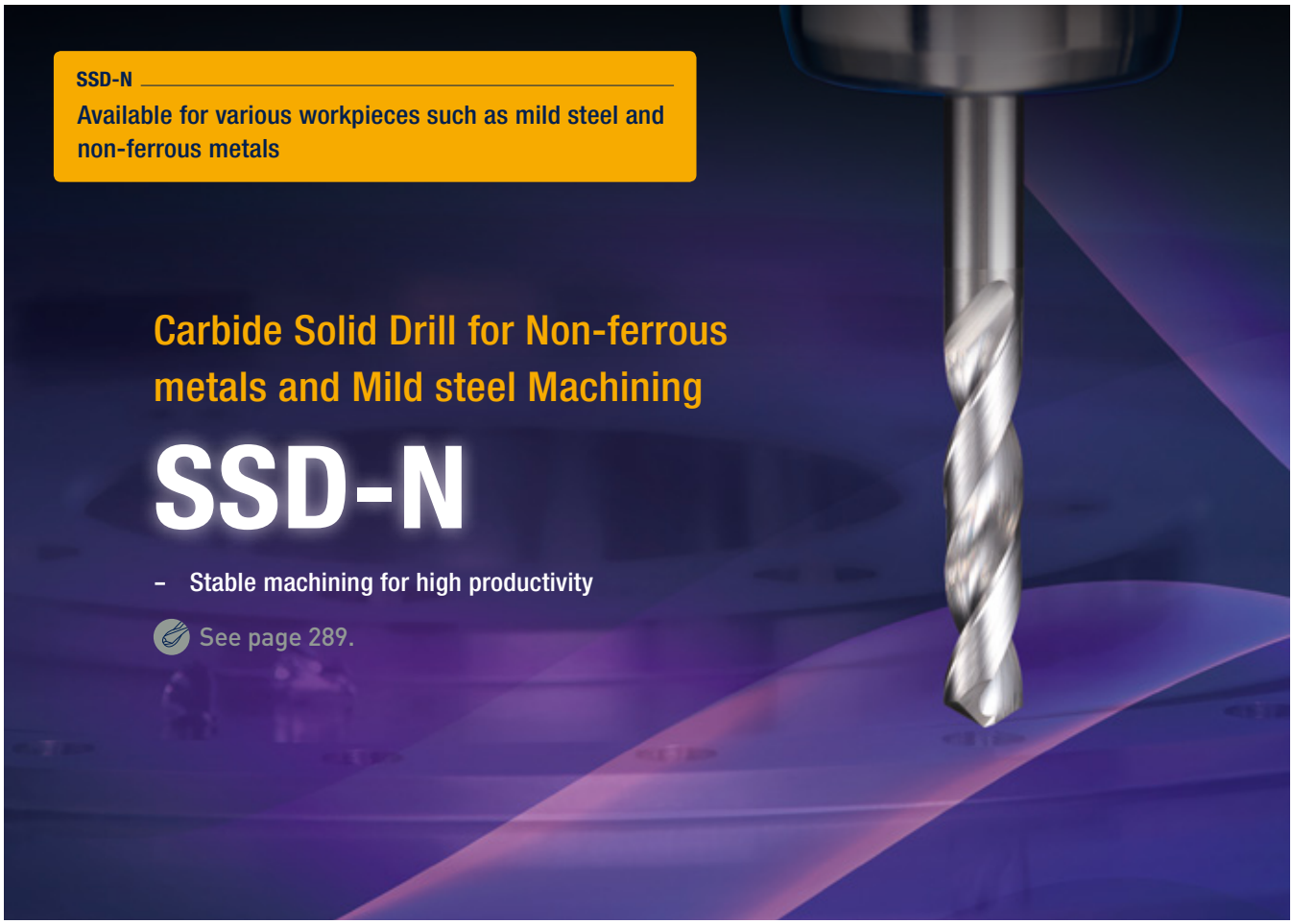
Drill applied with DIN standard is suitable for high speed machining(~HRC50).

HSD Plus new

- High toughness substrate enabling a high speed and high feed machining.
- The new coating strengthens surface hardness and thermal stability
- Internal coolant series of HSD Plus actualizes high machinability and reduces frictional heat.

See page 274.


ESD Plus
Improved wear resistance by the new grade PC325U
Highly Efficient Hole Machining for Various Workpiece Types Including Automotive Components
ESD Plus
– Excellent performance and cost efficiency
See page 283.


SSD-N
Available for various workpieces such as mild steel and non-ferrous metals
Carbide Solid Drill for Non-ferrous metals and Mild steel Machining
SSD-N
– Stable machining for high productivity
See page 289.

PCD Drill

PCD Drill for highly efficient machining

PCD Drill for High Precision Machining

PCD Drill new

- High functional drill for machining in various cutting applications
- Cone type drill
- Sandwich type drill
- Realizing excellent precision and surface finish

See page 297.

Counter Sink

Carbide/HSS countersink with fast and stable performance

Various counter sinks for high efficient machining

Counter Sink new

- Unequal division and unequal lead applied for a high efficiency machining.
- Improved machinability actualizes high precision and stable machining.
- The new coating layer ensures stable machinability and extended tool life.

See page 311.

Technical information for Endmill

Endmill

Product details / Recommended cutting conditions

KORLOY Endmill

Type	Used	Shape	Designation	Figure	Coated	No. of flute	Size (Ø) Min	Size (Ø) Max	Workpiece P Steel	Workpiece M Stainless steel	Workpiece K Cast iron	Workpiece N Non-ferrous metal	Workpiece S Heat resistant alloy, Titanium alloy	Workpiece H Hardened steel	page
new Super Endmill	HRSA	Radius	**SRES**		SL	4	3.0	20.0					◎		26
H Endmill	High speed, High hardness	Ball	**PBE**		TiSiN	2	0.5	12.0	◎		◎		○	◎	30
		Radius	**PRE**		TiSiN	4	3.0	12.0	◎		◎		○	◎	31
H+ Endmill	High speed, High hardness	Ball	**HPRBE**		TiN	2	0.1	5.0	◎		◎		○	◎	34
			HPRBE-TN		TiN	2	0.2	10.0	◎		◎		○	◎	36
					TiN	3	2.0	5.0	◎		◎		○	◎	38
					TiN	4	2.0	10.0	◎		◎		○	◎	39
			HPBE		TiN	2	0.1	12.0	◎		◎		○	◎	40
			HPLBE		TiN	2	1.0	12.0	◎		◎		○	◎	41
			HPBE		TiN	3	2.0	12.0	◎		◎		○	◎	42
		Flat	**HPRFE**		TiN	2	0.1	5.0	◎		◎		○	◎	43
					TiN	4	1.0	5.0	◎		◎		○	◎	45
			HPFE		TiN	2	0.1	20.0	◎		◎		○	◎	46
					TiN	2	1.0	12.0	◎		◎		○	◎	47
					TiN	4	1.0	20.0	◎		◎		○	◎	48
					TiN	4	1.0	12.0	◎		◎		○	◎	49
					TiN	4	1.0	5.0	◎		◎		○	◎	50
					TiN	4	2.0	12.0	◎		◎		○	◎	51
			HPLFE		TiN	4	1.0	12.0	◎		◎		○	◎	51
			HPFE		TiN	6	6.0	12.0	◎		◎		○	◎	52
					TiN	6	6.0	12.0	◎		◎		○	◎	52
		Radius	**HPRRE**		TiN	2	0.2	3.0	◎		◎		○	◎	53
					TiN	2	0.2	3.0	◎		◎		○	◎	55
			HPRE		TiN	2	1.0	12.0	◎		◎		○	◎	56
			HPLRE		TiN	2	1.0	12.0	◎		◎		○	◎	59
			HPRE		TiN	4	1.0	12.0	◎		◎		○	◎	60
			HPLRE		TiN	4	1.0	12.0	◎		◎		○	◎	62
					TiN	4	6.0	12.0	◎		◎		○	◎	63

◎ : Excellent ○ : Good

Type	Used	Shape	Designation	Figure	Coated	No. of flute	Size (Ø) Min	Size (Ø) Max	Workpiece P Steel	Workpiece M Stainless steel	Workpiece K Cast iron	Workpiece N Non-ferrous metal	Workpiece S Heat resistant alloy, Titanium alloy	Workpiece H Hardened steel	page
new H+ Endmill	High speed, High hardness	Radius	HPRE		TiN	4	1.0	12.0	◎		◎		○	◎	64
					TiN	4	3.0	12.0	◎		◎		○	◎	65
					TiN	4	3.0	10.0	◎		◎		○	◎	66
					TiN	6	6.0	12.0	◎		◎		○	◎	67
			HPLRE		TiN	6	6.0	12.0	◎		◎		○	◎	67
Z Endmill	General	Flat	ZFE		AlCrN	2	1.0	16.0	◎	○	◎		○		83
					AlCrN	4	1.0	16.0	◎	○	◎		○		84
		Short flat	ZSFE		AlCrN	2	1.0	12.0	◎	○	◎		○		85
					AlCrN	4	1.0	12.0	◎	○	◎		○		85
		Ball	ZBE		AlCrN	2	1.0	12.0	◎	○	◎		○		86
new U+ Endmill	General	Flat	UPRFE		W	4	1.0	12.0	◎	○	◎		○		89
			UPTFE		W	2	0.3	10.0	◎	○	◎		○		91
			UPTLFE		W	4	0.8	2.5	◎	○	◎		○		93
			UPTFE		W	4	3.0	10.0	◎	○	◎		○		96
			UPFE		W	2	0.1	25.0	◎	○	◎		○		97
			UPLFE		W	2	1.0	25.0	◎	○	◎		○		100
					W	4	1.0	25.0	◎	○	◎		○		102
			UPFE-U		W	4	0.8	25.0	◎	○	◎		○		104
			UPFE-UF		W	4	1.0	20.0	◎	○	◎		○		105
			UPFE-A45		W	4	1.0	20.0	◎	○	◎		○		106
					W	6	6.0	20.0	◎	○	◎		○		107
		Ball	UPRBE-TN		W	2	0.1	12.0	◎	○	◎		○		108
			UPTBE		W	2	0.3	2.0	◎	○	◎		○		114
			UPBE		W	2	0.1	25.0	◎	○	◎		○		115
			UPBE-P		W	2	0.1	12.0	◎	○	◎		○		117
			UPBE-H		W	2	0.1	12.0	◎	○	◎		○		118
			UPBE-ST		W	2	3.0	20.0	◎	○	◎		○		119
			UPBE-SP		W	2	3.0	12.0	◎	○	◎		○		119

◎ : Excellent ○ : Good

KORLOY Endmill

Type	Used	Shape	Designation	Figure	Coated	No. of flute	Size (Ø) Min	Size (Ø) Max	Workpiece P Steel	Workpiece M Stainless steel	Workpiece K Cast iron	Workpiece N Non-ferrous metal	Workpiece S Heat resistant alloy, Titanium alloy	Workpiece H Hardened steel	page
new U+ Endmill	General	Ball	UPBE		W	3	1.0	12.0	◎	○	◎		○		120
					W	4	1.0	12.0	◎	○	◎		○		120
		Radius	UPRRE		W	2	0.2	20.0	◎	○	◎		○		121
			UPRRE-TN		W	2	0.2	4.0	◎	○	◎		○		127
			UPRRE		W	4	6.0	12.0	◎	○	◎		○		132
			UPRRE-U		W	4	1.0	20.0	◎	○	◎		○		133
			UPRRE-TN		W	4	1.0	4.0	◎	○	◎		○		138
			UPTRE		W	4	0.8	2.5	◎	○	◎		○		142
			UPRE		W	2	0.2	20.0	◎	○	◎		○		146
			UPRE-U38		W	4	3.0	20.0	◎	○	◎		○		149
			UPRE-U		W	4	1.0	20.0	◎	○	◎		○		150
			UPRE-A45		W	6	6.0	20.0	◎	○	◎		○		152
			UPRE-HF		W	3	6.0	20.0	◎	○	◎		○		153
					W	4	1.0	20.0	◎	○	◎		○		154
		Roughing	UPRE-R		W	3	3.0	4.0	◎	○	◎		○		155
					W	4	5.0	12.0	◎	○	◎		○		155
					W	5	13.0	25.0	◎	○	◎		○		155
			UPRE-C		W	3	3.0	8.0	◎	○	◎		○		156
					W	4	9.0	20.0	◎	○	◎		○		156
					W	5	25.0	25.0	◎	○	◎		○		156
I+ Endmill	General	Flat	IPFE		AlTiN	5	25.0	25.0	◎	○	◎		○		172
					AlTiN	4	1.0	20.0	◎	○	◎		○		174
		Long flat	IPLFE		AlTiN	2	1.0	20.0	◎	○	◎		○		173
					AlTiN	4	1.0	20.0	◎	○	◎		○		175
		Ball	IPBE		AlTiN	2	1.0	20.0	◎	○	◎		○		176
					AlTiN	4	1.0	20.0	◎	○	◎		○		178
		Long ball	IPLBE		AlTiN	2	1.0	16.0	◎	○	◎		○		177
		Radius	IPRE		AlTiN	2	1.0	12.0	◎	○	◎		○		179

◎ : Excellent ○ : Good

Type	Used	Shape	Designation	Figure	Coated	No. of flute	Size (Ø) Min	Size (Ø) Max	Workpiece P Steel	Workpiece M Stainless steel	Workpiece K Cast iron	Workpiece N Non-ferrous metal	Workpiece S Heat resistant alloy, Titanium alloy	Workpiece H Hardened steel	page
I+ Endmill	General	Long radius	**IPLRE**		AlTiN	2	3.0	12.0	◎	○	◎		○		180
		Radius	**IPRE**		AlTiN	4	2.0	12.0	◎	○	◎		○		181
		Long radius	**IPLRE**		AlTiN	4	3.0	12.0	◎	○	◎		○		182
Z+ Endmill	General	Flat	**ZPFE**		AlCrSiN	2	1.0	20.0	◎	○	◎		○		185
		Short flat	**ZPSFE**		AlCrSiN	2	1.0	16.0	◎	○	◎		○		186
		Long flat	**ZPLFE**		AlCrSiN	2	2.0	20.0	◎	○	◎		○		187
		Long flute	**ZPLFE**		AlCrSiN	2	2.0	20.0	◎	○	◎		○		188
		Flat	**ZPFE**		AlCrSiN	4	1.0	20.0	◎	○	◎		○		189
		Short flat	**ZPSFE**		AlCrSiN	4	1.0	16.0	◎	○	◎		○		190
		Long flat	**ZPLFE**		AlCrSiN	4	2.0	20.0	◎	○	◎		○		191
		Long flute	**ZPLFE**		AlCrSiN	4	1.0	20.0	◎	○	◎		○		192
		Flat	**ZPFE**		AlCrSiN	3	2.0	25.0	◎	○	◎		○		193
					AlCrSiN	6	6.0	20.0	◎	○	◎		○		193
		Ball	**ZPBE**		AlCrSiN	2	0.8	20.0	◎	○	◎		○		194
		Long ball	**ZPLBE**		AlCrSiN	2	2.0	12.0	◎	○	◎		○		195
		Ball	**ZPBE**		AlCrSiN	4	2.0	20.0	◎	○	◎		○		196
		Radius	**ZPRE**		AlCrSiN	2	1.0	16.0	◎	○	◎		○		197
		Long radius	**ZPLRE**		AlCrSiN	2	6.0	16.0	◎	○	◎		○		198
		Radius	**ZPRE**		AlCrSiN	4	1.5	16.0	◎	○	◎		○		199
		Long radius	**ZPLRE**		AlCrSiN	4	6.0	16.0	◎	○	◎		○		200
R+ Endmill	Aluminum	Roughing	**RPAE**		Carbide, Non	3	6.0	25.0				◎			203
	General		**RPE-FP-H**		Carbide, TiAlN	4	5.0	20.0	◎	○	◎		○		203
			RPLE-FP-H		Carbide, TiAlN	4	5.0	20.0	◎	○	◎		○		204
			RPE-XG		Carbide, TiAlN	4	5.0	20.0	◎	○	◎		○		204
			RPE-FP-L		Carbide, TiAlN	4	5.0	20.0	◎	○	◎		○		205
			RPE-RG		Carbide, TiAlCrN	4	5.0	20.0	◎	○	◎		○		205
			RPE-RG		HSS, TiAlN	4	6.0	20.0	◎	○	◎		○		206
			RPE-FF		HSS, TiAlN	4	6.0	20.0	◎	○	◎		○		206

◎ : Excellent ○ : Good

KORLOY Endmill

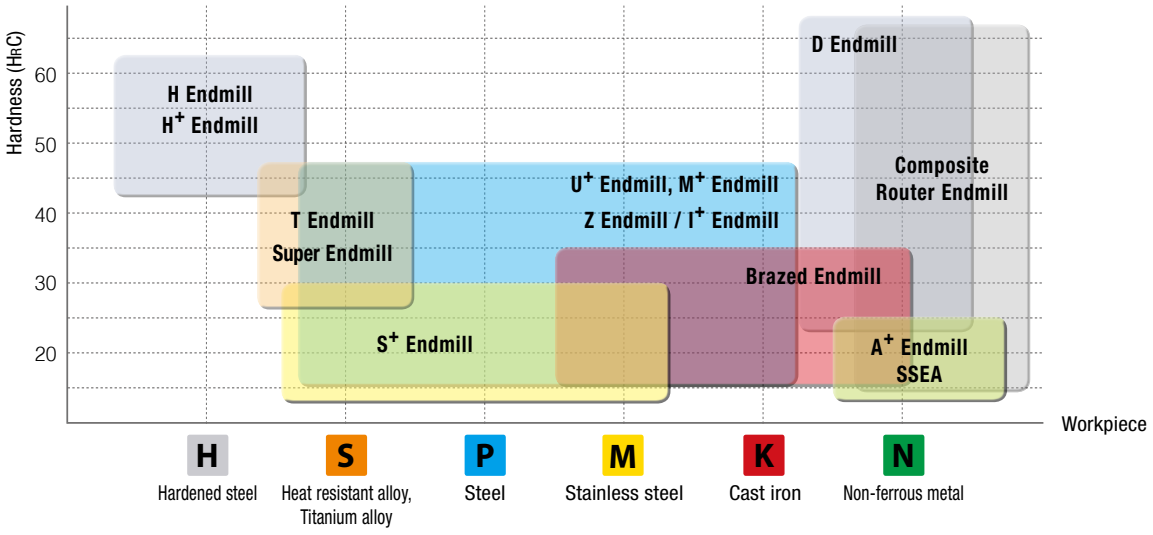
Type	Used	Shape	Designation	Figure	Coated	No. of flute	Size (Ø) Min	Size (Ø) Max	Workpiece P Steel	Workpiece M Stainless steel	Workpiece K Cast iron	Workpiece N Non-ferrous metal	Workpiece S Heat resistant alloy, Titanium alloy	Workpiece H Hardened steel	page
R+ Endmill	General	Roughing	**RPE-FP**		HSS, TiAlN	4	6.0	20.0	◎	○	◎		○		207
			RPE-RG		HSS, TiCN HSS, TiN	4	6.0	50.0	◎	○	◎		○		208
new S+ Endmill	STS	Flat	**SPFE**		AlTiCrN	4	1.0	12.0	○	◎	○		◎		213
		Radius	**SPRE**		AlTiCrN	4	1.0	12.0	○	◎	○		◎		214
A+ Endmill	Aluminum	Flat	**APFE**		Non	2	2.5	20.0	○			◎			216
					Non	3	2.5	20.0	○			◎			216
		Middle flat	**APMFE**		Non	2	3.0	20.0	○			◎			217
					Non	3	3.0	20.0	○			◎			217
		Long flat	**APLFE**		Non	2	3.0	20.0	○			◎			218
					Non	3	3.0	20.0	○			◎			218
		Ball	**APBE**		Non	2	1.0	12.0	○			◎			219
		Short flat	**AFE**		Non	3	1.0	20.0	○			◎			220
		Flat			Non	3	1.0	20.0	○			◎			221
		Long flat			Non	3	1.0	20.0	○			◎			222
		Roughing	**APRE**		Non	3	4.0	25.0	○			◎			223
		Wave roughing	**RPAE**		Carbide, Non	3	6.0	25.0				◎			224
Solid Endmill for Aluminum	Aluminum	Flat	**SSEA**		Non, Dlc	2	1.0	20.0	○			◎			226
					Non, Dlc	3	2.0	16.0	○			◎			226
		Ball	**SSBEA**		Non, Dlc	2	1.0	20.0	○			◎			227
D Endmill	Graphite, Ceramics	Flat	**DFE**		Diamond	2	1.0	12.0				◎			229
					Diamond	4	2.0	12.0				◎			230
		Ball	**DBE**		Diamond	2	0.6	12.0				◎			231
					Diamond	4	2.0	12.0				◎			232
Composite Router Endmill	Composite CFRP, GFRP	Flat	**CCDR**		Diamond	4	6.0	8.0				◎			234
					Diamond	6	10.0	12.0				◎			234
			CCR		Diamond	2	4.0	12.0				◎			235
			CCLR		Diamond	4	4.0	12.0				◎			236
			CCRR		Diamond	6	6.0	8.0				◎			237
					Diamond	8	10.0	12.0				◎			237

◎ : Excellent ○ : Good

Type	Used	Shape	Designation	Figure	Coated	No. of flute	Size (Ø) Min	Size (Ø) Max	Workpiece P Steel	Workpiece M Stainless steel	Workpiece K Cast iron	Workpiece N Non-ferrous metal	Workpiece S Heat resistant alloy, Titanium alloy	Workpiece H Hardened steel	page
T Endmill	Dental, Zirconia	Ball	TZBE		Diamond	2	0.6	3.0				◎			238
T Endmill	Dental, Metal	Ball	TTBE		Diamond	2	0.6	3.0					◎		238
T Endmill	Dental, Wax	Ball	TWBE		-	2	0.6	3.0				◎			238
new M+ Endmill	Multi	Flat	MPRE		TACrN	4	3.0	20.0	◎	○	◎		○		240
PCD Endmill	Nonferrous, High speed	Flat	PDE		-	1	4.6	6.0				◎			243
PCD Endmill	Nonferrous, High speed	Flat	PDE		-	2	6.0	12.0				◎			243
Brazed Endmill	Cast iron, Steel	Flat	ZSE		- (TiAlN)	2	14.0	50.0	○	○	◎		○		244
Brazed Endmill	Cast iron, Steel	Flat	ZSE		- (TiAlN)	3	14.0	50.0	○	○	◎		○		245 246
Brazed Endmill	Cast iron, Steel	Flat	ZSE		- (TiAlN)	4	14.0	50.0	○	○	◎		○		245
Brazed Endmill	Cast iron, Steel	Flat	ZSE		- (TiAlN)	6	34.0	50.0	○	○	◎		○		245
Brazed Endmill	Aluminum, Copper	Flat	ZSEA		-	2	15.0	50.0				◎			246
Brazed Endmill	Cast iron, Steel	Long flat	ZSEL		- (TiAlN)	2	14.0	50.0	○	○	◎		○		247
Brazed Endmill	Cast iron, Steel	Long flat	ZSEL		- (TiAlN)	4	16.0	40.0	○	○	◎		○		247
Brazed Endmill	Cast iron, Steel	Long flat	ZSEXL		- (TiAlN)	2	20.0	25.0	○	○	◎		○		247
Brazed Endmill	Cast iron, Steel	Ball	ZSBE		- (TiAlN)	2	13.0	50.0	○	○	◎		○		248

◎ : Excellent ○ : Good

Application area

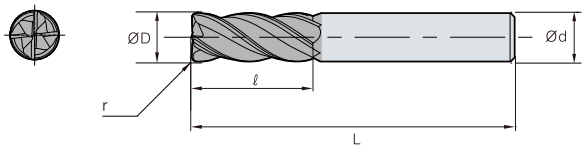


Super Endmill For HRSA

SRES4000 (Radius)

4 | H·A 35°/38° | h6 shank | SL Coating | Corner R ±0.01

ØD	Tolerance
Ø1.0 ~ Ø6.0	0.000 ~ -0.015
Ø6.1 ~ Ø20.0	0.000 ~ -0.020



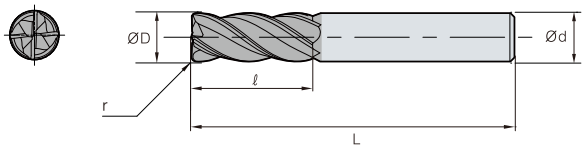
(mm)

	Designation	ØD	Ød	ℓ	L	r
SRES 4	4030-055-R02	3.0	6	8	55	0.2
	4030-055-R03	3.0	6	8	55	0.3
	4030-055-R05	3.0	6	8	55	0.5
	4040-055-R02	4.0	6	10	55	0.2
	4040-055-R03	4.0	6	10	55	0.3
	4040-055-R05	4.0	6	10	55	0.5
	4040-070-R02	4.0	6	10	70	0.2
	4040-070-R03	4.0	6	10	70	0.3
	4040-070-R05	4.0	6	10	70	0.5
	4050-055-R02	5.0	6	15	55	0.2
	4050-055-R03	5.0	6	15	55	0.3
	4050-055-R05	5.0	6	15	55	0.5
	4050-090-R02	5.0	6	15	90	0.2
	4050-090-R03	5.0	6	15	90	0.3
	4050-090-R05	5.0	6	15	90	0.5
	4060-060-R03	6.0	6	15	60	0.3
	4060-060-R05	6.0	6	15	60	0.5
	4060-060-R08	6.0	6	15	60	0.8
	4060-060-R10	6.0	6	15	60	1.0
	4060-060-R15	6.0	6	15	60	1.5
	4060-060-R20	6.0	6	15	60	2.0
	4060-090-R03	6.0	6	15	90	0.3
	4060-090-R05	6.0	6	15	90	0.5
	4060-090-R08	6.0	6	15	90	0.8
	4060-090-R10	6.0	6	15	90	1.0
	4060-090-R15	6.0	6	15	90	1.5
	4060-090-R20	6.0	6	15	90	2.0
	4080-070-R03	8.0	8	20	70	0.3
	4080-070-R05	8.0	8	20	70	0.5
	4080-070-R08	8.0	8	20	70	0.8
	4080-070-R10	8.0	8	20	70	1.0
	4080-070-R15	8.0	8	20	70	1.5
	4080-070-R20	8.0	8	20	70	2.0
	4080-070-R25	8.0	8	20	70	2.5
	4080-070-R30	8.0	8	20	70	3.0
	4080-100-R03	8.0	8	20	100	0.3

SRES4000 (Radius)

4 | H·A 35°/38° | h6 shank | SL Coating | Corner R ±0.01

ØD	Tolerance
Ø1.0 ~ Ø6.0	0.000 ~ -0.015
Ø6.1 ~ Ø20.0	0.000 ~ -0.020



(mm)

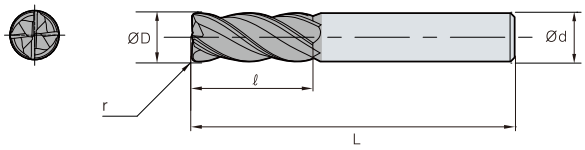
	Designation	ØD	Ød	ℓ	L	r
SRES 4	4080-100-R05	8.0	8	20	100	0.5
	4080-100-R08	8.0	8	20	100	0.8
	4080-100-R10	8.0	8	20	100	1.0
	4080-100-R15	8.0	8	20	100	1.5
	4080-100-R20	8.0	8	20	100	2.0
	4080-100-R25	8.0	8	20	100	2.5
	4080-100-R30	8.0	8	20	100	3.0
	4100-075-R03	10.0	10	25	75	0.3
	4100-075-R05	10.0	10	25	75	0.5
	4100-075-R08	10.0	10	25	75	0.8
	4100-075-R10	10.0	10	25	75	1.0
	4100-075-R15	10.0	10	25	75	1.5
	4100-075-R20	10.0	10	25	75	2.0
	4100-075-R25	10.0	10	25	75	2.5
	4100-075-R30	10.0	10	25	75	3.0
	4100-100-R03	10.0	10	25	100	0.3
	4100-100-R05	10.0	10	25	100	0.5
	4100-100-R08	10.0	10	25	100	0.8
	4100-100-R10	10.0	10	25	100	1.0
	4100-100-R15	10.0	10	25	100	1.5
	4100-100-R20	10.0	10	25	100	2.0
	4100-100-R25	10.0	10	25	100	2.5
	4100-100-R30	10.0	10	25	100	3.0
	4120-080-R05	12.0	12	30	80	0.5
	4120-080-R08	12.0	12	30	80	0.8
	4120-080-R10	12.0	12	30	80	1.0
	4120-080-R15	12.0	12	30	80	1.5
	4120-080-R20	12.0	12	30	80	2.0
	4120-080-R25	12.0	12	30	80	2.5
	4120-080-R30	12.0	12	30	80	3.0
	4120-080-R35	12.0	12	30	80	3.5
	4120-080-R40	12.0	12	30	80	4.0
	4120-110-R05	12.0	12	30	110	0.5
	4120-110-R08	12.0	12	30	110	0.8
	4120-110-R10	12.0	12	30	110	1.0
	4120-110-R15	12.0	12	30	110	1.5

Super Endmill For HRSA

SRES4000 (Radius)

4 | H·A 35°/38° | h6 shank | SL Coating | Corner R ±0.01

ØD	Tolerance
Ø1.0 ~ Ø6.0	0.000 ~ -0.015
Ø6.1 ~ Ø20.0	0.000 ~ -0.020



(mm)

	Designation	ØD	Ød	ℓ	L	r
SRES 4	4120-110-R20	12.0	12	30	110	2.0
	4120-110-R25	12.0	12	30	110	2.5
	4120-110-R30	12.0	12	30	110	3.0
	4120-110-R35	12.0	12	30	110	3.5
	4120-110-R40	12.0	12	30	110	4.0
	4140-090-R05	14.0	14	35	90	0.5
	4140-090-R08	14.0	14	35	90	0.8
	4140-090-R10	14.0	14	35	90	1.0
	4140-090-R15	14.0	14	35	90	1.5
	4140-090-R20	14.0	14	35	90	2.0
	4140-090-R30	14.0	14	35	90	3.0
	4140-150-R05	14.0	14	35	150	0.5
	4140-150-R08	14.0	14	35	150	0.8
	4140-150-R10	14.0	14	35	150	1.0
	4140-150-R15	14.0	14	35	150	1.5
	4140-150-R20	14.0	14	35	150	2.0
	4140-150-R30	14.0	14	35	150	3.0
	4160-100-R05	16.0	16	42	100	0.5
	4160-100-R08	16.0	16	42	100	0.8
	4160-100-R10	16.0	16	42	100	1.0
	4160-100-R15	16.0	16	42	100	1.5
	4160-100-R20	16.0	16	42	100	2.0
	4160-100-R25	16.0	16	42	100	2.5
	4160-100-R30	16.0	16	42	100	3.0
	4160-100-R35	16.0	16	42	100	3.5
	4160-100-R40	16.0	16	42	100	4.0
	4160-100-R50	16.0	16	42	100	5.0
	4160-100-R60	16.0	16	42	100	6.0
	4160-150-R05	16.0	16	42	150	0.5
	4160-150-R08	16.0	16	42	150	0.8
	4160-150-R10	16.0	16	42	150	1.0
	4160-150-R15	16.0	16	42	150	1.5
	4160-150-R20	16.0	16	42	150	2.0
	4160-150-R25	16.0	16	42	150	2.5
	4160-150-R30	16.0	16	42	150	3.0
	4160-150-R35	16.0	16	42	150	3.5

	Designation	ØD	Ød	ℓ	L	r
SRES 4	4160-150-R40	16.0	16	42	150	4.0
	4160-150-R50	16.0	16	42	150	5.0
	4160-150-R60	16.0	16	42	150	6.0
	4180-100-R05	18.0	20	45	100	0.5
	4180-100-R08	18.0	20	45	100	0.8
	4180-100-R10	18.0	20	45	100	1.0
	4180-100-R15	18.0	20	45	100	1.5
	4180-100-R20	18.0	20	45	100	2.0
	4180-100-R30	18.0	20	45	100	3.0
	4180-150-R05	18.0	20	45	150	0.5
	4180-150-R08	18.0	20	45	150	0.8
	4180-150-R10	18.0	20	45	150	1.0
	4180-150-R15	18.0	20	45	150	1.5
	4180-150-R20	18.0	20	45	150	2.0
	4180-150-R30	18.0	20	45	150	3.0
	4200-100-R05	20.0	20	48	100	0.5
	4200-100-R10	20.0	20	48	100	1.0
	4200-100-R15	20.0	20	48	100	1.5
	4200-100-R20	20.0	20	48	100	2.0
	4200-100-R25	20.0	20	48	100	2.5
	4200-100-R30	20.0	20	48	100	3.0
	4200-100-R35	20.0	20	48	100	3.5
	4200-100-R40	20.0	20	48	100	4.0
	4200-100-R50	20.0	20	48	100	5.0
	4200-100-R60	20.0	20	48	100	6.0
	4200-150-R05	20.0	20	48	150	0.5
	4200-150-R10	20.0	20	48	150	1.0
	4200-150-R15	20.0	20	48	150	1.5
	4200-150-R20	20.0	20	48	150	2.0
	4200-150-R25	20.0	20	48	150	2.5
	4200-150-R30	20.0	20	48	150	3.0
	4200-150-R35	20.0	20	48	150	3.5
	4200-150-R40	20.0	20	48	150	4.0
	4200-150-R50	20.0	20	48	150	5.0
	4200-150-R60	20.0	20	48	150	6.0

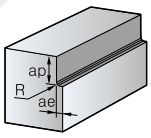
Super Endmill For HRSA

Recommended cutting conditions

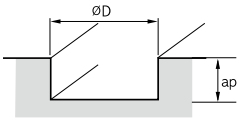
SRES4000 (Radius)

Workpiece / Conditions / Diameter (Ø)	Ni based heat resistant super alloy (Inconel718, 625)			
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
3.0	3,800	22 0	2,500	125
4.0	3,000	240	1,900	135
5.0	2,450	245	1,500	145
6.0	2,100	250	1,250	145
8.0	1,600	225	945	155
10.0	1,250	215	760	145
12.0	1,050	210	630	145
16.0	765	210	475	110
20.0	635	200	380	110

Application tip



■ Shouldering depth
- ap: ≤ 1.5D
- ae: ≤ 0.05D



■ Slotting depth
- ap: ≤ 0.2D

※ Notice

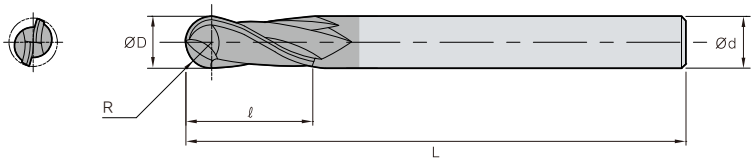
- Please adjust the recommended cutting conditions properly, according to the condition of your machines, the target shapes, and your purpose for machining.
- Please set the machine with high rigidity and check the workpiece clamping.
- Please select proper coolant for workpiece materials and check the pressure and amount of coolant enough for machining.
- In case of chattering, reduce RPM and feed rate by the same ratio.

H Endmill

PBE2000 (Ball)

2 | H·A 30° | h5 shank | Substrate PC303S

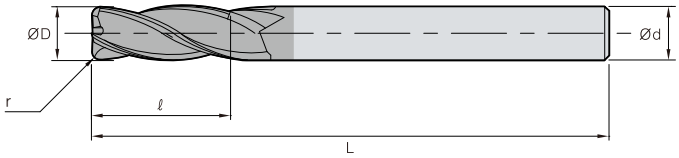
ØD	Tolerance
~ Ø5.9	0.000 ~ -0.015
Ø6.0 ~	0.000 ~ -0.025



(mm)

	Designation	R	ØD	Ød	ℓ	L
PBE	2005-040	0.25	0.5	6	1	40
2	2010-050	0.50	1.0	6	2.5	50
	2012-050	0.60	1.2	6	3	50
	2015-050	0.75	1.5	6	4	50
	2020-050	1.00	2.0	6	5	50
	2025-060	1.25	2.5	6	7	60
	2030-060	1.50	3.0	6	8	60
	2040-070	2.00	4.0	6	8	70
	2050-080	2.50	5.0	6	10	80
	2060-090	3.00	6.0	6	12	90
	2080-100	4.00	8.0	8	14	100
	2100-100	5.00	10.0	10	18	100
	2120-110	6.00	12.0	12	22	110

PRE4000 (Radius)



4 | H·A 30° | h5 shank | Substrate PC310U

ØD	Tolerance
~ Ø5.9	0.000 ~ -0.015
Ø6.0 ~	0.000 ~ -0.025

(mm)

	Designation	ØD	Ød	ℓ	L	r
PRE	4030-060-R01	3.0	6	8	60	0.1
4	4030-060-R02	3.0	6	8	60	0.2
	4030-060-R03	3.0	6	8	60	0.3
	4030-060-R05	3.0	6	8	60	0.5
	4040-070-R01	4.0	6	10	70	0.1
	4040-070-R02	4.0	6	10	70	0.2
	4040-070-R03	4.0	6	10	70	0.3
	4040-070-R05	4.0	6	10	70	0.5
	4040-070-R10	4.0	6	10	70	1.0
	4060-090-R02	6.0	6	15	90	0.2
	4060-090-R03	6.0	6	15	90	0.3
	4060-090-R05	6.0	6	15	90	0.5
	4060-090-R10	6.0	6	15	90	1.0
	4080-100-R02	8.0	8	20	100	0.2
	4080-100-R03	8.0	8	20	100	0.3
	4080-100-R05	8.0	8	20	100	0.5
	4080-100-R10	8.0	8	20	100	1.0
	4100-100-R03	10.0	10	25	100	0.3
	4100-100-R05	10.0	10	25	100	0.5
	4100-100-R10	10.0	10	25	100	1.0
	4120-110-R03	12.0	12	30	110	0.3
	4120-110-R05	12.0	12	30	110	0.5
	4120-110-R10	12.0	12	30	110	1.0

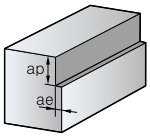
H Endmill

Recommended cutting conditions

PRE4000 (Radius)

Workpiece / Conditions / Diameter(Ø)	Pre-hardened steels HRC35~45		Hardened steels HRC45~55		High hardened steels HRC55~70	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
3.0	17,300	1,250	11,500	840	7,500	256
4.0	13,200	1,300	8,800	880	5,600	268
5.0	12,500	1,500	8,300	1,000	5,100	296
6.0	10,350	1,400	6,900	950	4,200	280
8.0	7,800	1,350	5,200	900	3,200	264
10.0	6,150	1,260	4,100	840	2,550	248
12.0	5,250	1,260	3,500	840	2,100	240

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**

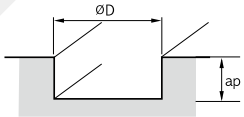
- ap = 0.1D
- ae = 0.03D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

PRE4000 (Radius)

Workpiece / Conditions / Diameter(Ø)	Pre-hardened steels HRC35~45		Hardened steels HRC45~55		High hardened steels HRC55~70	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
3.0	17,300	544	11,500	336	7,500	128
4.0	13,200	560	8,800	352	5,600	136
5.0	12,500	644	8,300	400	5,100	144
6.0	10,350	616	6,900	384	4,200	144
8.0	7,800	576	5,200	356	3,200	132
10.0	6,150	544	4,100	332	2,550	124
12.0	5,250	544	3,500	332	2,100	124

Application tip



■ **Slotting depth(ap)**

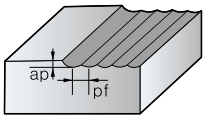
- ap = 0.05D
- ae = 1.0D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

PRE2000 (Ball)

Workpiece / Conditions / Diameter(Ø)	Pre-hardened steels HRC35~45		Hardened steels HRC45~55		High hardened Steels HRC55~70	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
0.5	35,000	1,470	31,500	1,330	28,000	1,050
1.0	35,000	2,940	31,500	2,660	28,000	2,000
1.2	33,600	3,010	30,100	2,695	26,600	2,100
1.5	33,600	3,150	30,100	2,800	25,900	2,150
2.0	33,460	3,360	28,000	2,800	24,500	2,200
2.5	25,900	3,710	22,400	2,800	17,500	2,200
3.0	22,260	3,710	18,550	2,800	16,500	2,200
4.0	16,730	3,710	14,000	2,800	13,000	2,200
5.0	17,800	4,900	15,000	3,750	12,500	2,100
6.0	13,400	4,100	11,000	3,100	10,000	2,500
8.0	10,700	3,500	9,000	2,700	8,000	2,150
10.0	8,900	3,100	7,500	2,400	6,600	1,900
12.0	6,680	2,500	5,600	1,900	5,000	1,550

Application tip

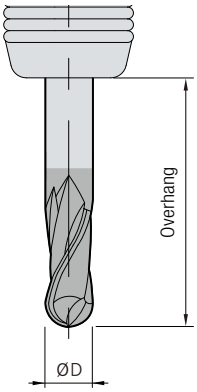


- ap = 0.03D
- pf = 0.05D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

Cutting condition by overhang

- Cutting conditions of the shank taper type in case of being clamped at neck
  - When the overhang is increased by 1D, decrease R.P.M and feed 10%
- In case of the straight type adjust conditions according to the overhang
  - Ex: When the overhang is 3D and is increased by 1D, decrease R.P.M and feed 10%



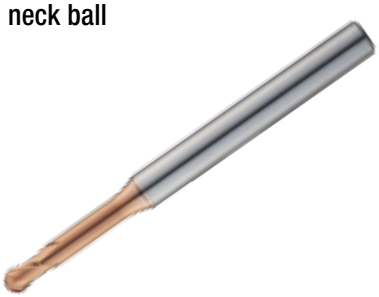
Notice

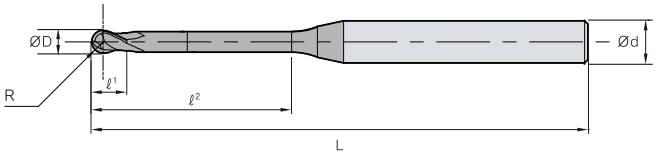
- Cutting conditions are up to the machine's condition and the shape of cutting
- Use cutting fluid that is proper to the workpiece and produces few temperature reactions

H+ Endmill

HPRBE2000 (Ball)

Long neck ball





2 | H·A 30° | h5 shank | Substrate PC305H

Category	Range	Tolerance
ØD	All	0.000 ~ -0.015
R	-	±0.005

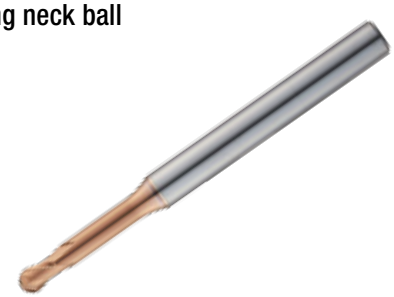
(mm)

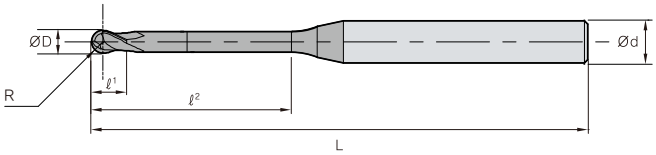
	Designation	R	ØD	Ød	ℓ1	ℓ2	L
HPRBE 2	2001-045-N0.2S04	0.05	0.1	4	0.08	0.2	45
	2001-045-N0.3S04	0.05	0.1	4	0.08	0.3	45
	2001-045-N0.5S04	0.05	0.1	4	0.08	0.5	45
	2002-050-N0.5S04	0.10	0.2	4	0.15	0.5	50
	2002-050-N1S04	0.10	0.2	4	0.15	1	50
	2002-050-N1.5S04	0.10	0.2	4	0.15	1.5	50
	2002-050-N2S04	0.10	0.2	4	0.15	2	50
	2002-050-N2.5S04	0.10	0.2	4	0.15	2.5	50
	2002-050-N3S04	0.10	0.2	4	0.15	3	50
	2003-050-N1S04	0.15	0.3	4	0.25	1	50
	2003-050-N1.5S04	0.15	0.3	4	0.25	1.5	50
	2003-050-N2S04	0.15	0.3	4	0.25	2	50
	2003-050-N2.5S04	0.15	0.3	4	0.25	2.5	50
	2003-050-N3S04	0.15	0.3	4	0.25	3	50
	2004-050-N1S04	0.20	0.4	4	0.3	1	50
	2004-050-N1.5S04	0.20	0.4	4	0.3	1.5	50
	2004-050-N2S04	0.20	0.4	4	0.3	2	50
	2004-050-N2.5S04	0.20	0.4	4	0.3	2.5	50
	2004-050-N3S04	0.20	0.4	4	0.3	3	50
	2004-050-N3.5S04	0.20	0.4	4	0.3	3.5	50
	2004-050-N4S04	0.20	0.4	4	0.3	4	50
	2004-050-N4.5S04	0.20	0.4	4	0.3	4.5	50
	2005-050-N1S04	0.25	0.5	4	0.35	1	50
	2005-050-N2S04	0.25	0.5	4	0.35	2	50
	2005-050-N3S04	0.25	0.5	4	0.35	3	50
	2005-050-N4S04	0.25	0.5	4	0.35	4	50
	2005-050-N5S04	0.25	0.5	4	0.35	5	50
	2005-050-N6S04	0.25	0.5	4	0.35	6	50
	2005-050-N8S04	0.25	0.5	4	0.35	8	50
	2006-050-N1S04	0.30	0.6	4	0.4	1	50
	2006-050-N10S04	0.30	0.6	4	0.4	10	50
	2006-050-N12S04	0.30	0.6	4	0.4	12	50
	2006-050-N2S04	0.30	0.6	4	0.4	2	50
	2006-050-N3S04	0.30	0.6	4	0.4	3	50

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
HPRBE 2	2006-050-N4S04	0.30	0.6	4	0.4	4	50
	2006-050-N5S04	0.30	0.6	4	0.4	5	50
	2006-050-N6S04	0.30	0.6	4	0.4	6	50
	2006-050-N7S04	0.30	0.6	4	0.4	7	50
	2006-050-N8S04	0.30	0.6	4	0.4	8	50
	2006-050-N9S04	0.30	0.6	4	0.4	9	50
	2008-050-N10S04	0.40	0.8	4	0.5	10	50
	2008-050-N2S04	0.40	0.8	4	0.5	2	50
	2008-050-N4S04	0.40	0.8	4	0.5	4	50
	2008-050-N5S04	0.40	0.8	4	0.5	5	50
	2008-050-N6S04	0.40	0.8	4	0.5	6	50
	2008-050-N8S04	0.40	0.8	4	0.5	8	50
	2010-050-N10S04	0.50	1.0	4	0.8	10	50
	2010-055-N12S04	0.50	1.0	4	0.8	12	55
	2010-055-N14S04	0.50	1.0	4	0.8	14	55
	2010-055-N16S04	0.50	1.0	4	0.8	16	55
	2010-060-N18S04	0.50	1.0	4	0.8	18	60
	2010-050-N2S04	0.50	1.0	4	0.8	2	50
	2010-060-N20S04	0.50	1.0	4	0.8	20	60
	2010-050-N3S04	0.50	1.0	4	0.8	3	50
	2010-050-N4S04	0.50	1.0	4	0.8	4	50
	2010-050-N5S04	0.50	1.0	4	0.8	5	50
	2010-050-N6S04	0.50	1.0	4	0.8	6	50
	2010-050-N7S04	0.50	1.0	4	0.8	7	50
	2010-050-N8S04	0.50	1.0	4	0.8	8	50
	2010-050-N9S04	0.50	1.0	4	0.8	9	50
	2012-050-N10S04	0.60	1.2	4	1.1	10	50
	2012-055-N12S04	0.60	1.2	4	1.1	12	55
	2012-050-N4S04	0.60	1.2	4	1.1	4	50
	2012-050-N6S04	0.60	1.2	4	1.1	6	50
	2012-050-N8S04	0.60	1.2	4	1.1	8	50
	2014-055-N12S04	0.70	1.4	4	1.3	12	55
	2014-055-N16S04	0.70	1.4	4	1.3	16	55
	2014-050-N8S04	0.70	1.4	4	1.3	8	50

HPRBE2000 (Ball)

Long neck ball





2 | H·A 30° | h5 shank | Substrate PC305H

Category	Range	Tolerance
ØD	All	0.000 ~ -0.015
R	-	±0.005

(mm)

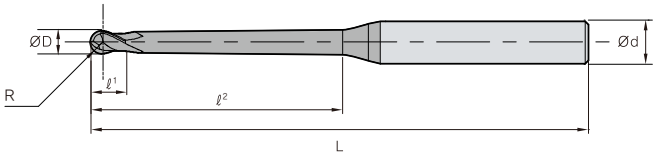
	Designation	R	ØD	Ød	ℓ1	ℓ2	L
HPRBE 2	2015-050-N10S04	0.75	1.5	4	1.35	10	50
	2015-055-N12S04	0.75	1.5	4	1.35	12	55
	2015-055-N14S04	0.75	1.5	4	1.35	14	55
	2015-055-N16S04	0.75	1.5	4	1.35	16	55
	2015-060-N20S04	0.75	1.5	4	1.35	20	60
	2015-050-N4S04	0.75	1.5	4	1.35	4	50
	2015-050-N6S04	0.75	1.5	4	1.35	6	50
	2015-050-N8S04	0.75	1.5	4	1.35	8	50
	2016-055-N10S04	0.80	1.6	4	1.4	10	55
	2016-055-N12S04	0.80	1.6	4	1.4	12	55
	2016-055-N16S04	0.80	1.6	4	1.4	16	55
	2016-060-N20S04	0.80	1.6	4	1.4	20	60
	2016-050-N8S04	0.80	1.6	4	1.4	8	50
	2018-055-N12S04	0.90	1.8	4	1.6	12	55
	2018-055-N16S04	0.90	1.8	4	1.6	16	55
	2018-060-N20S04	0.90	1.8	4	1.6	20	60
	2018-050-N8S04	0.90	1.8	4	1.8	8	50
	2020-050-N10S04	1.00	2.0	4	3	10	50
	2020-055-N12S04	1.00	2.0	4	3	12	55
	2020-055-N14S04	1.00	2.0	4	3	14	55
	2020-055-N16S04	1.00	2.0	4	3	16	55
	2020-060-N18S04	1.00	2.0	4	3	18	60
	2020-060-N20S04	1.00	2.0	4	3	20	60
	2020-060-N22S04	1.00	2.0	4	3	22	60
	2020-065-N25S04	1.00	2.0	4	3	25	65
	2020-050-N3S04	1.00	2.0	4	3	3	50
	2020-070-N30S04	1.00	2.0	4	3	30	70
	2020-075-N35S04	1.00	2.0	4	3	35	75
	2020-050-N4S04	1.00	2.0	4	3	4	50
	2020-080-N40S04	1.00	2.0	4	3	40	80

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
HPRBE 2	2020-050-N6S04	1.00	2.0	4	3	6	50
	2020-050-N8S04	1.00	2.0	4	3	8	50
	2025-050-N10S04	1.25	2.5	4	4	10	50
	2025-055-N16S04	1.25	2.5	4	4	16	55
	2025-060-N20S04	1.25	2.5	4	4	20	60
	2030-055-N10S06	1.50	3.0	6	4	10	55
	2030-060-N13S06	1.50	3.0	6	4	13	60
	2030-060-N16S06	1.50	3.0	6	4	16	60
	2030-060-N18S06	1.50	3.0	6	4	18	60
	2030-065-N20S06	1.50	3.0	6	4	20	65
	2030-070-N25S06	1.50	3.0	6	4	25	70
	2030-075-N30S06	1.50	3.0	6	4	30	75
	2030-080-N35S06	1.50	3.0	6	4	35	80
	2030-055-N8S06	1.50	3.0	6	4	8	55
	2040-055-N10S06	2.00	4.0	6	5	10	55
	2040-060-N13S06	2.00	4.0	6	5	13	60
	2040-060-N16S06	2.00	4.0	6	5	16	60
	2040-065-N20S06	2.00	4.0	6	5	20	65
	2040-070-N25S06	2.00	4.0	6	5	25	70
	2040-075-N30S06	2.00	4.0	6	5	30	75
	2040-080-N35S06	2.00	4.0	6	5	35	80
	2040-080-N40S06	2.00	4.0	6	5	40	80
	2040-090-N45S06	2.00	4.0	6	5	45	90
	2040-100-N50S06	2.00	4.0	6	5	50	100
	2050-065-N20S06	2.50	5.0	6	6	20	65
	2050-070-N25S06	2.50	5.0	6	6	25	70
	2050-075-N30S06	2.50	5.0	6	6	30	75
	2050-080-N35S06	2.50	5.0	6	6	35	80
	2050-090-N40S06	2.50	5.0	6	6	40	90

H+ Endmill

HPRBE2000-TN (Ball)

Taper neck ball



Category	Range	Tolerance
ØD	All	0.000 ~ -0.015
R	~ R6.0	±0.005
	R6.0 ~	±0.010

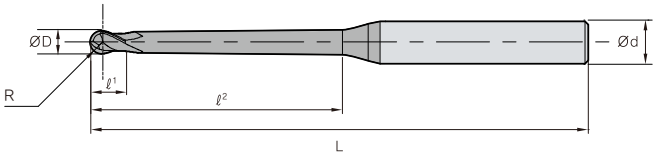
(mm)

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
HPRBE 2	2002-050-N1.5S04-TN04	0.10	0.2	4	0.15	1.5	50
	2002-050-N1S04-TN04	0.10	0.2	4	0.15	1	50
	2002-050-N2.5S04-TN09	0.10	0.2	4	0.15	2.5	50
	2002-050-N2S04-TN09	0.10	0.2	4	0.15	2	50
	2003-050-N2S04-TN04	0.15	0.3	4	0.25	2	50
	2003-050-N3S04-TN09	0.15	0.3	4	0.25	3	50
	2003-050-N4S04-TN09	0.15	0.3	4	0.25	4	50
	2004-050-N2S04-TN04	0.20	0.4	4	0.3	2	50
	2004-050-N3S04-TN04	0.20	0.4	4	0.3	3	50
	2004-050-N4S04-TN04	0.20	0.4	4	0.3	4	50
	2004-050-N4S04-TN09	0.20	0.4	4	0.3	4	50
	2004-050-N5S04-TN04	0.20	0.4	4	0.3	5	50
	2004-050-N5S04-TN09	0.20	0.4	4	0.3	5	50
	2005-050-N12S04-TN09	0.25	0.5	4	0.35	12	50
	2005-050-N4S04-TN04	0.25	0.5	4	0.35	4	50
	20054-050-N2S04-TN04	0.25	0.5	4	0.35	8	50
	20054-050-N4S04-TN04	0.27	0.54	4	0.37	2	50
	20054-050-N5S04-TN04	0.27	0.54	4	0.37	4	50
	20054-050-N6.5S04-TN04	0.27	0.54	4	0.37	5	50
	20054-050-N6S04-TN04	0.27	0.54	4	0.37	6.5	50
	20054-050-N7S04-TN04	0.27	0.54	4	0.37	6	50
	2005-050-N8S04-TN09	0.27	0.54	4	0.37	7	50
	2006-050-N10S04-TN04	0.30	0.6	4	0.4	10	50
	2006-050-N10S04-TN09	0.30	0.6	4	0.4	10	50
	2006-055-N12S04-TN09	0.30	0.6	4	0.4	12	55
	2006-055-N15S04-TN04	0.30	0.6	4	0.4	15	55
	2006-055-N15S04-TN09	0.30	0.6	4	0.4	15	55
	2006-050-N2S04-TN04	0.30	0.6	4	0.4	2	50
	2006-050-N4S04-TN04	0.30	0.6	4	0.4	4	50
	2006-050-N6S04-TN04	0.30	0.6	4	0.4	6	50
	2006-050-N6S04-TN09	0.30	0.6	4	0.4	6	50
	2006-050-N8S04-TN09	0.30	0.6	4	0.4	8	50
	2008-055-N12S04-TN09	0.40	0.8	4	0.5	12	55
	2008-055-N16S04-TN09	0.40	0.8	4	0.5	16	55

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
HPRBE 2	2008-050-N4S04-TN04	0.40	0.8	4	0.5	4	50
	2008-050-N6S04-TN04	0.40	0.8	4	0.5	6	50
	2008-050-N8S04-TN09	0.40	0.8	4	0.5	8	50
	2009-055-N12S04-TN04	0.45	0.9	4	0.6	12	55
	2009-060-N16S04-TN04	0.45	0.9	4	0.6	16	60
	2009-065-N18S04-TN04	0.45	0.9	4	0.6	18	65
	2009-065-N20S04-TN04	0.45	0.9	4	0.6	20	65
	2009-065-N22S04-TN04	0.45	0.9	4	0.6	22	65
	2009-070-N24S04-TN04	0.45	0.9	4	0.6	24	70
	2009-050-N4S04-TN04	0.45	0.9	4	0.6	4	50
	2009-055-N8S04-TN04	0.45	0.9	4	0.6	8	55
	2010-055-N10S06-TN04	0.50	1.0	6	0.8	10	55
	2010-055-N10S06-TN09	0.50	1.0	6	0.8	10	55
	2010-060-N15S06-TN09	0.50	1.0	6	0.8	15	60
	2010-065-N20S06-TN04	0.50	1.0	6	0.8	20	65
	2010-065-N20S06-TN09	0.50	1.0	6	0.8	20	65
	2010-070-N25S06-TN09	0.50	1.0	6	0.8	25	70
	2010-075-N30S06-TN04	0.50	1.0	6	0.8	30	75
	2010-075-N30S06-TN09	0.50	1.0	6	0.8	30	75
	2010-080-N35S06-TN09	0.50	1.0	6	0.8	35	80
	2010-085-N40S06-TN09	0.50	1.0	6	0.8	40	85
	2010-095-N50S06-TN09	0.50	1.0	6	0.8	50	95
	2010-105-N60S06-TN09	0.50	1.0	6	0.8	60	105
	2010-050-N6S06-TN04	0.50	1.0	6	0.8	6	50
	2010-115-N70S06-TN09	0.50	1.0	6	0.8	70	115
	2010-055-N8S06-TN04	0.50	1.0	6	0.8	8	55
	2015-055-N10S06-TN04	0.75	1.5	6	1.35	10	55
	2015-055-N12S06-TN04	0.75	1.5	6	1.35	12	55
	2015-060-N15S06-TN09	0.75	1.5	6	1.35	15	60
	2015-065-N20S06-TN09	0.75	1.5	6	1.35	20	65
	2015-075-N30S06-TN09	0.75	1.5	6	1.35	30	75
	2015-055-N8S06-TN04	0.75	1.5	6	1.35	8	55
	2018-055-N12S06-TN04	0.90	1.8	6	1.6	12	55
	2018-060-N16S06-TN04	0.90	1.8	6	1.6	16	60

HPRBE2000-TN (Ball)

Taper neck ball



2 | H·A 30° | h5 shank | Substrate PC305H

Category	Range	Tolerance
ØD	All	0.000 ~ -0.015
R	~ R6.0	±0.005
	R6.0 ~	±0.010

(mm)

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
HPRBE 2	2018-065-N20S06-TN04	0.9	1.8	6	1.6	20	65
	2018-065-N24S06-TN04	0.9	1.8	6	1.6	24	65
	2018-070-N28S06-TN04	0.9	1.8	6	1.6	28	70
	2018-070-N32S06-TN04	0.9	1.8	6	1.6	32	70
	2018-075-N36S06-TN04	0.9	1.8	6	1.6	36	75
	2018-080-N38S06-TN04	0.9	1.8	6	1.6	38	80
	2018-080-N40S06-TN04	0.9	1.8	6	1.6	40	80
	2018-050-N4S06-TN04	0.9	1.8	6	1.6	4	50
	2018-050-N8S06-TN04	0.9	1.8	6	1.6	8	50
	2020-055-N12S06-TN04	1.0	2.0	6	1.7	12	55
	2020-060-N16S06-TN04	1.0	2.0	6	1.7	16	60
	2020-065-N20S06-TN04	1.0	2.0	6	1.7	20	65
	2020-065-N20S06-TN09	1.0	2.0	6	1.7	20	65
	2020-065-N25S06-TN09	1.0	2.0	6	1.7	25	65
	2020-070-N30S06-TN04	1.0	2.0	6	1.7	30	70
	2020-070-N30S06-TN09	1.0	2.0	6	1.7	30	70
	2020-075-N35S06-TN09	1.0	2.0	6	1.7	35	75
	2020-080-N40S06-TN04	1.0	2.0	6	1.7	40	80
	2020-080-N40S06-TN09	1.0	2.0	6	1.7	40	80
	2020-090-N50S06-TN09	1.0	2.0	6	1.7	50	90
	2020-100-N60S06-TN09	1.0	2.0	6	1.7	60	100
	2020-110-N70S06-TN09	1.0	2.0	6	1.7	70	110
	2020-050-N8S06-TN04	1.0	2.0	6	1.7	8	50
	2030-055-N16S06-TN04	1.5	3.0	6	2.5	16	55
	2030-060-N20S06-TN04	1.5	3.0	6	2.5	20	60
	2030-070-N30S06-TN04	1.5	3.0	6	2.5	30	70
	2030-070-N30S06-TN09	1.5	3.0	6	2.5	30	70

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
HPRBE 2	2030-080-N40S06-TN04	1.5	3.0	6	2.5	40	80
	2030-080-N40S06-TN09	1.5	3.0	6	2.5	40	80
	2030-090-N50S06-TN09	1.5	3.0	6	2.5	50	90
	2030-100-N60S06-TN09	1.5	3.0	6	2.5	60	100
	2030-110-N70S06-TN09	1.5	3.0	6	2.5	70	110
	2030-050-N8S06-TN04	1.5	3.0	6	2.5	8	50
	2040-070-N20S08-TN10	2.0	4.0	8	8	20	70
	2040-080-N30S08-TN10	2.0	4.0	8	8	30	80
	2040-090-N40S08-TN10	2.0	4.0	8	8	40	90
	2040-100-N50S08-TN10	2.0	4.0	8	8	50	100
	2040-110-N60S08-TN10	2.0	4.0	8	8	60	110
	2050-080-N30S08-TN10	2.5	5.0	8	10	30	80
	2050-090-N40S08-TN10	2.5	5.0	8	10	40	90
	2050-110-N60S08-TN10	2.5	5.0	8	10	60	110
	2060-080-N30S08-TN10	3.0	6.0	8	12	30	80
	2060-090-N40S08-TN10	3.0	6.0	8	12	40	90
	2060-100-N50S08-TN10	3.0	6.0	8	12	50	100
	2060-110-S10-TN10	3.0	6.0	10	12	60	110
	2060-120-S10-TN10	3.0	6.0	10	12	70	120
	2060-130-S10-TN10	3.0	6.0	10	12	80	130
	2080-110-S10-TN10	4.0	8.0	10	14	50	110
	2080-120-S10-TN10	4.0	8.0	10	14	60	120
	2080-130-S10-TN10	4.0	8.0	10	14	70	130
	2080-140-S12-TN10	4.0	8.0	12	14	80	140
	2100-130-S12-TN10	5.0	10.0	12	18	60	130
	2100-140-S12-TN10	5.0	10.0	12	18	75	140

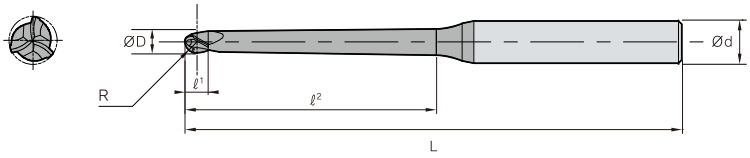
H+ Endmill

HPRBE3000-TN (Ball)

Taper neck ball

3 | H·A 30° | h5 shank | Substrate PC305H

Category	Range	Tolerance
ØD	All	0.000 ~ -0.015
R	-	±0.010



(mm)

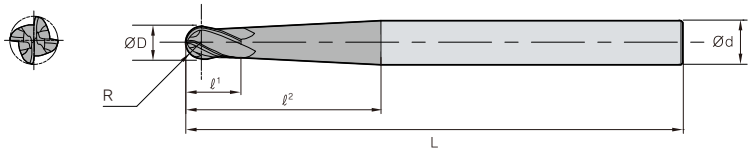
	Designation	R	ØD	Ød	ℓ1	ℓ2	L
HPRBE 3	3020-055-N12S06-TN04	1.0	2.0	6	1.7	12	55
	3020-060-N16S06-TN04	1.0	2.0	6	1.7	16	60
	3020-065-N20S06-TN04	1.0	2.0	6	1.7	20	65
	3020-065-N20S06-TN09	1.0	2.0	6	1.7	20	65
	3020-065-N25S06-TN09	1.0	2.0	6	1.7	25	65
	3020-070-N30S06-TN04	1.0	2.0	6	1.7	30	70
	3020-070-N30S06-TN09	1.0	2.0	6	1.7	30	70
	3020-075-N35S06-TN09	1.0	2.0	6	1.7	35	75
	3020-080-N40S06-TN04	1.0	2.0	6	1.7	40	80
	3020-080-N40S06-TN09	1.0	2.0	6	1.7	40	80
	3020-090-N50S06-TN09	1.0	2.0	6	1.7	50	90
	3020-100-N60S06-TN09	1.0	2.0	6	1.7	60	100
	3020-110-N70S06-TN09	1.0	2.0	6	1.7	70	110
	3020-050-N8S06-TN04	1.0	2.0	6	1.7	8	50
	3030-055-N16S06-TN04	1.5	3.0	6	2.5	16	55
	3030-060-N20S06-TN04	1.5	3.0	6	2.5	20	60
	3030-070-N30S06-TN04	1.5	3.0	6	2.5	30	70
	3030-070-N30S06-TN09	1.5	3.0	6	2.5	30	70
	3030-080-N40S06-TN04	1.5	3.0	6	2.5	40	80
	3030-080-N40S06-TN09	1.5	3.0	6	2.5	40	80
	3030-090-N50S06-TN09	1.5	3.0	6	2.5	50	90
	3030-100-N60S06-TN09	1.5	3.0	6	2.5	60	100
	3030-110-N70S06-TN09	1.5	3.0	6	2.5	70	110
	3030-050-N8S06-TN04	1.5	3.0	6	2.5	8	50
	3040-070-N20S08-TN10	2.0	4.0	8	8	20	70
	3040-080-N30S08-TN10	2.0	4.0	8	8	30	80
	3040-090-N40S08-TN10	2.0	4.0	8	8	40	90
	3040-100-N50S08-TN10	2.0	4.0	8	8	50	100
	3040-110-N60S08-TN10	2.0	4.0	8	8	60	110
	3050-080-N30S08-TN10	2.5	5.0	8	10	30	80
	3050-090-N40S08-TN10	2.5	5.0	8	10	40	90
	3050-110-N60S08-TN10	2.5	5.0	8	10	60	110

HPRBE4000-TN (Ball)

Taper neck ball

4 | H·A 15° | h5 shank | Substrate PC305H

Category	Range	Tolerance
ØD	All	0.000 ~ -0.015
R	-	±0.010



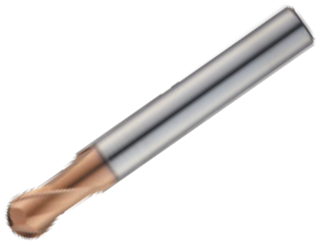
(mm)

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
HPRBE	4020-060-N25S04-TN25	1.0	2.0	4	2	25	60
4	4020-060-N18S04-TN35	1.0	2.0	4	2	18	60
	4025-060-N20S04-TN25	1.25	2.5	4	3	20	60
	4025-060-N17S04-TN30	1.25	2.5	4	3	17	60
	4030-070-N46S06-TN20	1.5	3.0	6	3	46	70
	4030-070-N37S06-TN25	1.5	3.0	6	3	37	70
	4040-070-N33S06-TN20	2.0	4.0	6	4	33	70
	4040-070-N27S06-TN25	2.0	4.0	6	4	27	70
	4050-070-N16S06-TN25	2.5	5.0	6	5	16	70
	4060-100-N44S08-TN15	3.0	6.0	8	6	44	100
	4060-100-N29S08-TN25	3.0	6.0	8	6	29	100
	4080-100-N46S10-TN15	4.0	8.0	10	8	46	100
	4080-100-N31S10-TN25	4.0	8.0	10	8	31	100
	4100-110-N48S12-TN15	5.0	10.0	12	10	48	110
	4100-110-N33S12-TN25	5.0	10.0	12	10	33	110

H+ Endmill

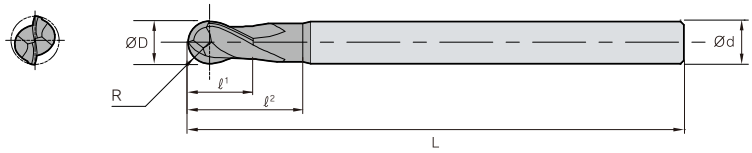
HPBE2000 (Ball)

General ball



2 | H·A 30° | h5 shank | Substrate PC305H

Category	Range	Tolerance
ØD	All	0.00 ~ -0.02
R	~ R3.0	±0.005
	R3.0 ~	±0.010

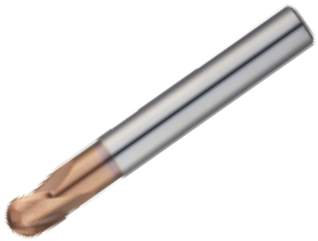


(mm)

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
HPBE	2001-040-S04	0.05	0.1	4	0.15	-	40
2	2002-040-S04	0.10	0.2	4	0.3	-	40
	2003-040-S04	0.15	0.3	4	0.5	-	40
	2004-040-S04	0.20	0.4	4	0.6	-	40
	2005-040-S04	0.25	0.5	4	0.7	-	40
	2006-040-S04	0.30	0.6	4	0.9	-	40
	2007-040-S04	0.35	0.7	4	1.1	-	40
	2008-040-S04	0.40	0.8	4	1.2	-	40
	2009-040-S04	0.45	0.9	4	1.4	-	40
	2010-050-S06	0.50	1.0	6	1.5	3	50
	2010-045-S04	0.50	1.0	4	1.5	-	45
	2015-050-S06	0.75	1.5	6	2	4	50
	2015-045-S04	0.75	1.5	4	2	-	45
	2020-050-S06	1.00	2.0	6	2.5	5	50
	2020-045-S04	1.00	2.0	4	2.5	-	45
	2025-050-S06	1.25	2.5	6	3	7	50
	2030-060-S06	1.50	3.0	6	4	10	60
	2030-050-S06	1.50	3.0	6	4	10	50
	2030-045-S04	1.50	3.0	4	4	-	45
	2030-070-S06	1.50	3.0	6	4	10	70
	2040-060-S06	2.00	4.0	6	5	10	60
	2040-050-S06	2.00	4.0	6	5	10	50
	2040-045-S04	2.00	4.0	4	5	-	45
	2040-070-S06	2.00	4.0	6	5	10	70
	2050-060-S06	2.50	5.0	6	6	12	60
	2060-060-S06	3.00	6.0	6	7	12	60
	2060-090-S06	3.00	6.0	6	7	12	90
	2080-070-S08	4.00	8.0	8	9	15	70
	2080-100-S08	4.00	8.0	8	9	15	100
	2100-075-S10	5.00	10.0	10	11	25	75
	2100-100-S10	5.00	10.0	10	11	25	100
	2120-080-S12	6.00	12.0	12	12	25	80
	2120-110-S12	6.00	12.0	12	12	25	110

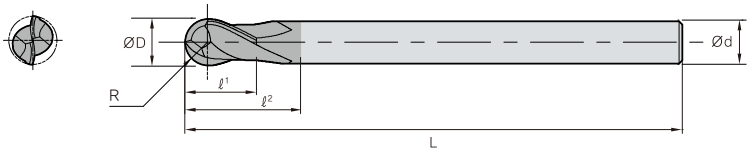
HPLBE2000 (Ball)

Long ball



2 | H·A 30° | h5 shank | Substrate PC305H

Category	Range	Tolerance
ØD	All	0.00 ~ -0.02
R	~ R3.0	±0.005
	R3.0 ~	±0.010



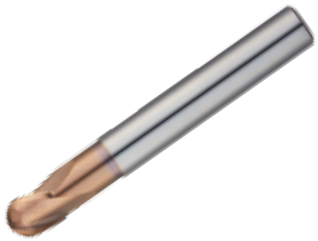
(mm)

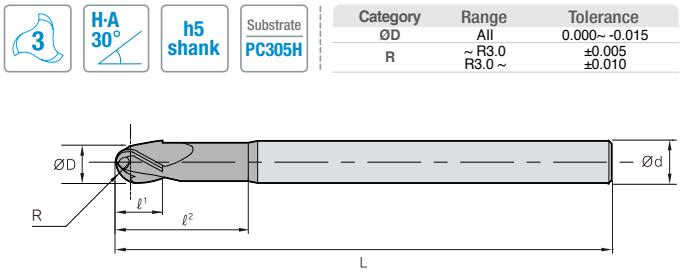
	Designation	R	ØD	Ød	ℓ1	L
HPLBE	2010-050-S06	0.50	1.0	6	2.5	50
2	2010-040-S06	0.50	1.0	6	1.5	40
	2010-050-S04	0.50	1.0	4	2.5	50
	2012-050-S06	0.60	1.2	6	3	50
	2015-050-S06	0.75	1.5	6	4	50
	2015-040-S06	0.75	1.5	6	2.5	40
	2015-050-S04	0.75	1.5	4	2.5	50
	2020-050-S06	1.00	2.0	6	5	50
	2020-040-S06	1.00	2.0	6	3	40
	2020-050-S04	1.00	2.0	4	5	50
	2025-060-S06	1.25	2.5	6	7	60
	2030-060-S06	1.50	3.0	6	8	60
	2030-050-S06	1.50	3.0	6	4.5	50
	2030-060-S04	1.50	3.0	4	8	60
	2040-070-S06	2.00	4.0	6	8	70
	2040-050-S06	2.00	4.0	6	6	50
	2050-080-S06	2.50	5.0	6	10	80
	2050-050-S06	2.50	5.0	6	7.5	50
	2060-090-S06	3.00	6.0	6	12	90
	2060-050-S06	3.00	6.0	6	9	50
	2080-050-S08	4.00	8.0	8	12	50
	2080-100-S08	4.00	8.0	8	14	100
	2100-100-S10	5.00	10.0	10	18	100
	2100-060-S10	5.00	10.0	10	15	60
	2120-110-S12	6.00	12.0	12	22	110
	2120-060-S12	6.00	12.0	12	18	60

H+ Endmill

HPBE3000 (Ball)

General ball





3 | H·A 30° | h5 shank | Substrate PC305H

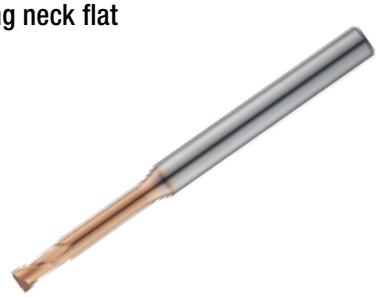
Category	Range	Tolerance
ØD	All	0.000~ -0.015
R	~ R3.0	±0.005
	R3.0 ~	±0.010

(mm)

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
HPBE	3020-050-S06	1.00	2.0	6	2.5	5	50
3	3025-050-S06	1.25	2.5	6	3	7	50
	3030-060-S06	1.50	3.0	6	4	10	60
	3030-050-S06	1.50	3.0	6	4	10	50
	3030-070-S06	1.50	3.0	6	4	10	70
	3040-060-S06	2.00	4.0	6	5	10	60
	3040-050-S06	2.00	4.0	6	5	10	50
	3040-070-S06	2.00	4.0	6	5	10	70
	3050-060-S06	2.50	5.0	6	6	12	60
	3060-060-S06	3.00	6.0	6	7	12	60
	3060-090-S06	3.00	6.0	6	7	12	90
	3080-070-S08	4.00	8.0	8	9	15	70
	3080-100-S08	4.00	8.0	8	9	15	100
	3100-075-S10	5.00	10.0	10	11	25	75
	3100-100-S10	5.00	10.0	10	11	25	100
	3120-080-S12	6.00	12.0	12	12	25	80
	3120-110-S12	6.00	12.0	12	12	25	110

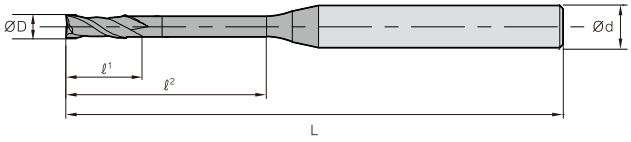
HPRFE2000 (Flat)

Long neck flat



2 | H·A 30° | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.000 ~ -0.015



(mm)

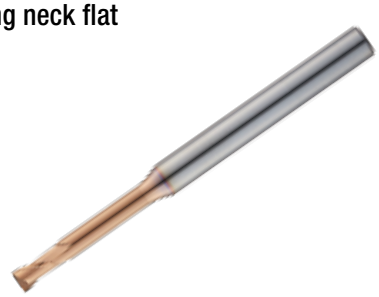
	Designation	ØD	Ød	ℓ1	ℓ2	L
HPRFE 2	2001-045-N0.3S04	0.1	4	0.15	0.3	45
	2001-045-N0.5S04	0.1	4	0.15	0.5	45
	2001-045-N1S04	0.1	4	0.15	1	45
	2002-050-N0.5S04	0.2	4	0.3	0.5	50
	2002-050-N1S04	0.2	4	0.3	1	50
	2002-050-N1.5S04	0.2	4	0.3	1.5	50
	2003-050-N1S04	0.3	4	0.45	1	50
	2003-050-N1.5S04	0.3	4	0.45	1.5	50
	2003-050-N2S04	0.3	4	0.45	2	50
	2003-050-N2.5S04	0.3	4	0.45	2.5	50
	2003-050-N3S04	0.3	4	0.45	3	50
	2004-050-N1S04	0.4	4	0.6	1	50
	2004-050-N1.5S04	0.4	4	0.6	1.5	50
	2004-050-N2S04	0.4	4	0.6	2	50
	2004-050-N2.5S04	0.4	4	0.6	2.5	50
	2004-050-N3S04	0.4	4	0.6	3	50
	2004-050-N3.5S04	0.4	4	0.6	3.5	50
	2004-050-N4S04	0.4	4	0.6	4	50
	2004-050-N5S04	0.4	4	0.6	5	50
	2004-050-N6S04	0.4	4	0.6	6	50
	2005-050-N1S04	0.5	4	0.75	1	50
	2005-050-N1.5S04	0.5	4	0.75	1.5	50
	2005-050-N2S04	0.5	4	0.75	2	50
	2005-050-N2.5S04	0.5	4	0.75	2.5	50
	2005-050-N3S04	0.5	4	0.75	3	50
	2005-050-N4S04	0.5	4	0.75	4	50
	2005-050-N5S04	0.5	4	0.75	5	50
	2005-050-N6S04	0.5	4	0.75	6	50
	2005-050-N8S04	0.5	4	0.75	8	50
	2006-050-N10S04	0.6	4	0.9	10	50
	2006-050-N2S04	0.6	4	0.9	2	50
	2006-050-N4S04	0.6	4	0.9	4	50
	2006-050-N6S04	0.6	4	0.9	6	50
	2006-050-N8S04	0.6	4	0.9	8	50
	2007-050-N10S04	0.7	4	1.05	10	50
	2007-050-N2S04	0.7	4	1.05	2	50

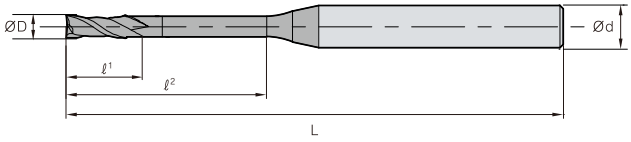
	Designation	ØD	Ød	ℓ1	ℓ2	L
HPRFE 2	2007-050-N4S04	0.7	4	1.05	4	50
	2007-050-N6S04	0.7	4	1.05	6	50
	2007-050-N8S04	0.7	4	1.05	8	50
	2008-050-N10S04	0.8	4	1.2	10	50
	2008-055-N12S04	0.8	4	1.2	12	55
	2008-050-N4S04	0.8	4	1.2	4	50
	2008-050-N6S04	0.8	4	1.2	6	50
	2008-050-N8S04	0.8	4	1.2	8	50
	2009-050-N10S04	0.9	4	1.35	10	50
	2009-055-N12S04	0.9	4	1.35	12	55
	2009-050-N6S04	0.9	4	1.35	6	50
	2009-050-N8S04	0.9	4	1.35	8	50
	2010-050-N10S04	1.0	4	1.5	10	50
	2010-055-N12S04	1.0	4	1.5	12	55
	2010-055-N14S04	1.0	4	1.5	14	55
	2010-060-N16S04	1.0	4	1.5	16	60
	2010-050-N2S04	1.0	4	1.5	2	50
	2010-060-N20S04	1.0	4	1.5	20	60
	2010-050-N4S04	1.0	4	1.5	4	50
	2010-050-N6S04	1.0	4	1.5	6	50
	2010-050-N8S04	1.0	4	1.5	8	50
	2012-050-N10S04	1.2	4	1.8	10	50
	2012-055-N12S04	1.2	4	1.8	12	55
	2012-055-N16S04	1.2	4	1.8	16	55
	2012-050-N6S04	1.2	4	1.8	6	50
	2012-050-N8S04	1.2	4	1.8	8	50
	2014-050-N10S04	1.4	4	2.1	10	50
	2014-055-N12S04	1.4	4	2.1	12	55
	2014-055-N14S04	1.4	4	2.1	14	55
	2014-055-N16S04	1.4	4	2.1	16	55
	2014-050-N6S04	1.4	4	2.1	6	50
	2014-050-N8S04	1.4	4	2.1	8	50
	2015-050-N10S04	1.5	4	2.25	10	50
	2015-055-N12S04	1.5	4	2.25	12	55
	2015-055-N14S04	1.5	4	2.25	14	55
	2015-055-N16S04	1.5	4	2.25	16	55

H+ Endmill

HPRFE2000 (Flat)

Long neck flat





2	H·A 30°	h5 shank	Substrate PC305H

ØD	Tolerance
All	0.000 ~ -0.015

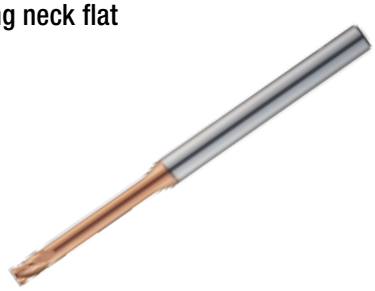
(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L
HPRFE 2	2015-060-N18S04	1.5	4	2.25	18	60
	2015-060-N20S04	1.5	4	2.25	20	60
	2015-065-N25S04	1.5	4	2.25	25	65
	2015-050-N4S04	1.5	4	2.25	4	50
	2015-050-N6S04	1.5	4	2.25	6	50
	2015-050-N8S04	1.5	4	2.25	8	50
	2016-050-N10S04	1.6	4	2.4	10	50
	2016-055-N12S04	1.6	4	2.4	12	55
	2016-055-N14S04	1.6	4	2.4	14	55
	2016-055-N16S04	1.6	4	2.4	16	55
	2016-060-N18S04	1.6	4	2.4	18	60
	2016-060-N20S04	1.6	4	2.4	20	60
	2016-050-N6S04	1.6	4	2.4	6	50
	2016-050-N8S04	1.6	4	2.4	8	50
	2018-050-N10S04	1.8	4	2.7	10	50
	2018-055-N12S04	1.8	4	2.7	12	55
	2018-055-N14S04	1.8	4	2.7	14	55
	2018-055-N16S04	1.8	4	2.7	16	55
	2018-060-N18S04	1.8	4	2.7	18	60
	2018-060-N20S04	1.8	4	2.7	20	60
	2018-050-N6S04	1.8	4	2.7	6	50
	2018-050-N8S04	1.8	4	2.7	8	50
	2020-050-N10S04	2.0	4	3	10	50
	2020-055-N12S04	2.0	4	3	12	55
	2020-055-N14S04	2.0	4	3	14	55
	2020-055-N16S04	2.0	4	3	16	55
	2020-060-N18S04	2.0	4	3	18	60
	2020-060-N20S04	2.0	4	3	20	60
	2020-065-N25S04	2.0	4	3	25	65
	2020-070-N30S04	2.0	4	3	30	70
	2020-050-N4S04	2.0	4	3	4	50
	2020-050-N6S04	2.0	4	3	6	50
	2020-050-N8S04	2.0	4	3	8	50
	2025-050-N10S04	2.5	4	3.75	10	50
	2025-055-N12S04	2.5	4	3.75	12	55

	Designation	ØD	Ød	ℓ1	ℓ2	L
HPRFE 2	2025-055-N14S04	2.5	4	3.75	14	55
	2025-055-N16S04	2.5	4	3.75	16	55
	2025-055-N18S04	2.5	4	3.75	18	55
	2025-060-N20S04	2.5	4	3.75	20	60
	2025-060-N25S04	2.5	4	3.75	25	60
	2025-070-N30S04	2.5	4	3.75	30	70
	2025-050-N8S04	2.5	4	3.75	8	50
	2030-055-N10S06	3.0	6	4.5	10	55
	2030-060-N12S06	3.0	6	4.5	12	60
	2030-060-N14S06	3.0	6	4.5	14	60
	2030-060-N16S06	3.0	6	4.5	16	60
	2030-060-N18S06	3.0	6	4.5	18	60
	2030-065-N20S06	3.0	6	4.5	20	65
	2030-070-N25S06	3.0	6	4.5	25	70
	2030-075-N30S06	3.0	6	4.5	30	75
	2030-080-N35S06	3.0	6	4.5	35	80
	2030-090-N40S06	3.0	6	4.5	40	90
	2030-055-N8S06	3.0	6	4.5	8	55
	2040-060-N12S06	4.0	6	6	12	60
	2040-060-N16S06	4.0	6	6	16	60
	2040-070-N20S06	4.0	6	6	20	70
	2040-070-N25S06	4.0	6	6	25	70
	2040-080-N30S06	4.0	6	6	30	80
	2040-080-N35S06	4.0	6	6	35	80
	2040-090-N40S06	4.0	6	6	40	90
	2040-090-N45S06	4.0	6	6	45	90
	2040-100-N50S06	4.0	6	6	50	100
	2050-060-N16S06	5.0	6	7.5	16	60
	2050-060-N20S06	5.0	6	7.5	20	60
	2050-070-N25S06	5.0	6	7.5	25	70
	2050-070-N30S06	5.0	6	7.5	30	70
	2050-080-N35S06	5.0	6	7.5	35	80
	2050-090-N40S06	5.0	6	7.5	40	90
	2050-100-N50S06	5.0	6	7.5	50	100

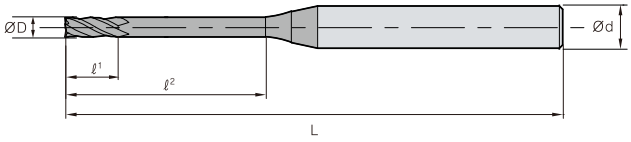
HPRFE4000 (Flat)

Long neck flat



4 | H·A 30° | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.000 ~ -0.015



(mm)

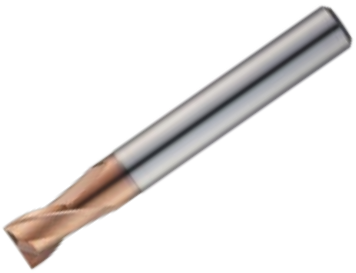
	Designation	ØD	Ød	ℓ1	ℓ2	L
HPRFE 4	4010-050-N10S04	1.0	4	1.5	10	50
	4010-050-N4S04	1.0	4	1.5	4	50
	4010-050-N6S04	1.0	4	1.5	6	50
	4010-050-N8S04	1.0	4	1.5	8	50
	4015-050-N10S04	1.5	4	2.25	10	50
	4015-055-N12S04	1.5	4	2.25	12	55
	4015-055-N14S04	1.5	4	2.25	14	55
	4015-055-N16S04	1.5	4	2.25	16	55
	4015-060-N18S04	1.5	4	2.25	18	60
	4015-060-N20S04	1.5	4	2.25	20	60
	4015-065-N25S04	1.5	4	2.25	25	65
	4015-050-N4S04	1.5	4	2.25	4	50
	4015-050-N6S04	1.5	4	2.25	6	50
	4015-050-N8S04	1.5	4	2.25	8	50
	4020-050-N10S04	2.0	4	3	10	50
	4020-055-N12S04	2.0	4	3	12	55
	4020-055-N14S04	2.0	4	3	14	55
	4020-055-N16S04	2.0	4	3	16	55
	4020-060-N18S04	2.0	4	3	18	60
	4020-060-N20S04	2.0	4	3	20	60
	4020-065-N25S04	2.0	4	3	25	65
	4020-070-N30S04	2.0	4	3	30	70
	4020-050-N4S04	2.0	4	3	4	50
	4020-050-N6S04	2.0	4	3	6	50
	4020-050-N8S04	2.0	4	3	8	50
	4025-050-N10S04	2.5	4	3.75	10	50
	4025-055-N12S04	2.5	4	3.75	12	55
	4025-055-N14S04	2.5	4	3.75	14	55
	4025-055-N16S04	2.5	4	3.75	16	55
	4025-060-N18S04	2.5	4	3.75	18	60
	4025-060-N20S04	2.5	4	3.75	20	60

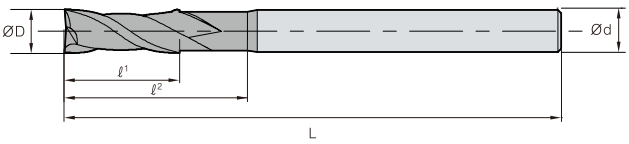
	Designation	ØD	Ød	ℓ1	ℓ2	L
HPRFE 4	4025-065-N25S04	2.5	4	3.75	25	65
	4025-070-N30S04	2.5	4	3.75	30	70
	4025-050-N8S04	2.5	4	3.75	8	50
	4030-055-N10S06	3.0	6	4.5	10	55
	4030-060-N12S06	3.0	6	4.5	12	60
	4030-060-N14S06	3.0	6	4.5	14	60
	4030-060-N16S06	3.0	6	4.5	16	60
	4030-060-N18S06	3.0	6	4.5	18	60
	4030-065-N20S06	3.0	6	4.5	20	65
	4030-070-N25S06	3.0	6	4.5	25	70
	4030-075-N30S06	3.0	6	4.5	30	75
	4030-080-N35S06	3.0	6	4.5	35	80
	4030-090-N40S06	3.0	6	4.5	40	90
	4030-055-N8S06	3.0	6	4.5	8	55
	4040-060-N12S06	4.0	6	6	12	60
	4040-060-N16S06	4.0	6	6	16	60
	4040-070-N20S06	4.0	6	6	20	70
	4040-070-N25S06	4.0	6	6	25	70
	4040-080-N30S06	4.0	6	6	30	80
	4040-080-N35S06	4.0	6	6	35	80
	4040-090-N40S06	4.0	6	6	40	90
	4040-090-N45S06	4.0	6	6	45	90
	4040-100-N50S06	4.0	6	6	50	100
	4050-060-N16S06	5.0	6	7.5	16	60
	4050-060-N20S06	5.0	6	7.5	20	60
	4050-070-N25S06	5.0	6	7.5	25	70
	4050-070-N30S06	5.0	6	7.5	30	70
	4050-080-N35S06	5.0	6	7.5	35	80
	4050-090-N40S06	5.0	6	7.5	40	90
	4050-100-N50S06	5.0	6	7.5	50	100

H+ Endmill

HPFE2000 (Flat)

General flat





2 | H-A 30° | h5 shank | Substrate PC305H

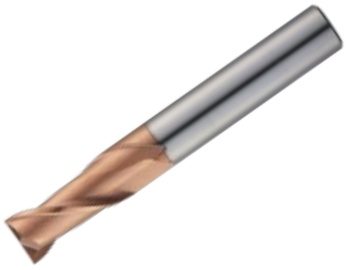
ØD	Tolerance
~ Ø6.0	0.000 ~ -0.012
Ø8.0 ~ Ø20.0	0.000 ~ -0.015

(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L
HPFE 2	2001-040-V0.2S04	0.1	4	0.2	-	40
	2002-040-V0.4S04	0.2	4	0.4	-	40
	2003-040-V0.5S04	0.3	4	0.5	-	40
	2004-040-V0.7S04	0.4	4	0.7	-	40
	2005-040-V1S04	0.5	4	1	-	40
	2006-040-V1.2S04	0.6	4	1.2	-	40
	2007-040-V1.4S04	0.7	4	1.4	-	40
	2008-040-V1.6S04	0.8	4	1.6	-	40
	2009-040-V2S04	0.9	4	2	-	40
	2010-040-V1.5S06	1.0	6	1.5	-	40
	2010-040-V1.5S04	1.0	4	1.5	-	40
	2015-040-V2.2S06	1.5	6	2.2	-	40
	2020-040-V3N6S06	2.0	6	3	6	40
	2020-040-V3N6S04	2.0	4	3	6	40
	2025-040-V4N6S06	2.5	6	4	6	40
	2030-045-V4N7S06	3.0	6	4	7	45
	2035-045-V6N9S06	3.5	6	6	9	45
	2040-045-V6N9S06	4.0	6	6	9	45
	2045-045-V6N10S06	4.5	6	6	10	45
	2050-050-V6N11S06	5.0	6	6	11	50
	2060-050-V7N14S06	6.0	6	7	14	50
	2080-060-V9N18S08	8.0	8	9	18	60
	2100-075-V12N25S010	10.0	10	12	25	75
	2120-075-V15N30S012	12.0	12	15	30	75
	2160-090-V18N38S016	16.0	16	18	38	90
	2200-100-V24N45S020	20.0	20	24	45	100

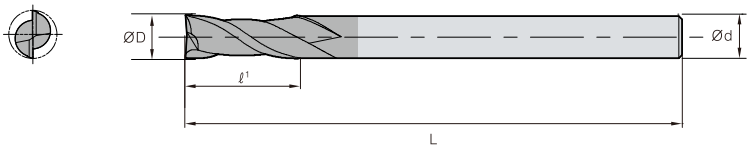
HPFE2000-A35 (Flat)

High-helix flat



2 | H·A 35° | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.00 ~ -0.02



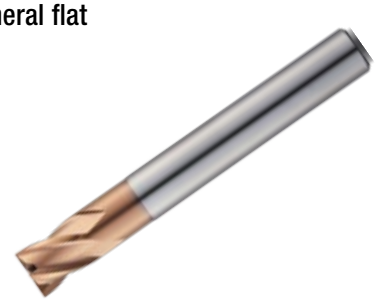
(mm)

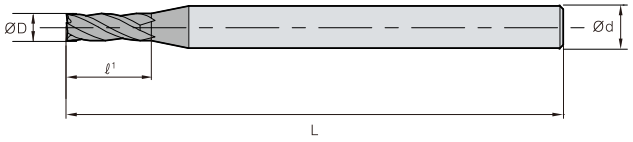
	Designation	ØD	Ød	ℓ¹	L
HPFE	2010-040-V3S06-A35	1.0	6	3	40
2	2010-040-V2S06-A35	1.0	6	2	40
	2010-040-V2S04-A35	1.0	4	2	40
	2010-040-V4S06-A35	1.0	6	4	40
	2012-040-V3S06-A35	1.2	6	3	40
	2015-040-V4S06-A35	1.5	6	4	40
	2015-040-V6S06-A35	1.5	6	6	40
	2015-040-V8S06-A35	1.5	6	8	40
	2015-040-V4S04-A35	1.5	4	4	40
	2020-040-V5S06-A35	2.0	6	5	40
	2020-040-V8S06-A35	2.0	6	8	40
	2020-050-V10S06-A35	2.0	6	10	50
	2020-040-V5S04-A35	2.0	4	5	40
	2025-040-V6S06-A35	2.5	6	6	40
	2025-040-V6S04-A35	2.5	4	6	40
	2030-045-V8S06-A35	3.0	6	8	45
	2030-050-V10S06-A35	3.0	6	10	50
	2030-050-V12S06-A35	3.0	6	12	50
	2030-045-V8S04-A35	3.0	4	8	45
	2035-045-V10S06-A35	3.5	6	10	45
	2040-045-V10S06-A35	4.0	6	10	45
	2040-050-V12S06-A35	4.0	6	12	50
	2040-060-V16S06-A35	4.0	6	16	60
	2040-045-V10S04-A35	4.0	4	10	45
	2045-045-V11S06-A35	4.5	6	11	45
	2050-050-V13S06-A35	5.0	6	13	50
	2055-050-V13S06-A35	5.5	6	13	50
	2060-050-V13S06-A35	6.0	6	13	50
	2060-060-V15S06-A35	6.0	6	15	60
	2065-060-V16S08-A35	6.5	8	16	60
	2070-060-V18S08-A35	7.0	8	18	60
	2080-060-V19S08-A35	8.0	8	19	60
	2100-070-V22S10-A35	10.0	10	22	70
	2100-070-V25S10-A35	10.0	10	25	70
	2120-075-V26S12-A35	12.0	12	26	75
	2120-075-V30S12-A35	12.0	12	30	75

H+ Endmill

HPFE4000 (Flat)

General flat





4 | H·A 30° | h5 shank | Substrate PC305H

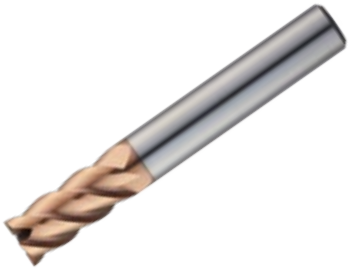
ØD	Tolerance
~ Ø6.0	0.000 ~ -0.012
Ø8.0 ~ Ø20.0	0.000 ~ -0.015

(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L
HPFE	4010-040-V1.5S06	1.0	6	1.5	-	40
4	4010-040-V1.5S04	1.0	4	1.5	-	40
	4015-040-V2.2S06	1.5	6	2.2	-	40
	4015-040-V2.2S04	1.5	4	2.2	-	40
	4020-040-V3N6S06	2.0	6	3	6	40
	4020-040-V3N6S04	2.0	4	3	6	40
	4025-040-V4N6S06	2.5	6	4	6	40
	4025-040-V4N6S04	2.5	4	4	6	40
	4030-045-V4N7S06	3.0	6	4	7	45
	4030-045-V4N7S04	3.0	4	4	7	45
	4035-045-V5N9S06	3.5	6	5	9	45
	4040-045-V5N9S06	4.0	6	5	9	45
	4040-045-V5N9S04	4.0	4	5	9	45
	4045-045-V6N10S06	4.5	6	6	10	45
	4050-050-V6N11S06	5.0	6	6	11	50
	4060-050-V7N14S06	6.0	6	7	14	50
	4080-060-V9N18S08	8.0	8	9	18	60
	4100-075-V12N25S010	10.0	10	12	25	75
	4120-075-V15N30S012	12.0	12	15	30	75
	4160-090-V18N38S016	16.0	16	18	38	90
	4200-100-V24N45S020	20.0	20	24	45	100

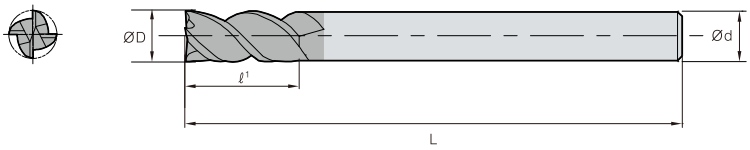
HPFE4000-A45 (Flat)

High-helix flat



4 | H·A 45° | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.00 ~ -0.02



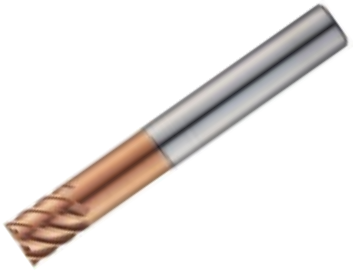
(mm)

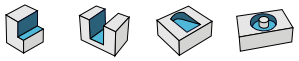
	Designation	ØD	Ød	ℓ¹	L
HPFE 4	4010-040-V2.5S6-A45	1.0	6	2.5	40
	4010-040-V2.5S4-A45	1.0	4	2.5	40
	4010-040-V3S06-A45	1.0	6	3	40
	4015-040-V4S06-A45	1.5	6	4	40
	4015-040-V4S04-A45	1.5	4	4	40
	4020-040-V5S06-A45	2.0	6	5	40
	4020-040-V5S04-A45	2.0	4	5	40
	4025-040-V6S06-A45	2.5	6	6	40
	4025-040-V6S04-A45	2.5	4	6	40
	4030-045-V8S06-A45	3.0	6	8	45
	4030-045-V8S04-A45	3.0	4	8	45
	4035-045-V9S06-A45	3.5	6	9	45
	4040-045-V10S06-A45	4.0	6	10	45
	4040-045-V10S04-A45	4.0	4	10	45
	4050-050-V13S06-A45	5.0	6	13	50
	4060-050-V13S06-A45	6.0	6	13	50
	4060-060-V15S06-A45	6.0	6	15	60
	4060-090-V15S06-A45	6.0	6	15	90
	4080-060-V19S08-A45	8.0	8	19	60
	4080-100-V19S08-A45	8.0	8	19	100
	4100-070-V22S10-A45	10.0	10	22	70
	4100-070-V25S10-A45	10.0	10	25	70
	4100-100-V25S10-A45	10.0	10	25	100
	4120-075-V26S12-A45	12.0	12	26	75
	4120-080-V30S12-A45	12.0	12	30	80
	4120-100-V30S12-A45	12.0	12	30	100

H+ Endmill

HPFE4000-A45 (Flat)

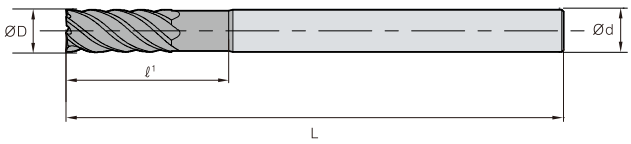
Long neck type high-helix flat





4 | H-A 45° | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.000 ~ -0.015



(mm)

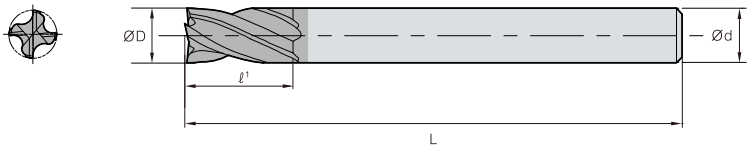
	Designation	ØD	Ød	ℓ1	ℓ2	L
HPFE	4010-045-V1.5N5S06-A45	1.0	6	1.5	5	45
4	4015-045-V2.2N6S06-A45	1.5	6	2.2	6	45
	4020-045-V3N8S06-A45	2.0	6	3	8	45
	4030-050-V4N9S06-A45	3.0	6	4	9	50
	4040-050-V5N12S06-A45	4.0	6	5	12	50
	4040-075-V5N12S04-A45	4.0	4	5	12	75
	4050-050-V6N15S06-A45	5.0	6	6	15	50

HPFE4000-U (Flat)

Irregular flute spacing and lead flat

4 | H·A Multi | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.00 ~ -0.02

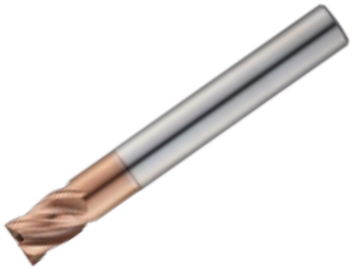


(mm)

	Designation	ØD	Ød	ℓ1	L
HPFE 4	4020-045-V5S04-U	2.0	4	5	45
	4030-045-V8S06-U	3.0	6	8	45
	4040-045-V10S06-U	4.0	6	10	45
	4040-045-V10S04-U	4.0	4	10	45
	4060-050-V16S06-U	6.0	6	16	50
	4080-060-V20S08-U	8.0	8	20	60
	4100-075-V25S10-U	10.0	10	25	75
	4120-085-V35S12-U	12.0	12	35	85

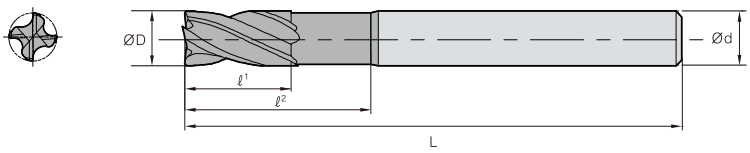
HPLFE4000-U (Flat)

Irregular flute spacing and lead flat



4 | H·A Multi | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.00 ~ -0.02



(mm)

	Designation	ØD	Ød1	Ød	ℓ1	ℓ2	L
HPLFE 4	4010-045-V1.5N4S04-U	1.0	0.9	4	1.5	4	45
	4020-045-V3N6S04-U	2.0	1.9	4	3	6	45
	4030-045-V4N7S06-U	3.0	2.9	6	4	7	45
	4040-045-V5N9S06-U	4.0	3.8	6	5	9	45
	4060-050-V7N14S06-U	6.0	5.8	6	7	14	50
	4080-060-V9N18S08-U	8.0	7.8	8	9	18	60
	4100-075-V12N25S010-U	10.0	9.7	10	12	25	75
	4120-075-V15N30S012-U	12.0	11.7	12	15	30	75

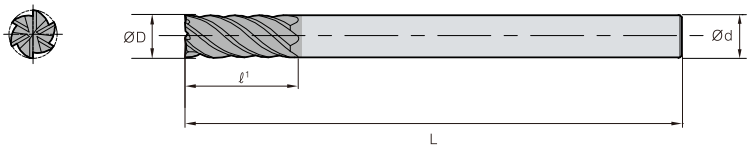
H+ Endmill

HPFE6000-A50 (Flat)

High-helix flat

6 | H·A 50° | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.00 ~ -0.02

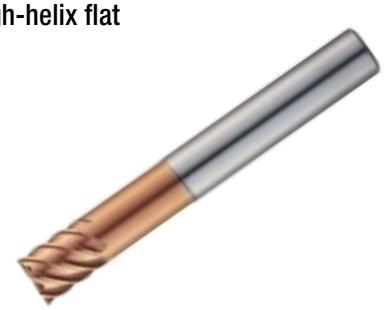


(mm)

	Designation	ØD	Ød	ℓ1	L
HPFE	6060-050-V13S06-A50	6.0	6	13	50
6	6080-060-V18S08-A50	8.0	8	18	60
	6100-070-V22S10-A50	10.0	10	22	70
	6120-075-V26S12-A50	12.0	12	26	75
	6160-090-V35S16-A50	16.0	16	35	90
	6200-100-V44S20-A50	20.0	20	44	100

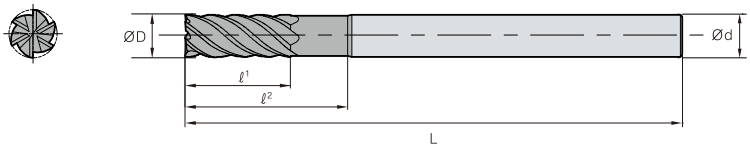
HPFE6000-A60 (Flat)

High-helix flat



6 | H·A 60° | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.000 ~ -0.015

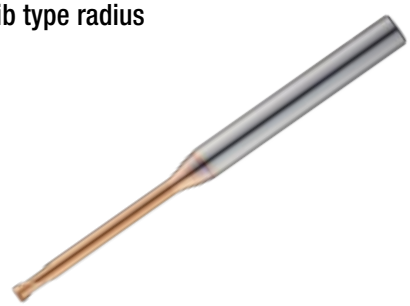


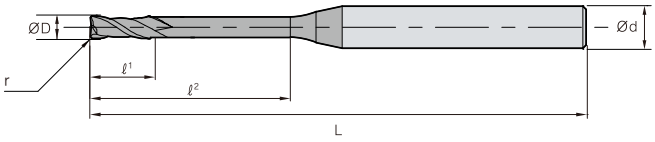
(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L
HPFE	6060-060-V7N20S06-A60	6.0	6	7	20	60
6	6080-070-V9N25S08-A60	8.0	8	9	25	70
	6100-075-V12N32S010-A60	10.0	10	12	32	75
	6120-080-V15N38S012-A60	12.0	12	15	38	80

HPRRE2000 (Radius)

Rib type radius





2 | H·A 30° | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.000 ~ -0.015

(mm)

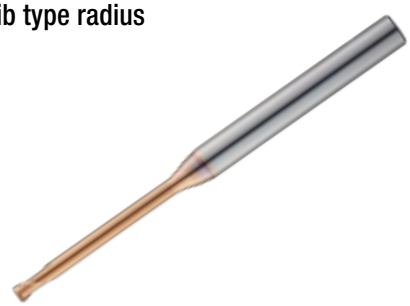
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRRE 2	2002-050-N0.5S04-R005	0.2	4	0.15	0.5	50	0.05
	2002-050-N1.5S04-R005	0.2	4	0.15	1.5	50	0.05
	2002-050-N1S04-R005	0.2	4	0.15	1	50	0.05
	2002-050-N2S04-R005	0.2	4	0.15	2	50	0.05
	2003-050-N1.5S04-R005	0.3	4	0.25	1.5	50	0.05
	2003-050-N1S04-R005	0.3	4	0.25	1	50	0.05
	2003-050-N2.5S04-R005	0.3	4	0.25	2.5	50	0.05
	2003-050-N2S04-R005	0.3	4	0.25	2	50	0.05
	2003-050-N3S04-R005	0.3	4	0.25	3	50	0.05
	2004-050-N1.5S04-R005	0.4	4	0.3	1.5	50	0.05
	2004-050-N1S04-R005	0.4	4	0.3	1	50	0.05
	2004-050-N2.5S04-R005	0.4	4	0.3	2.5	50	0.05
	2004-050-N2S04-R005	0.4	4	0.3	2	50	0.05
	2004-050-N2S04-R01	0.4	4	0.3	2	50	0.1
	2004-050-N3.5S04-R005	0.4	4	0.3	3.5	50	0.05
	2004-050-N3S04-R005	0.4	4	0.3	3	50	0.05
	2004-050-N3S04-R01	0.4	4	0.3	3	50	0.1
	2004-050-N4S04-R005	0.4	4	0.3	4	50	0.05
	2004-050-N4S04-R01	0.4	4	0.3	4	50	0.1
	2005-050-N1S04-R005	0.5	4	0.35	1	50	0.05
	2005-050-N1S04-R01	0.5	4	0.35	1	50	0.1
	2005-050-N2S04-R005	0.5	4	0.35	2	50	0.05
	2005-050-N2S04-R01	0.5	4	0.35	2	50	0.1
	2005-050-N3S04-R005	0.5	4	0.35	3	50	0.05
	2005-050-N3S04-R01	0.5	4	0.35	3	50	0.1
	2005-050-N4S04-R005	0.5	4	0.35	4	50	0.05
	2005-050-N4S04-R01	0.5	4	0.35	4	50	0.1
	2005-050-N5S04-R005	0.5	4	0.35	5	50	0.05
	2005-050-N5S04-R01	0.5	4	0.35	5	50	0.1
	2005-050-N6S04-R005	0.5	4	0.35	6	50	0.05
	2005-050-N6S04-R01	0.5	4	0.35	6	50	0.1
	2006-050-N10S04-R01	0.6	4	0.4	10	50	0.1
	2006-050-N2S04-R01	0.6	4	0.4	2	50	0.1
	2006-050-N4S04-R01	0.6	4	0.4	4	50	0.1

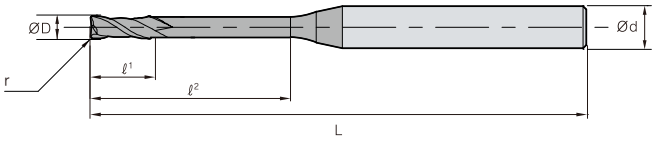
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRRE 2	2006-050-N6S04-R01	0.6	4	0.4	6	50	0.1
	2006-050-N8S04-R01	0.6	4	0.4	8	50	0.1
	2008-050-N12S04-R01	0.8	4	0.5	12	50	0.1
	2008-050-N4S04-R01	0.8	4	0.5	4	50	0.1
	2008-050-N4S04-R02	0.8	4	0.5	4	50	0.2
	2008-050-N6S04-R01	0.8	4	0.5	6	50	0.1
	2008-050-N6S04-R02	0.8	4	0.5	6	50	0.2
	2008-050-N8S04-R01	0.8	4	0.5	8	50	0.1
	2010-050-N4S04-R01	1.0	4	0.8	4	50	0.1
	2010-050-N4S04-R02	1.0	4	0.8	4	50	0.2
	2010-050-N6S04-R01	1.0	4	0.8	6	50	0.1
	2010-050-N6S04-R02	1.0	4	0.8	6	50	0.2
	2010-050-N6S04-R03	1.0	4	0.8	6	50	0.3
	2010-050-N8S04-R01	1.0	4	0.8	8	50	0.1
	2010-050-N8S04-R02	1.0	4	0.8	8	50	0.2
	2010-050-N10S04-R01	1.0	4	0.8	10	50	0.1
	2010-050-N10S04-R02	1.0	4	0.8	10	50	0.2
	2010-050-N10S04-R03	1.0	4	0.8	10	50	0.3
	2010-055-N12S04-R01	1.0	4	0.8	12	55	0.1
	2010-055-N12S04-R02	1.0	4	0.8	12	55	0.2
	2010-060-N16S04-R01	1.0	4	0.8	16	60	0.1
	2010-060-N16S04-R02	1.0	4	0.8	16	60	0.2
	2010-060-N16S04-R03	1.0	4	0.8	16	60	0.3
	2010-060-N20S04-R01	1.0	4	0.8	20	60	0.1
	2010-060-N20S04-R02	1.0	4	0.8	20	60	0.2
	2010-060-N20S04-R03	1.0	4	0.8	20	60	0.3
	2015-050-N4S04-R01	1.5	4	1.35	4	50	0.1
	2015-050-N4S04-R02	1.5	4	1.35	4	50	0.2
	2015-050-N8S04-R01	1.5	4	1.35	8	50	0.1
	2015-050-N8S04-R02	1.5	4	1.35	8	50	0.2
	2015-050-N8S04-R03	1.5	4	1.35	8	50	0.3
	2015-055-N12S04-R01	1.5	4	1.35	12	55	0.1
	2015-055-N12S04-R02	1.5	4	1.35	12	55	0.2
	2015-055-N15S04-R01	1.5	4	1.35	15	55	0.1

H+ Endmill

HPRRE2000 (Radius)

Rib type radius





2 | H·A 30° | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.000 ~ -0.015

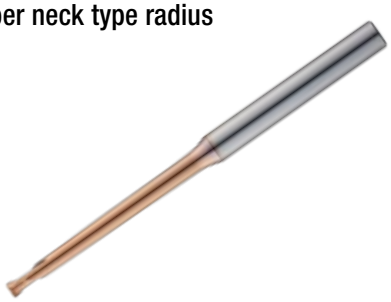
(mm)

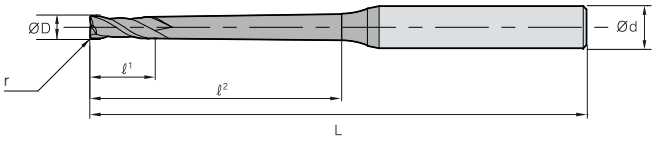
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRRE 2	2015-055-N15S04-R02	1.5	4	1.35	15	55	0.2
	2015-055-N15S04-R03	1.5	4	1.35	15	55	0.3
	2015-060-N20S04-R01	1.5	4	1.35	20	60	0.1
	2015-060-N20S04-R02	1.5	4	1.35	20	60	0.2
	2015-060-N20S04-R03	1.5	4	1.35	20	60	0.3
	2020-050-N6S04-R02	2.0	4	1.7	6	50	0.2
	2020-050-N6S04-R05	2.0	4	1.7	6	50	0.5
	2020-050-N8S04-R02	2.0	4	1.7	8	50	0.2
	2020-050-N8S04-R03	2.0	4	1.7	8	50	0.3
	2020-050-N8S04-R05	2.0	4	1.7	8	50	0.5
	2020-050-N8S04-R08	2.0	4	1.7	8	50	0.8
	2020-055-N12S04-R02	2.0	4	1.7	12	55	0.2
	2020-055-N12S04-R05	2.0	4	1.7	12	55	0.5
	2020-055-N16S04-R02	2.0	4	1.7	16	55	0.2
	2020-055-N16S04-R03	2.0	4	1.7	16	55	0.3
	2020-055-N16S04-R05	2.0	4	1.7	16	55	0.5
	2020-055-N16S04-R08	2.0	4	1.7	16	55	0.8
	2020-060-N20S04-R02	2.0	4	1.7	20	60	0.2
	2020-060-N20S04-R03	2.0	4	1.7	20	60	0.3
	2020-060-N20S04-R05	2.0	4	1.7	20	60	0.5
	2020-060-N20S04-R08	2.0	4	1.7	20	60	0.8

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRRE 2	2020-065-N25S04-R02	2.0	4	1.7	25	65	0.2
	2020-065-N25S04-R05	2.0	4	1.7	25	65	0.5
	2020-070-N30S04-R02	2.0	4	1.7	30	70	0.2
	2020-070-N30S04-R05	2.0	4	1.7	30	70	0.5
	2030-055-N8S06-R02	3.0	6	2.5	8	55	0.2
	2030-055-N8S06-R03	3.0	6	2.5	8	55	0.3
	2030-055-N8S06-R05	3.0	6	2.5	8	55	0.5
	2030-060-N12S06-R02	3.0	6	2.5	12	60	0.2
	2030-060-N12S06-R05	3.0	6	2.5	12	60	0.5
	2030-060-N16S06-R02	3.0	6	2.5	16	60	0.2
	2030-060-N16S06-R03	3.0	6	2.5	16	60	0.3
	2030-060-N16S06-R05	3.0	6	2.5	16	60	0.5
	2030-065-N20S06-R02	3.0	6	2.5	20	65	0.2
	2030-065-N20S06-R03	3.0	6	2.5	20	65	0.3
	2030-065-N20S06-R05	3.0	6	2.5	20	65	0.5
	2030-075-N30S06-R02	3.0	6	2.5	30	75	0.2
	2030-075-N30S06-R03	3.0	6	2.5	30	75	0.3
	2030-075-N30S06-R05	3.0	6	2.5	30	75	0.5
	2030-080-N35S06-R02	3.0	6	2.5	35	80	0.2
	2030-080-N35S06-R05	3.0	6	2.5	35	80	0.5

HPRRE2000-TN (Radius)

Taper neck type radius





2 | H·A 30° | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.000 ~ -0.015

(mm)

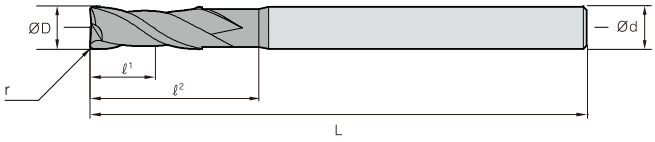
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRRE 2	2002-050-N2S04-R005-TN09	0.2	4	0.15	2	50	0.05
	2004-050-N4S04-R005-TN09	0.4	4	0.3	4	50	0.05
	2004-050-N4S04-R01-TN09	0.4	4	0.3	4	50	0.1
	2004-050-N5S04-R005-TN09	0.4	4	0.3	5	50	0.05
	2004-050-N5S04-R01-TN09	0.4	4	0.3	5	50	0.1
	2005-050-N5S04-R01-TN09	0.5	4	0.35	5	50	0.1
	2005-050-N8S04-R01-TN09	0.5	4	0.35	8	50	0.1
	2005-055-N10S04-R01-TN09	0.5	4	0.35	10	55	0.1
	2006-055-N12S04-R01-TN09	0.6	4	0.4	12	55	0.1
	2006-055-N15S04-R01-TN09	0.6	4	0.4	15	55	0.1
	2008-050-N6S04-R02-TN04	0.8	4	0.5	6	50	0.2
	2008-055-N12S04-R02-TN09	0.8	4	0.5	12	55	0.2
	2010-055-N8S06-R02-TN04	1.0	6	0.8	8	55	0.2
	2010-055-N8S06-R03-TN04	1.0	6	0.8	8	55	0.3
	2010-055-N10S06-R02-TN09	1.0	6	0.8	10	55	0.2
	2010-060-N15S06-R02-TN09	1.0	6	0.8	15	60	0.2
	2010-060-N15S06-R03-TN09	1.0	6	0.8	15	60	0.3
	2010-065-N20S06-R02-TN09	1.0	6	0.8	20	65	0.2
	2010-070-N25S06-R02-TN09	1.0	6	0.8	25	70	0.2
	2010-070-N25S06-R03-TN09	1.0	6	0.8	25	70	0.3
	2010-075-N30S06-R02-TN09	1.0	6	0.8	30	75	0.2
	2010-075-N30S06-R03-TN09	1.0	6	0.8	30	75	0.3
	2010-080-N35S06-R02-TN09	1.0	6	0.8	35	80	0.2
	2015-055-N10S06-R02-TN04	1.5	6	1.35	10	55	0.2
	2015-055-N10S06-R03-TN04	1.5	6	1.35	10	55	0.3
	2015-060-N15S06-R02-TN09	1.5	6	1.35	15	60	0.2
	2015-065-N20S06-R02-TN09	1.5	6	1.35	20	65	0.2
	2015-065-N20S06-R03-TN09	1.5	6	1.35	20	65	0.3
	2015-070-N25S06-R02-TN09	1.5	6	1.35	25	70	0.2

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRRE 2	2015-070-N25S06-R03-TN09	1.5	6	1.35	25	70	0.3
	2015-075-N30S06-R02-TN09	1.5	6	1.35	30	75	0.2
	2015-075-N30S06-R03-TN09	1.5	6	1.35	30	75	0.3
	2020-050-N8S06-R05-TN04	2.0	6	1.7	8	50	0.5
	2020-055-N12S06-R03-TN04	2.0	6	1.7	12	55	0.3
	2020-055-N12S06-R05-TN04	2.0	6	1.7	12	55	0.5
	2020-060-N16S06-R05-TN04	2.0	6	1.7	16	60	0.5
	2020-065-N20S06-R03-TN09	2.0	6	1.7	20	65	0.3
	2020-065-N20S06-R05-TN09	2.0	6	1.7	20	65	0.5
	2020-065-N25S06-R05-TN09	2.0	6	1.7	25	65	0.5
	2020-070-N30S06-R02-TN09	2.0	6	1.7	30	70	0.2
	2020-070-N30S06-R03-TN09	2.0	6	1.7	30	70	0.3
	2020-070-N30S06-R05-TN09	2.0	6	1.7	30	70	0.5
	2020-080-N40S06-R02-TN09	2.0	6	1.7	40	80	0.2
	2020-080-N40S06-R03-TN09	2.0	6	1.7	40	80	0.3
	2020-080-N40S06-R05-TN09	2.0	6	1.7	40	80	0.5
	2020-090-N50S06-R02-TN09	2.0	6	1.7	50	90	0.2
	2020-090-N50S06-R03-TN09	2.0	6	1.7	50	90	0.3
	2020-090-N50S06-R05-TN09	2.0	6	1.7	50	90	0.5
	2030-080-N40S06-R02-TN09	3.0	6	2.5	40	80	0.2
	2030-080-N40S06-R03-TN09	3.0	6	2.5	40	80	0.3
	2030-080-N40S06-R05-TN09	3.0	6	2.5	40	80	0.5
	2030-090-N50S06-R02-TN09	3.0	6	2.5	50	90	0.2
	2030-090-N50S06-R03-TN09	3.0	6	2.5	50	90	0.3
	2030-090-N50S06-R05-TN09	3.0	6	2.5	50	90	0.5
	2030-100-N60S06-R02-TN09	3.0	6	2.5	60	100	0.2
	2030-100-N60S06-R03-TN09	3.0	6	2.5	60	100	0.3
	2030-100-N60S06-R05-TN09	3.0	6	2.5	60	100	0.5

H+ Endmill

HPRE2000 (Radius)

General radius



2 | H·A 30° | h5 shank | Substrate PC305H

ØD	Tolerance
~ Ø6.0	0.000 ~ -0.012
Ø8.0 ~ Ø12.0	0.000 ~ -0.015

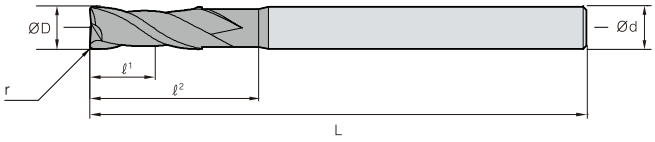
(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE 2	2010-050-N3S04-R005	1.0	4	1.5	3	50	0.05
	2010-050-N4S04-R005	1.0	4	1.5	4	50	0.05
	2010-050-N6S04-R005	1.0	4	1.5	6	50	0.05
	2010-050-N8S04-R005	1.0	4	1.5	8	50	0.05
	2010-050-N10S04-R005	1.0	4	1.5	10	50	0.05
	2010-050-N3S04-R01	1.0	4	1.5	3	50	0.10
	2010-050-N4S06-R01	1.0	6	1.5	4	50	0.10
	2010-050-N4S04-R01	1.0	4	1.5	4	50	0.10
	2010-050-N6S06-R01	1.0	6	1.5	6	50	0.10
	2010-050-N6S04-R01	1.0	4	1.5	6	50	0.10
	2010-050-N8S04-R01	1.0	4	1.5	8	50	0.10
	2010-050-N10S04-R01	1.0	4	1.5	10	50	0.10
	2010-050-N3S04-R02	1.0	4	1.5	3	50	0.20
	2010-050-N4S06-R02	1.0	6	1.5	4	50	0.20
	2010-050-N4S04-R02	1.0	4	1.5	4	50	0.20
	2010-050-N6S06-R02	1.0	6	1.5	6	50	0.20
	2010-050-N6S04-R02	1.0	4	1.5	6	50	0.20
	2010-050-N8S04-R02	1.0	4	1.5	8	50	0.20
	2010-050-N10S06-R02	1.0	6	1.5	10	50	0.20
	2010-050-N10S04-R02	1.0	4	1.5	10	50	0.20
	2010-050-N12S06-R02	1.0	6	1.5	12	50	0.20
	2010-050-N3S04-R03	1.0	4	1.5	3	50	0.30
	2010-050-N4S04-R03	1.0	4	1.5	4	50	0.30
	2010-050-N6S04-R03	1.0	4	1.5	6	50	0.30
	2010-050-N8S04-R03	1.0	4	1.5	8	50	0.30
	2010-050-N10S04-R03	1.0	4	1.5	10	50	0.30
	2012-050-N8S06-R02	1.2	6	2	8	50	0.20
	2012-050-N12S06-R02	1.2	6	2	12	50	0.20
	2015-050-N4S04-R005	1.5	4	2.5	4	50	0.05
	2015-050-N6S04-R005	1.5	4	2.5	6	50	0.05
	2015-050-N8S04-R005	1.5	4	2.5	8	50	0.05
	2015-050-N10S04-R005	1.5	4	2.5	10	50	0.05
	2015-050-N12S04-R005	1.5	4	2.5	12	50	0.05
	2015-050-N4S04-R01	1.5	4	2.5	4	50	0.10

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE 2	2015-050-N6S04-R01	1.5	4	2.5	6	50	0.10
	2015-050-N8S04-R01	1.5	4	2.5	8	50	0.10
	2015-050-N10S04-R01	1.5	4	2.5	10	50	0.10
	2015-050-N12S04-R01	1.5	4	2.5	12	50	0.10
	2015-050-N4S06-R02	1.5	6	2.5	4	50	0.20
	2015-050-N4S04-R02	1.5	4	2.5	4	50	0.20
	2015-050-N6S06-R02	1.5	6	2.5	6	50	0.20
	2015-050-N6S04-R02	1.5	4	2.5	6	50	0.20
	2015-050-N8S06-R02	1.5	6	2.5	8	50	0.20
	2015-050-N8S04-R02	1.5	4	2.5	8	50	0.20
	2015-050-N10S06-R02	1.5	6	2.5	10	50	0.20
	2015-050-N10S04-R02	1.5	4	2.5	10	50	0.20
	2015-050-N12S04-R02	1.5	4	2.5	12	50	0.20
	2015-050-N15S06-R02	1.5	6	2.5	15	50	0.20
	2015-050-N4S04-R03	1.5	4	2.5	4	50	0.30
	2015-050-N6S04-R03	1.5	4	2.5	6	50	0.30
	2015-050-N8S04-R03	1.5	4	2.5	8	50	0.30
	2015-050-N10S04-R03	1.5	4	2.5	10	50	0.30
	2015-050-N12S04-R03	1.5	4	2.5	12	50	0.30
	2015-050-N4S04-R05	1.5	4	2.5	4	50	0.50
	2015-050-N6S04-R05	1.5	4	2.5	6	50	0.50
	2015-050-N8S04-R05	1.5	4	2.5	8	50	0.50
	2015-050-N10S04-R05	1.5	4	2.5	10	50	0.50
	2015-050-N12S04-R05	1.5	4	2.5	12	50	0.50
	2020-050-N6S04-R01	2.0	4	3	6	50	0.10
	2020-050-N8S06-R01	2.0	6	3	8	50	0.10
	2020-050-N8S04-R01	2.0	4	3	8	50	0.10
	2020-050-N10S04-R01	2.0	4	3	10	50	0.10
	2020-050-N12S06-R01	2.0	6	3	12	50	0.10
	2020-050-N12S04-R01	2.0	4	3	12	50	0.10
	2020-050-N16S04-R01	2.0	4	3	16	50	0.10
	2020-050-N20S04-R01	2.0	4	3	20	50	0.10
	2020-050-N6S06-R02	2.0	6	3	6	50	0.20
	2020-050-N6S04-R02	2.0	4	3	6	50	0.20

HPRE2000 (Radius)

General radius



2 | H·A 30° | h5 shank | Substrate PC305H

ØD	Tolerance
~ Ø6.0	0.000 ~ -0.012
Ø8.0 ~ Ø12.0	0.000 ~ -0.015

(mm)

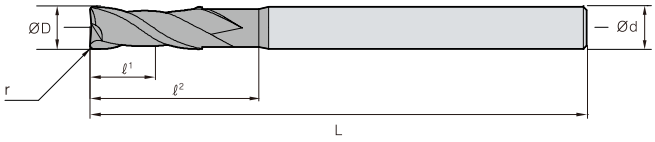
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE 2	2020-050-N8S04-R02	2.0	4	3	8	50	0.20
	2020-050-N9S06-R02	2.0	6	3	9	50	0.20
	2020-050-N10S04-R02	2.0	4	3	10	50	0.20
	2020-050-N12S04-R02	2.0	4	3	12	50	0.20
	2020-050-N16S06-R02	2.0	6	3	16	50	0.20
	2020-050-N16S04-R02	2.0	4	3	16	50	0.20
	2020-050-N20S04-R02	2.0	4	3	20	50	0.20
	2020-050-N6S06-R03	2.0	6	3	6	50	0.30
	2020-050-N6S04-R03	2.0	4	3	6	50	0.30
	2020-050-N8S04-R03	2.0	4	3	8	50	0.30
	2020-050-N10S04-R03	2.0	4	3	10	50	0.30
	2020-050-N12S04-R03	2.0	4	3	12	50	0.30
	2020-050-N16S04-R03	2.0	4	3	16	50	0.30
	2020-050-N20S04-R03	2.0	4	3	20	50	0.30
	2020-050-N6S06-R05	2.0	6	3	6	50	0.50
	2020-050-N6S04-R05	2.0	4	3	6	50	0.50
	2020-050-N8S04-R05	2.0	4	3	8	50	0.50
	2020-050-N9S06-R05	2.0	6	3	9	50	0.50
	2020-050-N10S04-R05	2.0	4	3	10	50	0.50
	2020-050-N12S06-R05	2.0	6	3	12	50	0.50
	2020-050-N12S04-R05	2.0	4	3	12	50	0.50
	2020-050-N16S06-R05	2.0	6	3	16	50	0.50
	2020-050-N16S04-R05	2.0	4	3	16	50	0.50
	2020-050-N20S04-R05	2.0	4	3	20	50	0.50
	2025-050-N8S04-R02	2.5	4	3.5	8	50	0.20
	2025-050-N10S04-R02	2.5	4	3.5	10	50	0.20
	2025-050-N12S04-R02	2.5	4	3.5	12	50	0.20
	2025-050-N16S04-R02	2.5	4	3.5	16	50	0.20
	2025-050-N8S04-R03	2.5	4	3.5	8	50	0.30
	2025-050-N10S04-R03	2.5	4	3.5	10	50	0.30
	2025-050-N12S04-R03	2.5	4	3.5	12	50	0.30
	2025-050-N16S04-R03	2.5	4	3.5	16	50	0.30
	2025-050-N8S04-R05	2.5	4	3.5	8	50	0.50
	2025-050-N10S04-R05	2.5	4	3.5	10	50	0.50

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE 2	2025-050-N12S04-R05	2.5	4	3.5	12	50	0.50
	2025-050-N16S04-R05	2.5	4	3.5	16	50	0.50
	2030-055-N8S06-R01	3.0	6	4.5	8	55	0.10
	2030-055-N10S06-R01	3.0	6	4.5	10	55	0.10
	2030-055-N12S06-R01	3.0	6	4.5	12	55	0.10
	2030-055-N16S06-R01	3.0	6	4.5	16	55	0.10
	2030-060-N20S06-R01	3.0	6	4.5	20	60	0.10
	2030-055-N8S06-R02	3.0	6	4.5	8	55	0.20
	2030-055-N9S06-R02	3.0	6	4.5	9	55	0.20
	2030-055-N10S06-R02	3.0	6	4.5	10	55	0.20
	2030-055-N12S06-R02	3.0	6	4.5	12	55	0.20
	2030-055-N16S06-R02	3.0	6	4.5	16	55	0.20
	2030-060-N20S06-R02	3.0	6	4.5	20	60	0.20
	2030-055-N8S06-R03	3.0	6	4.5	8	55	0.30
	2030-055-N9S06-R03	3.0	6	4.5	9	55	0.30
	2030-055-N10S06-R03	3.0	6	4.5	10	55	0.30
	2030-055-N12S06-R03	3.0	6	4.5	12	55	0.30
	2030-055-N14S06-R03	3.0	6	4.5	14	55	0.30
	2030-055-N16S06-R03	3.0	6	4.5	16	55	0.30
	2030-060-N20S06-R03	3.0	6	4.5	20	60	0.30
	2030-055-N8S06-R05	3.0	6	4.5	8	55	0.50
	2030-055-N9S06-R05	3.0	6	4.5	9	55	0.50
	2030-055-N10S06-R05	3.0	6	4.5	10	55	0.50
	2030-055-N12S06-R05	3.0	6	4.5	12	55	0.50
	2030-055-N16S06-R05	3.0	6	4.5	16	55	0.50
	2030-060-N20S06-R05	3.0	6	4.5	20	60	0.50
	2030-055-N8S06-R10	3.0	6	4.5	8	55	1.00
	2030-055-N10S06-R10	3.0	6	4.5	10	55	1.00
	2030-055-N12S06-R10	3.0	6	4.5	12	55	1.00
	2030-055-N16S06-R10	3.0	6	4.5	16	55	1.00
	2030-060-N20S06-R10	3.0	6	4.5	20	60	1.00
	2030-060-N25S06-R10	3.0	6	4.5	25	60	1.00
	2040-055-N10S06-R01	4.0	6	6	10	55	0.10
	2040-055-N12S06-R01	4.0	6	6	12	55	0.10

H+ Endmill

HPRE2000 (Radius)

General radius



2 | H·A 30° | h5 shank | Substrate PC305H

ØD	Tolerance
~ Ø6.0	0.000 ~ -0.012
Ø8.0 ~ Ø12.0	0.000 ~ -0.015

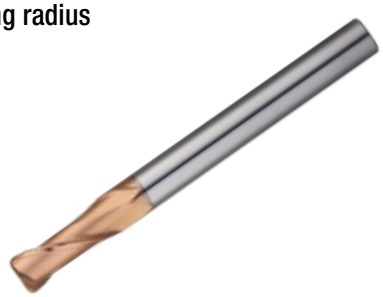
(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE 2	2040-055-N16S06-R01	4.0	6	6	16	55	0.1
	2040-060-N20S06-R01	4.0	6	6	20	60	0.1
	2040-060-N25S06-R01	4.0	6	6	25	60	0.1
	2040-055-N10S06-R02	4.0	6	6	10	55	0.2
	2040-055-N12S06-R02	4.0	6	6	12	55	0.2
	2040-055-N16S06-R02	4.0	6	6	16	55	0.2
	2040-060-N20S06-R02	4.0	6	5	20	60	0.2
	2040-060-N25S06-R02	4.0	6	6	25	60	0.2
	2040-055-N10S06-R03	4.0	6	6	10	55	0.3
	2040-055-N12S06-R03	4.0	6	6	12	55	0.3
	2040-055-N16S06-R03	4.0	6	6	16	55	0.3
	2040-060-N20S06-R03	4.0	6	6	20	60	0.3
	2040-060-N25S06-R03	4.0	6	6	25	60	0.3
	2040-055-N10S06-R05	4.0	6	6	10	55	0.5
	2040-055-N12S06-R05	4.0	6	6	12	55	0.5
	2040-055-N16S06-R05	4.0	6	6	16	55	0.5
	2040-060-N20S06-R05	4.0	6	6	20	60	0.5
	2040-060-N25S06-R05	4.0	6	6	25	60	0.5
	2040-070-N30S06-R05	4.0	6	6	30	70	0.5
	2040-055-N10S06-R10	4.0	6	6	10	55	1
	2040-055-N12S06-R10	4.0	6	6	12	55	1
	2040-055-N16S06-R10	4.0	6	6	16	55	1
	2040-060-N20S06-R10	4.0	6	6	20	60	1
	2040-060-N25S06-R10	4.0	6	6	25	60	1

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE 2	2040-070-N30S06-R10	4.0	6	6	30	70	1.0
	2050-060-N18S06-R03	5.0	6	8	18	60	0.3
	2060-060-N20S06-R02	6.0	6	9	20	60	0.2
	2060-060-N20S06-R03	6.0	6	9	20	60	0.3
	2060-060-N20S06-R05	6.0	6	9	20	60	0.5
	2060-060-N20S06-R10	6.0	6	9	20	60	1.0
	2060-060-N20S06-R15	6.0	6	9	20	60	1.5
	2060-060-N20S06-R20	6.0	6	9	20	60	2.0
	2080-060-N25S08-R02	8.0	8	12	25	60	0.2
	2080-060-N25S08-R03	8.0	8	12	25	60	0.3
	2080-060-N25S08-R05	8.0	8	12	25	60	0.5
	2080-060-N25S08-R10	8.0	8	12	25	60	1.0
	2080-060-N25S08-R15	8.0	8	12	25	60	1.5
	2100-070-N32S10-R02	10.0	10	15	32	70	0.2
	2100-070-N32S10-R03	10.0	10	15	32	70	0.3
	2100-070-N32S10-R05	10.0	10	15	32	70	0.5
	2100-070-N32S10-R10	10.0	10	15	32	70	1.0
	2100-070-N32S10-R15	10.0	10	15	32	70	1.5
	2100-070-N32S10-R20	10.0	10	15	32	70	2.0
	2120-080-N38S12-R03	12.0	12	18	38	80	0.3
	2120-080-N38S12-R05	12.0	12	18	38	80	0.5
	2120-080-N38S12-R10	12.0	12	18	38	80	1.0
	2120-080-N38S12-R15	12.0	12	18	38	80	1.5
	2120-080-N38S12-R20	12.0	12	18	38	80	2.0

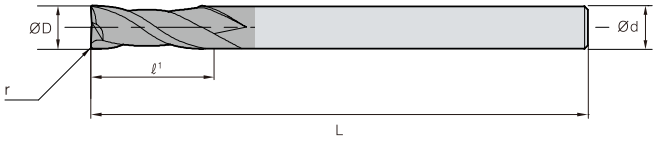
HPLRE2000 (Radius)

Long radius



2 | H·A 30° | h5 shank | Substrate PC305H

ØD	Tolerance
~ Ø6.0	0.000 ~ -0.012
Ø8.0 ~ Ø12.0	0.000 ~ -0.015



(mm)

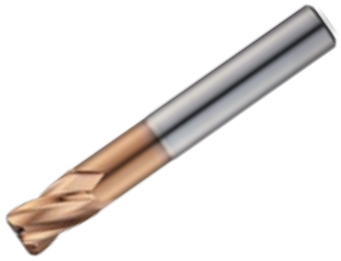
	Designation	ØD	Ød	ℓ1	L	r
HPLRE 2	2010-050-S06-R01	1.0	6	2	50	0.1
	2010-050-S06-R02	1.0	6	2	50	0.2
	2010-050-S06-R03	1.0	6	2	50	0.3
	2015-050-S06-R01	1.5	6	3	50	0.1
	2015-050-S06-R02	1.5	6	3	50	0.2
	2015-050-S06-R03	1.5	6	3	50	0.3
	2015-050-S06-R05	1.5	6	3	50	0.5
	2020-050-S06-R01	2.0	6	5	50	0.1
	2020-050-S06-R02	2.0	6	5	50	0.2
	2020-050-S06-R03	2.0	6	5	50	0.3
	2020-050-S06-R05	2.0	6	5	50	0.5
	2025-060-S06-R01	2.5	6	7	60	0.1
	2025-060-S06-R02	2.5	6	7	60	0.2
	2025-060-S06-R03	2.5	6	7	60	0.3
	2025-060-S06-R05	2.5	6	7	60	0.5
	2030-060-S06-R01	3.0	6	8	60	0.1
	2030-060-S06-R02	3.0	6	8	60	0.2
	2030-060-S06-R03	3.0	6	8	60	0.3
	2030-060-S06-R05	3.0	6	8	60	0.5
	2040-070-S06-R01	4.0	6	10	70	0.1
	2040-070-S06-R02	4.0	6	10	70	0.2
	2040-070-S06-R03	4.0	6	10	70	0.3
	2040-070-S06-R05	4.0	6	10	70	0.5
	2040-070-S06-R10	4.0	6	10	70	1.0
	2050-080-S06-R01	5.0	6	13	80	0.1

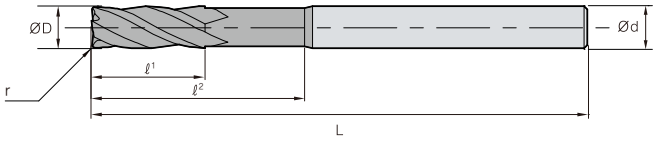
	Designation	ØD	Ød	ℓ1	L	r
HPLRE 2	2050-080-S06-R02	5.0	6	13	80	0.2
	2050-080-S06-R03	5.0	6	13	80	0.3
	2050-080-S06-R05	5.0	6	13	80	0.5
	2050-080-S06-R10	5.0	6	13	80	1.0
	2060-090-S06-R01	6.0	6	15	90	0.1
	2060-090-S06-R02	6.0	6	15	90	0.2
	2060-090-S06-R03	6.0	6	15	90	0.3
	2060-090-S06-R05	6.0	6	15	90	0.5
	2060-090-S06-R10	6.0	6	15	90	1.0
	2080-100-S08-R01	8.0	8	20	100	0.1
	2080-100-S08-R02	8.0	8	20	100	0.2
	2080-100-S08-R03	8.0	8	20	100	0.3
	2080-100-S08-R05	8.0	8	20	100	0.5
	2080-100-S08-R10	8.0	8	20	100	1.0
	2080-100-S08-R20	8.0	8	20	100	2.0
	2100-100-S10-R02	10.0	10	25	100	0.2
	2100-100-S10-R03	10.0	10	25	100	0.3
	2100-100-S10-R05	10.0	10	25	100	0.5
	2100-100-S10-R10	10.0	10	25	100	1.0
	2100-100-S10-R20	10.0	10	25	100	2.0
	2120-110-S12-R02	12.0	12	30	110	0.2
	2120-110-S12-R03	12.0	12	30	110	0.3
	2120-110-S12-R05	12.0	12	30	110	0.5
	2120-110-S12-R10	12.0	12	30	110	1.0
	2120-110-S12-R20	12.0	12	30	110	2.0

H+ Endmill

HPRE4000 (Radius)

General radius





4 | H·A 30° | h5 shank | Substrate PC305H

ØD	Tolerance
~ Ø6.0	0.000 ~ -0.012
Ø8.0 ~ Ø12.0	0.000 ~ -0.015

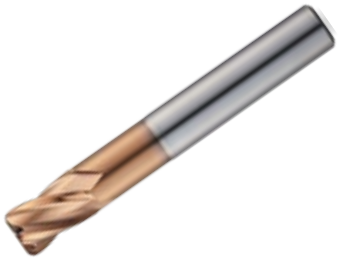
(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE 4	4010-050-N3S04-R01	1.0	4	2	3	50	0.1
	4010-050-N4S04-R01	1.0	4	2	4	50	0.1
	4010-050-N6S04-R01	1.0	4	2	6	50	0.1
	4010-050-N3S04-R02	1.0	4	2	3	50	0.2
	4010-050-N4S04-R02	1.0	4	2	4	50	0.2
	4010-050-N6S04-R02	1.0	4	2	6	50	0.2
	4010-050-N3S04-R03	1.0	4	2	3	50	0.3
	4010-050-N4S04-R03	1.0	4	2	4	50	0.3
	4010-050-N6S04-R03	1.0	4	2	6	50	0.3
	4015-050-N4S04-R01	1.5	4	2.5	4	50	0.1
	4015-050-N6S04-R01	1.5	4	2.5	6	50	0.1
	4015-050-N4S04-R02	1.5	4	2.5	4	50	0.2
	4015-050-N6S04-R02	1.5	4	2.5	6	50	0.2
	4015-050-N4S04-R03	1.5	4	2.5	4	50	0.3
	4015-050-N6S04-R03	1.5	4	2.5	6	50	0.3
	4020-050-N6S04-R01	2.0	4	3	6	50	0.1
	4020-050-N8S04-R01	2.0	4	3	8	50	0.1
	4020-050-N6S04-R02	2.0	4	3	6	50	0.2
	4020-050-N8S06-R02	2.0	6	3	8	50	0.2
	4020-050-N8S04-R02	2.0	4	3	8	50	0.2
	4020-050-N10S06-R02	2.0	6	3	10	50	0.2
	4020-050-N12S06-R02	2.0	6	3	12	50	0.2
	4020-050-N6S04-R03	2.0	4	3	6	50	0.3
	4020-050-N8S04-R03	2.0	4	3	8	50	0.3
	4020-050-N6S04-R05	2.0	4	3	6	50	0.5
	4020-050-N8S04-R05	2.0	4	3	8	50	0.5
	4025-050-N6S04-R01	2.5	4	3.5	6	50	0.1
	4030-055-N8S06-R01	3.0	6	4	8	55	0.1
	4030-055-N10S06-R01	3.0	6	4	10	55	0.1
	4030-055-N12S06-R01	3.0	6	4	12	55	0.1
	4030-055-N16S06-R01	3.0	6	4	16	55	0.1
	4030-060-N20S06-R01	3.0	6	4	20	60	0.1
	4030-055-N8S06-R02	3.0	6	4	8	55	0.2
	4030-055-N10S06-R02	3.0	6	4	10	55	0.2

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE 4	4030-055-N12S06-R02	3.0	6	4	12	55	0.2
	4030-055-N16S06-R02	3.0	6	4	16	55	0.2
	4030-060-N20S06-R02	3.0	6	4	20	60	0.2
	4030-055-N8S06-R03	3.0	6	4	8	55	0.3
	4030-055-N9S06-R03	3.0	6	4	9	55	0.3
	4030-055-N10S06-R03	3.0	6	4	10	55	0.3
	4030-055-N12S06-R03	3.0	6	4	12	55	0.3
	4030-055-N16S06-R03	3.0	6	4	16	55	0.3
	4030-060-N20S06-R03	3.0	6	4	20	60	0.3
	4030-055-N8S06-R05	3.0	6	4	8	55	0.5
	4030-055-N9S06-R05	3.0	6	4	9	55	0.5
	4030-055-N10S06-R05	3.0	6	4	10	55	0.5
	4030-055-N12S06-R05	3.0	6	4	12	55	0.5
	4030-055-N16S06-R05	3.0	6	4	16	55	0.5
	4030-060-N20S06-R05	3.0	6	4	20	60	0.5
	4030-055-N8S06-R10	3.0	6	4	8	55	1.0
	4030-055-N10S06-R10	3.0	6	4	10	55	1.0
	4030-055-N12S06-R10	3.0	6	4	12	55	1.0
	4030-055-N16S06-R10	3.0	6	4	16	55	1.0
	4030-060-N20S06-R10	3.0	6	4	20	60	1.0
	4040-055-N10S06-R01	4.0	6	6	10	55	0.1
	4040-055-N12S06-R01	4.0	6	6	12	55	0.1
	4040-055-N16S06-R01	4.0	6	6	16	55	0.1
	4040-060-N20S06-R01	4.0	6	6	20	60	0.1
	4040-060-N25S06-R01	4.0	6	6	25	60	0.1
	4040-055-N10S06-R02	4.0	6	6	10	55	0.2
	4040-055-N12S06-R02	4.0	6	6	12	55	0.2
	4040-055-N16S06-R02	4.0	6	6	16	55	0.2
	4040-060-N20S06-R02	4.0	6	6	20	60	0.2
	4040-060-N25S06-R02	4.0	6	6	25	60	0.2
	4040-055-N10S06-R03	4.0	6	6	10	55	0.3
	4040-055-N12S06-R03	4.0	6	6	12	55	0.3
	4040-055-N16S06-R03	4.0	6	6	16	55	0.3
	4040-060-N20S06-R03	4.0	6	6	20	60	0.3

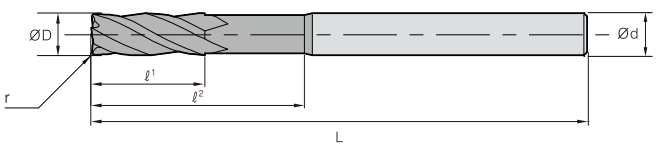
HPRE4000 (Radius)

General radius



4 | H·A 30° | h5 shank | Substrate PC305H

ØD	Tolerance
~ Ø6.0	0.000 ~ -0.012
Ø8.0 ~ Ø12.0	0.000 ~ -0.015



(mm)

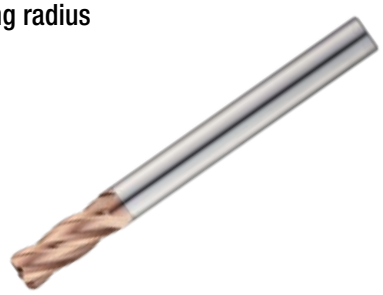
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE 4	4040-060-N25S06-R03	4.0	6	6	25	60	0.3
	4040-055-N10S06-R05	4.0	6	6	10	55	0.5
	4040-055-N12S06-R05	4.0	6	5	12	55	0.5
	4040-055-N16S06-R05	4.0	6	6	16	55	0.5
	4040-060-N20S06-R05	4.0	6	5	20	60	0.5
	4040-060-N25S06-R05	4.0	6	6	25	60	0.5
	4040-055-N10S06-R10	4.0	6	6	10	55	1.0
	4040-055-N12S06-R10	4.0	6	6	12	55	1.0
	4040-055-N16S06-R10	4.0	6	6	16	55	1.0
	4040-060-N20S06-R10	4.0	6	6	20	60	1.0
	4040-060-N25S06-R10	4.0	6	6	25	60	1.0
	4060-060-N20S06-R02	6.0	6	9	20	60	0.2
	4060-060-N20S06-R03	6.0	6	9	20	60	0.3
	4060-060-N20S06-R05	6.0	6	9	20	60	0.5
	4060-060-N20S06-R10	6.0	6	9	20	60	1.0
	4060-060-N20S06-R15	6.0	6	9	20	60	1.5
	4060-060-N20S06-R20	6.0	6	9	20	60	2.0

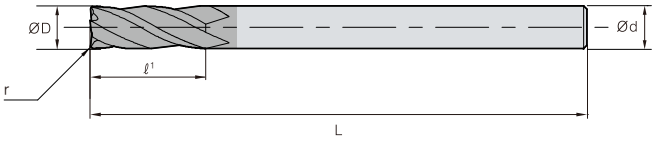
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE 4	4080-060-N25S08-R02	8.0	8	12	25	60	0.2
	4080-060-N25S08-R03	8.0	8	12	25	60	0.3
	4080-060-N25S08-R05	8.0	8	12	25	60	0.5
	4080-060-N25S08-R10	8.0	8	12	25	60	1.0
	4080-060-N25S08-R15	8.0	8	12	25	60	1.5
	4080-060-N25S08-R20	8.0	8	12	25	60	2.0
	4100-070-N32S10-R02	10.0	10	15	32	70	0.2
	4100-070-N32S10-R03	10.0	10	15	32	70	0.3
	4100-070-N32S10-R05	10.0	10	15	32	70	0.5
	4100-070-N32S10-R10	10.0	10	15	32	70	1.0
	4100-070-N32S10-R15	10.0	10	15	32	70	1.5
	4100-070-N32S10-R20	10.0	10	15	32	70	2.0
	4120-080-N38S12-R03	12.0	12	18	38	80	0.3
	4120-080-N38S12-R05	12.0	12	18	38	80	0.5
	4120-080-N38S12-R10	12.0	12	18	38	80	1.0
	4120-080-N38S12-R15	12.0	12	18	38	80	1.5
	4120-080-N38S12-R20	12.0	12	18	38	80	2.0

H+ Endmill

HPLRE4000 (Radius)

Long radius





4 | H·A 30° | h5 shank | Substrate PC305H

ØD	Tolerance
~ Ø6.0	0.000 ~ -0.012
Ø8.0 ~ Ø12.0	0.000 ~ -0.015

(mm)

	Designation	ØD	Ød	ℓ1	L	r
HPLRE 4	4010-050-S06-R01	1.0	6	2	50	0.1
	4010-050-S06-R02	1.0	6	2	50	0.2
	4010-050-S06-R03	1.0	6	2	50	0.3
	4015-050-S06-R01	1.5	6	3	50	0.1
	4015-050-S06-R02	1.5	6	3	50	0.2
	4015-050-S06-R03	1.5	6	3	50	0.3
	4015-050-S06-R05	1.5	6	3	50	0.5
	4020-050-S06-R01	2.0	6	5	50	0.1
	4020-050-S06-R02	2.0	6	5	50	0.2
	4020-050-S06-R03	2.0	6	5	50	0.3
	4020-050-S06-R05	2.0	6	5	50	0.5
	4025-060-S06-R01	2.5	6	7	60	0.1
	4025-060-S06-R02	2.5	6	7	60	0.2
	4025-060-S06-R03	2.5	6	7	60	0.3
	4025-060-S06-R05	2.5	6	7	60	0.5
	4030-060-S06-R01	3.0	6	8	60	0.1
	4030-060-S06-R02	3.0	6	8	60	0.2
	4030-060-S06-R03	3.0	6	8	60	0.3
	4030-060-S06-R05	3.0	6	8	60	0.5
	4040-070-S06-R01	4.0	6	10	70	0.1
	4040-070-S06-R02	4.0	6	10	70	0.2
	4040-070-S04-R02	4.0	4	10	70	0.2
	4040-070-S06-R03	4.0	6	10	70	0.3
	4040-070-S06-R05	4.0	6	10	70	0.5
	4040-070-S04-R05	4.0	4	10	70	0.5
	4040-070-S06-R10	4.0	6	10	70	1.0
	4050-080-S06-R01	5.0	6	13	80	0.1

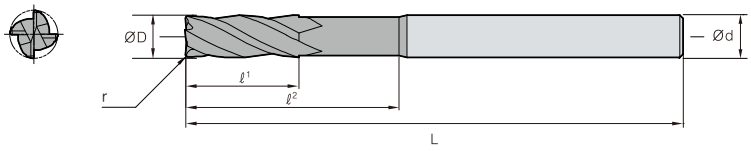
	Designation	ØD	Ød	ℓ1	L	r
HPLRE 4	4050-080-S06-R02	5.0	6	13	80	0.2
	4050-080-S06-R03	5.0	6	13	80	0.3
	4050-080-S06-R05	5.0	6	13	80	0.5
	4050-080-S06-R10	5.0	6	13	80	1.0
	4060-090-S06-R01	6.0	6	15	90	0.1
	4060-090-S06-R02	6.0	6	15	90	0.2
	4060-090-S06-R03	6.0	6	15	90	0.3
	4060-090-S06-R05	6.0	6	15	90	0.5
	4060-090-S06-R10	6.0	6	15	90	1.0
	4080-100-S08-R01	8.0	8	20	100	0.1
	4080-100-S08-R02	8.0	8	20	100	0.2
	4080-100-S08-R03	8.0	8	20	100	0.3
	4080-100-S08-R05	8.0	8	20	100	0.5
	4080-100-S08-R10	8.0	8	20	100	1.0
	4080-100-S08-R20	8.0	8	20	100	2.0
	4100-100-S10-R02	10.0	10	25	100	0.2
	4100-100-S10-R03	10.0	10	25	100	0.3
	4100-100-S10-R05	10.0	10	25	100	0.5
	4100-100-S10-R10	10.0	10	25	100	1.0
	4100-100-S10-R20	10.0	10	25	100	2.0
	4120-110-S12-R02	12.0	12	30	110	0.2
	4120-110-S12-R03	12.0	12	30	110	0.3
	4120-110-S12-R05	12.0	12	30	110	0.5
	4120-110-S12-R10	12.0	12	30	110	1.0
	4120-150-S12-R10	12.0	12	30	150	1.0
	4120-110-S12-R20	12.0	12	30	110	2.0

HPRE4000-LS (Radius)

Long shank radius

4 | H·A 30° | h5 shank | Substrate PC305H

ØD	Tolerance
~ Ø6.0	0.000 ~ -0.012
Ø8.0 ~ Ø12.0	0.000 ~ -0.015



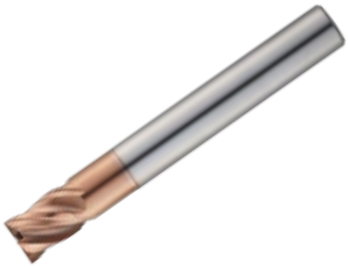
(mm)

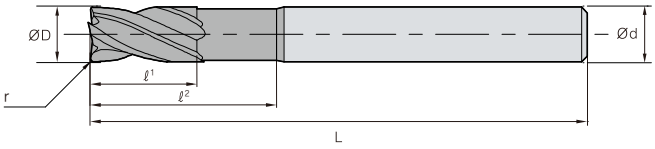
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE 4	4060-090-N20S06-R05-LS	6.0	6	9	20	90	0.5
	4060-090-N20S06-R10-LS	6.0	6	9	20	90	1.0
	4080-100-N25S08-R05-LS	8.0	8	12	25	100	0.5
	4080-100-N25S08-R10-LS	8.0	8	12	25	100	1.0
	4100-100-N32S10-R05-LS	10.0	10	15	32	100	0.5
	4100-100-N32S10-R10-LS	10.0	10	15	32	100	1.0
	4100-100-N32S10-R20-LS	10.0	10	15	32	100	2.0
	4120-110-N38S12-R05-LS	12.0	12	18	38	110	0.5
	4120-110-N38S12-R10-LS	12.0	12	18	38	110	1.0
	4120-110-N38S12-R20-LS	12.0	12	18	38	110	2.0

H+ Endmill

HPRE4000-U (Radius)

Irregular flute spacing and lead radius





4 | H·A Multi | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.00 ~ -0.02

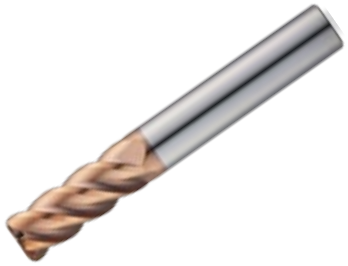
(mm)

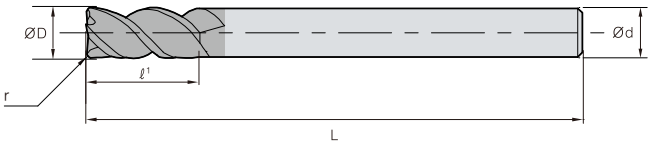
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE 2	4010-045-N4S04-R005-U	1.0	4	1.5	4	45	0.05
	4020-045-N6S04-R005-U	2.0	4	3	6	45	0.05
	4020-050-N7S04-R005-U	2.0	4	2.5	7	50	0.05
	4020-050-N7S04-R01-U	2.0	4	2.5	7	50	0.10
	4030-045-N7S06-R01-U	3.0	6	4	7	45	0.10
	4030-055-N9S06-R01-U	3.0	6	4	9	55	0.10
	4030-055-N9S06-R02-U	3.0	6	4	9	55	0.20
	4030-055-N9S06-R03-U	3.0	6	4	9	55	0.30
	4030-055-N12S06-R03-U	3.0	6	4	12	55	0.30
	4030-055-N16S06-R03-U	3.0	6	4	16	55	0.30
	4040-045-N9S06-R01-U	4.0	6	5	9	45	0.10
	4040-055-N12S06-R02-U	4.0	6	5	12	55	0.20
	4040-055-N12S04-R02-U	4.0	4	5	12	55	0.20
	4040-055-N12S06-R03-U	4.0	6	5	12	55	0.30
	4040-055-N16S06-R03-U	4.0	6	5	16	55	0.30
	4040-055-N20S06-R03-U	4.0	6	5	20	55	0.30
	4040-055-N12S06-R05-U	4.0	6	5	12	55	0.50
	4040-055-N16S06-R05-U	4.0	6	5	16	55	0.50
	4040-055-N16S04-R05-U	4.0	4	5	16	55	0.50
	4040-055-N20S06-R05-U	4.0	6	5	20	55	0.50
	4040-055-N12S06-R10-U	4.0	6	5	12	55	1.00
	4050-060-N16S06-R01-U	5.0	6	6	16	60	0.10
	4050-060-N16S06-R02-U	5.0	6	6	16	60	0.20
	4050-060-N16S06-R03-U	5.0	6	6	16	60	0.30
	4050-060-N16S06-R05-U	5.0	6	6	16	60	0.50
	4050-060-N16S06-R10-U	5.0	6	6	16	60	1.00
	4060-050-N14S06-R02-U	6.0	6	7	14	50	0.20
	4060-060-N20S06-R01-U	6.0	6	7	20	60	0.10

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE 2	4060-060-N20S06-R02-U	6.0	6	7	20	60	0.20
	4060-060-N20S06-R03-U	6.0	6	7	20	60	0.30
	4060-060-N20S06-R05-U	6.0	6	7	20	60	0.50
	4060-060-N20S06-R10-U	6.0	6	7	20	60	1.00
	4060-060-N20S06-R15-U	6.0	6	7	20	60	1.50
	4080-060-N18S08-R02-U	8.0	8	9	18	60	0.20
	4080-060-N25S08-R01-U	8.0	8	9	25	60	0.10
	4080-060-N25S08-R02-U	8.0	8	9	25	60	0.20
	4080-060-N25S08-R03-U	8.0	8	9	25	60	0.30
	4080-060-N25S08-R05-U	8.0	8	9	25	60	0.50
	4080-060-N25S08-R10-U	8.0	8	9	25	60	1.00
	4080-060-N25S08-R15-U	8.0	8	9	25	60	1.50
	4080-060-N25S08-R20-U	8.0	8	9	25	60	2.00
	4100-075-N25S10-R02-U	10.0	10	12	25	75	0.20
	4100-075-N32S10-R02-U	10.0	10	11	32	75	0.20
	4100-075-N32S10-R03-U	10.0	10	11	32	75	0.30
	4100-075-N32S10-R05-U	10.0	10	11	32	75	0.50
	4100-075-N32S10-R10-U	10.0	10	11	32	75	1.00
	4100-075-N32S10-R15-U	10.0	10	11	32	75	1.50
	4100-075-N32S10-R20-U	10.0	10	11	32	75	2.00
	4120-075-N30S12-R03-U	12.0	12	15	30	75	0.30
	4120-075-N38S12-R02-U	12.0	12	12	38	75	0.20
	4120-075-N38S12-R03-U	12.0	12	12	38	75	0.30
	4120-075-N38S12-R05-U	12.0	12	12	38	75	0.50
	4120-075-N38S12-R10-U	12.0	12	12	38	75	1.00
	4120-075-N38S12-R15-U	12.0	12	12	38	75	1.50
	4120-075-N38S12-R20-U	12.0	12	12	38	75	2.00

HPRE4000-A45 (Radius)

High-helix radius





4 | H·A 45° | h5 shank | Substrate PC305H

ØD	Tolerance
~ Ø6.0	0.000 ~ -0.012
Ø8.0 ~ Ø12.0	0.000 ~ -0.015

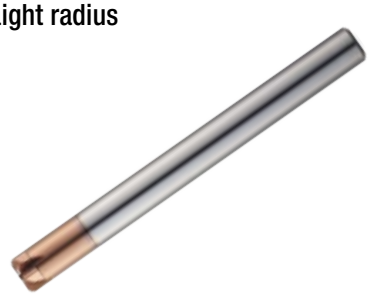
(mm)

	Designation	ØD	Ød	ℓ¹	L	r
HPRE 4	4030-050-S06-R03-A45	3.0	6	8	50	0.30
	4030-050-S06-R05-A45	3.0	6	8	50	0.50
	4030-050-S04-R05-A45	3.0	4	8	50	0.50
	4040-050-S06-R03-A45	4.0	6	11	50	0.30
	4040-050-S06-R05-A45	4.0	6	11	50	0.50
	4040-050-S04-R05-A45	4.0	4	11	50	0.50
	4040-050-S06-R10-A45	4.0	6	11	50	1.00
	4060-060-S06-R03-A45	6.0	6	15	60	0.30
	4060-060-S06-R05-A45	6.0	6	15	60	0.50
	4060-060-S06-R10-A45	6.0	6	15	60	1.00
	4080-060-S08-R03-A45	8.0	8	20	60	0.30
	4080-060-S08-R05-A45	8.0	8	20	60	0.50
	4080-060-S08-R10-A45	8.0	8	20	60	1.00
	4080-060-S08-R15-A45	8.0	8	20	60	1.50
	4080-060-S08-R20-A45	8.0	8	20	60	2.00
	4100-070-S10-R03-A45	10.0	10	25	70	0.30
	4100-070-S10-R05-A45	10.0	10	25	70	0.50
	4100-070-S10-R10-A45	10.0	10	25	70	1.00
	4100-070-S10-R15-A45	10.0	10	25	70	1.50
	4100-070-S10-R20-A45	10.0	10	25	70	2.00
	4100-070-S10-R25-A45	10.0	10	25	70	2.50
	4100-070-S10-R30-A45	10.0	10	25	70	3.00
	4120-080-S12-R03-A45	12.0	12	30	80	0.30
	4120-080-S12-R05-A45	12.0	12	30	80	0.50
	4120-080-S12-R10-A45	12.0	12	30	80	1.00
	4120-080-S12-R15-A45	12.0	12	30	80	1.50
	4120-080-S12-R20-A45	12.0	12	30	80	2.00
	4120-080-S12-R25-A45	12.0	12	30	80	2.50
	4120-080-S12-R30-A45	12.0	12	30	80	3.00

H+ Endmill

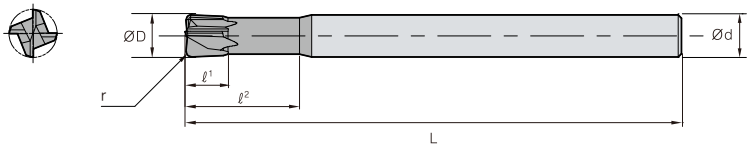
HPRE4000-ST (Straight)

Straight radius



4 | H·A 0° | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.00 ~ -0.02

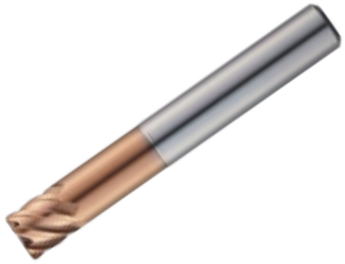


(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE 4	4030-050-S06-R05-ST	3.0	6	1.2	8	50	0.50
	4040-050-S06-R05-ST	4.0	6	1.5	10	50	0.50
	4060-060-S06-R05-ST	6.0	6	2.5	12	60	0.50
	4060-060-S06-R10-ST	6.0	6	2.5	12	60	1.00
	4060-060-S06-R15-ST	6.0	6	2.5	12	60	1.50
	4060-090-S06-R15-ST	6.0	6	2.5	12	90	1.50
	4080-060-S08-R10-ST	8.0	8	3.5	16	60	1.00
	4080-060-S08-R20-ST	8.0	8	3.5	16	60	2.00
	4080-100-S08-R20-ST	8.0	8	3.5	16	100	2.00
	4100-070-S10-R10-ST	10.0	10	4	20	70	1.00
	4100-070-S10-R20-ST	10.0	10	4	20	70	2.00
	4100-100-S10-R20-ST	10.0	10	4	20	100	2.00
	4120-080-S12-R20-ST	12.0	12	5	25	80	2.00
	4120-080-S12-R30-ST	12.0	12	5	25	80	3.00
	4120-110-S12-R30-ST	12.0	12	5	25	110	3.00

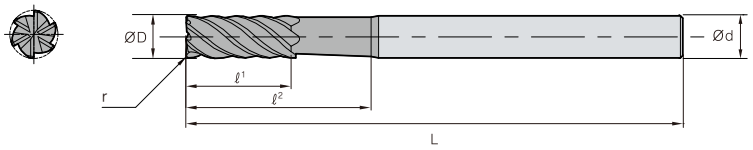
HPRE6000

High-helix radius



6 | H·A 45° | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.00 ~ -0.02

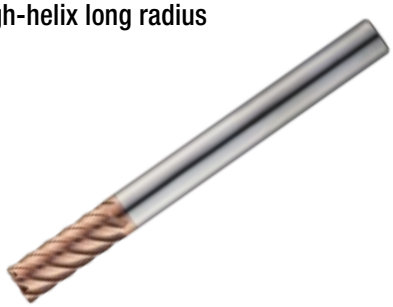


(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
HPRE	6060-050-N14S06-R03	6.0	6	6	14	50	0.30
6	6060-050-N14S06-R05	6.0	6	6	14	50	0.50
	6080-060-N24S08-R05	8.0	8	8	24	60	0.50
	6080-060-N24S08-R10	8.0	8	8	24	60	1.00
	6100-070-N30S10-R05	10.0	10	10	30	70	0.50
	6100-070-N30S10-R10	10.0	10	10	30	70	1.00
	6120-075-N30S12-R05	12.0	12	12	30	75	0.50
	6120-075-N30S12-R10	12.0	12	12	30	75	1.00

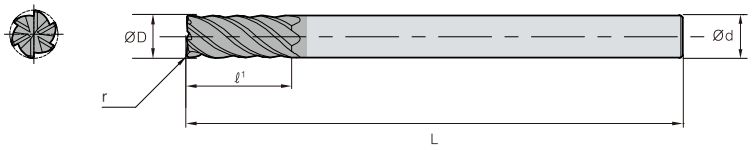
HPLRE6000

High-helix long radius



6 | H·A 45° | h5 shank | Substrate PC305H

ØD	Tolerance
All	0.00 ~ -0.02



(mm)

	Designation	ØD	Ød	ℓ1	L	r
HPLRE	HPLRE6060-090-S06-R05	6.0	6	15	90	0.50
6	HPLRE6060-090-S06-R10	6.0	6	15	90	1.00
	HPLRE6080-100-S08-R05	8.0	8	20	100	0.50
	HPLRE6080-100-S08-R10	8.0	8	20	100	1.00
	HPLRE6100-100-S10-R05	10.0	10	25	100	0.50
	HPLRE6100-100-S10-R10	10.0	10	25	100	1.00
	HPLRE6120-110-S12-R05	12.0	12	30	110	0.50
	HPLRE6120-110-S12-R10	12.0	12	30	110	1.00

H+ Endmill

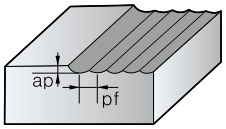
Recommended cutting conditions

HPRBE2000 (Ball)

Long neck ball

Workpiece / Conditions / Diameter (Ø)	Pre-hardened steels HRC30~45		Hardened steels HRC45~55		High-hardened steels HRC55~65		Copper Alloys	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
0.5	34,100~49,500	600~870	31,900~35,200	490~540	31,900~35,200	440~480	49,000~50,000	1,100~1,400
0.6	28,600~40,700	590~850	26,400~29,700	480~540	26,400~29,700	400~480	42,000~50,000	1,100~1,700
0.8	22,000~30,800	640~890	19,800~22,000	490~550	19,800~22,000	440~500	31,000~50,000	1,100~2,250
1.0	17,600~24,200	600~850	15,400~17,600	470~540	15,400~17,600	440~500	24,000~49,500	1,100~2,200
1.2	14,300~18,700	590~780	12,000~14,000	480~540	12,000~14,000	420~480	28,500~38,500	1,480~1,950
1.5	11,000~14,300	580~760	10,000~11,500	480~540	10,000~11,500	420~480	17,000~28,500	1,100~1,950
2.0	8,500~11,000	590~800	7,900~8,800	470~530	7,900~8,800	440~480	12,600~24,000	1,100~2,150
3.0	5,700~8,200	730~1,000	5,300~5,800	590~650	5,300~5,800	550~620	11,900~17,000	1,850~2,700
4.0	4,300~6,200	680~990	3,950~4,400	550~620	3,850~4,400	530~570	6,600~12,500	1,260~2,500

Application tip



- ap = 0.02D
- pf = 0.05D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

HPRBE2000-TN / HPRBE3000-TN (Ball)

Taper neck ball

Workpiece				Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Hardened steels HRC45~55		High-hardened steels HRC55~65	
Diameter (Ø)	Neck length	Taper angle	ap (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
0.2	1	0.4	0.017	40,000	800	28,000	504	26,000	416	26,000	364
	1.5	0.4	0.009	40,000	800	28,000	504	26,000	416	26,000	364
	2	0.9	0.007	32,000	461	22,400	323	20,800	266	20,800	233
	2.5	0.9	0.004	26,000	333	18,200	204	16,900	189	16,900	162
0.3	2	0.4	0.025	40,000	1,200	28,000	756	26,000	624	26,000	546
	3	0.9	0.013	32,000	691	22,400	484	20,800	399	20,800	349
	4	0.9	0.010	26,000	499	18,200	306	16,900	284	16,900	243
0.4	2	0.4	0.035	40,000	1,600	28,000	1,008	26,000	832	26,000	728
	3	0.4	0.020	40,000	1,600	28,000	1,008	26,000	832	26,000	728
	4	0.4	0.007	32,000	922	22,400	645	20,800	532	20,800	466
	4	0.9	0.009	32,000	922	22,400	645	20,800	532	20,800	466
	5	0.4	0.006	26,000	666	18,200	408	16,900	379	16,900	324
	5	0.9	0.007	26,000	666	18,200	408	16,900	379	16,900	324
0.5	4	0.4	0.040	40,000	2,000	28,000	1,260	26,000	1,040	26,000	910
	8	0.9	0.010	26,000	728	18,200	446	16,900	414	16,900	355
	12	0.9	0.005	22,400	627	15,680	384	14,560	357	14,560	306

HPRBE2000-TN / HPRBE3000-TN (Ball)

Taper neck ball

Workpiece				Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Hardened steels HRC45~55		High-hardened steels HRC55~65	
Diameter (Ø)	Neck length	Taper angle	ap (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
0.54	2	0.4	0.050	40,000	2,160	28,000	1,361	26,000	1,123	26,000	983
	4	0.4	0.037	40,000	2,160	28,000	1,361	26,000	1,123	26,000	983
	5	0.4	0.031	40,000	1,512	28,000	1,176	26,000	1,040	26,000	832
	6	0.4	0.025	26,000	1,244	18,200	871	16,900	676	16,900	629
	6.5	0.4	0.020	26,000	1,011	18,200	619	16,900	575	16,900	493
	7	0.4	0.015	26,000	899	18,200	585	16,900	543	16,900	465
0.6	2	0.4	0.055	40,000	2,400	28,000	1,512	26,000	1,248	26,000	1,092
	4	0.4	0.035	40,000	2,400	28,000	1,512	26,000	1,248	26,000	1,092
	6	0.4	0.018	32,000	1,382	22,400	968	20,800	799	20,800	699
	6	0.9	0.020	32,000	1,382	22,400	968	20,800	799	20,800	699
	8	0.9	0.020	26,000	998	18,200	612	16,900	568	16,900	487
	10	0.4	0.013	26,000	874	18,200	535	16,900	497	16,900	426
	10	0.9	0.015	26,000	874	18,200	535	16,900	497	16,900	426
	12	0.9	0.010	26,000	874	18,200	535	16,900	497	16,900	426
	15	0.4	0.005	22,400	753	15,680	461	14,560	367	14,560	367
	15	0.9	0.006	22,400	753	15,680	461	14,560	367	14,560	367
0.8	4	0.4	0.062	32,000	2,560	22,400	1,613	20,800	1,331	20,800	1,165
	6	0.4	0.045	32,000	2,560	22,400	1,613	20,800	1,331	20,800	1,165
	8	0.9	0.026	25,600	1,475	17,920	1,032	16,640	852	16,640	745
	12	0.9	0.020	20,800	1,065	14,560	699	13,520	606	13,520	519
	16	0.9	0.018	20,800	932	14,560	612	13,520	530	13,520	454
0.9	4	0.4	0.063	28,300	2,547	19,810	1,605	18,395	1,324	18,395	1,159
	8	0.4	0.050	28,300	2,547	19,810	1,605	18,395	1,324	18,395	1,159
	12	0.4	0.037	18,400	1,325	12,880	811	11,960	753	11,960	646
	16	0.4	0.024	18,400	1,325	12,880	811	11,960	753	11,960	646
	18	0.4	0.018	18,400	1,325	12,880	811	11,960	753	11,960	646
	20	0.4	0.015	15,850	1,141	11,095	699	10,303	649	10,303	556
	22	0.4	0.012	15,850	1,141	11,095	699	10,303	649	10,303	556
	24	0.4	0.009	14,150	1,019	9,905	624	9,198	579	9,198	497
1.0	6	0.4	0.055	25,600	2,560	17,920	1,613	16,640	1,331	16,640	1,165
	8	0.4	0.055	25,600	2,560	17,920	1,613	16,640	1,331	16,640	1,165
	10	0.4	0.032	20,800	1,872	14,560	1,310	13,520	1,082	13,520	946
	10	0.9	0.035	20,800	1,872	14,560	1,310	13,520	1,082	13,520	946
	15	0.9	0.028	16,640	1,331	11,648	874	10,816	757	10,816	649
	20	0.4	0.018	16,640	1,331	11,648	874	10,816	757	10,816	649
	20	0.9	0.020	16,640	1,331	11,648	874	10,816	757	10,816	649
	25	0.9	0.017	14,560	1,165	10,192	764	9,464	662	9,464	568
	30	0.4	0.015	12,480	874	8,736	568	8,112	487	8,112	406
	30	0.9	0.017	12,480	874	8,736	568	8,112	487	8,112	406
	35	0.9	0.010	10,400	728	7,280	473	6,760	406	6,760	338
	40	0.9	0.009	10,000	700	7,000	455	6,500	390	6,500	325

H+ Endmill

Recommended cutting conditions

HPRBE2000-TN / HPRBE3000-TN (Ball)

Taper neck ball

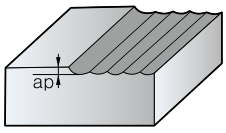
Workpiece				Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Hardened steels HRC45~55		High-hardened steels HRC55~65	
Diameter (Ø)	Neck length	Taper angle	ap (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	50	0.9	0.007	9,500	665	6,650	432	6,175	371	6,175	309
	60	0.9	0.005	9,000	630	6,300	410	5,850	351	5,850	293
	70	0.9	0.003	8,500	595	5,950	387	5,525	332	5,525	276
15.0	8	0.4	0.070	16,960	2,544	11,872	1,603	11,024	1,323	11,024	1,158
	10	0.4	0.070	16,960	2,544	11,872	1,603	11,024	1,323	11,024	1,158
	12	0.4	0.070	16,960	2,544	11,872	1,603	11,024	1,323	11,024	1,158
	15	0.9	0.045	13,568	1,832	9,498	1,282	8,819	1,058	8,819	926
	20	0.9	0.040	11,024	1,323	7,717	810	7,166	752	7,166	645
	30	0.9	0.028	11,024	1,323	7,717	810	7,166	752	7,166	645
1.8	4	0.4	0.120	14,200	2,556	9,940	1,610	9,230	1,329	9,230	1,163
	8	0.4	0.100	14,200	2,556	9,940	1,610	9,230	1,329	9,230	1,163
	12	0.4	0.080	14,200	2,556	9,940	1,610	9,230	1,329	9,230	1,163
	16	0.4	0.071	14,200	2,556	9,940	1,610	9,230	1,329	9,230	1,163
	20	0.4	0.062	9,230	1,329	6,461	814	6,000	756	6,000	648
	24	0.4	0.053	9,230	1,329	6,461	814	6,000	756	6,000	648
	28	0.4	0.044	9,230	1,329	6,461	814	6,000	756	6,000	648
	32	0.4	0.036	9,230	1,329	6,461	814	6,000	756	6,000	648
	36	0.4	0.028	9,230	1,329	6,461	814	6,000	756	6,000	648
	38	0.4	0.020	8,000	1,152	5,600	706	5,200	655	5,200	562
	40	0.4	0.015	8,000	1,152	5,600	706	5,200	655	5,200	562
2.0	8	0.4	0.150	15,200	3,040	10,640	1,915	9,880	1,581	9,880	1,383
	12	0.4	0.090	15,200	3,040	10,640	1,915	9,880	1,581	9,880	1,383
	16	0.4	0.090	15,200	3,040	10,640	1,915	9,880	1,581	9,880	1,383
	20	0.4	0.060	12,160	2,189	8,512	1,532	7,904	1,265	7,904	1,107
	20	0.9	0.070	12,160	2,189	8,512	1,532	7,904	1,265	7,904	1,107
	25	0.9	0.070	9,880	1,581	6,916	968	6,442	899	6,422	771
	30	0.4	0.040	9,880	1,581	6,916	968	6,442	899	6,422	771
	30	0.9	0.045	9,880	1,581	6,916	968	6,442	899	6,422	771
	35	0.9	0.045	9,880	1,581	6,916	968	6,442	899	6,422	771
	40	0.4	0.030	9,880	1,581	6,916	968	6,442	899	6,422	771
	40	0.9	0.035	9,880	1,581	6,916	968	6,442	899	6,422	771
	50	0.9	0.170	8,512	1,192	5,958	775	5,533	664	5,533	553
	60	0.9	0.009	7,235	1,013	5,065	658	4,703	564	4,703	470
	70	0.9	0.005	6,150	861	4,305	560	3,997	480	3,997	400
3.0	8	0.4	0.320	12,720	3,816	8,904	2,404	8,268	1,984	8,268	1,736
	16	0.4	0.220	12,720	3,816	8,904	2,404	8,268	1,984	8,268	1,736
	20	0.4	0.150	12,720	3,434	8,904	2,137	8,268	1,736	8,268	1,488
	30	0.4	0.080	10,176	2,748	7,123	1,496	6,614	1,389	6,614	1,191
	30	0.9	0.090	10,176	2,748	7,123	1,496	6,614	1,389	6,614	1,191
	40	0.4	0.060	8,268	1,984	5,788	1,215	5,374	1,129	5,374	967
	40	0.9	0.070	8,268	1,984	5,788	1,215	5,374	1,129	5,374	967

HPRBE2000-TN / HPRBE3000-TN (Ball)

Taper neck ball

Workpiece				Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Hardened steels HRC45~55		High-hardened steels HRC55~65	
Diameter (Ø)	Neck length	Taper angle	ap (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
3.0	50	0.9	0.050	8,268	1,984	5,788	1,215	5,374	1,129	5,374	967
	60	0.9	0.030	7,123	1,710	4,986	1,047	4,630	972	4,630	833
	70	0.9	0.020	6,233	1,496	4,363	916	4,051	851	4,051	729
4.0	20	1	0.32	11,900	2,860	9,000	2,050	7,800	1,680	7,800	1,590
	30	1	0.23	11,900	2,570	9,000	1,850	7,800	1,520	7,800	1,430
	40	1	0.14	9,500	1,940	7,200	1,400	6,200	1,140	6,200	1,080
	50	1	0.11	7,800	1,590	5,800	1,120	5,000	920	5,000	870
	60	1	0.07	7,800	1,590	5,800	1,120	5,000	920	5,000	870
5.0	30	1	0.34	9,500	2,140	7,200	1,540	6,200	1,260	6,200	1,190
	40	1	0.25	9,500	2,140	7,200	1,540	6,200	1,260	6,200	1,190
	60	1	0.15	6,200	1,320	4,700	950	4,000	770	4,000	720
6.0	30	1	0.45	8,000	2,000	6,000	1,430	5,200	1,170	5,200	1,110
	40	1	0.40	8,000	1,800	6,000	1,280	5,200	1,050	5,200	990
	50	1	0.32	8,000	1,800	6,000	1,280	5,200	1,050	5,200	990
	60	1	0.22	6,400	1,360	4,800	970	4,100	780	4,100	740
	70	1	0.18	5,200	1,110	3,900	790	3,400	650	3,400	610
	80	1	0.14	5,200	1,110	3,900	790	3,400	650	3,400	610
8.0	50	1	0.50	6,000	1,460	4,500	1,040	3,900	850	3,900	810
	60	1	0.43	6,000	1,460	4,500	1,040	3,900	850	3,900	810
	70	1	0.33	6,000	1,460	4,500	1,040	3,900	850	3,900	810
	80	1	0.25	4,800	1,100	3,600	780	3,100	640	3,100	600
10.0	60	1	0.70	4,800	1,300	3,600	920	3,100	750	3,100	710
	75	1	0.50	4,800	1,300	3,600	920	3,100	750	3,100	710

Application tip



- ap = follow above information

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

H+ Endmill

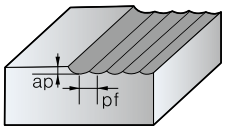
Recommended cutting conditions

HPRBE4000-TN (Ball)

Taper neck ball

Workpiece	Hardened steels											
Conditions	HRC30~40		HRC40~50		HRC50~55		HRC55~60		HRC60~65		HRC65~70	
Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
2.0	62,100	8,600	59,800	7,200	50,000	6,000	43,800	4,700	40,000	4,200	35,600	3,500
2.5	62,100	8,600	59,800	7,200	50,000	6,000	43,800	4,700	40,000	4,200	35,600	3,500
3.0	41,400	9,000	39,800	8,000	33,100	6,000	29,400	4,700	26,300	4,200	23,800	3,500
4.0	31,100	9,000	29,900	8,000	25,000	6,000	21,900	4,700	20,000	4,200	18,100	3,500
5.0	23,300	8,700	22,300	7,400	18,800	5,600	16,900	4,600	14,400	3,800	13,100	3,200
6.0	17,400	7,300	16,800	6,200	13,800	4,700	12,500	3,800	11,000	3,200	10,000	2,600
8.0	13,900	6,300	13,400	5,300	11,300	4,100	10,000	3,200	8,800	2,800	8,100	2,300
10.0	11,600	5,600	11,100	4,700	9,400	3,600	8,300	2,900	7,300	2,500	6,600	2,100

Application tip



- ap = 0.02D
- pf = 0.05D

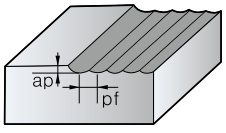
※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

HPBE2000 /HPLBE2000 (Ball)

General ball / Long ball

Workpiece	Hardened steels Heat resistant alloy		Hardened steels									
Conditions	HRC30~40		HRC40~50		HRC50~55		HRC55~60		HRC60~65		HRC65~70	
Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
0.2	50,000	1,200	50,000	1,050	45,000	960	40,000	770	35,000	674	31,500	570
0.3	50,000	1,500	50,000	1,350	45,000	1,200	40,000	965	35,000	840	31,500	700
0.4	50,000	1,900	50,000	1,700	45,000	1,500	40,000	1,200	35,000	1,050	31,500	890
0.5	50,000	2,400	50,000	2,100	45,000	1,900	40,000	1,500	35,000	1,300	31,500	1,100
0.6	50,000	2,900	50,000	2,500	45,000	2,200	40,000	1,800	35,000	1,600	31,500	1,400
0.8	50,000	3,900	50,000	3,300	45,000	3,000	40,000	2,400	35,000	2,100	31,500	1,800
1.0	50,000	4,800	50,000	4,200	45,000	3,800	40,000	3,000	35,000	2,600	35,000	2,300
1.5	50,000	5,400	48,000	4,500	43,000	4,000	37,000	3,100	33,000	2,700	29,700	2,300
2.0	49,700	5,700	47,800	4800	40,000	4,000	35,000	3,150	32,000	2,800	28,500	2,300
3.0	33,100	6,000	31,800	5300	26,500	4,000	23,500	3,150	21,000	2,800	19,000	2,300
4.0	24,900	6,000	23,900	5300	20,000	4,000	17,500	3,150	16,000	2,800	14,500	2,300
5.0	18,600	5,800	17,800	4900	15,000	3,750	13,500	3,050	11,500	2,550	10,500	2,100
6.0	13,900	4,850	13,400	4100	11,000	3,100	10,000	2,500	8,800	2,150	8,000	1,750
8.0	11,100	4,200	10,700	3,500	9,000	2,700	8,000	2,150	7,000	1,850	6,500	1,550
10.0	9,300	3,700	8,900	3,100	7,500	2,400	6,600	1,900	5,800	1,650	5,300	1,380
12.0	6,950	2,950	6,680	2,500	5,600	1,900	5,000	1,550	4,400	1,250	4,000	1,050

Application tip



- ap = 0.02D
- pf = 0.05D

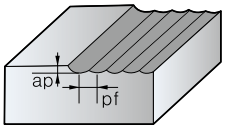
※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

HPBE3000 (Ball)

General ball

Workpiece / Conditions / Diameter(Ø)	Hardened steels											
	HRC30~40		HRC40~50		HRC50~55		HRC55~60		HRC60~65		HRC65~70	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
2.0	57,000	7,100	55,000	6,000	46,000	5,000	40,300	3,900	36,800	3,500	32,800	2,900
2.5	57,000	7,100	55,000	6,000	46,000	5,000	40,300	3,900	36,800	3,500	32,800	2,900
3.0	38,000	7,500	36,600	6,600	30,500	5,000	27,000	3,900	24,200	3,500	21,900	2,900
4.0	28,500	7,500	27,500	6,600	23,000	5,000	20,100	3,900	18,400	3,500	16,700	2,900
5.0	21,500	7,300	20,500	6,100	17,300	4,700	15,500	3,800	13,200	3,200	12,100	2,600
6.0	16,000	6,100	15,400	5,100	12,700	3,900	11,500	3,100	10,100	2,700	9,200	2,200
8.0	12,700	5,300	12,300	4,400	10,400	3,400	9,200	2,700	8,100	2,300	7,500	1,900
10.0	10,700	4,600	10,200	3,900	8,600	3,000	7,600	2,400	6,700	2,100	6,100	1,700
12.0	8,000	3,700	7,700	3,100	6,400	2,400	5,800	1,900	5,100	1,600	4,600	1,300

Application tip



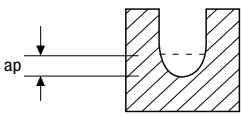
- ap = 0.02D
- pf = 0.05D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

HPRFE2000/4000 (Flat)

Long neck flat

Workpiece / Conditions / Diameter(Ø)	Pre-hardened steels HRC30~45			Hardened steels HRC45~55			High-hardened steels HRC55~65			Copper Alloys		
	R.P.M n (min⁻¹)	Feed vf (mm/min)	ap (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)	ap (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)	ap (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)	ap (mm)
0.4	34,100~50,000	350~590	0.005~0.028	30,500~35,200	295~340	0.003~0.020	18,300~24,600	120~200	0.002~0.012	48,000~50,000	790~920	0.008~0.048
0.5	25,650~33,000	370~470	0.006~0.035	23,750~26,000	285~315	0.004~0.025	14,200~18,000	115~130	0.003~0.015	44,000~50,000	800~1,150	0.010~0.060
0.6	20,900~35,200	330~560	0.007~0.030	19,900~22,000	260~290	0.005~0.021	11,900~15,500	100~120	0.003~0.013	37,500~50,000	770~1,250	0.011~0.051
0.8	16,150~26,400	360~590	0.009~0.040	15,200~16,700	280~310	0.006~0.028	9,000~11,700	110~125	0.004~0.017	28,500~47,000	770~1,300	0.015~0.068
1.0	12,300~18,700	350~540	0.011~0.028	10,500~11,500	250~280	0.008~0.020	6,300~8,050	100~115	0.005~0.012	22,500~34,000	810~1,300	0.018~0.048
1.2	10,450~17,600	350~590	0.025~0.070	9,100~10,000	250~280	0.015~0.042	5,400~7,000	100~115	0.009~0.026	22,500~31,500	950~1,350	0.036~0.101
1.5	9,100~17,600	430~830	0.017~0.077	7,000~8,000	250~280	0.012~0.055	4,300~5,500	100~115	0.007~0.033	14,500~25,000	770~1,320	0.028~0.132
2.0	6,350~10,550	340~570	0.021~0.140	6,100~6,700	270~300	0.015~0.100	3,600~4,700	100~120	0.009~0.060	11,500~18,500	770~1,250	0.036~0.240
3.0	4,300~7,050	550~900	0.056~0.210	3,990~4,600	445~515	0.040~0.150	2,400~3,200	105~310	0.024~0.090	9,000~13,000	1,400~2,110	0.096~0.360
4.0	3,200~5,300	400~675	0.074~0.280	3,000~3,400	335~380	0.053~0.200	1,800~2,400	75~230	0.032~0.120	6,750~9,750	1,050~1,575	0.128~0.480



H+ Endmill

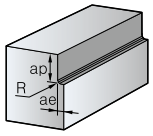
Recommended cutting conditions

HPFE2000 /HPFE2000-A35 (Flat)

General flat / High-helix flat

Workpiece	Hardened steel Heat resistant alloy		Hardened steels									
Conditions	HRC30~40		HRC40~50		HRC50~55		HRC55~60		HRC60~65		HRC65~70	
Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	48,000	1,050	38,000	820	25,500	510	20,500	310	16,000	190	12,500	125
2.0	33,300	1,200	26,000	970	17,500	600	14,500	370	11,000	230	9,500	165
3.0	21,800	1,200	17,300	970	11,500	600	9,500	370	7,500	230	6,400	165
4.0	16,700	1,250	13,200	1,000	8,800	625	7,200	385	5,600	240	4,750	170
5.0	15,700	1,450	12,500	1,150	8,300	710	6,400	410	5,100	260	4,450	190
6.0	13,100	1,350	10,350	1,100	6,900	690	5,300	400	4,200	255	3,700	185
8.0	9,880	1,320	7,800	1,030	5,200	635	4,000	365	3,200	235	2,800	170
10.0	7,800	1,200	6,150	970	4,100	590	3,200	340	2,550	220	2,200	160
12.0	6,650	1,200	5,250	970	3,500	590	2,650	340	2,100	220	1,860	160
16.0	4,900	1,050	3,900	840	2,600	520	2,000	300	1,600	190	1,400	140
20.0	3,900	950	3,100	750	2,050	475	1,600	275	1,300	175	1,100	125

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**

- ap = 1.0D
- ae = 0.05D

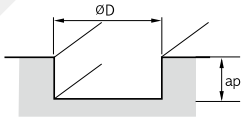
※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

HPFE4000 /HPFE4000-A45 (Flat)

General flat / High-helix flat

Workpiece	Hardened steel Heat resistant alloy		Hardened steels									
Conditions	HRC30~40		HRC40~50		HRC50~55		HRC55~60		HRC60~65		HRC65~70	
Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
0.2	50,000	130	45,000	115	40,000	95	33,000	60	33,000	45	26,400	30
0.3	50,000	190	45,000	140	40,000	115	33,000	70	25,000	50	20,000	35
0.4	50,000	235	45,000	180	40,000	140	33,000	90	25,000	55	20,000	40
0.5	50,000	370	45,000	280	40,000	220	33,000	140	25,000	85	20,000	60
0.6	50,000	470	45,000	360	40,000	285	30,000	160	25,000	105	20,000	75
0.8	50,000	600	40,000	440	30,000	295	25,000	185	19,000	110	15,200	80
0.9	49,000	655	39,000	520	27,800	330	22,700	205	17,500	125	14,000	90
1.0	48,000	750	38,000	570	25,500	360	20,500	215	16,000	135	12,500	85
2.0	33,300	850	26,000	680	17,500	420	14,500	260	11,000	160	9,500	115
3.0	21,800	850	17,300	680	11,500	420	9,500	260	7,500	160	6,400	115
4.0	16,700	880	13,200	700	8,800	440	7,200	270	5,600	170	4,750	118
5.0	15,700	1,000	12,500	805	8,300	500	6,400	285	5,100	180	4,450	132
6.0	13,100	950	10,350	770	6,900	480	5,300	280	4,200	180	3,700	130
8.0	9,880	930	7,800	720	5,200	445	4,000	255	3,200	165	2,800	120
10.0	7,800	850	6,150	680	4,100	415	3,200	240	2,550	155	2,200	112
12.0	6,650	850	5,250	680	3,500	415	2,650	240	2,100	155	1,860	112
16.0	4,900	730	3,900	580	2,600	365	2,000	210	1,600	135	1,400	95
20.0	3,900	660	3,100	525	2,050	335	1,600	195	1,300	125	1,100	85

Application tip



■ **Shouldering depth(ap)**

- ap = 0.05D
- ae = 1.0D

■ **Shouldering depth(ap)**

- ap = 0.02D
- ae = 1.0D

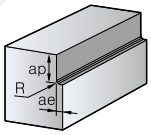
※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

HPFE4000-A45 /HP(L)FE4000 (Flat)

Long neck type High-helix Flat / Irregular flute spacing and lead flat

Workpiece	Hardened steels									
Conditions	HRC40~50		HRC50~55		HRC55~60		HRC60~65		HRC65~70	
Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
4.0	17,200	1,690	11,440	1,140	9,360	700	7,280	430	6,170	310
6.0	13,450	1,820	8,970	1,230	6,890	720	5,460	450	4,810	330
8.0	9,100	1,750	6,760	1,170	5,200	670	4,160	420	3,640	310
10.0	8,000	1,630	5,330	1,090	4,160	620	3,320	400	2,860	280
12.0	6,830	1,630	4,550	1,010	3,450	580	2,730	370	2,420	260

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**

- ap = 1.0D
- ae = 0.03D

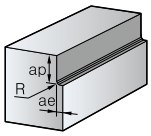
※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

HPFE6000-A50/A60 (Flat)

High-helix flat

Workpiece	Hardened steels Heat resistant alloy		Hardened steels									
Conditions	HRC30~40		HRC40~50		HRC50~55		HRC55~60		HRC60~65		HRC65~70	
Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
6.0	24,800	5,350	23,500	4,900	16,000	4,900	13,500	3,300	10,500	2,100	8,000	1,450
8.0	20,000	5,500	19,000	5,000	12,000	4,600	10,000	3,100	8,000	2,000	6,000	1,400
10.0	16,000	4,900	15,500	4,500	9,500	4,100	8,000	2,900	6,400	1,800	4,800	1,300
12.0	13,000	4,500	12,500	4,100	8,000	3,800	6,600	2,500	5,300	1,600	4,000	1,150
16.0	10,000	4,000	9,700	3,700	6,000	3,400	5,000	2,300	4,000	1,250	3,000	870
20.0	8,000	3,350	7,800	3,400	4,800	3,200	4,000	2,100	3,200	1,020	2,400	690

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**

- ap = 1.0D
- ae = 0.05D

■ **Shouldering depth(ap) and radial depth(ae)**

- ap = 1.0D
- ae = 0.03D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

H+ Endmill

Recommended cutting conditions

HPRRE2000 (Radius)

Rib type high-helix radius

Workpiece			Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Hardened steels HRC45~55		High-hardened steels HRC55~65	
Diameter(Ø)	Neck length	ap (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
0.2	0.5	0.02	50,000	258	50,000	205	50,000	180	50,000	160
	1	0.014	50,000	258	50,000	205	50,000	180	50,000	160
	1.5	0.008	50,000	240	45,900	202	45,900	170	45,900	153
	2	0.008	42,000	202	36,700	176	36,700	162	36,700	147
0.3	1	0.021	50,000	585	50,000	456	50,000	336	50,000	320
	1.5	0.016	50,000	585	45,000	456	45,000	336	45,000	320
	2	0.012	45,000	530	45,000	420	45,000	300	45,000	290
	2.5	0.01	40,000	471	40,000	373	40,000	267	40,000	258
	3	0.008	35,000	412	35,000	326	30,000	200	30,000	194
0.4	1	0.025	50,000	580	50,000	461	40,000	320	36,000	270
	1.5	0.02	50,000	580	50,000	461	40,000	320	36,000	270
	2	0.016	45,000	520	45,000	410	36,000	290	34,000	240
	2.5	0.015	40,500	480	40,500	370	33,400	270	30,600	220
	3	0.014	40,000	410	40,000	330	32,800	240	25,600	200
	3.5	0.012	36,000	380	36,000	300	29,400	200	22,920	180
	4	0.008	30,000	320	30,000	250	21,600	160	19,200	150
	2	0.028	45,000	520	45,000	410	36,000	290	34,000	240
	3	0.016	40,000	410	40,000	330	32,800	240	25,600	200
	4	0.01	30,000	320	30,000	250	21,600	160	19,200	150
0.5	1	0.03	50,000	898	40,000	464	30,000	378	28,000	315
	2	0.023	50,000	898	40,000	464	30,000	378	28,000	315
	3	0.017	45,000	810	36,000	414	27,000	315	24,500	261
	4	0.017	40,000	820	32,000	378	24,000	279	20,000	234
	5	0.011	28,800	540	19,400	280	18,000	250	15,000	200
	6	0.008	28,800	480	19,400	260	18,000	250	15,000	200
	1	0.035	50,000	898	40,000	464	30,000	378	28,000	315
	2	0.03	50,000	898	40,000	464	30,000	378	28,000	315
	3	0.02	45,000	810	36,000	414	27,000	315	24,500	261
	4	0.02	40,000	720	32,000	378	24,000	279	20,000	234
	5	0.013	28,800	540	19,400	280	18,000	250	15,000	200
	6	0.013	28,800	480	19,400	260	18,000	250	15,000	200
0.6	2	0.035	50,000	1,159	37,830	600	28,200	390	23,000	320
	4	0.024	40,000	830	27,800	440	23,600	280	21,000	230
	6	0.015	24,000	490	18,000	300	17,800	240	15,000	210
	8	0.013	24,000	466	18,000	285	17,800	228	15,000	200
	10	0.009	24,000	451	18,000	276	17,800	221	15,000	193
0.8	4	0.032	48,000	1,102	28,000	518	20,000	320	20,000	288
	6	0.019	38,700	800	25,000	461	18,000	288	18,000	256
	8	0.015	29,025	600	20,000	369	16,200	259	16,200	230
	12	0.012	29,025	570	20,000	350	16,200	246	16,200	219
	4	0.056	48,000	1,102	28,000	518	20,000	320	20,000	288
	6	0.032	38,700	800	25,000	461	18,000	288	18,000	256

HPRRE2000 (Radius)

Rib type high-helix radius

Workpiece			Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Hardened steels HRC45~55		High-hardened steels HRC55~65	
Diameter(Ø)	Neck length	ap (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	4	0.038	32,400	1,359	27,540	1,039	24,300	815	22,680	666
	6	0.024	26,244	990	22,307	842	19,683	660	18,371	539
	8	0.024	23,328	880	19,829	748	17,496	587	16,330	479
	10	0.015	20,412	770	17,350	655	15,309	514	14,288	419
	12	0.015	18,144	609	15,422	453	13,608	399	12,701	320
	16	0.009	18,144	533	15,422	420	13,608	342	12,701	266
	20	0.006	13,608	399	11,567	315	10,206	257	9,526	200
	4	0.07	32,400	1,359	27,540	1,039	24,300	815	22,680	666
	6	0.04	26,244	990	22,307	842	19,683	660	18,371	539
	8	0.04	23,328	880	19,829	748	17,496	587	16,330	479
	10	0.025	20,412	770	17,350	655	15,309	514	14,288	419
	12	0.025	18,144	609	15,422	453	13,608	399	12,701	320
	16	0.015	18,144	533	15,422	420	13,608	342	12,701	266
	20	0.01	13,608	399	11,567	315	10,206	257	9,526	200
	6	0.04	26,244	990	22,307	842	19,683	660	18,371	539
	10	0.025	20,412	770	17,350	655	15,309	514	14,288	419
	16	0.015	18,144	533	15,422	420	13,608	342	12,701	266
	20	0.01	13,608	399	11,567	315	10,206	257	9,526	200
1.5	4	0.042	24,930	1,130	20,956	868	18,711	678	17,364	556
	8	0.036	22,680	1,027	19,278	873	17,010	685	15,876	559
	12	0.036	18,144	822	15,422	698	13,608	548	12,701	447
	15	0.023	14,112	568	11,995	423	10,584	373	9,878	298
	20	0.018	14,112	568	11,995	423	10,584	373	9,878	298
	4	0.07	24,930	1,130	20,956	868	18,711	678	17,364	556
	8	0.06	22,680	1,027	19,278	873	17,010	685	15,876	559
	12	0.06	18,144	822	15,422	698	13,608	548	12,701	447
	15	0.038	14,112	568	11,995	423	10,584	373	9,878	298
	20	0.03	14,112	568	11,995	423	10,584	373	9,878	298
	8	0.06	22,680	1,027	19,278	873	17,010	685	15,876	559
	15	0.038	14,112	568	11,995	423	10,584	373	9,878	298
	20	0.03	14,112	568	11,995	423	10,584	373	9,878	298
2.0	6	0.08	20,790	1,635	17,672	1,389	15,593	981	14,553	801
	8	0.07	18,900	1,486	16,065	1,263	14,175	892	13,230	728
	12	0.04	15,309	1,083	13,013	921	11,482	722	10,716	590
	16	0.04	13,608	963	11,567	818	10,206	642	9,526	524
	20	0.035	11,907	843	10,121	716	8,930	562	8,335	459
	25	0.025	11,907	843	10,121	716	8,930	562	8,335	459
	30	0.017	11,312	800	9,615	680	8,484	534	7,918	436
	8	0.09	18,900	1,651	16,065	1,403	14,175	991	13,230	809
	16	0.06	13,608	1,070	11,567	909	10,206	713	9,526	583
	20	0.037	11,907	936	10,121	796	8,930	624	8,335	510
	6	0.017	20,709	1,635	17,672	1,389	15,593	981	14,553	801

H+ Endmill

Recommended cutting conditions

HPRRE2000 (Radius)

Rib type high-helix radius

Workpiece			Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Hardened steels HRC45~55		High-hardened steels HRC55~65	
Diameter(Ø)	Neck length	ap (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
2.0	8	0.014	18,900	1,651	16,065	1,403	14,175	991	13,230	809
	12	0.08	15,309	1,204	13,013	1,023	11,482	802	10,716	655
	16	0.08	13,608	1,070	11,567	909	10,206	713	9,526	583
	20	0.05	11,907	936	10,121	796	8,930	624	8,335	510
	25	0.05	11,907	936	10,121	796	8,930	624	8,335	510
	30	0.03	11,312	889	9,615	756	8,484	593	7,918	484
	8	0.2	18,900	1,651	16,065	1,403	14,175	991	13,230	809
	16	0.1	13,608	1,070	11,567	909	10,206	713	9,526	583
	20	0.06	11,907	936	10,121	796	8,930	624	8,335	510
3.0	8	0.09	14,400	1,415	12,240	1,203	10,800	849	10,080	693
	12	0.07	14,400	1,415	12,240	1,203	10,800	849	10,080	693
	16	0.05	14,400	1,415	12,240	1,203	10,800	849	10,080	693
	20	0.05	11,664	1,146	9,914	974	8,748	764	8,165	624
	30	0.04	9,072	1,146	7,711	974	6,804	764	6,350	624
	35	0.035	9,072	1,146	7,711	974	6,804	764	6,350	624
	8	0.13	14,400	1,572	12,240	1,337	10,800	943	10,080	771
	16	0.075	14,400	1,572	12,240	1,337	10,800	943	10,080	771
	20	0.075	11,664	1,274	9,914	1,083	8,748	849	8,165	693
	30	0.06	9,072	1,274	7,711	1,083	6,804	849	6,350	693
	8	0.18	14,400	1,572	12,240	1,337	10,800	943	10,080	771
	12	0.13	14,400	1,572	12,240	1,337	10,800	943	10,080	771
	16	0.1	14,400	1,572	12,240	1,337	10,800	943	10,080	771
	20	0.1	11,664	1,274	9,914	1,083	8,748	849	8,165	693
	30	0.08	9,072	1,274	7,711	1,083	6,804	849	6,350	693
	35	0.065	9,072	1,274	7,711	1,083	6,804	849	6,350	693

HPRRE2000-TN (Radius)

Taper neck type high-helix radius

Workpiece			Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Hardened steels HRC45~55		High-hardened steels HRC55~65	
Diameter(Ø)	Neck length	ap (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
0.2	2	0.007	39,660	887	33,660	754	29,700	591	27,720	483
0.4	4	0.009	30,096	899	25,582	764	22,572	599	21,067	489
	5	0.007	26,752	710	22,739	528	20,064	466	18,726	373
	4	0.009	31,680	946	26,928	804	23,760	631	22,176	515
	5	0.007	28,160	747	23,936	556	21,120	490	19,712	392
0.5	5	0.013	30,413	1,090	25,851	753	22,810	562	21,289	453
	8	0.008	24,330	678	20,681	468	18,248	350	17,031	282
	10	0.007	18,248	509	15,511	351	13,686	262	12,773	211
0.6	12	0.01	20,377	791	17,320	546	15,282	408	14,264	329
	15	0.006	16,727	649	14,218	448	12,545	335	11,709	270
0.8	6	0.045	31,680	1,084	26,928	921	23,760	723	22,176	590
	12	0.02	28,160	943	23,936	695	21,120	613	19,712	490
1.0	8	0.04	28,512	1,463	24,235	1,244	21,384	976	19,958	797
	10	0.035	28,512	1,596	24,235	1,357	21,384	1,064	19,958	869
	15	0.028	25,344	1,261	21,542	938	19,008	828	17,741	662
	20	0.02	19,008	828	16,157	653	14,256	532	13,306	414
	25	0.017	15,840	690	13,464	544	11,880	443	11,088	345
	30	0.017	15,840	690	13,464	544	11,880	443	11,088	345
	35	0.01	15,840	690	13,464	544	11,880	443	11,088	345
	8	0.04	28,512	1,463	24,235	1,244	21,384	976	19,958	797
	15	0.028	25,344	1,261	21,542	938	19,008	828	17,741	662
	25	0.017	15,840	690	13,464	544	11,880	443	11,088	345
	30	0.017	15,840	690	13,464	544	11,880	443	11,088	345
1.5	10	0.05	21,683	1,079	18,431	803	16,262	708	15,178	567
	15	0.045	19,712	981	16,755	730	14,784	644	13,798	515
	20	0.042	17,347	863	14,745	642	13,010	567	12,143	453
	25	0.032	14,784	644	12,566	508	11,088	414	10,349	322
	30	0.028	12,320	536	10,472	423	9,240	345	8,624	268
	10	0.05	21,683	1,079	18,431	803	16,262	708	15,178	567
	20	0.042	17,347	863	14,745	642	13,010	567	12,143	453
	25	0.032	14,784	644	12,566	508	11,088	414	10,349	322
	30	0.028	12,320	536	10,472	423	9,240	345	8,624	268
2.0	30	0.045	13,440	1,254	11,424	933	10,080	823	9,408	658
	40	0.035	10,080	823	8,568	650	7,560	529	7,056	412
	50	0.017	8,400	686	7,140	541	6,300	441	5,880	343
	12	0.088	22,680	1,814	19,278	1,427	17,010	1,191	15,876	1,048
	20	0.054	18,144	1,452	15,422	1,141	13,608	953	12,701	838
	30	0.045	13,440	1,393	11,424	1,036	10,080	914	9,408	732
	40	0.035	10,080	914	8,568	722	7,560	588	7,056	457
	50	0.017	8,400	762	7,140	601	6,300	490	5,880	381
	8	0.17	22,680	1,814	19,278	1,427	17,010	1,191	15,876	1,048
	12	0.088	22,680	1,814	19,278	1,427	17,010	1,191	15,876	1,048

H+ Endmill

Recommended cutting conditions

HPRRE2000-TN (Radius)

Taper neck type high-helix radius

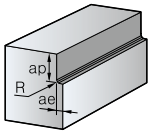
Workpiece			Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Hardened steels HRC45~55		High-hardened steels HRC55~65	
Diameter(Ø)	Neck length	ap (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
2.0	16	0.088	19,278	1,542	16,386	1,213	14,459	1,012	13,495	891
	20	0.054	18,114	1,452	15,422	1,141	13,608	953	12,701	838
	25	0.054	15,876	1,270	13,495	999	11,907	833	11,113	733
	30	0.045	13,440	1,393	11,424	1,036	10,080	914	9,408	732
	40	0.035	10,080	914	8,568	722	7,560	588	7,056	457
	50	0.017	8,400	762	7,140	601	6,300	490	5,880	381
3.0	40	0.07	10,240	956	8,704	711	7,680	627	7,168	502
	50	0.05	7,680	627	6,528	495	5,760	403	5,376	314
	60	0.03	6,400	523	5,440	412	4,800	336	4,480	261
	40	0.07	10,240	1,062	8,704	790	7,680	697	7,168	557
	50	0.05	7,680	697	6,528	550	5,760	448	5,376	348
	60	0.03	6,400	581	5,440	458	4,800	373	4,480	290
	40	0.07	10,240	1,062	8,704	790	7,680	697	7,168	557
	50	0.05	7,680	697	6,528	550	5,760	448	5,376	348
	60	0.03	6,400	581	5,440	458	4,800	373	4,480	290

HP(L)RE2000 (Radius)

General radius / Long radius

Workpiece	Hardened steels Heat resistant alloy		Hardened steels									
Conditions	HRC30~40		HRC40~50		HRC50~55		HRC55~60		HRC60~65		HRC65~70	
Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
2.0	33,300	960	26,000	776	17,500	480	14,500	296	11,000	184	9,500	132
3.0	21,800	960	17,300	776	11,500	480	9,500	296	7,500	184	6,400	132
4.0	16,700	1,000	13,200	800	8,800	500	7,200	308	5,600	192	4,750	136
5.0	15,700	1,160	12,500	920	8,300	568	6,400	328	5,100	208	4,450	152
6.0	13,100	1,080	10,350	880	6,900	552	5,300	320	4,200	204	3,700	148
8.0	9,880	1,056	7,800	824	5,200	508	4,000	292	3,200	188	2,800	136
10.0	7,800	960	6,150	776	4,100	472	3,200	272	2,550	176	2,200	128
12.0	6,650	960	5,250	776	3,500	472	2,650	272	2,100	176	1,860	128
16.0	4,900	840	3,900	672	2,600	416	2,000	240	1,600	152	1,400	112
20.0	3,900	760	3,100	600	2,050	380	1,600	220	1,300	140	1,100	100

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**

- ap = 1.0D
- ae = 0.03D

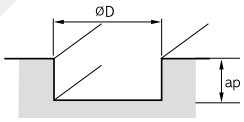
※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

HP(L)RE4000 (Radius)

General radius / Long radius

Workpiece	Hardened steels Heat resistant alloy		Hardened steels									
Conditions	HRC30~40		HRC40~50		HRC50~55		HRC55~60		HRC60~65		HRC65~70	
Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
2.0	33,300	680	26,000	544	17,500	336	14,500	208	11,000	128	9,500	92
3.0	21,800	680	17,300	544	11,500	336	9,500	208	7,500	128	6,400	92
4.0	16,700	704	13,200	560	8,800	352	7,200	216	5,600	136	4,750	94
5.0	15,700	800	12,500	644	8,300	400	6,400	228	5,100	144	4,450	106
6.0	13,100	760	10,350	616	6,900	384	5,300	224	4,200	144	3,700	104
8.0	9,880	744	7,800	576	5,200	356	4,000	204	3,200	132	2,800	96
10.0	7,800	680	6,150	544	4,100	332	3,200	192	2,550	124	2,200	90
12.0	6,650	680	5,250	544	3,500	332	2,650	192	2,100	124	1,860	90
16.0	4,900	584	3,900	464	2,600	292	2,000	168	1,600	108	1,400	78
20.0	3,900	528	3,100	420	2,050	268	1,600	168	1,300	100	1,100	70

Application tip



■ **Shouldering depth(ap)**
- ap = 0.05D
- ae = 1.0D

■ **Shouldering depth(ap)**
- ap = 0.02D
- ae = 1.0D

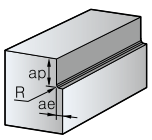
※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

HPRE4000-LS / U / A45 (Radius)

Long shank radius / Irregular flute spacing and lead radius / High-helix radius

Workpiece	Hardened steel Heat resistant alloy		Hardened steels									
Conditions	HRC30~40		HRC40~50		HRC50~55		HRC55~60		HRC60~65		HRC65~70	
Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
3.0	21,800	1,400	17,300	1,000	11,500	672	9,500	416	7,500	256	6,400	184
4.0	16,700	1,440	13,200	1,040	8,800	704	7,200	432	5,600	268	4,750	192
5.0	15,700	1,600	12,500	1,200	8,300	800	6,400	464	5,100	296	4,450	216
6.0	13,100	1,560	10,350	1,120	6,900	760	5,300	448	4,200	280	3,700	208
8.0	9,880	1,504	7,800	1,080	5,200	720	4,000	416	3,200	264	2,800	192
10.0	7,800	1,400	6,150	1,008	4,100	672	3,200	384	2,550	248	2,200	176
12.0	6,650	1,400	5,250	1,008	3,500	672	2,650	384	2,100	240	1,860	176
16.0	4,900	1,200	3,900	880	2,600	584	2,000	336	1,600	216	1,400	160
20.0	3,900	1,040	3,100	776	2,050	520	1,600	304	1,300	200	1,100	144

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**
- ap = 1.0D
- ae = 0.03D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

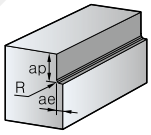
H+ Endmill

Recommended cutting conditions

HPRE4000-ST (Straight)

Workpiece	Hardened steel									
Conditions	HRC40~50		HRC50~55		HRC55~60		HRC60~65		HRC65~70	
Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
3 X R0.5	22,000	16,000	17,000	10,000	12,500	8,000	9,500	4,600	6,900	2,500
4 X R0.5	17,000	17,500	13,000	12,000	11,000	9,200	8,000	5,500	5,600	2,900
6 X R0.5	13,500	18,500	10,500	13,800	9,000	11,000	6,400	6,400	4,500	3,600
6 X R1.0	13,500	18,500	10,500	13,800	9,000	11,000	6,400	6,400	4,500	3,600
8 X R1.0	10,000	18,500	8,000	14,000	6,800	11,000	4,800	6,700	3,400	4,100
8 X R2.0	10,000	18,500	8,000	14,000	6,800	11,000	4,800	6,700	3,400	4,100
10 X R1.0	8,000	18,500	6,400	14,000	5,400	11,000	3,800	6,800	2,700	3,800
10 X R2.0	8,000	18,500	6,400	14,000	5,400	11,000	3,800	6,800	2,700	3,800
12 X R2.0	6,600	18,500	5,300	14,000	4,500	11,000	3,200	7,000	2,250	3,600
12 X R3.0	6,600	18,500	5,300	14,000	4,500	11,000	3,200	7,000	2,250	3,600

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**
- ap = 0.1R
- ae = 0.3D

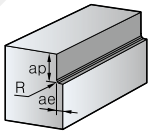
■ **Shouldering depth(ap) and radial depth(ae)**
- ap = 0.05R
- ae = 0.3D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

HP(L)RE6000

Workpiece	Hardened steels									
Conditions	HRC40~50		HRC50~55		HRC55~60		HRC60~65		HRC65~70	
Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
3 X R0.5	9,550	6,500	6,900	4,150	4,550	2,750	2,850	1,150	1,900	610
4 X R0.5	7,950	7,000	5,750	4,600	4,000	3,200	2,550	1,350	1,750	700
6 X R0.5	5,800	7,650	4,100	4,900	2,900	3,500	1,850	1,850	1,350	795
6 X R1.0	5,800	7,650	4,100	4,900	2,900	3,500	1,850	1,850	1,350	795
8 X R1.0	4,350	7,650	3,050	4,900	2,200	3,500	1,400	1,850	995	795
8 X R2.0	4,350	7,650	3,050	4,900	2,200	3,500	1,400	1,850	995	795
10 X R1.0	3,500	7,650	2,450	4,900	1,750	3,500	1,100	1,850	795	795
10 X R2.0	3,500	7,650	2,450	4,900	1,750	3,500	1,100	1,850	795	795
12 X R2.0	2,900	7,650	2,050	4,900	1,450	3,500	925	1,850	665	795
12 X R3.0	2,900	7,650	2,050	4,900	1,450	3,500	925	1,850	665	795

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**
- ap = 0.2R
- ae = 0.5D

■ **Shouldering depth(ap) and radial depth(ae)**
- ap = 0.05R
- ae = 0.5D

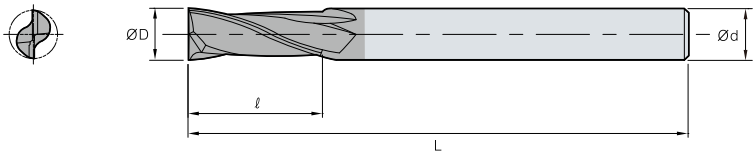
※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

Z Endmill

ZFE2000 (Flat)

2 | H A 35° | h5 shank | Substrate PC315E

ØD	Tolerance
~ Ø5.9	0.000 ~ -0.015
Ø6.0 ~	0.000 ~ -0.025



(mm)

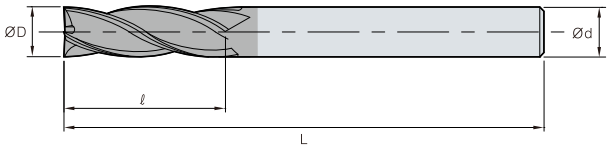
	Designation	ØD	Ød	ℓ	L
ZFE	2010-050-S4	1.0	4	2.5	50
2	2010-050-S6	1.0	6	2.5	50
	2012-050-S4	1.2	4	3	50
	2012-050-S6	1.2	6	3	50
	2015-050-S4	1.5	4	4	50
	2015-050-S6	1.5	6	4	50
	2020-050-S4	2.0	4	6	50
	2020-050-S6	2.0	6	6	50
	2025-050-S4	2.5	4	7.5	50
	2025-050-S6	2.5	6	7.5	50
	2030-050-S4	3.0	4	9	50
	2030-050-S6	3.0	6	9	50
	2035-050	3.5	6	10	50
	2040-050-S4	4.0	4	11	50
	2040-050-S6	4.0	6	11	50
	2045-050	4.5	6	14	50
	2050-060	5.0	6	15	60
	2055-060	5.5	6	15	60
	2060-060	6.0	6	15	60
	2065-060	6.5	8	18	60
	2070-060	7.0	8	20	60
	2075-060	7.5	8	20	60
	2080-070	8.0	8	20	70
	2085-070	8.5	10	22	70
	2090-070	9.0	10	22	70
	2095-070	9.5	10	24	70
	2100-075	10.0	10	25	75
	2120-080	12.0	12	30	80
	2140-100	14.0	14	35	100
	2160-100	16.0	16	40	100

Z Endmill

ZFE4000 (Flat)

2 | Multiple H·A | h5 shank | Substrate PC315E

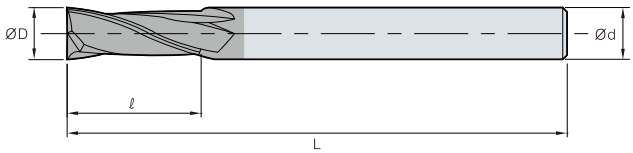
ØD	Tolerance
~ Ø5.9	0.000 ~ -0.015
Ø6.0 ~	0.000 ~ -0.025



(mm)

	Designation	ØD	Ød	ℓ	L
ZFE	4010-050-S4	1.0	4	2.5	50
4	4010-050-S6	1.0	6	2.5	50
	4012-050-S4	1.2	4	3	50
	4012-050-S6	1.2	6	3	50
	4015-050-S4	1.5	4	4	50
	4015-050-S6	1.5	6	4	50
	4020-050-S4	2.0	4	6	50
	4020-050-S6	2.0	6	6	50
	4025-050-S4	2.5	4	7.5	50
	4025-050-S6	2.5	6	7.5	50
	4030-050-S4	3.0	4	9	50
	4030-050-S6	3.0	6	9	50
	4035-050	3.5	6	10	50
	4040-050-S4	4.0	4	11	50
	4040-050-S6	4.0	6	11	50
	4045-050	4.5	6	14	50
	4050-060	5.0	6	15	60
	4055-060	5.5	6	15	60
	4060-060	6.0	6	15	60
	4065-060	6.5	8	18	60
	4070-060	7.0	8	20	60
	4075-060	7.5	8	20	60
	4080-070	8.0	8	20	70
	4085-070	8.5	10	22	70
	4090-070	9.0	10	22	70
	4095-070	9.5	10	24	70
	4100-075	10.0	10	25	75
	4120-080	12.0	12	30	80
	4140-100	14.0	14	35	100
	4160-100	16.0	16	40	100

ZSFE2000/4000 (Short flat)



2 | 4 | H·A 35° | h5 shank | Substrate PC315E

ØD	Tolerance
~ Ø5.9	0.000 ~ -0.015
Ø6.0 ~	0.000 ~ -0.025

(mm)

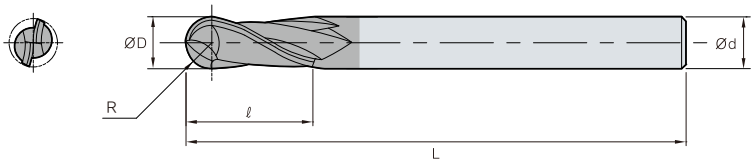
	Designation	ØD	Ød	ℓ	L
ZSFE 2	2010-040-S4	1.0	4	1.5	40
	2010-040-S6	1.0	6	1.5	40
	2012-040-S4	1.2	4	1.5	40
	2012-040-S6	1.2	6	1.5	40
	2015-040-S4	1.5	4	2.2	40
	2015-040-S6	1.5	6	2.2	40
	2020-040-S4	2.0	4	3	40
	2020-040-S6	2.0	6	3	40
	2025-040-S4	2.5	4	4	40
	2025-040-S6	2.5	6	4	40
	2030-045-S4	3.0	4	4.5	45
	2030-045-S6	3.0	6	4.5	45
	2040-045-S4	4.0	4	6	45
	2040-045-S6	4.0	6	6	45
	2060-050	6.0	6	9	50
	2080-060	8.0	8	12	60
	2100-065	10.0	10	15	65
	2120-070	12.0	12	18	70
ZSFE 4	4010-040-S4	1.0	4	1.5	40
	4010-040-S6	1.0	6	1.5	40
	4012-040-S4	1.2	4	1.5	40
	4012-040-S6	1.2	6	1.5	40
	4015-040-S4	1.5	4	2.2	40
	4015-040-S6	1.5	6	2.2	40
	4020-040-S4	2.0	4	3	40
	4020-040-S6	2.0	6	3	40
	4025-040-S4	2.5	4	4	40
	4025-040-S6	2.5	6	4	40
	4030-045-S4	3.0	4	4.5	45
	4030-045-S6	3.0	6	4.5	45
	4040-045-S4	4.0	4	6	45
	4040-045-S6	4.0	6	6	45
	4060-050	6.0	6	9	50
	4080-060	8.0	8	12	60
	4100-065	10.0	10	15	65
	4120-070	12.0	12	18	70

Z Endmill

ZBE2000 (Ball)

2 | H·A 30° | h5 shank | Substrate PC315E

ØD	Tolerance
~ Ø5.9	0.000 ~ -0.015
Ø6.0 ~	0.000 ~ -0.025



(mm)

	Designation	R	ØD	Ød	ℓ	L
ZBE	2010-050-S4	0.50	1.0	4	2.5	50
2	2010-050-S6	0.50	1.0	6	2.5	50
	2012-050-S4	0.60	1.2	4	3	50
	2012-050-S6	0.60	1.2	6	3	50
	2015-050-S4	0.75	1.5	4	4	50
	2015-050-S6	0.75	1.5	6	4	50
	2020-050-S4	1.00	2.0	4	5	50
	2020-050-S6	1.00	2.0	6	5	50
	2025-060-S4	1.25	2.5	4	6	60
	2025-060-S6	1.25	2.5	6	6	60
	2030-060-S4	1.50	3.0	4	8	60
	2030-060-S6	1.50	3.0	6	8	60
	2035-070	1.75	3.5	6	8	70
	2040-070-S4	2.00	4.0	4	8	70
	2040-070-S6	2.00	4.0	6	8	70
	2045-080	2.25	4.5	6	9	80
	2050-080	2.50	5.0	6	10	80
	2055-090	2.75	5.5	6	11	90
	2060-090	3.00	6.0	6	12	90
	2065-090	3.25	6.5	8	13	90
	2070-090	3.50	7.0	8	14	90
	2080-100	4.00	8.0	8	14	100
	2085-100	4.25	8.5	10	16	100
	2090-100	4.50	9.0	10	18	100
	2100-100	5.00	10.0	10	18	100
	2120-110	6.00	12.0	12	22	110

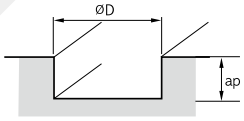
Z Endmill

Recommended cutting conditions

ZFE2000/ZSFE2000 (Flat)

Workpiece / Conditions / Diameter(Ø)	Alloy steels & carbon steels (SCM, SNCM, SM45C etc) under HRC30		Pre-hardened steels (STD, KP4M, NAK etc) HRC30~45		Stainless steels (STS304, STS316 etc)	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	19,745	175	13,057	100	10,500	70
2.0	11,560	190	7,560	120	6,300	90
3.0	8,920	210	5,560	140	4,620	120
4.0	7,560	300	4,620	180	3,880	150
5.0	6,300	320	3,780	190	3,160	160
6.0	5,560	350	3,360	220	2,840	180
8.0	4,200	380	2,520	200	2,100	180
10.0	3,260	330	2,000	160	1,680	160
12.0	2,740	280	1,680	130	1,360	130
16.0	2,200	220	1,360	110	1,060	110

Application tip



■ **Shouldering depth(ap)** ■ **Slotting depth(ap)**

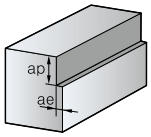
- D ≤ Ø3 (ap = 0.2D)
- D > Ø3 (ap = 0.5D)

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

ZFE4000/ZSFE4000 (Flat)

Workpiece / Conditions / Diameter(Ø)	Alloy steels & carbon steels (SCM, SNCM, SM45C etc) under HRC30		Pre-hardened steels (STD, KP4M, NAK etc) HRC30~45		Stainless steels (STS304, STS316 etc)	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
2.0	11,560	280	7,560	170	6,300	140
3.0	8,920	320	5,560	200	4,620	170
4.0	7,560	570	4,620	350	3,880	280
5.0	6,300	600	3,780	360	3,160	300
6.0	5,560	660	3,360	410	2,840	330
8.0	4,200	710	2,520	380	2,100	350
10.0	3,260	610	2,000	300	1,680	300
12.0	2,740	520	1,680	250	1,360	240
16.0	2,200	410	1,360	200	1,100	200

Application tip



■ **Shouldering depth(ap)**

- ap = 1.0D
- ae = 0.05D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

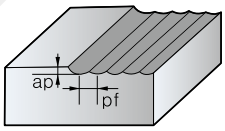
Z Endmill

Recommended cutting conditions

ZFE4000/ZSFE4000 (Ball)

Workpiece / Conditions / Diameter(Ø)	Alloy steels & carbon steels (SCM, SNCM, SM45C etc) under HRC30		Pre-hardened steels (STD, KP4M, NAK etc) HRC30~45	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	30,000	2,880	30,000	2,520
1.2	30,000	3,060	28,800	2,580
1.5	30,000	3,240	28,800	2,700
2.0	29,820	3,420	28,680	2,880
3.0	19,860	3,600	19,080	3,180
4.0	14,940	3,600	14,340	3,180
5.0	11,160	3,480	10,680	2,940
6.0	8,340	2,910	8,040	2,460
8.0	6,660	2,520	6,420	2,100
10.0	5,580	2,220	5,340	1,860
12.0	4,170	1,770	4,008	1,500

Application tip

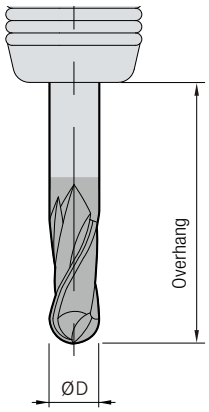


- ap = 0.03D
- pf = 0.05D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

Cutting condition by overhang

- Cutting conditions of the shank taper type in case of being clamped at neck
  - When the overhang is increased by 1D, decrease R.P.M and feed 10%
- In case of the straight type adjust conditions according to the overhang
  - Ex: When the overhang is 3D and is increased by 1D, decrease R.P.M and feed 10%



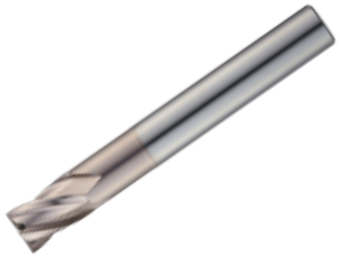
Notice

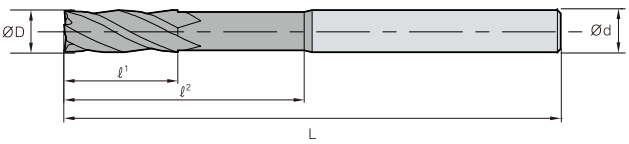
- Cutting conditions are up to the machine's condition and the shape of cutting
- Use cutting fluid that is proper to the workpiece and produces few temperature reactions

U+ Endmill

UPRFE4000 (Flat)

Long neck flat





4 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

(mm)

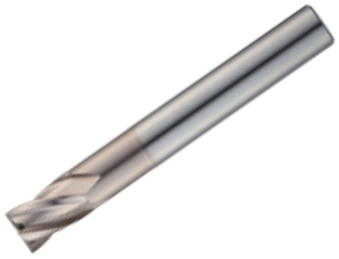
	Designation	ØD	Ød	ℓ1	ℓ2	L
UPRFE 4	4010-050-V1.5N2S04	1.0	4	1.5	2	50
	4010-050-V1.5N3S04	1.0	4	1.5	3	50
	4010-050-V1.5N4S04	1.0	4	1.5	4	50
	4010-050-V1.5N5S04	1.0	4	1.5	5	50
	4010-050-V1.5N6S04	1.0	4	1.5	6	50
	4010-050-V1.5N7S04	1.0	4	1.5	7	50
	4010-050-V1.5N8S04	1.0	4	1.5	8	50
	4010-050-V1.5N10S04	1.0	4	1.5	10	50
	4010-050-V1.5N12S04	1.0	4	1.5	12	50
	4010-050-V1.5N14S04	1.0	4	1.5	14	50
	4010-050-V1.5N16S04	1.0	4	1.5	16	50
	4010-050-V1.5N18S04	1.0	4	1.5	18	50
	4010-050-V1.5N20S04	1.0	4	1.5	20	50
	4010-060-V1.5N22S04	1.0	4	1.5	22	60
	4010-060-V1.5N26S04	1.0	4	1.5	26	60
	4010-070-V1.5N30S04	1.0	4	1.5	30	70
	4010-080-V1.5N40S04	1.0	4	1.5	40	80
	4010-100-V1.5N50S04	1.0	4	1.5	50	100
	4012-050-V1.8N4S04	1.2	4	1.8	4	50
	4012-050-V1.8N6S04	1.2	4	1.8	6	50
	4012-050-V1.8N8S04	1.2	4	1.8	8	50
	4012-050-V1.8N10S04	1.2	4	1.8	10	50
	4012-050-V1.8N12S04	1.2	4	1.8	12	50
	4012-050-V1.8N14S04	1.2	4	1.8	14	50
	4012-050-V1.8N16S04	1.2	4	1.8	16	50
	4012-050-V1.8N20S04	1.2	4	1.8	20	50
	4012-060-V1.8N26S04	1.2	4	1.8	26	60
	4012-070-V1.8N30S04	1.2	4	1.8	30	70
	4015-050-V2.3N4S04	1.5	4	2.3	4	50
	4015-050-V2.3N5S04	1.5	4	2.3	5	50
	4015-050-V2.3N6S04	1.5	4	2.3	6	50
	4015-050-V2.3N7S04	1.5	4	2.3	7	50
	4015-050-V2.3N8S04	1.5	4	2.3	8	50
	4015-050-V2.3N10S04	1.5	4	2.3	10	50
	4015-050-V2.3N12S04	1.5	4	2.3	12	50
	4015-050-V2.3N14S04	1.5	4	2.3	14	50

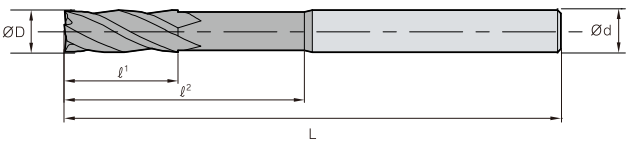
	Designation	ØD	Ød	ℓ1	ℓ2	L
UPRFE 4	4015-050-V2.3N16S04	1.5	4	2.3	16	50
	4015-050-V2.3N18S04	1.5	4	2.3	18	50
	4015-050-V2.3N20S04	1.5	4	2.3	20	50
	4015-060-V2.3N22S04	1.5	4	2.3	22	60
	4015-060-V2.3N26S04	1.5	4	2.3	26	60
	4015-070-V2.3N30S04	1.5	4	2.3	30	70
	4020-050-V3N6S04	2.0	4	3	6	50
	4020-050-V3N8S04	2.0	4	3	8	50
	4020-050-V3N10S04	2.0	4	3	10	50
	4020-050-V3N12S04	2.0	4	3	12	50
	4020-050-V3N14S04	2.0	4	3	14	50
	4020-050-V3N16S04	2.0	4	3	16	50
	4020-050-V3N18S04	2.0	4	3	18	50
	4020-050-V3N20S04	2.0	4	3	20	50
	4020-060-V3N22S04	2.0	4	3	22	60
	4020-060-V3N26S04	2.0	4	3	26	60
	4020-070-V3N30S04	2.0	4	3	30	70
	4020-070-V3N35S04	2.0	4	3	35	70
	4020-080-V3N40S04	2.0	4	3	40	80
	4020-090-V3N45S04	2.0	4	3	45	90
	4020-100-V3N50S04	2.0	4	3	50	100
	4020-110-V3N60S04	2.0	4	3	60	110
	4025-050-V4N8S04	2.5	4	4	8	50
	4025-050-V4N10S04	2.5	4	4	10	50
	4025-050-V4N12S04	2.5	4	4	12	50
	4025-050-V4N14S04	2.5	4	4	14	50
	4025-050-V4N16S04	2.5	4	4	16	50
	4025-050-V4N18S04	2.5	4	4	18	50
	4025-050-V4N20S04	2.5	4	4	20	50
	4025-060-V4N22S04	2.5	4	4	22	60
	4025-060-V4N26S04	2.5	4	4	26	60
	4025-070-V4N30S04	2.5	4	4	30	70
	4025-070-V4N35S04	2.5	4	4	35	70
	4025-080-V4N40S04	2.5	4	4	40	80
	4025-090-V4N45S04	2.5	4	4	45	90
	4025-100-V4N50S04	2.5	4	4	50	100

U+ Endmill

UPRFE4000 (Flat)

Long neck flat





4 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

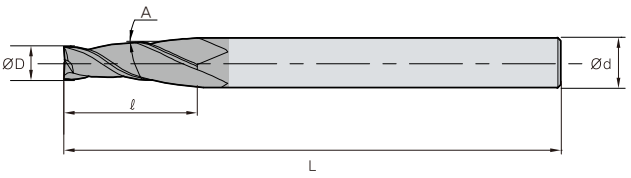
(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L
UPRFE 4	4030-050-V4.5N6S06	3.0	6	4.5	6	50
	4030-050-V4.5N8S06	3.0	6	4.5	8	50
	4030-050-V4.5N10S06	3.0	6	4.5	10	50
	4030-050-V4.5N12S06	3.0	6	4.5	12	50
	4030-060-V4.5N14S06	3.0	6	4.5	14	60
	4030-060-V4.5N16S06	3.0	6	4.5	16	60
	4030-060-V4.5N18S06	3.0	6	4.5	18	60
	4030-060-V4.5N20S06	3.0	6	4.5	20	60
	4030-065-V4.5N22S06	3.0	6	4.5	22	65
	4030-065-V4.5N26S06	3.0	6	4.5	26	65
	4030-070-V4.5N30S06	3.0	6	4.5	30	70
	4030-070-V4.5N35S06	3.0	6	4.5	35	70
	4030-080-V4.5N40S06	3.0	6	4.5	40	80
	4030-090-V4.5N45S06	3.0	6	4.5	45	90
	4030-100-V4.5N50S06	3.0	6	4.5	50	100
	4030-100-V4.5N60S06	3.0	6	4.5	60	100
	4040-050-V4.5N8S06	4.0	6	4.5	8	50
	4040-050-V4.5N10S06	4.0	6	4.5	10	50
	4040-050-V4.5N12S06	4.0	6	4.5	12	50
	4040-060-V4.5N14S06	4.0	6	4.5	14	60
	4040-060-V4.5N16S06	4.0	6	4.5	16	60
	4040-060-V4.5N18S06	4.0	6	4.5	18	60
	4040-060-V4.5N20S06	4.0	6	4.5	20	60
	4040-065-V4.5N22S06	4.0	6	4.5	22	65
	4040-065-V4.5N26S06	4.0	6	4.5	26	65
	4040-070-V4.5N30S06	4.0	6	4.5	30	70

	Designation	ØD	Ød	ℓ1	ℓ2	L
UPRFE 4	4040-070-V4.5N35S06	4.0	6	4.5	35	70
	4040-080-V4.5N40S06	4.0	6	4.5	40	80
	4040-090-V4.5N45S06	4.0	6	4.5	45	90
	4040-100-V4.5N50S06	4.0	6	4.5	50	100
	4040-100-V4.5N60S06	4.0	6	4.5	60	100
	4050-060-V8N16S06	5.0	6	8	16	60
	4050-060-V8N20S06	5.0	6	8	20	60
	4050-065-V8N26S06	5.0	6	8	26	65
	4050-070-V8N30S06	5.0	6	8	30	70
	4050-075-V8N35S06	5.0	6	8	35	75
	4050-080-V8N40S06	5.0	6	8	40	80
	4050-090-V8N50S06	5.0	6	8	50	90
	4050-100-V8N60S06	5.0	6	8	60	100
	4060-060-V9N15S06	6.0	6	9	15	60
	4060-060-V9N20S06	6.0	6	9	20	60
	4060-070-V9N30S06	6.0	6	9	30	70
	4060-090-V9N32S06	6.0	6	9	32	90
	4080-070-V12N25S08	8.0	8	12	25	70
	4080-080-V12N30S08	8.0	8	12	30	80
	4080-100-V12N42S08	8.0	8	12	42	100
	4100-075-V15N30S10	10.0	10	15	30	75
	4100-080-V15N35S10	10.0	10	15	35	80
	4100-100-V15N45S10	10.0	10	15	45	100
	4120-080-V20N35S12	12.0	12	20	35	80
	4120-090-V20N40S12	12.0	12	20	40	90
	4120-110-V20N50S12	12.0	12	20	50	110

UPTFE2000 (Flat)

Taper flat



2 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

(mm)

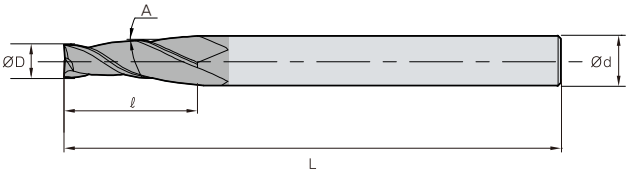
	Designation	ØD	Ød	ℓ	L	A
UPTFE 2	2003-040-A0.5V1.2S04	0.3	4	1.2	40	0.5°
	2003-040-A1V1.2S04	0.3	4	1.2	40	1°
	2003-040-A1.5V1.2S04	0.3	4	1.2	40	1.5°
	2003-040-A2V1.2S04	0.3	4	1.2	40	2°
	2003-040-A3V1.5S04	0.3	4	1.5	40	3°
	2003-040-A5V1.5S04	0.3	4	1.5	40	5°
	2003-040-A7V1.5S04	0.3	4	1.5	40	7°
	2003-040-A10V1.5S04	0.3	4	1.5	40	10°
	2004-040-A0.5V1.6S04	0.4	4	1.6	40	0.5°
	2004-040-A1V1.6S04	0.4	4	1.6	40	1°
	2004-040-A1.5V1.6S04	0.4	4	1.6	40	1.5°
	2004-040-A2V1.6S04	0.4	4	1.6	40	2°
	2004-040-A3V1.6S04	0.4	4	1.6	40	3°
	2004-040-A5V2S04	0.4	4	2	40	5°
	2004-040-A7V2S04	0.4	4	2	40	7°
	2004-040-A10V2S04	0.4	4	2	40	10°
	2005-045-A0.5V2S04	0.5	4	2	45	0.5°
	2005-045-A1V2S04	0.5	4	2	45	1°
	2005-045-A1.5V2S04	0.5	4	2	45	1.5°
	2005-045-A2V2S04	0.5	4	2	45	2°
	2005-045-A3V2S04	0.5	4	2	45	3°
	2005-045-A5V2.5S04	0.5	4	2.5	45	5°
	2005-045-A7V2.5S04	0.5	4	2.5	45	7°
	2005-045-A10V2.5S04	0.5	4	2.5	45	10°
	2006-045-A0.5V2.4S04	0.6	4	2.4	45	0.5°
	2006-045-A1V2.4S04	0.6	4	2.4	45	1°
	2006-045-A1.5V2.4S04	0.6	4	2.4	45	1.5°
	2006-045-A2V2.4S04	0.6	4	2.4	45	2°
	2006-045-A3V2.4S04	0.6	4	2.4	45	3°
	2006-045-A5V3S04	0.6	4	3	45	5°
	2006-045-A7V3S04	0.6	4	3	45	7°
	2006-045-A10V3S04	0.6	4	3	45	10°
	2007-045-A0.5V2.8S04	0.7	4	2.8	45	0.5°
	2007-045-A1V2.8S04	0.7	4	2.8	45	1°
	2007-045-A1.5V2.8S04	0.7	4	2.8	45	1.5°
	2007-045-A2V2.8S04	0.7	4	2.8	45	2°

	Designation	ØD	Ød	ℓ	L	A
UPTFE 2	2007-045-A3V2.8S04	0.7	4	2.8	45	3°
	2007-045-A5V3.5S04	0.7	4	3.5	45	5°
	2007-045-A7V3.5S04	0.7	4	3.5	45	7°
	2007-045-A10V3.5S04	0.7	4	3.5	45	10°
	2008-045-A0.5V3.2S04	0.8	4	3.2	45	0.5°
	2008-045-A1V3.2S04	0.8	4	3.2	45	1°
	2008-045-A1.5V3.2S04	0.8	4	3.2	45	1.5°
	2008-045-A2V3.2S04	0.8	4	3.2	45	2°
	2008-045-A3V3.2S04	0.8	4	3.2	45	3°
	2008-045-A5V4S04	0.8	4	4	45	5°
	2008-045-A7V4S04	0.8	4	4	45	7°
	2008-045-A10V4S04	0.8	4	4	45	10°
	2010-050-A0.5V4S04	1.0	4	4	50	0.5°
	2010-050-A1V4S04	1.0	4	4	50	1°
	2010-050-A1.5V4S04	1.0	4	4	50	1.5°
	2010-050-A2V6S04	1.0	4	6	50	2°
	2010-050-A3V6S04	1.0	4	6	50	3°
	2010-050-A5V8S04	1.0	4	8	50	5°
	2010-050-A7V8S04	1.0	4	8	50	7°
	2010-050-A10V8S04	1.0	4	8	50	10°
	2015-050-A0.5V6S04	1.5	4	6	50	0.5°
	2015-050-A1V6S04	1.5	4	6	50	1°
	2015-050-A1.5V6S04	1.5	4	6	50	1.5°
	2015-050-A2V8S04	1.5	4	8	50	2°
	2015-050-A3V8S04	1.5	4	8	50	3°
	2015-050-A5V10S04	1.5	4	10	50	5°
	2015-050-A7V10S04	1.5	4	10	50	7°
	2015-050-A10V10S06	1.5	6	10	50	10°
	2020-050-A0.5V8S04	2.0	4	8	50	0.5°
	2020-050-A1V8S04	2.0	4	8	50	1°
	2020-050-A1.5V8S04	2.0	4	8	50	1.5°
	2020-050-A2V10S04	2.0	4	10	50	2°
	2020-050-A3V10S04	2.0	4	10	50	3°
	2020-050-A5V12S06	2.0	6	12	50	5°
	2020-050-A7V12S06	2.0	6	12	50	7°
	2020-050-A10V12S08	2.0	8	12	50	10°

U+ Endmill

UPTFE2000 (Flat)

Taper flat



2 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

(mm)

	Designation	ØD	Ød	ℓ	L	A
UPTLFE	2025-050-A0.5V10S06	2.5	6	10	50	0.5°
2	2025-050-A1V10S06	2.5	6	10	50	1°
	2025-050-A1.5V10S06	2.5	6	10	50	1.5°
	2025-050-A2V12S06	2.5	6	12	50	2°
	2025-050-A3V12S06	2.5	6	12	50	3°
	2025-050-A5V14S06	2.5	6	14	50	5°
	2025-050-A7V14S06	2.5	6	14	50	7°
	2025-050-A10V14S08	2.5	8	14	50	10°
	2030-050-A0.5V12S06	3.0	6	12	50	0.5°
	2030-050-A1V12S06	3.0	6	12	50	1°
	2030-050-A1.5V12S06	3.0	6	12	50	1.5°
	2030-050-A2V14S06	3.0	6	14	50	2°
	2030-050-A3V14S06	3.0	6	14	50	3°
	2030-050-A5V16S06	3.0	6	16	50	5°
	2030-050-A7V16S08	3.0	8	16	50	7°
	2030-050-A10V16S10	3.0	10	16	50	10°
	2040-060-A0.5V16S06	4.0	6	16	60	0.5°
	2040-060-A1V16S06	4.0	6	16	60	1°
	2040-060-A1.5V16S06	4.0	6	16	60	1.5°
	2040-060-A2V16S06	4.0	6	16	60	2°
	2040-065-A7V16S08	4.0	8	16	65	7°
	2040-065-A10V17S10	4.0	10	17	65	10°
	2040-060-A3V19S06	4.0	6	19	60	3°
	2040-065-A5V22S08	4.0	8	22	65	5°
	2060-075-A10V17S12	6.0	12	17	75	10°
	2060-065-A3V19S08	6.0	8	19	65	3°
	2060-065-A0.5V20S08	6.0	8	20	65	0.5°
	2060-065-A1V20S08	6.0	8	20	65	1°

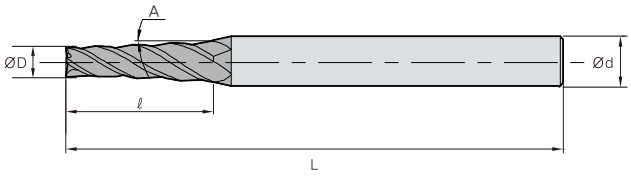
	Designation	ØD	Ød	ℓ	L	A
UPTLFE	2060-065-A1.5V20S08	6.0	8	20	65	1.5°
2	2060-065-A2V20S08	6.0	8	20	65	2°
	2060-075-A5V22S10	6.0	10	22	75	5°
	2060-075-A7V24S12	6.0	12	24	75	7°
	2070-070-A0.5V28S08	7.0	8	28	70	0.5°
	2070-070-A1V28S08	7.0	8	28	70	1°
	2070-070-A1.5V28S10	7.0	10	28	70	1.5°
	2070-080-A2V28S10	7.0	10	28	80	2°
	2070-080-A3V28S10	7.0	10	28	80	3°
	2070-080-A5V28S12	7.0	12	28	80	5°
	2080-090-A2V28S10	8.0	10	28	90	2°
	2080-090-A7V32S16	8.0	16	32	90	7°
	2080-100-A10V34S20	8.0	20	34	100	10°
	2080-090-A0.5V35S10	8.0	10	35	90	0.5°
	2080-090-A1V35S10	8.0	10	35	90	1°
	2080-090-A1.5V35S10	8.0	10	35	90	1.5°
	2080-090-A3V38S12	8.0	12	38	90	3°
	2080-100-A5V45S16	8.0	16	45	100	5°
	2080-150-A10V48S25	8.0	25	48	150	10°
	2100-100-A5V34S16	10.0	16	34	100	5°
	2100-090-A1.5V38S12	10.0	12	38	90	1.5°
	2100-090-A0.5V40S12	10.0	12	40	90	0.5°
	2100-090-A1V40S12	10.0	12	40	90	1°
	2100-075-A2V40S16	10.0	16	40	75	2°
	2100-100-A3V40S16	10.0	16	40	100	3°
	2100-090-A7V40S20	10.0	20	40	90	7°
	2100-100-A10V42S25	10.0	25	42	100	10°

UPTLFE4000 (Flat)

Taper flat

4 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03



(mm)

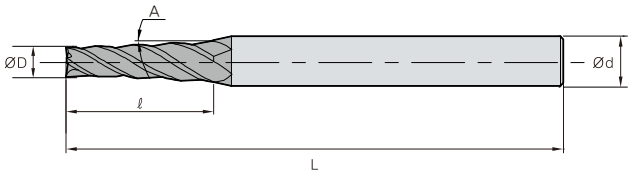
Designation	ØD	Ød	ℓ	L	A
UPTLFE 4008-045-A0.5V4S04	0.8	4	4	45	0.5°
4008-045-A1V4S04	0.8	4	4	45	1°
4008-045-A1.5V4S04	0.8	4	4	45	1.5°
4008-045-A2V4S04	0.8	4	4	45	2°
4008-045-A0.5V6S04	0.8	4	6	45	0.5°
4008-045-A1V6S04	0.8	4	6	45	1°
4008-045-A1.5V6S04	0.8	4	6	45	1.5°
4008-045-A2V6S04	0.8	4	6	45	2°
4008-045-A0.5V8S04	0.8	4	8	45	0.5°
4008-045-A1V8S04	0.8	4	8	45	1°
4008-045-A1.5V8S04	0.8	4	8	45	1.5°
4008-045-A2V8S04	0.8	4	8	45	2°
4008-045-A0.5V10S04	0.8	4	10	45	0.5°
4008-045-A1V10S04	0.8	4	10	45	1°
4008-045-A1.5V10S04	0.8	4	10	45	1.5°
4008-045-A2V10S04	0.8	4	10	45	2°
4008-045-A0.5V12S04	0.8	4	12	45	0.5°
4008-045-A1V12S04	0.8	4	12	45	1°
4008-045-A1.5V12S04	0.8	4	12	45	1.5°
4008-045-A2V12S04	0.8	4	12	45	2°
4010-050-A0.5V4S04	1.0	4	4	50	0.5°
4010-050-A1V4S04	1.0	4	4	50	1°
4010-050-A1.5V4S04	1.0	4	4	50	1.5°
4010-050-A2V4S04	1.0	4	4	50	2°
4010-050-A3V4S04	1.0	4	4	50	3°
4010-050-A0.5V6S04	1.0	4	6	50	0.5°
4010-050-A1V6S04	1.0	4	6	50	1°
4010-050-A1.5V6S04	1.0	4	6	50	1.5°
4010-050-A2V6S04	1.0	4	6	50	2°
4010-050-A3V6S04	1.0	4	6	50	3°
4010-050-A0.5V8S04	1.0	4	8	50	0.5°
4010-050-A1V8S04	1.0	4	8	50	1°
4010-050-A1.5V8S04	1.0	4	8	50	1.5°
4010-050-A2V8S04	1.0	4	8	50	2°
4010-050-A3V8S04	1.0	4	8	50	3°
4010-050-A0.5V10S04	1.0	4	10	50	0.5°

Designation	ØD	Ød	ℓ	L	A
UPTLFE 4010-050-A1V10S04	1.0	4	10	50	1°
4010-050-A1.5V10S04	1.0	4	10	50	1.5°
4010-050-A2V10S04	1.0	4	10	50	2°
4010-050-A3V10S04	1.0	4	10	50	3°
4010-050-A0.5V12S04	1.0	4	12	50	0.5°
4010-050-A1V12S04	1.0	4	12	50	1°
4010-050-A1.5V12S04	1.0	4	12	50	1.5°
4010-050-A2V12S04	1.0	4	12	50	2°
4010-050-A3V12S04	1.0	4	12	50	3°
4010-050-A0.5V16S04	1.0	4	16	50	0.5°
4010-050-A1V16S04	1.0	4	16	50	1°
4010-050-A1.5V16S04	1.0	4	16	50	1.5°
4010-050-A2V16S04	1.0	4	16	50	2°
4010-050-A3V16S04	1.0	4	16	50	3°
4012-050-A0.5V6S04	1.2	4	6	50	0.5°
4012-050-A1V6S04	1.2	4	6	50	1°
4012-050-A1.5V6S04	1.2	4	6	50	1.5°
4012-050-A2V6S04	1.2	4	6	50	2°
4012-050-A3V6S04	1.2	4	6	50	3°
4012-050-A0.5V8S04	1.2	4	8	50	0.5°
4012-050-A1V8S04	1.2	4	8	50	1°
4012-050-A1.5V8S04	1.2	4	8	50	1.5°
4012-050-A2V8S04	1.2	4	8	50	2°
4012-050-A3V8S04	1.2	4	8	50	3°
4012-050-A0.5V10S04	1.2	4	10	50	0.5°
4012-050-A1V10S04	1.2	4	10	50	1°
4012-050-A1.5V10S04	1.2	4	10	50	1.5°
4012-050-A2V10S04	1.2	4	10	50	2°
4012-050-A3V10S04	1.2	4	10	50	3°
4012-050-A0.5V12S04	1.2	4	12	50	0.5°
4012-050-A1V12S04	1.2	4	12	50	1°
4012-050-A1.5V12S04	1.2	4	12	50	1.5°
4012-050-A2V12S04	1.2	4	12	50	2°
4012-050-A3V12S04	1.2	4	12	50	3°
4012-050-A0.5V16S04	1.2	4	16	50	0.5°
4012-050-A1V16S04	1.2	4	16	50	1°

U+ Endmill

UPTLFE4000 (Flat)

Taper flat



4	H·A 30°	h6 shank	Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

(mm)

	Designation	ØD	Ød	ℓ	L	A
UPTLFE 4	4012-050-A1.5V16S04	1.2	4	16	50	1.5°
	4012-050-A2V16S04	1.2	4	16	50	2°
	4012-050-A3V16S04	1.2	4	16	50	3°
	4015-050-A0.5V6S04	1.5	4	6	50	0.5°
	4015-050-A1V6S04	1.5	4	6	50	1°
	4015-050-A1.5V6S04	1.5	4	6	50	1.5°
	4015-050-A2V6S04	1.5	4	6	50	2°
	4015-050-A3V6S04	1.5	4	6	50	3°
	4015-050-A0.5V8S04	1.5	4	8	50	0.5°
	4015-050-A1V8S04	1.5	4	8	50	1°
	4015-050-A1.5V8S04	1.5	4	8	50	1.5°
	4015-050-A2V8S04	1.5	4	8	50	2°
	4015-050-A3V8S04	1.5	4	8	50	3°
	4015-050-A0.5V10S04	1.5	4	10	50	0.5°
	4015-050-A1V10S04	1.5	4	10	50	1°
	4015-050-A1.5V10S04	1.5	4	10	50	1.5°
	4015-050-A2V10S04	1.5	4	10	50	2°
	4015-050-A3V10S04	1.5	4	10	50	3°
	4015-050-A0.5V12S04	1.5	4	12	50	0.5°
	4015-050-A1V12S04	1.5	4	12	50	1°
	4015-050-A1.5V12S04	1.5	4	12	50	1.5°
	4015-050-A2V12S04	1.5	4	12	50	2°
	4015-050-A3V12S04	1.5	4	12	50	3°
	4015-050-A0.5V16S04	1.5	4	16	50	0.5°
	4015-050-A1V16S04	1.5	4	16	50	1°
	4015-050-A1.5V16S04	1.5	4	16	50	1.5°
	4015-050-A2V16S04	1.5	4	16	50	2°
	4015-050-A3V16S04	1.5	4	16	50	3°
	4015-060-A0.5V20S04	1.5	4	20	60	0.5°
	4015-060-A1V20S04	1.5	4	20	60	1°
	4015-060-A1.5V20S04	1.5	4	20	60	1.5°
	4015-060-A2V20S04	1.5	4	20	60	2°
	4015-060-A3V20S04	1.5	4	20	60	3°
	4020-050-A0.5V8S04	2.0	4	8	50	0.5°
	4020-050-A1V8S04	2.0	4	8	50	1°
	4020-050-A1.5V8S04	2.0	4	8	50	1.5°

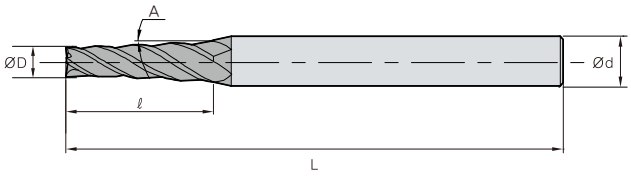
	Designation	ØD	Ød	ℓ	L	A
UPTLFE 4	4020-050-A2V8S04	2.0	4	8	50	2°
	4020-050-A3V8S04	2.0	4	8	50	3°
	4020-050-A0.5V10S04	2.0	4	10	50	0.5°
	4020-050-A1V10S04	2.0	4	10	50	1°
	4020-050-A1.5V10S04	2.0	4	10	50	1.5°
	4020-050-A2V10S04	2.0	4	10	50	2°
	4020-050-A3V10S04	2.0	4	10	50	3°
	4020-050-A0.5V12S04	2.0	4	12	50	0.5°
	4020-050-A1V12S04	2.0	4	12	50	1°
	4020-050-A1.5V12S04	2.0	4	12	50	1.5°
	4020-050-A2V12S04	2.0	4	12	50	2°
	4020-050-A3V12S04	2.0	4	12	50	3°
	4020-050-A0.5V16S04	2.0	4	16	50	0.5°
	4020-050-A1V16S04	2.0	4	16	50	1°
	4020-050-A1.5V16S04	2.0	4	16	50	1.5°
	4020-050-A2V16S04	2.0	4	16	50	2°
	4020-050-A3V16S04	2.0	4	16	50	3°
	4020-060-A0.5V20S04	2.0	4	20	60	0.5°
	4020-060-A1V20S04	2.0	4	20	60	1°
	4020-060-A1.5V20S04	2.0	4	20	60	1.5°
	4020-060-A2V20S04	2.0	4	20	60	2°
	4020-060-A3V20S06	2.0	6	20	60	3°
	4020-060-A0.5V25S04	2.0	4	25	60	0.5°
	4020-060-A1V25S04	2.0	4	25	60	1°
	4020-060-A1.5V25S04	2.0	4	25	60	1.5°
	4020-060-A2V25S04	2.0	4	25	60	2°
	4020-060-A3V25S06	2.0	6	25	60	3°
	4025-050-A0.5V10S04	2.5	4	10	50	0.5°
	4025-050-A1V10S04	2.5	4	10	50	1°
	4025-050-A1.5V10S04	2.5	4	10	50	1.5°
	4025-050-A2V10S04	2.5	4	10	50	2°
	4025-050-A3V10S04	2.5	4	10	50	3°
	4025-050-A0.5V12S04	2.5	4	12	50	0.5°
	4025-050-A1V12S04	2.5	4	12	50	1°
	4025-050-A1.5V12S04	2.5	4	12	50	1.5°
	4025-050-A2V12S04	2.5	4	12	50	2°

UPTLFE4000 (Flat)

Taper flat

4 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03



(mm)

Designation	ØD	Ød	ℓ	L	A
UPTLFE 4025-050-A3V12S04	2.5	4	12	50	3°
4025-050-A0.5V16S04	2.5	4	16	50	0.5°
4025-050-A1V16S04	2.5	4	16	50	1°
4025-050-A1.5V16S04	2.5	4	16	50	1.5°
4025-050-A2V16S04	2.5	4	16	50	2°
4025-050-A3V16S06	2.5	6	16	50	3°
4025-060-A0.5V20S04	2.5	4	20	60	0.5°
4025-060-A1V20S04	2.5	4	20	60	1°
4025-060-A1.5V20S04	2.5	4	20	60	1.5°
4025-060-A2V20S04	2.5	4	20	60	2°
4025-060-A3V20S06	2.5	6	20	60	3°

Designation	ØD	Ød	ℓ	L	A
UPTLFE 4025-060-A0.5V25S04	2.5	4	25	60	0.5°
4025-060-A1V25S04	2.5	4	25	60	1°
4025-060-A1.5V25S04	2.5	4	25	60	1.5°
4025-060-A2V25S06	2.5	6	25	60	2°
4025-060-A3V25S06	2.5	6	25	60	3°
4025-060-A0.5V30S04	2.5	4	30	60	0.5°
4025-060-A1V30S04	2.5	4	30	60	1°
4025-060-A1.5V30S06	2.5	6	30	60	1.5°
4025-060-A2V30S06	2.5	6	30	60	2°
4025-060-A3V30S06	2.5	6	30	60	3°

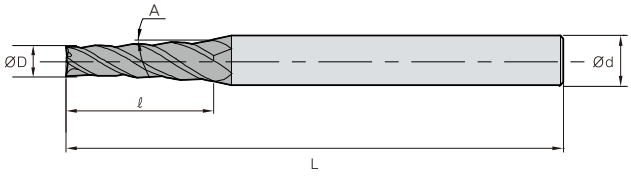
U+ Endmill

UPTFE4000 (Flat)

Taper flat

4 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03



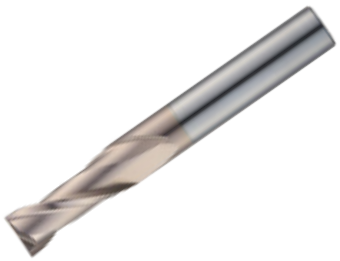
(mm)

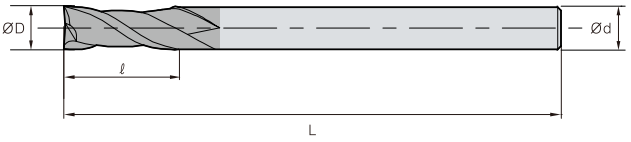
	Designation	ØD	Ød	ℓ	L	A
UPTFE	4030-050-A0.5V12S06	3.0	6	12	50	0.5°
4	4030-050-A1V12S06	3.0	6	12	50	1°
	4030-050-A1.5V12S06	3.0	6	12	50	1.5°
	4030-050-A2V14S06	3.0	6	14	50	2°
	4030-050-A3V14S06	3.0	6	14	50	3°
	4030-050-A5V16S06	3.0	6	16	50	5°
	4030-050-A7V16S08	3.0	8	16	50	7°
	4030-050-A10V16S10	3.0	10	16	50	10°
	4040-060-A0.5V16S06	4.0	6	16	60	0.5°
	4040-060-A1V16S06	4.0	6	16	60	1°
	4040-060-A1.5V16S06	4.0	6	16	60	1.5°
	4040-060-A2V16S06	4.0	6	16	60	2°
	4040-065-A7V16S08	4.0	8	16	65	7°
	4040-065-A10V17S10	4.0	10	17	65	10°
	4040-060-A3V19S06	4.0	6	19	60	3°
	4040-065-A5V22S08	4.0	8	22	65	5°
	4060-075-A10V17S12	6.0	12	17	75	10°
	4060-065-A3V19S08	6.0	8	19	65	3°
	4060-065-A0.5V20S08	6.0	8	20	65	0.5°
	4060-065-A1V20S08	6.0	8	20	65	1°
	4060-065-A1.5V20S08	6.0	8	20	65	1.5°
	4060-065-A2V20S08	6.0	8	20	65	2°
	4060-075-A5V22S10	6.0	10	22	75	5°

	Designation	ØD	Ød	ℓ	L	A
UPTFE	4060-075-A7V24S12	6.0	12	24	75	7°
4	4070-070-A0.5V28S08	7.0	8	28	70	0.5°
	4070-070-A1V28S08	7.0	8	28	70	1°
	4070-070-A1.5V28S10	7.0	10	28	70	1.5°
	4070-080-A2V28S10	7.0	10	28	80	2°
	4070-080-A3V28S10	7.0	10	28	80	3°
	4070-080-A5V28S12	7.0	12	28	80	5°
	4080-090-A2V28S10	8.0	10	28	90	2°
	4080-090-A7V32S16	8.0	16	32	90	7°
	4080-100-A10V34S20	8.0	20	34	100	10°
	4080-090-A0.5V35S10	8.0	10	35	90	0.5°
	4080-090-A1V35S10	8.0	10	35	90	1°
	4080-090-A1.5V35S10	8.0	10	35	90	1.5°
	4080-090-A3V38S12	8.0	12	38	90	3°
	4080-100-A5V45S16	8.0	16	45	100	5°
	4100-100-A5V34S16	10.0	16	34	100	5°
	4100-090-A1.5V38S12	10.0	12	38	90	1.5°
	4100-090-A0.5V40S12	10.0	12	40	90	0.5°
	4100-090-A1V40S12	10.0	12	40	90	1°
	4100-090-A2V40S16	10.0	16	40	90	2°
	4100-100-A3V40S16	10.0	16	40	100	3°
	4100-090-A7V40S20	10.0	20	40	90	7°
	4100-100-A10V42S25	10.0	25	42	100	10°

UPFE2000 (Flat)

General flat





2 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
~ Ø6.5	0.000 ~ -0.012
Ø8.5 ~ Ø25.0	0.000 ~ -0.025

(mm)

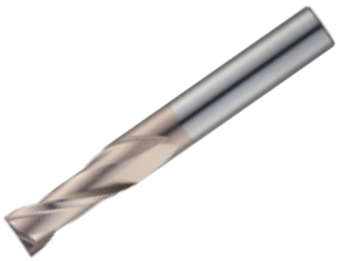
	Designation	ØD	Ød	ℓ	L
UPFE 2	2001-040-V0.2S03	0.10	3	0.2	40
	2001-040-V0.1S04	0.10	4	0.1	40
	2001-040-V0.2S04	0.10	4	0.2	40
	2001-040-V0.3S04	0.10	4	0.3	40
	20015-040-S04	0.15	4	0.3	40
	2002-040-V0.4S03	0.20	3	0.4	40
	2002-040-V0.2S04	0.20	4	0.2	40
	2002-040-V0.4S04	0.20	4	0.4	40
	2002-040-V0.6S04	0.20	4	0.6	40
	20025-040-S04	0.25	4	0.5	40
	2003-040-V0.6S03	0.30	3	0.6	40
	2003-040-V0.3S04	0.30	4	0.3	40
	2003-040-V0.6S04	0.30	4	0.6	40
	2003-040-V0.9S04	0.30	4	0.9	40
	20035-040-S04	0.35	4	0.7	40
	2004-040-V0.8S03	0.40	3	0.8	40
	2004-040-V0.4S04	0.40	4	0.4	40
	2004-040-V0.8S04	0.40	4	0.8	40
	2004-040-V1.2S04	0.40	4	1.2	40
	20045-040-S04	0.45	4	0.9	40
	2005-040-V1S03	0.50	3	1	40
	2005-040-V0.5S04	0.50	4	0.5	40
	2005-040-V1S04	0.50	4	1	40
	2005-040-V1.5S04	0.50	4	1.5	40
	20055-040-S04	0.55	4	1.1	40
	2006-040-V1.2S03	0.60	3	1.2	40
	2006-040-V0.6S04	0.60	4	0.6	40
	2006-040-V1.2S04	0.60	4	1.2	40
	2006-040-V1.8S04	0.60	4	1.8	40
	20065-040-S04	0.65	4	1.3	40
	2007-040-V1.4S03	0.70	3	1.4	40
	2007-040-V0.7S04	0.70	4	0.7	40
	2007-040-V1.4S04	0.70	4	1.4	40
	2007-040-V2.1S04	0.70	4	2.1	40
	20075-040-S04	0.75	4	1.5	40
	2008-040-V1.6S03	0.80	3	1.6	40

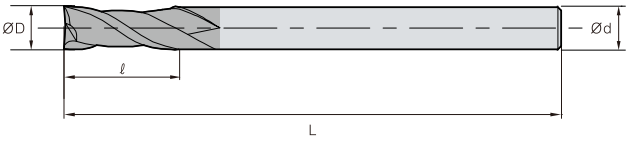
	Designation	ØD	Ød	ℓ	L
UPFE 2	2008-040-V0.8S04	0.80	4	0.8	40
	2008-040-V1.6S04	0.80	4	1.6	40
	2008-040-V2.4S04	0.80	4	2.4	40
	20085-040-S04	0.85	4	1.7	40
	2009-040-V1.8S03	0.90	3	1.8	40
	2009-040-V0.9S04	0.90	4	0.9	40
	2009-040-V1.8S04	0.90	4	1.8	40
	2009-040-V2.7S04	0.90	4	2.7	40
	20095-040-S04	0.95	4	2	40
	2010-050-V2.5S03	1.00	3	2.5	50
	2010-050-V2.5S04	1.00	4	2.5	50
	2010-040-V1S06	1.00	6	1	40
	2010-040-V2S06	1.00	6	2	40
	2010-050-V2.5S06	1.00	6	2.5	50
	2010-050-V3S06	1.00	6	3	50
	2010-050-V4S06	1.00	6	4	50
	2010-050-V6S06	1.00	6	6	50
	2011-050-V3S04	1.10	4	3	50
	2012-050-V3S03	1.20	3	3	50
	2012-050-V3S04	1.20	4	3	50
	2012-040-V2S06	1.20	6	2	40
	2012-050-V3S06	1.20	6	3	50
	2012-050-V4S06	1.20	6	4	50
	2012-050-V6S06	1.20	6	6	50
	2013-050-V3S04	1.30	4	3	50
	2014-050-V4S04	1.40	4	4	50
	2015-050-V4S03	1.50	3	4	50
	2015-050-V4S04	1.50	4	4	50
	2015-040-V1.5S06	1.50	6	1.5	40
	2015-040-V3S06	1.50	6	3	40
	2015-050-V4S06	1.50	6	4	50
	2015-050-V6S06	1.50	6	6	50
	2015-050-V8S06	1.50	6	8	50
	2015-050-V10S06	1.50	6	10	50
	2016-050-V4S04	1.60	4	4	50
	2017-050-V4S04	1.70	4	4	50

U+ Endmill

UPFE2000 (Flat)

General flat





2	H·A 30°	h6 shank	Substrate PC315W

ØD	Tolerance
~ Ø6.5	0.000 ~ -0.012
Ø8.5 ~ Ø25.0	0.000 ~ -0.025

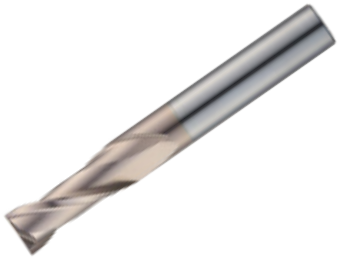
(mm)

	Designation	ØD	Ød	ℓ	L
UPFE 2	2018-050-V5S04	1.80	4	5	50
	2019-050-V5S04	1.90	4	5	50
	2020-050-V6S03	2.00	3	6	50
	2020-050-V6S04	2.00	4	6	50
	2020-040-V2S06	2.00	6	2	40
	2020-040-V4S06	2.00	6	4	40
	2020-050-V6S06	2.00	6	6	50
	2020-050-V8S06	2.00	6	8	50
	2020-050-V10S06	2.00	6	10	50
	2020-050-V12S06	2.00	6	12	50
	2021-050-V6S04	2.10	4	6	50
	2022-050-V6S04	2.20	4	6	50
	2023-050-V6S04	2.30	4	6	50
	2024-050-V6S04	2.40	4	6	50
	2025-050-V7S03	2.50	3	7	50
	2025-050-V8S04	2.50	4	8	50
	2025-040-V2.5S06	2.50	6	2.5	40
	2025-040-V5S06	2.50	6	5	40
	2025-050-V7S06	2.50	6	7	50
	2025-050-V10S06	2.50	6	10	50
	2025-050-V12S06	2.50	6	12	50
	2026-050-V8S04	2.60	4	8	50
	2027-050-V8S04	2.70	4	8	50
	2028-050-V8S04	2.80	4	8	50
	2029-050-V8S04	2.90	4	8	50
	2030-050-V8S03	3.00	3	8	50
	2030-050-V8S04	3.00	4	8	50
	2030-040-V3S06	3.00	6	3	40
	2030-040-V6S06	3.00	6	6	40
	2030-050-V8S06	3.00	6	8	50
	2030-050-V10S06	3.00	6	10	50
	2030-050-V12S06	3.00	6	12	50
	2030-050-V14S06	3.00	6	14	50
	2035-050-V10S04	3.50	4	10	50
	2035-050-S06	3.50	6	10	50
	2040-050-V10S04	4.00	4	10	50

	Designation	ØD	Ød	ℓ	L
UPFE 2	2040-080-V10S04	4.00	4	10	80
	2040-040-V4S06	4.00	6	4	40
	2040-040-V8S06	4.00	6	8	40
	2040-050-V10S06	4.00	6	10	50
	2040-050-V12S06	4.00	6	12	50
	2040-050-V14S06	4.00	6	14	50
	2040-050-V16S06	4.00	6	16	50
	2045-050-S06	4.50	6	14	50
	2050-050-V5S06	5.00	6	5	50
	2050-050-V10S06	5.00	6	10	50
	2050-060-V15S06	5.00	6	15	60
	2050-060-V20S06	5.00	6	20	60
	2050-060-V25S06	5.00	6	25	60
	2055-060-S06	5.50	6	15	60
	2060-050-V6S06	6.00	6	6	50
	2060-050-V12S06	6.00	6	12	50
	2060-060-V15S06	6.00	6	15	60
	2060-060-V20S06	6.00	6	20	60
	2060-060-V25S06	6.00	6	25	60
	2065-060-S08	6.50	8	18	60
	2070-060-S08	7.00	8	20	60
	2075-060-S08	7.50	8	20	60
	2080-060-V16S08	8.00	8	16	60
	2080-070-V20S08	8.00	8	20	70
	2080-070-V25S08	8.00	8	25	70
	2080-070-V30S08	8.00	8	30	70
	2085-070-S10	8.50	10	22	70
	2090-070-S10	9.00	10	22	70
	2095-070-S10	9.50	10	24	70
	2100-065-V22S10	10.00	10	22	65
	2100-075-V25S10	10.00	10	25	75
	2100-075-V30S10	10.00	10	30	75
	2100-075-V35S10	10.00	10	35	75
	2105-075-S12	10.50	12	26	75
	2110-075-S12	11.00	12	30	75
	2115-080-S12	11.50	12	30	80

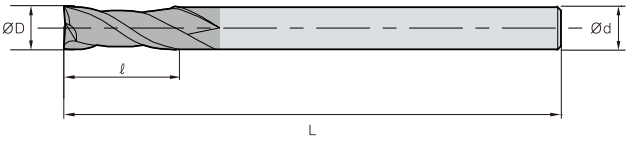
UPFE2000 (Flat)

General flat



2 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
~ Ø6.5	0.000 ~ -0.012
Ø8.5 ~ Ø25.0	0.000 ~ -0.025



(mm)

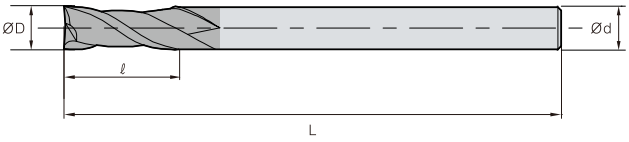
	Designation	ØD	Ød	ℓ	L
UPFE 2	2120-070-V26S12	12.00	12	26	70
	2120-080-V30S12	12.00	12	30	80
	2120-080-V35S12	12.00	12	35	80
	2120-080-V40S12	12.00	12	40	80
	2130-100-S12	13.00	12	35	100
	2140-100-S12	14.00	12	35	100
	2140-100-S14	14.00	14	35	100
	2140-100-V35S16	14.00	16	35	100
	2150-100-S16	15.00	16	38	100
	2160-100-V32S16	16.00	16	32	100
	2160-100-V40S16	16.00	16	40	100

	Designation	ØD	Ød	ℓ	L
UPFE 2	2170-100-S16	17.00	16	42	100
	2180-100-S16	18.00	16	45	100
	2180-100-S18	18.00	18	45	100
	2180-100-V45S20	18.00	20	45	100
	2190-100-S20	19.00	20	45	100
	2200-100-V45S20	20.00	20	45	100
	2210-100-S20	21.00	20	45	100
	2220-100-S20	22.00	20	45	100
	2230-120-S25	23.00	25	50	120
	2240-120-S25	24.00	25	50	120
	2250-120-S25	25.00	25	50	120

U+ Endmill

UPLFE2000 (Flat)

Long flat



2	H-A 30°	h6 shank	Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

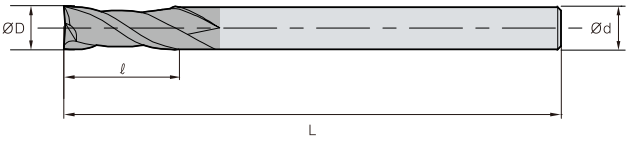
(mm)

	Designation	ØD	Ød	ℓ	L
UPLFE 2	2010-060-V3S06	1.0	6	3	60
	2010-060-V4S06	1.0	6	4	60
	2010-060-V5S06	1.0	6	5	60
	2010-060-V6S06	1.0	6	6	60
	2010-060-V7S06	1.0	6	7	60
	2010-060-V8S06	1.0	6	8	60
	2010-060-V10S06	1.0	6	10	60
	2010-060-V12S06	1.0	6	12	60
	2012-060-V4S06	1.2	6	4	60
	2012-060-V6S06	1.2	6	6	60
	2012-060-V8S06	1.2	6	8	60
	2012-060-V10S06	1.2	6	10	60
	2012-060-V12S06	1.2	6	12	60
	2015-060-V6S06	1.5	6	6	60
	2015-060-V8S06	1.5	6	8	60
	2015-060-V10S06	1.5	6	10	60
	2015-060-V12S06	1.5	6	12	60
	2015-060-V14S06	1.5	6	14	60
	2015-060-V16S06	1.5	6	16	60
	2020-060-V8S06	2.0	6	8	60
	2020-060-V10S06	2.0	6	10	60
	2020-060-V12S06	2.0	6	12	60
	2020-060-V14S06	2.0	6	14	60
	2020-060-V16S06	2.0	6	16	60
	2025-060-V10S06	2.5	6	10	60
	2025-060-V12S06	2.5	6	12	60
	2025-060-V16S06	2.5	6	16	60
	2025-060-V20S06	2.5	6	20	60
	2025-060-V26S06	2.5	6	26	60
	2030-070-V10S06	3.0	6	10	70
	2030-070-V12S06	3.0	6	12	70
	2030-070-V14S06	3.0	6	14	70
	2030-100-V16S03	3.0	3	16	100
	2030-070-V16S06	3.0	6	16	70
	2030-070-V20S06	3.0	6	20	70
	2030-070-V26S06	3.0	6	26	70

	Designation	ØD	Ød	ℓ	L
UPLFE 2	2030-070-V30S06	3.0	6	30	70
	2040-070-V12S06	4.0	6	12	70
	2040-070-V16S06	4.0	6	16	70
	2040-100-V20S04	4.0	4	20	100
	2040-070-V20S06	4.0	6	20	70
	2040-070-V26S06	4.0	6	26	70
	2040-070-V30S06	4.0	6	30	70
	2050-070-V20S06	5.0	6	20	70
	2050-070-V25S06	5.0	6	25	70
	2050-100-V25S06	5.0	6	25	100
	2050-080-V30S06	5.0	6	30	80
	2050-090-V35S06	5.0	6	35	90
	2050-100-V40S06	5.0	6	40	100
	2060-060-V15S06	6.0	6	15	60
	2060-080-V15S06	6.0	6	15	80
	2060-070-V20S06	6.0	6	20	70
	2060-090-V20S06	6.0	6	20	90
	2060-075-V25S06	6.0	6	25	75
	2060-080-V30S06	6.0	6	30	80
	2060-100-V30S06	6.0	6	30	100
	2060-150-V30S06	6.0	6	30	150
	2060-090-V35S06	6.0	6	35	90
	2060-090-V40S06	6.0	6	40	90
	2060-120-V40S06	6.0	6	40	120
	2060-150-V45S06	6.0	6	45	150
	2080-080-V25S08	8.0	8	25	80
	2080-080-V30S08	8.0	8	30	80
	2080-100-V30S08	8.0	8	30	100
	2080-090-V35S08	8.0	8	35	90
	2080-090-V40S08	8.0	8	40	90
	2080-120-V40S08	8.0	8	40	120
	2080-150-V40S08	8.0	8	40	150
	2080-100-V45S08	8.0	8	45	100
	2080-100-V50S08	8.0	8	50	100
	2080-150-V50S08	8.0	8	50	150
	2100-080-V30S10	10.0	10	30	80

UPLFE2000 (Flat)

Long flat



2 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

(mm)

	Designation	ØD	Ød	ℓ	L
UPLFE 2	2100-100-V30S10	10.0	10	30	100
	2100-090-V35S10	10.0	10	35	90
	2100-090-V40S10	10.0	10	40	90
	2100-120-V40S10	10.0	10	40	120
	2100-100-V45S10	10.0	10	45	100
	2100-100-V50S10	10.0	10	50	100
	2100-150-V50S10	10.0	10	50	150
	2100-200-V50S10	10.0	10	50	200
	2100-150-V55S10	10.0	10	55	150
	2100-110-V60S10	10.0	10	60	110
	2100-200-V60S10	10.0	10	60	200
	2120-090-V35S12	12.0	12	35	90
	2120-100-V40S12	12.0	12	40	100
	2120-120-V40S12	12.0	12	40	120
	2120-130-V45S12	12.0	12	45	130
	2120-100-V50S12	12.0	12	50	100
	2120-150-V50S12	12.0	12	50	150
	2120-110-V55S12	12.0	12	55	110
	2120-110-V60S12	12.0	12	60	110
	2120-150-V60S12	12.0	12	60	150
	2120-200-V60S12	12.0	12	60	200
	2120-150-V65S12	12.0	12	65	150
	2120-120-V70S12	12.0	12	70	120
	2120-200-V70S12	12.0	12	70	200
	2140-110-V50S16	14.0	16	50	110
	2140-150-V60S16	14.0	16	60	150
	2160-150-V40S16	16.0	16	40	150
	2160-110-V50S16	16.0	16	50	110

	Designation	ØD	Ød	ℓ	L
UPLFE 2	2160-150-V50S16	16.0	16	50	150
	2160-120-V60S16	16.0	16	60	120
	2160-130-V70S16	16.0	16	70	130
	2160-150-V70S16	16.0	16	70	150
	2160-200-V70S16	16.0	16	70	200
	2160-150-V80S16	16.0	16	80	150
	2160-150-V90S16	16.0	16	90	150
	2160-200-V110S16	16.0	16	110	200
	2160-250-V120S16	16.0	16	120	250
	2180-120-V50S20	18.0	20	50	120
	2180-130-V70S20	18.0	20	70	130
	2180-200-V100S20	18.0	20	100	200
	2200-110-V50S20	20.0	20	50	110
	2200-150-V50S20	20.0	20	50	150
	2200-130-V60S20	20.0	20	60	130
	2200-130-V70S20	20.0	20	70	130
	2200-150-V80S20	20.0	20	80	150
	2200-150-V90S20	20.0	20	90	150
	2200-200-V90S20	20.0	20	90	200
	2200-200-V110S20	20.0	20	110	200
	2200-250-V120S20	20.0	20	120	250
	2220-150-V75S20	22.0	20	75	150
	2220-200-V110S20	22.0	20	110	200
	2250-150-V70S25	25.0	25	70	150
	2250-150-V90S25	25.0	25	90	150
	2250-200-V110S25	25.0	25	110	200
	2250-250-V120S25	25.0	25	120	250

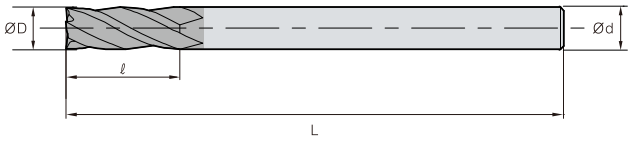
U+ Endmill

UPLFE4000 (Flat)

Long flat

4 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03



(mm)

	Designation	ØD	Ød	ℓ	L
UPLFE 4	4010-060-V3S06	1.0	6	3	60
	4010-060-V4S06	1.0	6	4	60
	4010-060-V5S06	1.0	6	5	60
	4010-060-V6S06	1.0	6	6	60
	4010-060-V7S06	1.0	6	7	60
	4010-060-V8S06	1.0	6	8	60
	4010-060-V10S06	1.0	6	10	60
	4010-060-V12S06	1.0	6	12	60
	4012-060-V4S06	1.2	6	4	60
	4012-060-V6S06	1.2	6	6	60
	4012-060-V8S06	1.2	6	8	60
	4012-060-V10S06	1.2	6	10	60
	4012-060-V12S06	1.2	6	12	60
	4015-060-V6S06	1.5	6	6	60
	4015-060-V8S06	1.5	6	8	60
	4015-060-V10S06	1.5	6	10	60
	4015-060-V12S06	1.5	6	12	60
	4015-060-V14S06	1.5	6	14	60
	4015-060-V16S06	1.5	6	16	60
	4020-060-V8S06	2.0	6	8	60
	4020-060-V10S06	2.0	6	10	60
	4020-060-V12S06	2.0	6	12	60
	4020-060-V14S06	2.0	6	14	60
	4020-060-V16S06	2.0	6	16	60
	4025-060-V10S06	2.5	6	10	60
	4025-060-V12S06	2.5	6	12	60
	4025-060-V16S06	2.5	6	16	60
	4025-060-V20S06	2.5	6	20	60
	4025-060-V26S06	2.5	6	26	60
	4030-070-V10S06	3.0	6	10	70
	4030-070-V12S06	3.0	6	12	70
	4030-070-V14S06	3.0	6	14	70
	4030-100-V16S03	3.0	3	16	100
	4030-070-V16S06	3.0	6	16	70
	4030-070-V20S06	3.0	6	20	70
	4030-070-V26S06	3.0	6	26	70

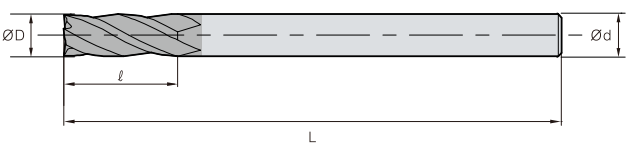
	Designation	ØD	Ød	ℓ	L
UPLFE 4	4030-070-V30S06	3.0	6	30	70
	4030-090-V35S06	3.0	6	35	90
	4040-070-V12S06	4.0	6	12	70
	4040-070-V16S06	4.0	6	16	70
	4040-100-V20S04	4.0	4	20	100
	4040-070-V20S06	4.0	6	20	70
	4040-070-V26S06	4.0	6	26	70
	4040-070-V30S06	4.0	6	30	70
	4050-070-V20S06	5.0	6	20	70
	4050-070-V25S06	5.0	6	25	70
	4050-100-V25S06	5.0	6	25	100
	4050-080-V30S06	5.0	6	30	80
	4050-090-V35S06	5.0	6	35	90
	4050-100-V40S06	5.0	6	40	100
	4060-060-V15S06	6.0	6	15	60
	4060-080-V15S06	6.0	6	15	80
	4060-070-V20S06	6.0	6	20	70
	4060-090-V20S06	6.0	6	20	90
	4060-075-V25S06	6.0	6	25	75
	4060-080-V30S06	6.0	6	30	80
	4060-100-V30S06	6.0	6	30	100
	4060-150-V30S06	6.0	6	30	150
	4060-090-V35S06	6.0	6	35	90
	4060-090-V40S06	6.0	6	40	90
	4060-120-V40S06	6.0	6	40	120
	4060-150-V45S06	6.0	6	45	150
	4080-080-V25S08	8.0	8	25	80
	4080-080-V30S08	8.0	8	30	80
	4080-100-V30S08	8.0	8	30	100
	4080-090-V35S08	8.0	8	35	90
	4080-090-V40S08	8.0	8	40	90
	4080-120-V40S08	8.0	8	40	120
	4080-150-V40S08	8.0	8	40	150
	4080-100-V45S08	8.0	8	45	100
	4080-100-V50S08	8.0	8	50	100
	4080-150-V50S08	8.0	8	50	150

UPLFE4000 (Flat)

Long flat

4 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03



(mm)

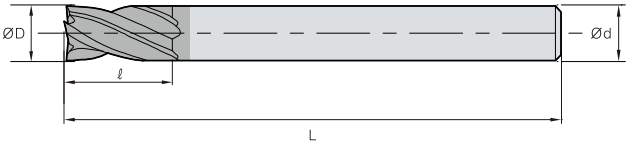
	Designation	ØD	Ød	ℓ	L
UPLFE	4100-100-V30S10	10.0	10	30	100
4	4100-080-V30S10	10.0	10	30	80
	4100-090-V35S10	10.0	10	35	90
	4100-090-V40S10	10.0	10	40	90
	4100-120-V40S10	10.0	10	40	120
	4100-100-V45S10	10.0	10	45	100
	4100-100-V50S10	10.0	10	50	100
	4100-150-V50S10	10.0	10	50	150
	4100-200-V50S10	10.0	10	50	200
	4100-150-V55S10	10.0	10	55	150
	4100-110-V60S10	10.0	10	60	110
	4100-200-V60S10	10.0	10	60	200
	4120-090-V35S12	12.0	12	35	90
	4120-100-V40S12	12.0	12	40	100
	4120-120-V40S12	12.0	12	40	120
	4120-130-V45S12	12.0	12	45	130
	4120-100-V50S12	12.0	12	50	100
	4120-150-V50S12	12.0	12	50	150
	4120-110-V55S12	12.0	12	55	110
	4120-110-V60S12	12.0	12	60	110
	4120-150-V60S12	12.0	12	60	150
	4120-200-V60S12	12.0	12	60	200
	4120-150-V65S12	12.0	12	65	150
	4120-120-V70S12	12.0	12	70	120
	4120-200-V70S12	12.0	12	70	200
	4140-110-V50S16	14.0	16	50	110
	4140-150-V60S16	14.0	16	60	150
	4160-150-V40S16	16.0	16	40	150

	Designation	ØD	Ød	ℓ	L
UPLFE	4160-110-V50S16	16.0	16	50	110
4	4160-150-V50S16	16.0	16	50	150
	4160-120-V60S16	16.0	16	60	120
	4160-130-V70S16	16.0	16	70	130
	4160-150-V70S16	16.0	16	70	150
	4160-200-V70S16	16.0	16	70	200
	4160-150-V80S16	16.0	16	80	150
	4160-150-V90S16	16.0	16	90	150
	4160-200-V110S16	16.0	16	110	200
	4160-250-V120S16	16.0	16	120	250
	4180-120-V50S20	18.0	20	50	120
	4180-130-V70S20	18.0	20	70	130
	4180-200-V100S20	18.0	20	100	200
	4200-110-V50S20	20.0	20	50	110
	4200-150-V50S20	20.0	20	50	150
	4200-130-V60S20	20.0	20	60	130
	4200-130-V70S20	20.0	20	70	130
	4200-150-V80S20	20.0	20	80	150
	4200-150-V90S20	20.0	20	90	150
	4200-200-V90S20	20.0	20	90	200
	4200-200-V110S20	20.0	20	110	200
	4200-250-V120S20	20.0	20	120	250
	4220-150-V75S20	22.0	20	75	150
	4220-200-V110S20	22.0	20	110	200
	4250-150-V70S25	25.0	25	70	150
	4250-150-V90S25	25.0	25	90	150
	4250-200-V110S25	25.0	25	110	200
	4250-250-V120S25	25.0	25	120	250

U+ Endmill

UPFE4000-U (Flat)

Irregular flute spacing and lead flat



4 | H·A Multi | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

(mm)

	Designation	ØD	Ød	ℓ	L
UPFE 4	4008-040-V1.6S04-U	0.8	4	1.6	40
	4009-040-V1.8S04-U	0.9	4	1.8	40
	4010-050-V2.5S06-U	1.0	6	2.5	50
	4012-050-V3S06-U	1.2	6	3	50
	4015-050-V4S06-U	1.5	6	4	50
	4020-050-V6S06-U	2.0	6	6	50
	4025-050-V7S06-U	2.5	6	7	50
	4030-050-V8S06-U	3.0	6	8	50
	4035-050-V10S06-U	3.5	6	10	50
	4040-050-V10S06-U	4.0	6	10	50
	4045-050-V14S06-U	4.5	6	14	50
	4050-060-V15S06-U	5.0	6	15	60
	4055-060-V15S06-U	5.5	6	15	60
	4060-060-V15S06-U	6.0	6	15	60
	4065-060-V18S08-U	6.5	8	18	60
	4070-060-V20S08-U	7.0	8	20	60
	4075-060-V20S08-U	7.5	8	20	60
	4080-070-V20S08-U	8.0	8	20	70
	4085-070-V22S10-U	8.5	10	22	70
	4090-070-V22S10-U	9.0	10	22	70
	4095-070-V24S10-U	9.5	10	24	70

	Designation	ØD	Ød	ℓ	L
UPFE 4	4100-075-V25S10-U	10.0	10	25	75
	4105-075-V26S12-U	10.5	12	26	75
	4110-075-V30S12-U	11.0	12	30	75
	4115-080-V30S12-U	11.5	12	30	80
	4120-080-V30S12-U	12.0	12	30	80
	4130-100-V35S12-U	13.0	12	35	100
	4140-100-V35S12-U	14.0	12	35	100
	4140-100-V35S14-U	14.0	14	35	100
	4140-100-V35S16-U	14.0	16	35	100
	4150-100-V38S16-U	15.0	16	38	100
	4160-100-V40S16-U	16.0	16	40	100
	4170-100-V42S16-U	17.0	16	42	100
	4180-100-V45S16-U	18.0	16	45	100
	4180-100-V45S18-U	18.0	18	45	100
	4190-100-V45S20-U	19.0	20	45	100
	4200-100-V45S20-U	20.0	20	45	100
	4210-100-V45S20-U	21.0	20	45	100
	4220-100-V45S20-U	22.0	20	45	100
	4230-120-V50S25-U	23.0	25	50	120
	4240-120-V50S25-U	24.0	25	50	120
	4250-120-V50S25-U	25.0	25	50	120

UPFE4000-UF (Flat)

Irregular flute spacing and lead flat for high perfomance

4 | H·A Multi | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

(mm)

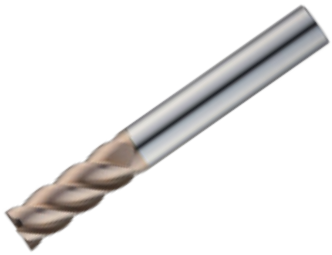
	Designation	ØD	Ød	ℓ	L
UPFE 4	4010-040-V1S06-UF	1.0	6	1	40
	4010-040-V2S06-UF	1.0	6	2	40
	4010-050-V2.5S06-UF	1.0	6	2.5	50
	4010-050-V3S06-UF	1.0	6	3	50
	4010-050-V4S06-UF	1.0	6	4	50
	4010-050-V6S06-UF	1.0	6	6	50
	4012-040-V2S06-UF	1.2	6	2	40
	4012-050-V3S06-UF	1.2	6	3	50
	4012-050-V4S06-UF	1.2	6	4	50
	4012-050-V6S06-UF	1.2	6	6	50
	4015-040-V1.5S06-UF	1.5	6	1.5	40
	4015-040-V3S06-UF	1.5	6	3	40
	4015-050-V4S06-UF	1.5	6	4	50
	4015-050-V6S06-UF	1.5	6	6	50
	4015-050-V8S06-UF	1.5	6	8	50
	4015-050-V10S06-UF	1.5	6	10	50
	4020-040-V2S06-UF	2.0	6	2	40
	4020-040-V4S06-UF	2.0	6	4	40
	4020-050-V6S06-UF	2.0	6	6	50
	4020-050-V8S06-UF	2.0	6	8	50
	4020-050-V10S06-UF	2.0	6	10	50
	4020-050-V12S06-UF	2.0	6	12	50
	4025-040-V2.5S06-UF	2.5	6	2.5	40
	4025-040-V5S06-UF	2.5	6	5	40
	4025-050-V7S06-UF	2.5	6	7	50
	4025-050-V10S06-UF	2.5	6	10	50
	4025-050-V12S06-UF	2.5	6	12	50
	4030-040-V3S06-UF	3.0	6	3	40
	4030-040-V6S06-UF	3.0	6	6	40
	4030-050-V8S06-UF	3.0	6	8	50
	4030-050-V10S06-UF	3.0	6	10	50
	4030-050-V12S06-UF	3.0	6	12	50
	4030-050-V14S06-UF	3.0	6	14	50

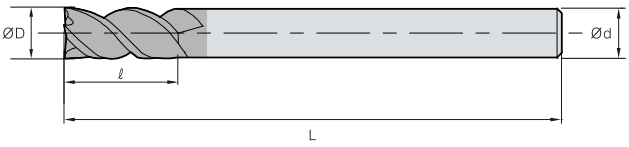
	Designation	ØD	Ød	ℓ	L
UPFE 4	4040-040-V4S06-UF	4.0	6	4	40
	4040-040-V8S06-UF	4.0	6	8	40
	4040-050-V10S06-UF	4.0	6	10	50
	4040-050-V12S06-UF	4.0	6	12	50
	4040-050-V14S06-UF	4.0	6	14	50
	4040-050-V16S06-UF	4.0	6	16	50
	4050-050-V5S06-UF	5.0	6	5	50
	4050-050-V10S06-UF	5.0	6	10	50
	4050-060-V15S06-UF	5.0	6	15	60
	4050-060-V20S06-UF	5.0	6	20	60
	4050-060-V25S06-UF	5.0	6	25	60
	4060-050-V6S06-UF	6.0	6	6	50
	4060-050-V12S06-UF	6.0	6	12	50
	4060-060-V15S06-UF	6.0	6	15	60
	4060-060-V20S06-UF	6.0	6	20	60
	4060-060-V25S06-UF	6.0	6	25	60
	4080-060-V16S08-UF	8.0	8	16	60
	4080-070-V20S08-UF	8.0	8	20	70
	4080-070-V25S08-UF	8.0	8	25	70
	4080-070-V30S08-UF	8.0	8	30	70
	4100-065-V22S10-UF	10.0	10	22	65
	4100-075-V25S10-UF	10.0	10	25	75
	4100-075-V30S10-UF	10.0	10	30	75
	4100-075-V35S10-UF	10.0	10	35	75
	4120-070-V26S12-UF	12.0	12	26	70
	4120-080-V30S12-UF	12.0	12	30	80
	4120-080-V35S12-UF	12.0	12	35	80
	4120-080-V40S12-UF	12.0	12	40	80
	4140-100-V35S16-UF	14.0	16	35	100
	4160-100-V32S16-UF	16.0	16	32	100
	4160-100-V40S16-UF	16.0	16	40	100
	4180-100-V45S20-UF	18.0	20	45	100
	4200-100-V45S20-UF	20.0	20	45	100

U+ Endmill

UPFE4000-A45 (Flat)

High-helix flat





4 | H-A 45° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

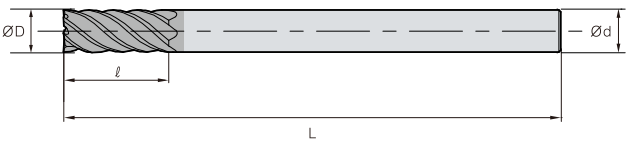
(mm)

	Designation	ØD	Ød	ℓ	L
UPFE	4010-050-V2.5S06-A45	1.0	6	2.5	50
4	4010-060-V4S06-A45	1.0	6	4	60
	4010-060-V6S06-A45	1.0	6	6	60
	4015-050-V4S06-A45	1.5	6	4	50
	4015-060-V6S06-A45	1.5	6	6	60
	4015-060-V8S06-A45	1.5	6	8	60
	4020-050-V6S06-A45	2.0	6	6	50
	4020-060-V8S06-A45	2.0	6	8	60
	4020-060-V10S06-A45	2.0	6	10	60
	4030-050-V8S06-A45	3.0	6	8	50
	4030-070-V10S06-A45	3.0	6	10	70
	4030-070-V12S06-A45	3.0	6	12	70
	4030-070-V16S06-A45	3.0	6	16	70
	4040-050-V10S06-A45	4.0	6	10	50
	4040-070-V12S06-A45	4.0	6	12	70
	4040-070-V16S06-A45	4.0	6	16	70
	4040-070-V20S06-A45	4.0	6	20	70
	4050-050-V15S06-A45	5.0	6	15	50
	4050-080-V30S06-A45	5.0	6	30	80
	4060-060-V15S06-A45	6.0	6	15	60
	4060-070-V20S06-A45	6.0	6	20	70

	Designation	ØD	Ød	ℓ	L
UPFE	4060-080-V30S06-A45	6.0	6	30	80
4	4080-070-V20S08-A45	8.0	8	20	70
	4080-080-V30S08-A45	8.0	8	30	80
	4080-090-V35S08-A45	8.0	8	35	90
	4080-090-V40S08-A45	8.0	8	40	90
	4100-075-V25S10-A45	10.0	10	25	75
	4100-080-V30S10-A45	10.0	10	30	80
	4100-090-V40S10-A45	10.0	10	40	90
	4100-100-V50S10-A45	10.0	10	50	100
	4120-080-V30S12-A45	12.0	12	30	80
	4120-090-V40S12-A45	12.0	12	40	90
	4120-100-V50S12-A45	12.0	12	50	100
	4120-110-V60S12-A45	12.0	12	60	110
	4160-100-V40S16-A45	16.0	16	40	100
	4160-110-V50S16-A45	16.0	16	50	110
	4160-120-V60S16-A45	16.0	16	60	120
	4160-200-V110S16-A45	16.0	16	110	200
	4200-100-V45S20-A45	20.0	20	45	100
	4200-120-V60S20-A45	20.0	20	60	120
	4200-130-V70S20-A45	20.0	20	70	130
	4200-200-V110S20-A45	20.0	20	110	200

UPFE6000-A45 (Flat)

High-helix flat



6 | H·A 45° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

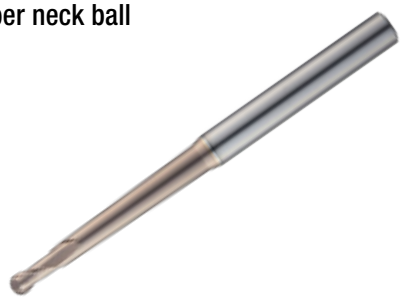
(mm)

	Designation	ØD	Ød	ℓ	L
UPFE	6060-060-V15S06-A45	6.0	6	15	60
6	6060-070-V20S06-A45	6.0	6	20	70
	6060-080-V30S06-A45	6.0	6	30	80
	6060-110-V30S06-A45	6.0	6	30	110
	6080-070-V20S08-A45	8.0	8	20	70
	6080-080-V30S08-A45	8.0	8	30	80
	6080-090-V35S08-A45	8.0	8	35	90
	6080-090-V40S08-A45	8.0	8	40	90
	6080-130-V40S08-A45	8.0	8	40	130
	6100-075-V25S10-A45	10.0	10	25	75
	6100-080-V30S10-A45	10.0	10	30	80
	6100-090-V40S10-A45	10.0	10	40	90
	6100-100-V50S10-A45	10.0	10	50	100
	6100-150-V50S10-A45	10.0	10	50	150
	6120-080-V30S12-A45	12.0	12	30	80
	6120-090-V40S12-A45	12.0	12	40	90
	6120-100-V50S12-A45	12.0	12	50	100
	6120-110-V60S12-A45	12.0	12	60	110
	6120-150-V60S12-A45	12.0	12	60	150
	6160-100-V40S16-A45	16.0	16	40	100
	6160-110-V50S16-A45	16.0	16	50	110
	6160-120-V60S16-A45	16.0	16	60	120
	6160-150-V90S16-A45	16.0	16	90	150
	6160-200-V110S16-A45	16.0	16	110	200
	6160-250-V110S16-A45	16.0	16	110	250
	6200-100-V45S20-A45	20.0	20	45	100
	6200-120-V60S20-A45	20.0	20	60	120
	6200-130-V70S20-A45	20.0	20	70	130
	6200-200-V110S20-A45	20.0	20	110	200
	6200-250-V110S20-A45	20.0	20	110	250
	6200-300-V110S20-A45	20.0	20	110	300

U+ Endmill

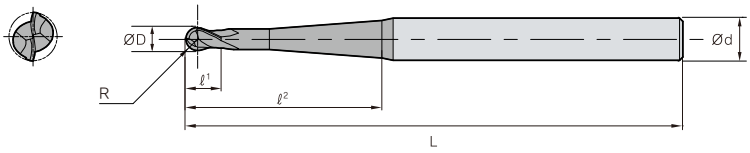
UPRBE2000-TN (Ball)

Taper neck ball



2 | H·A 30° | h6 shank | Substrate PC315W

Category	Range	Tolerance
ØD	Ø0.1 ~ Ø6.0 Ø8.0 ~ Ø12.0	0.000 ~ -0.012 0.000 ~ -0.015
R	~R3.0 R3.0~	±0.005 ±0.010



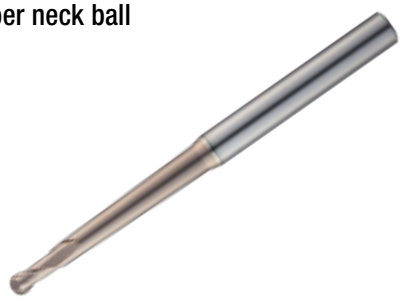
(mm)

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
UPRBE 2	2001-040-V0.1N0.5S04-TN05	0.05	0.1	4	0.1	0.5	40
	2001-040-V0.1N1S04-TN05	0.05	0.1	4	0.1	1	40
	2001-040-V0.1N0.5S04-TN10	0.05	0.1	4	0.1	0.5	40
	2001-040-V0.1N1S04-TN10	0.05	0.1	4	0.1	1	40
	2001-040-V0.1N0.5S04-TN15	0.05	0.1	4	0.1	0.5	40
	2001-040-V0.1N1S04-TN15	0.05	0.1	4	0.1	1	40
	2001-040-V0.1N0.5S04-TN20	0.05	0.1	4	0.1	0.5	40
	2001-040-V0.1N1S04-TN20	0.05	0.1	4	0.1	1	40
	2001-040-V0.1N0.5S04-TN30	0.05	0.1	4	0.1	0.5	40
	2001-040-V0.1N1S04-TN30	0.05	0.1	4	0.1	1	40
	2002-040-V0.2N1S04-TN05	0.10	0.2	4	0.2	1	40
	2002-040-V0.2N2S04-TN05	0.10	0.2	4	0.2	2	40
	2002-040-V0.2N3S04-TN05	0.10	0.2	4	0.2	3	40
	2002-040-V0.2N1S04-TN10	0.10	0.2	4	0.2	1	40
	2002-040-V0.2N2S04-TN10	0.10	0.2	4	0.2	2	40
	2002-040-V0.2N3S04-TN10	0.10	0.2	4	0.2	3	40
	2002-040-V0.2N1S04-TN15	0.10	0.2	4	0.2	1	40
	2002-040-V0.2N2S04-TN15	0.10	0.2	4	0.2	2	40
	2002-040-V0.2N3S04-TN15	0.10	0.2	4	0.2	3	40
	2002-040-V0.2N1S04-TN20	0.10	0.2	4	0.2	1	40
	2002-040-V0.2N2S04-TN20	0.10	0.2	4	0.2	2	40
	2002-040-V0.2N3S04-TN20	0.10	0.2	4	0.2	3	40
	2002-040-V0.2N1S04-TN30	0.10	0.2	4	0.2	1	40
	2002-040-V0.2N2S04-TN30	0.10	0.2	4	0.2	2	40
	2002-040-V0.2N3S04-TN30	0.10	0.2	4	0.2	3	40
	2002-040-V0.2N2S04-TN50	0.10	0.2	4	0.2	2	40
	2002-040-V0.2N3S04-TN50	0.10	0.2	4	0.2	3	40
	2003-040-V0.3N2S04-TN05	0.15	0.3	4	0.3	2	40
	2003-040-V0.3N3S04-TN05	0.15	0.3	4	0.3	3	40
	2003-040-V0.3N4S04-TN05	0.15	0.3	4	0.3	4	40
	2003-040-V0.3N5S04-TN05	0.15	0.3	4	0.3	5	40
	2003-040-V0.3N2S04-TN10	0.15	0.3	4	0.3	2	40
	2003-040-V0.3N3S04-TN10	0.15	0.3	4	0.3	3	40
	2003-040-V0.3N4S04-TN10	0.15	0.3	4	0.3	4	40

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
UPRBE 2	2003-040-V0.3N5S04-TN10	0.15	0.3	4	0.3	5	40
	2003-040-V0.3N2S04-TN15	0.15	0.3	4	0.3	2	40
	2003-040-V0.3N3S04-TN15	0.15	0.3	4	0.3	3	40
	2003-040-V0.3N4S04-TN15	0.15	0.3	4	0.3	4	40
	2003-040-V0.3N5S04-TN15	0.15	0.3	4	0.3	5	40
	2003-040-V0.3N2S04-TN20	0.15	0.3	4	0.3	2	40
	2003-040-V0.3N3S04-TN20	0.15	0.3	4	0.3	3	40
	2003-040-V0.3N4S04-TN20	0.15	0.3	4	0.3	4	40
	2003-040-V0.3N5S04-TN20	0.15	0.3	4	0.3	5	40
	2003-040-V0.3N2S04-TN30	0.15	0.3	4	0.3	2	40
	2003-040-V0.3N3S04-TN30	0.15	0.3	4	0.3	3	40
	2003-040-V0.3N4S04-TN30	0.15	0.3	4	0.3	4	40
	2003-040-V0.3N5S04-TN30	0.15	0.3	4	0.3	5	40
	2003-040-V0.3N5S04-TN50	0.15	0.3	4	0.3	5	40
	2004-050-V0.4N2S04-TN05	0.20	0.4	4	0.4	2	50
	2004-050-V0.4N3S04-TN05	0.20	0.4	4	0.4	3	50
	2004-050-V0.4N4S04-TN05	0.20	0.4	4	0.4	4	50
	2004-050-V0.4N5S04-TN05	0.20	0.4	4	0.4	5	50
	2004-050-V0.4N6S04-TN05	0.20	0.4	4	0.4	6	50
	2004-050-V0.4N2S04-TN10	0.20	0.4	4	0.4	2	50
	2004-050-V0.4N3S04-TN10	0.20	0.4	4	0.4	3	50
	2004-050-V0.4N4S04-TN10	0.20	0.4	4	0.4	4	50
	2004-050-V0.4N5S04-TN10	0.20	0.4	4	0.4	5	50
	2004-050-V0.4N6S04-TN10	0.20	0.4	4	0.4	6	50
	2004-050-V0.4N2S04-TN15	0.20	0.4	4	0.4	2	50
	2004-050-V0.4N3S04-TN15	0.20	0.4	4	0.4	3	50
	2004-050-V0.4N4S04-TN15	0.20	0.4	4	0.4	4	50
	2004-050-V0.4N5S04-TN15	0.20	0.4	4	0.4	5	50
	2004-050-V0.4N6S04-TN15	0.20	0.4	4	0.4	6	50
	2004-050-V0.4N2S04-TN20	0.20	0.4	4	0.4	2	50
	2004-050-V0.4N3S04-TN20	0.20	0.4	4	0.4	3	50
	2004-050-V0.4N4S04-TN20	0.20	0.4	4	0.4	4	50
	2004-050-V0.4N5S04-TN20	0.20	0.4	4	0.4	5	50
	2004-050-V0.4N6S04-TN20	0.20	0.4	4	0.4	6	50

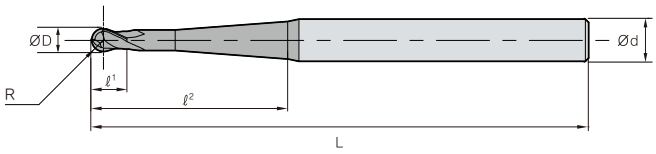
UPRBE2000-TN (Ball)

Taper neck ball



2 | H·A 30° | h6 shank | Substrate PC315W

Category	Range	Tolerance
ØD	Ø0.1 ~ Ø6.0 Ø8.0 ~ Ø12.0	0.000 ~ -0.012 0.000 ~ -0.015
R	~R3.0 R3.0~	±0.005 ±0.010



(mm)

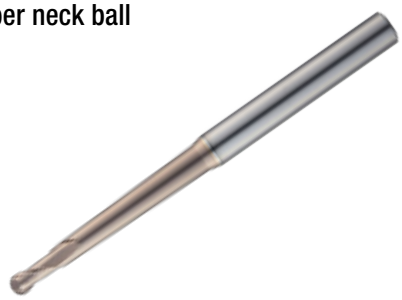
	Designation	R	ØD	Ød	ℓ1	ℓ2	L
UPRBE 2	2004-050-V0.4N2S04-TN30	0.20	0.4	4	0.4	2	50
	2004-050-V0.4N3S04-TN30	0.20	0.4	4	0.4	3	50
	2004-050-V0.4N4S04-TN30	0.20	0.4	4	0.4	4	50
	2004-050-V0.4N5S04-TN30	0.20	0.4	4	0.4	5	50
	2004-050-V0.4N6S04-TN30	0.20	0.4	4	0.4	6	50
	2004-050-V0.4N4S04-TN50	0.20	0.4	4	0.4	4	50
	2004-050-V0.4N6S04-TN50	0.20	0.4	4	0.4	6	50
	2005-050-V0.5N4S04-TN05	0.25	0.5	4	0.5	4	50
	2005-050-V0.5N6S04-TN05	0.25	0.5	4	0.5	6	50
	2005-050-V0.5N8S04-TN05	0.25	0.5	4	0.5	8	50
	2005-050-V0.5N10S04-TN05	0.25	0.5	4	0.5	10	50
	2005-050-V0.5N4S04-TN10	0.25	0.5	4	0.5	4	50
	2005-050-V0.5N6S04-TN10	0.25	0.5	4	0.5	6	50
	2005-050-V0.5N8S04-TN10	0.25	0.5	4	0.5	8	50
	2005-050-V0.5N10S04-TN10	0.25	0.5	4	0.5	10	50
	2005-050-V0.5N4S04-TN15	0.25	0.5	4	0.5	4	50
	2005-050-V0.5N6S04-TN15	0.25	0.5	4	0.5	6	50
	2005-050-V0.5N8S04-TN15	0.25	0.5	4	0.5	8	50
	2005-050-V0.5N10S04-TN15	0.25	0.5	4	0.5	10	50
	2005-050-V0.5N4S04-TN20	0.25	0.5	4	0.5	4	50
	2005-050-V0.5N6S04-TN20	0.25	0.5	4	0.5	6	50
	2005-050-V0.5N8S04-TN20	0.25	0.5	4	0.5	8	50
	2005-050-V0.5N10S04-TN20	0.25	0.5	4	0.5	10	50
	2005-050-V0.5N4S04-TN30	0.25	0.5	4	0.5	4	50
	2005-050-V0.5N6S04-TN30	0.25	0.5	4	0.5	6	50
	2005-050-V0.5N8S04-TN30	0.25	0.5	4	0.5	8	50
	2005-050-V0.5N10S04-TN30	0.25	0.5	4	0.5	10	50
	2006-050-V0.6N4S04-TN05	0.30	0.6	4	0.6	4	50
	2006-050-V0.6N6S04-TN05	0.30	0.6	4	0.6	6	50
	2006-050-V0.6N8S04-TN05	0.30	0.6	4	0.6	8	50
	2006-050-V0.6N10S04-TN05	0.30	0.6	4	0.6	10	50
	2006-050-V0.6N12S04-TN05	0.30	0.6	4	0.6	12	50
	2006-050-V0.6N4S04-TN10	0.30	0.6	4	0.6	4	50
	2006-050-V0.6N6S04-TN10	0.30	0.6	4	0.6	6	50

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
UPRBE 2	2006-050-V0.6N8S04-TN10	0.30	0.6	4	0.6	8	50
	2006-050-V0.6N10S04-TN10	0.30	0.6	4	0.6	10	50
	2006-050-V0.6N12S04-TN10	0.30	0.6	4	0.6	12	50
	2006-050-V0.6N4S04-TN15	0.30	0.6	4	0.6	4	50
	2006-050-V0.6N6S04-TN15	0.30	0.6	4	0.6	6	50
	2006-050-V0.6N8S04-TN15	0.30	0.6	4	0.6	8	50
	2006-050-V0.6N10S04-TN15	0.30	0.6	4	0.6	10	50
	2006-050-V0.6N12S04-TN15	0.30	0.6	4	0.6	12	50
	2006-050-V0.6N4S04-TN20	0.30	0.6	4	0.6	4	50
	2006-050-V0.6N6S04-TN20	0.30	0.6	4	0.6	6	50
	2006-050-V0.6N8S04-TN20	0.30	0.6	4	0.6	8	50
	2006-050-V0.6N10S04-TN20	0.30	0.6	4	0.6	10	50
	2006-050-V0.6N12S04-TN20	0.30	0.6	4	0.6	12	50
	2006-050-V0.6N4S04-TN30	0.30	0.6	4	0.6	4	50
	2006-050-V0.6N6S04-TN30	0.30	0.6	4	0.6	6	50
	2006-050-V0.6N8S04-TN30	0.30	0.6	4	0.6	8	50
	2006-050-V0.6N10S04-TN30	0.30	0.6	4	0.6	10	50
	2006-050-V0.6N12S04-TN30	0.30	0.6	4	0.6	12	50
	2008-050-V0.8N4S04-TN05	0.40	0.8	4	0.8	4	50
	2008-050-V0.8N6S04-TN05	0.40	0.8	4	0.8	6	50
	2008-050-V0.8N8S04-TN05	0.40	0.8	4	0.8	8	50
	2008-050-V0.8N10S04-TN05	0.40	0.8	4	0.8	10	50
	2008-050-V0.8N12S04-TN05	0.40	0.8	4	0.8	12	50
	2008-050-V0.8N16S04-TN05	0.40	0.8	4	0.8	16	50
	2008-050-V0.8N4S04-TN10	0.40	0.8	4	0.8	4	50
	2008-050-V0.8N6S04-TN10	0.40	0.8	4	0.8	6	50
	2008-050-V0.8N8S04-TN10	0.40	0.8	4	0.8	8	50
	2008-050-V0.8N10S04-TN10	0.40	0.8	4	0.8	10	50
	2008-050-V0.8N12S04-TN10	0.40	0.8	4	0.8	12	50
	2008-050-V0.8N16S04-TN10	0.40	0.8	4	0.8	16	50
	2008-050-V0.8N4S04-TN15	0.40	0.8	4	0.8	4	50
	2008-050-V0.8N6S04-TN15	0.40	0.8	4	0.8	6	50
	2008-050-V0.8N8S04-TN15	0.40	0.8	4	0.8	8	50
	2008-050-V0.8N10S04-TN15	0.40	0.8	4	0.8	10	50

U+ Endmill

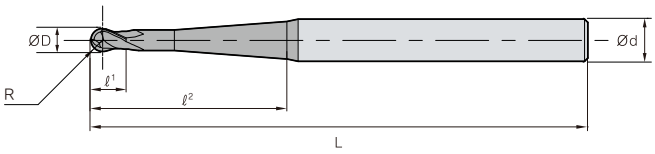
UPRBE2000-TN (Ball)

Taper neck ball



2 | H·A 30° | h6 shank | Substrate PC315W

Category	Range	Tolerance
ØD	Ø0.1 ~ Ø6.0 Ø8.0 ~ Ø12.0	0.000 ~ -0.012 0.000 ~ -0.015
R	~R3.0 R3.0~	±0.005 ±0.010



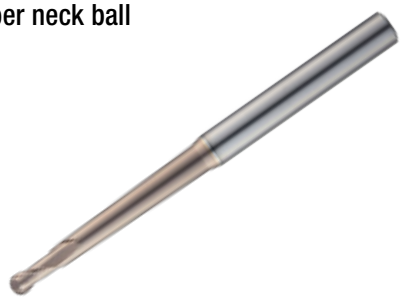
(mm)

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
UPRBE 2	2008-050-V0.8N12S04-TN15	0.40	0.8	4	0.8	12	50
	2008-050-V0.8N16S04-TN15	0.40	0.8	4	0.8	16	50
	2008-050-V0.8N4S04-TN20	0.40	0.8	4	0.8	4	50
	2008-050-V0.8N6S04-TN20	0.40	0.8	4	0.8	6	50
	2008-050-V0.8N8S04-TN20	0.40	0.8	4	0.8	8	50
	2008-050-V0.8N10S04-TN20	0.40	0.8	4	0.8	10	50
	2008-050-V0.8N12S04-TN20	0.40	0.8	4	0.8	12	50
	2008-050-V0.8N16S04-TN20	0.40	0.8	4	0.8	16	50
	2008-050-V0.8N4S04-TN30	0.40	0.8	4	0.8	4	50
	2008-050-V0.8N6S04-TN30	0.40	0.8	4	0.8	6	50
	2008-050-V0.8N8S04-TN30	0.40	0.8	4	0.8	8	50
	2008-050-V0.8N10S04-TN30	0.40	0.8	4	0.8	10	50
	2008-050-V0.8N12S04-TN30	0.40	0.8	4	0.8	12	50
	2008-050-V0.8N16S04-TN30	0.40	0.8	4	0.8	16	50
	2010-050-V1N6S04-TN05	0.50	1.0	4	1	6	50
	2010-050-V1N8S04-TN05	0.50	1.0	4	1	8	50
	2010-050-V1N10S04-TN05	0.50	1.0	4	1	10	50
	2010-050-V1N12S04-TN05	0.50	1.0	4	1	12	50
	2010-050-V1N16S04-TN05	0.50	1.0	4	1	16	50
	2010-050-V1N20S04-TN05	0.50	1.0	4	1	20	50
	2010-060-V1N25S04-TN05	0.50	1.0	4	1	25	60
	2010-070-V1N30S04-TN05	0.50	1.0	4	1	30	70
	2010-080-V1N40S04-TN05	0.50	1.0	4	1	40	80
	2010-090-V1N50S04-TN05	0.50	1.0	4	1	50	90
	2010-050-V1N6S04-TN10	0.50	1.0	4	1	6	50
	2010-050-V1N8S04-TN10	0.50	1.0	4	1	8	50
	2010-050-V1N10S04-TN10	0.50	1.0	4	1	10	50
	2010-050-V1N12S04-TN10	0.50	1.0	4	1	12	50
	2010-050-V1N16S04-TN10	0.50	1.0	4	1	16	50
	2010-050-V1N20S04-TN10	0.50	1.0	4	1	20	50
	2010-060-V1N25S04-TN10	0.50	1.0	4	1	25	60
	2010-070-V1N60S04-TN10	0.50	1.0	4	1	60	70
	2010-080-V1N40S04-TN10	0.50	1.0	4	1	40	80
	2010-090-V1N50S04-TN10	0.50	1.0	4	1	50	90

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
UPRBE 2	2010-050-V1N6S04-TN15	0.50	1.0	4	1	6	50
	2010-050-V1N8S04-TN15	0.50	1.0	4	1	8	50
	2010-050-V1N10S04-TN15	0.50	1.0	4	1	10	50
	2010-050-V1N12S04-TN15	0.50	1.0	4	1	12	50
	2010-050-V1N16S04-TN15	0.50	1.0	4	1	16	50
	2010-050-V1N20S04-TN15	0.50	1.0	4	1	20	50
	2010-060-V1N25S04-TN15	0.50	1.0	4	1	25	60
	2010-070-V1N30S04-TN15	0.50	1.0	4	1	30	70
	2010-080-V1N40S04-TN15	0.50	1.0	4	1	40	80
	2010-090-V1N50S04-TN15	0.50	1.0	4	1	50	90
	2010-050-V1N6S04-TN20	0.50	1.0	4	1	6	50
	2010-050-V1N8S04-TN20	0.50	1.0	4	1	8	50
	2010-050-V1N10S04-TN20	0.5	1.0	4	1	10	50
	2010-050-V1N12S04-TN20	0.50	1.0	4	1	12	50
	2010-050-V1N16S04-TN20	0.50	1.0	4	1	16	50
	2010-050-V1N20S04-TN20	0.50	1.0	4	1	20	50
	2010-060-V1N25S04-TN20	0.50	1.0	4	1	25	60
	2010-070-V1N30S04-TN20	0.50	1.0	4	1	30	70
	2010-080-V1N40S04-TN20	0.50	1.0	4	1	40	80
	2010-050-V1N6S04-TN30	0.50	1.0	4	1	6	50
	2010-050-V1N8S04-TN30	0.50	1.0	4	1	8	50
	2010-050-V1N10S04-TN30	0.50	1.0	4	1	10	50
	2010-050-V1N12S04-TN30	0.50	1.0	4	1	12	50
	2010-050-V1N16S04-TN30	0.50	1.0	4	1	16	50
	2010-050-V1N20S04-TN30	0.50	1.0	4	1	20	50
	2010-060-V1N25S04-TN30	0.50	1.0	4	1	25	60
	2010-090-V1N50S06-TN20	0.50	1.0	6	1	50	90
	2010-070-V1N30S06-TN30	0.50	1.0	6	1	30	70
	2010-080-V1N40S06-TN30	0.50	1.0	6	1	40	80
	2010-090-V1N50S06-TN30	0.50	1.0	6	1	50	90
	2010-070-V1N30S06-TN50	0.50	1.0	6	1	30	70
	2012-050-V1.2N8S04-TN05	0.60	1.2	4	1.2	8	50
	2012-050-V1.2N12S04-TN05	0.60	1.2	4	1.2	12	50
	2012-050-V1.2N16S04-TN05	0.60	1.2	4	1.2	16	50

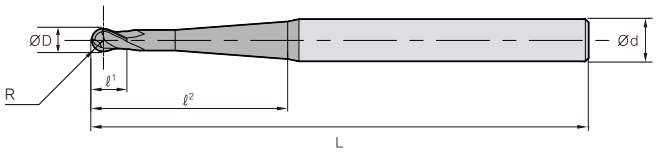
UPRBE2000-TN (Ball)

Taper neck ball



2 | H·A 30° | h6 shank | Substrate PC315W

Category	Range	Tolerance
ØD	Ø0.1 ~ Ø6.0 Ø8.0 ~ Ø12.0	0.000 ~ -0.012 0.000 ~ -0.015
R	~R3.0 R3.0~	±0.005 ±0.010



(mm)

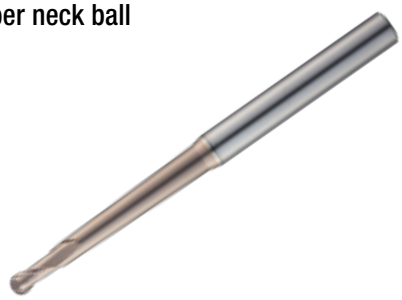
	Designation	R	ØD	Ød	ℓ1	ℓ2	L
UPRBE 2	2012-050-V1.2N20S04-TN05	0.60	1.2	4	1.2	2	50
	2012-060-V1.2N25S04-TN05	0.60	1.2	4	1.2	2	60
	2012-070-V1.2N30S04-TN05	0.60	1.2	4	1.2	3	70
	2012-050-V1.2N8S04-TN10	0.60	1.2	4	1.2	8	50
	2012-050-V1.2N12S04-TN10	0.6	1.2	4	1.2	12	50
	2012-050-V1.2N16S04-TN10	0.60	1.2	4	1.2	16	50
	2012-050-V1.2N20S04-TN10	0.60	1.2	4	1.2	2	50
	2012-060-V1.2N25S04-TN10	0.60	1.2	4	1.2	2	60
	2012-070-V1.2N30S04-TN10	0.60	1.2	4	1.2	3	70
	2012-050-V1.2N8S04-TN15	0.60	1.2	4	1.2	8	50
	2012-050-V1.2N12S04-TN15	0.60	1.2	4	1.2	12	50
	2012-050-V1.2N16S04-TN15	0.60	1.2	4	1.2	16	50
	2012-050-V1.2N20S04-TN15	0.60	1.2	4	1.2	2	50
	2012-060-V1.2N25S04-TN15	0.60	1.2	4	1.2	2	60
	2012-070-V1.2N30S04-TN15	0.60	1.2	4	1.2	3	70
	2012-050-V1.2N8S04-TN20	0.60	1.2	4	1.2	8	50
	2012-050-V1.2N12S04-TN20	0.60	1.2	4	1.2	12	50
	2012-050-V1.2N16S04-TN20	0.60	1.2	4	1.2	16	50
	2012-050-V1.2N20S04-TN20	0.60	1.2	4	1.2	2	50
	2012-060-V1.2N25S04-TN20	0.60	1.2	4	1.2	2	60
	2012-070-V1.2N30S04-TN20	0.60	1.2	4	1.2	3	70
	2012-050-V1.2N8S04-TN30	0.60	1.2	4	1.2	8	50
	2012-050-V1.2N12S04-TN30	0.60	1.2	4	1.2	12	50
	2012-050-V1.2N16S04-TN30	0.60	1.2	4	1.2	16	50
	2012-050-V1.2N20S04-TN30	0.60	1.2	4	1.2	2	50
	2012-060-V1.2N25S04-TN30	0.60	1.2	4	1.2	2	60
	2012-070-V1.2N30S06-TN30	0.60	1.2	6	1.2	3	70
	2015-050-V1.5N8S04-TN05	0.75	1.5	4	1.5	8	50
	2015-050-V1.5N10S04-TN05	0.75	1.5	4	1.5	10	50
	2015-050-V1.5N12S04-TN05	0.75	1.5	4	1.5	12	50
	2015-050-V1.5N16S04-TN05	0.75	1.5	4	1.5	16	50
	2015-050-V1.5N20S04-TN05	0.75	1.5	4	1.5	2	50
	2015-060-V1.5N25S04-TN05	0.75	1.5	4	1.5	2	60
	2015-070-V1.5N30S04-TN05	0.75	1.5	4	1.5	3	70

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
UPRBE 2	2015-080-V1.5N40S04-TN05	0.75	1.5	4	1.5	4	80
	2015-090-V1.5N50S04-TN05	0.75	1.5	4	1.5	5	90
	2015-050-V1.5N8S04-TN10	0.75	1.5	4	1.5	8	50
	2015-050-V1.5N10S04-TN10	0.75	1.5	4	1.5	10	50
	2015-050-V1.5N12S04-TN10	0.75	1.5	4	1.5	12	50
	2015-050-V1.5N16S04-TN10	0.75	1.5	4	1.5	16	50
	2015-050-V1.5N20S04-TN10	0.75	1.5	4	1.5	2	50
	2015-060-V1.5N25S04-TN10	0.75	1.5	4	1.5	2	60
	2015-070-V1.5N30S04-TN10	0.75	1.5	4	1.5	3	70
	2015-080-V1.5N40S04-TN10	0.75	1.5	4	1.5	4	80
	2015-090-V1.5N50S04-TN10	0.75	1.5	4	1.5	5	90
	2015-050-V1.5N8S04-TN15	0.75	1.5	4	1.5	8	50
	2015-050-V1.5N10S04-TN15	0.75	1.5	4	1.5	10	50
	2015-050-V1.5N12S04-TN15	0.75	1.5	4	1.5	12	50
	2015-050-V1.5N16S04-TN15	0.75	1.5	4	1.5	16	50
	2015-050-V1.5N20S04-TN15	0.75	1.5	4	1.5	2	50
	2015-060-V1.5N25S04-TN15	0.75	1.5	4	1.5	2	60
	2015-070-V1.5N30S04-TN15	0.75	1.5	4	1.5	3	70
	2015-080-V1.5N40S04-TN15	0.75	1.5	4	1.5	4	80
	2015-090-V1.5N50S04-TN15	0.75	1.5	4	1.5	5	90
	2015-050-V1.5N8S04-TN20	0.75	1.5	4	1.5	8	50
	2015-050-V1.5N10S04-TN20	0.75	1.5	4	1.5	10	50
	2015-050-V1.5N12S04-TN20	0.75	1.5	4	1.5	12	50
	2015-050-V1.5N16S04-TN20	0.75	1.5	4	1.5	16	50
	2015-050-V1.5N20S04-TN20	0.75	1.5	4	1.5	2	50
	2015-060-V1.5N25S04-TN20	0.75	1.5	4	1.5	2	60
	2015-070-V1.5N30S04-TN20	0.75	1.5	4	1.5	3	70
	2015-080-V1.5N40S06-TN20	0.75	1.5	6	1.5	4	80
	2015-090-V1.5N50S06-TN20	0.75	1.5	6	1.5	5	90
	2015-050-V1.5N20S06-TN30	0.75	1.5	6	1.5	2	50
	2015-070-V1.5N30S06-TN30	0.75	1.5	6	1.5	3	70
	2015-080-V1.5N40S06-TN30	0.75	1.5	6	1.5	4	80
	2015-090-V1.5N50S08-TN30	0.75	1.5	8	1.5	5	90
	2015-070-V1.5N30S08-TN50	0.75	1.5	8	1.5	3	70

U+ Endmill

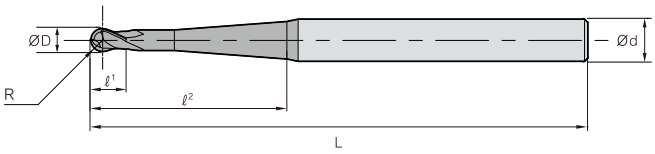
UPRBE2000-TN (Ball)

Taper neck ball



2 | H·A 30° | h6 shank | Substrate PC315W

Category	Range	Tolerance
ØD	Ø0.1 ~ Ø6.0 Ø8.0 ~ Ø12.0	0.000 ~ -0.012 0.000 ~ -0.015
R	~R3.0 R3.0~	±0.005 ±0.010



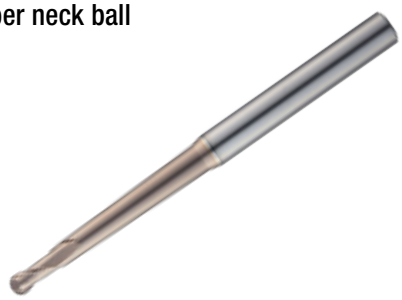
(mm)

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
UPRBE 2	2020-050-V2N10S04-TN05	1.00	2.0	4	2	10	50
	2020-050-V2N12S04-TN05	1.00	2.0	4	2	12	50
	2020-050-V2N16S04-TN05	1.00	2.0	4	2	16	50
	2020-050-V2N20S04-TN05	1.00	2.0	4	2	20	50
	2020-060-V2N25S04-TN05	1.00	2.0	4	2	25	60
	2020-070-V2N30S04-TN05	1.00	2.0	4	2	30	70
	2020-080-V2N40S04-TN05	1.00	2.0	4	2	40	80
	2020-050-V2N10S04-TN10	1.00	2.0	4	2	10	50
	2020-050-V2N12S04-TN10	1.00	2.0	4	2	12	50
	2020-050-V2N16S04-TN10	1.00	2.0	4	2	16	50
	2020-050-V2N20S04-TN10	1.00	2.0	4	2	20	50
	2020-060-V2N25S04-TN10	1.00	2.0	4	2	25	60
	2020-070-V2N30S04-TN10	1.00	2.0	4	2	30	70
	2020-050-V2N10S04-TN15	1.00	2.0	4	2	10	50
	2020-050-V2N12S04-TN15	1.00	2.0	4	2	12	50
	2020-050-V2N16S04-TN15	1.00	2.0	4	2	16	50
	2020-050-V2N20S04-TN15	1.00	2.0	4	2	20	50
	2020-060-V2N25S04-TN15	1.00	2.0	4	2	25	60
	2020-050-V2N10S04-TN20	1.00	2.0	4	2	10	50
	2020-050-V2N12S04-TN20	1.00	2.0	4	2	12	50
	2020-050-V2N16S04-TN20	1.00	2.0	4	2	16	50
	2020-055-V2N20S04-TN20	1.00	2.0	4	2	20	55
	2020-060-V2N25S04-TN20	1.00	2.0	4	2	25	60
	2020-070-V2N30S04-TN20	1.00	2.0	4	2	30	70
	2020-100-V2N50S06-TN05	1.00	2.0	6	2	50	100
	2020-100-V2N60S06-TN05	1.00	2.0	6	2	60	100
	2020-140-V2N80S06-TN05	1.00	2.0	6	2	80	140
	2020-080-V2N40S06-TN10	1.00	2.0	6	2	40	80
	2020-100-V2N50S06-TN10	1.00	2.0	6	2	50	100
	2020-100-V2N60S06-TN10	1.00	2.0	6	2	60	100
	2020-140-V2N80S06-TN10	1.00	2.0	6	2	80	140
	2020-070-V2N30S06-TN15	1.00	2.0	6	2	30	70
	2020-080-V2N40S06-TN15	1.00	2.0	6	2	40	80
	2020-100-V2N50S06-TN15	1.00	2.0	6	2	50	100

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
UPRBE 2	2020-100-V2N60S06-TN15	1.00	2.0	6	2	60	100
	2020-140-V2N80S06-TN15	1.00	2.0	6	2	80	140
	2020-080-V2N40S06-TN20	1.00	2.0	6	2	40	80
	2020-090-V2N50S06-TN20	1.00	2.0	6	2	50	90
	2020-100-V2N60S06-TN20	1.00	2.0	6	2	60	100
	2020-070-V2N30S06-TN30	1.00	2.0	6	2	30	70
	2020-080-V2N40S06-TN30	1.00	2.0	6	2	40	80
	2020-140-V2N80S08-TN20	1.00	2.0	8	2	80	140
	2020-090-V2N50S08-TN30	1.00	2.0	8	2	50	90
	2020-100-V2N60S08-TN30	1.00	2.0	8	2	60	100
	2020-070-V2N30S08-TN50	1.00	2.0	8	2	30	70
	2020-140-V2N80S10-TN30	1.00	2.0	10	2	80	140
	2020-090-V2N40S10-TN50	1.00	2.0	10	2	40	90
	2030-060-V4.5N16S06-TN05	1.50	3.0	6	4.5	16	60
	2030-065-V4.5N20S06-TN05	1.50	3.0	6	4.5	2	65
	2030-070-V4.5N30S06-TN05	1.50	3.0	6	4.5	3	70
	2030-080-V4.5N40S06-TN05	1.50	3.0	6	4.5	4	80
	2030-090-V4.5N50S06-TN05	1.50	3.0	6	4.5	5	90
	2030-100-V4.5N60S06-TN05	1.50	3.0	6	4.5	6	100
	2030-060-V4.5N16S06-TN10	1.50	3.0	6	4.5	16	60
	2030-065-V4.5N20S06-TN10	1.50	3.0	6	4.5	2	65
	2030-070-V4.5N30S06-TN10	1.50	3.0	6	4.5	3	70
	2030-080-V4.5N40S06-TN10	1.50	3.0	6	4.5	4	80
	2030-090-V4.5N50S06-TN10	1.50	3.0	6	4.5	5	90
	2030-100-V4.5N60S06-TN10	1.50	3.0	6	4.5	6	100
	2030-120-V4.5N70S06-TN10	1.50	3.0	6	4.5	7	120
	2030-060-V4.5N16S06-TN15	1.50	3.0	6	4.5	16	60
	2030-065-V4.5N20S06-TN15	1.50	3.0	6	4.5	2	65
	2030-070-V4.5N30S06-TN15	1.50	3.0	6	4.5	3	70
	2030-080-V4.5N40S06-TN15	1.50	3.0	6	4.5	4	80
	2030-090-V4.5N50S06-TN15	1.50	3.0	6	4.5	5	90
	2030-100-V4.5N60S06-TN15	1.50	3.0	6	4.5	6	100
	2030-060-V4.5N16S06-TN20	1.50	3.0	6	4.5	16	60
	2030-065-V4.5N20S06-TN20	1.50	3.0	6	4.5	2	65

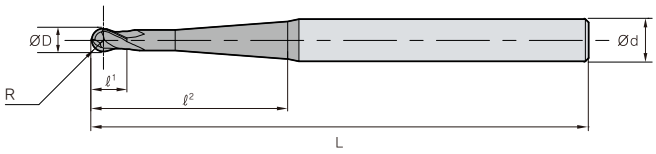
UPRBE2000-TN (Ball)

Taper neck ball



2 | H·A 30° | h6 shank | Substrate PC315W

Category	Range	Tolerance
ØD	Ø0.1 ~ Ø6.0 Ø8.0 ~ Ø12.0	0.000 ~ -0.012 0.000 ~ -0.015
R	~R3.0 R3.0~	±0.005 ±0.010



(mm)

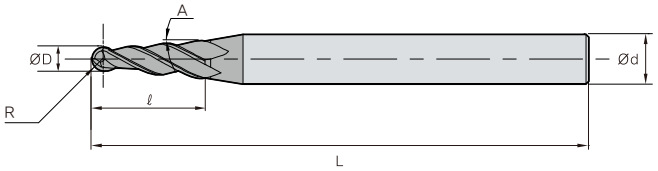
	Designation	R	ØD	Ød	ℓ1	ℓ2	L
UPRBE 2	2030-070-V4.5N30S06-TN20	1.50	3.0	6	4.5	3	70
	2030-080-V4.5N40S06-TN20	1.50	3.0	6	4.5	4	80
	2030-070-V4.5N30S06-TN30	1.50	3.0	6	4.5	3	70
	2030-090-V4.5N50S08-TN20	1.50	3.0	8	4.5	5	90
	2030-090-V4.5N40S08-TN30	1.50	3.0	8	4.5	4	90
	2030-070-V4.5N30S08-TN50	1.50	3.0	8	4.5	3	70
	2030-090-V4.5N40S10-TN50	1.50	3.0	10	4.5	4	90
	2040-090-V6N40S06-TN05	2.00	4.0	6	6	40	90
	2040-100-V6N50S06-TN05	2.00	4.0	6	6	50	100
	2040-110-V6N60S06-TN05	2.00	4.0	6	6	60	110
	2040-120-V6N70S06-TN05	2.00	4.0	6	6	70	120
	2040-090-V6N40S06-TN10	2.00	4.0	6	6	40	90
	2040-100-V6N50S06-TN10	2.00	4.0	6	6	50	100
	2040-090-V6N40S06-TN15	2.00	4.0	6	6	40	90
	2040-110-V6N60S08-TN10	2.00	4.0	8	6	60	110
	2040-120-V6N70S08-TN10	2.00	4.0	8	6	70	120
	2040-100-V6N50S08-TN15	2.00	4.0	8	6	50	100
	2040-110-V6N60S08-TN15	2.00	4.0	8	6	60	110
	2040-120-V6N70S08-TN15	2.00	4.0	8	6	70	120
	2040-100-V6N50S10-TN30	2.00	4.0	10	6	50	100
	2040-100-V6N50S12-TN50	2.00	4.0	12	6	50	100
	2050-120-V10N60S08-TN10	2.50	5.0	8	10	60	120
	2050-120-V10N60S08-TN15	2.50	5.0	8	10	60	120
	2050-120-V10N40S08-TN30	2.50	5.0	8	10	40	120
	2060-120-V12N60S08-TN10	3.00	6.0	8	12	60	120
	2060-150-V12N90S10-TN10	3.00	6.0	10	12	90	150
	2060-120-V12N60S10-TN15	3.00	6.0	10	12	60	120
	2060-150-V12N90S10-TN15	3.00	6.0	10	12	90	150
	2060-120-V12N60S10-TN20	3.00	6.0	10	12	60	120
	2060-150-V12N90S12-TN20	3.00	6.0	12	12	90	150
	2060-120-V12N60S12-TN30	3.00	6.0	12	12	60	120
	2060-150-V12N90S14-TN30	3.00	6.0	14	12	90	150
	2080-130-V14N70S10-TN10	4.00	8.0	10	14	70	130
	2080-150-V14N100S12-TN10	4.00	8.0	12	14	10	150

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
UPRBE 2	2080-130-V14N70S12-TN15	4.00	8.0	12	14	70	130
	2080-130-V14N70S12-TN20	4.00	8.0	12	14	70	130
	2080-150-V14N100S14-TN15	4.00	8.0	14	14	10	150
	2080-150-V14N100S14-TN20	4.00	8.0	14	14	10	150
	2080-130-V14N70S14-TN30	4.00	8.0	14	14	70	130
	2080-150-V14N100S18-TN30	4.00	8.0	18	14	10	150
	2100-130-V18N70S12-TN10	5.00	10.0	12	18	70	130
	2100-200-V18N100S14-TN10	5.00	10.0	14	18	10	200
	2100-150-V18N80S14-TN10	5.00	10.0	14	18	80	150
	2100-130-V18N70S14-TN15	5.00	10.0	14	18	70	130
	2100-150-V18N80S14-TN15	5.00	10.0	14	18	80	150
	2100-130-V18N70S14-TN20	5.00	10.0	14	18	70	130
	2100-200-V18N100S16-TN15	5.00	10.0	16	18	10	200
	2100-200-V18N100S16-TN20	5.00	10.0	16	18	10	200
	2100-150-V18N80S16-TN20	5.00	10.0	16	18	80	150
	2100-130-V18N70S16-TN30	5.00	10.0	16	18	70	130
	2100-150-V18N80S18-TN30	5.00	10.0	18	18	80	150
	2100-200-V18N100S20-TN30	5.00	10.0	20	18	10	200
	2120-130-V22N60S14-TN10	6.00	12.0	14	22	60	130
	2120-150-V22N80S14-TN10	6.00	12.0	14	22	80	150
	2120-130-V22N60S14-TN15	6.00	12.0	14	22	60	130
	2120-200-V22N100S16-TN10	6.00	12.0	16	22	10	200
	2120-180-V22N90S16-TN10	6.00	12.0	16	22	90	180
	2120-200-V22N100S16-TN15	6.00	12.0	16	22	10	200
	2120-150-V22N80S16-TN15	6.00	12.0	16	22	80	150
	2120-180-V22N90S16-TN15	6.00	12.0	16	22	90	180
	2120-130-V22N60S16-TN20	6.00	12.0	16	22	60	130
	2120-150-V22N80S16-TN20	6.00	12.0	16	22	80	150
	2120-130-V22N60S16-TN30	6.00	12.0	16	22	60	130
	2120-200-V22N100S18-TN20	6.00	12.0	18	22	10	200
	2120-180-V22N90S18-TN20	6.00	12.0	18	22	90	180
	2120-150-V22N80S18-TN30	6.00	12.0	18	22	80	150
	2120-200-V22N100S20-TN30	6.00	12.0	20	22	10	200
	2120-180-V22N90S20-TN30	6.00	12.0	20	22	90	180

U+ Endmill

UPTBE2000 (Ball)

Taper ball



2	H·A 30°	h6 shank	Substrate PC315W

Category	Range	Tolerance
ØD	All	0.00 ~ -0.03
R	-	±0.01

(mm)

	Designation	R	ØD	Ød	ℓ	L	A
UPTBE 2	2003-040-A0.5V1.2S04	0.15	0.3	4	1.2	40	0.5°
	2003-040-A1V1.2S04	0.15	0.3	4	1.2	40	1°
	2003-040-A1.5V1.2S04	0.15	0.3	4	1.2	40	1.5°
	2003-040-A2V1.2S04	0.15	0.3	4	1.2	40	2°
	2003-040-A3V1.2S04	0.15	0.3	4	1.2	40	3°
	2003-040-A5V1.2S04	0.15	0.3	4	1.2	40	5°
	2003-040-A7V1.5S04	0.15	0.3	4	1.5	40	7°
	2003-040-A10V1.5S04	0.15	0.3	4	1.5	40	10°
	2004-040-A0.5V1.6S04	0.20	0.4	4	1.6	40	0.5°
	2004-040-A1V1.6S04	0.20	0.4	4	1.6	40	1°
	2004-040-A1.5V1.6S04	0.20	0.4	4	1.6	40	1.5°
	2004-040-A2V1.6S04	0.20	0.4	4	1.6	40	2°
	2004-040-A3V1.6S04	0.20	0.4	4	1.6	40	3°
	2004-040-A5V1.6S04	0.20	0.4	4	1.6	40	5°
	2004-040-A7V2S04	0.20	0.4	4	2	40	7°
	2004-040-A10V2S04	0.20	0.4	4	2	40	10°
	2005-045-A0.5V2S04	0.25	0.5	4	2	45	0.5°
	2005-045-A1V2S04	0.25	0.5	4	2	45	1°
	2005-045-A1.5V2S04	0.25	0.5	4	2	45	1.5°
	2005-045-A2V2S04	0.25	0.5	4	2	45	2°
	2005-045-A3V2S04	0.25	0.5	4	2	45	3°
	2005-045-A5V2S04	0.25	0.5	4	2	45	5°
	2005-045-A7V2.5S04	0.25	0.5	4	2.5	45	7°
	2005-045-A10V2.5S04	0.25	0.5	4	2.5	45	10°
	2006-045-A0.5V2S04	0.30	0.6	4	2	45	0.5°
	2006-045-A1V2S04	0.30	0.6	4	2	45	1°
	2006-045-A1.5V2S04	0.30	0.6	4	2	45	1.5°
	2006-045-A2V2S04	0.30	0.6	4	2	45	2°
	2006-045-A3V2S04	0.30	0.6	4	2	45	3°
	2006-045-A5V2S04	0.30	0.6	4	2	45	5°
	2006-045-A7V2.5S04	0.30	0.6	4	2.5	45	7°
	2006-045-A10V2.5S04	0.30	0.6	4	2.5	45	10°
	2007-045-A0.5V2.5S04	0.35	0.7	4	2.5	45	0.5°
	2007-045-A1V2.5S04	0.35	0.7	4	2.5	45	1°
	2007-045-A1.5V2.5S04	0.35	0.7	4	2.5	45	1.5°
	2007-045-A2V2.5S04	0.35	0.7	4	2.5	45	2°

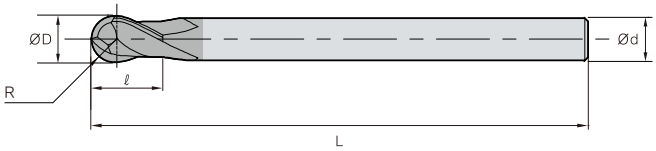
	Designation	R	ØD	Ød	ℓ	L	A
UPTBE 2	2007-045-A3V2.5S04	0.35	0.7	4	2.5	45	3°
	2007-045-A5V2.5S04	0.35	0.7	4	2.5	45	5°
	2007-045-A7V3S04	0.35	0.7	4	3	45	7°
	2007-045-A10V3S04	0.35	0.7	4	3	45	10°
	2008-045-A0.5V3.2S04	0.40	0.8	4	3.2	45	0.5°
	2008-045-A1V3.2S04	0.40	0.8	4	3.2	45	1°
	2008-045-A1.5V3.2S04	0.40	0.8	4	3.2	45	1.5°
	2008-045-A2V3.2S04	0.40	0.8	4	3.2	45	2°
	2008-045-A3V3.2S04	0.40	0.8	4	3.2	45	3°
	2008-045-A5V3.2S04	0.40	0.8	4	3.2	45	5°
	2008-045-A7V3.2S04	0.40	0.8	4	3.2	45	7°
	2008-045-A10V3.2S04	0.40	0.8	4	3.2	45	10°
	2010-050-A0.5V4S04	0.50	1.0	4	4	50	0.5°
	2010-050-A1V4S04	0.50	1.0	4	4	50	1°
	2010-050-A1.5V4S04	0.50	1.0	4	4	50	1.5°
	2010-050-A2V4S04	0.50	1.0	4	4	50	2°
	2010-050-A3V4S04	0.50	1.0	4	4	50	3°
	2010-050-A5V4S04	0.50	1.0	4	4	50	5°
	2010-050-A7V4S04	0.50	1.0	4	4	50	7°
	2010-050-A10V4S04	0.50	1.0	4	4	50	10°
	2015-050-A0.5V6S04	0.75	1.5	4	6	50	0.5°
	2015-050-A1V6S04	0.75	1.5	4	6	50	1°
	2015-050-A1.5V6S04	0.75	1.5	4	6	50	1.5°
	2015-050-A2V7S04	0.75	1.5	4	7	50	2°
	2015-050-A3V8S04	0.75	1.5	4	8	50	3°
	2015-050-A5V10S04	0.75	1.5	4	10	50	5°
	2015-050-A7V10S04	0.75	1.5	4	10	50	7°
	2015-050-A10V10S06	0.75	1.5	6	10	50	10°
	2020-050-A0.5V6S04	1.00	2.0	4	6	50	0.5°
	2020-050-A1V6S04	1.00	2.0	4	6	50	1°
	2020-050-A1.5V6S04	1.00	2.0	4	6	50	1.5°
	2020-050-A2V10S04	1.00	2.0	4	10	50	2°
	2020-050-A3V10S04	1.00	2.0	4	10	50	3°
	2020-050-A5V10S04	1.00	2.0	4	10	50	5°
	2020-050-A7V10S06	1.00	2.0	6	10	50	7°
	2020-050-A10V11S06	1.00	2.0	6	11	50	10°

UPBE2000 (Ball)

General Ball

2 | H·A 30° | h6 shank | Substrate PC315W

Category	Range	Tolerance
ØD	Ø1.0 ~ Ø6.0 Ø6.5 ~ Ø25.0	0.000 ~ -0.012 0.000 ~ -0.015
R	~R3.0 R3.0~	±0.005 ±0.010



(mm)

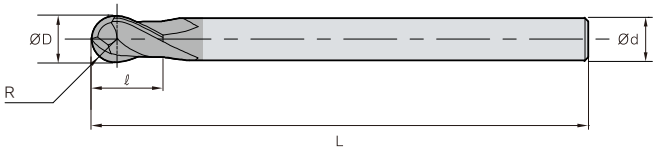
	Designation	R	ØD	Ød	ℓ	L
UPBE 2	2001-040-V0.1S04	0.05	0.1	4	0.1	40
	2001-040-V0.2S03	0.05	0.1	3	0.2	40
	2001-040-V0.2S04	0.05	0.1	4	0.2	40
	20015-040-V0.15S04	0.075	0.15	4	0.15	40
	20015-040-V0.3S03	0.075	0.15	3	0.3	40
	20015-040-V0.3S04	0.075	0.15	4	0.3	40
	2002-040-V0.2S04	0.10	0.2	4	0.2	40
	2002-040-V0.4S03	0.10	0.2	3	0.4	40
	2002-040-V0.4S04	0.10	0.2	4	0.4	40
	2003-040-V0.3S04	0.15	0.3	4	0.3	40
	2003-040-V0.6S03	0.15	0.3	3	0.6	40
	2003-040-V0.6S04	0.15	0.3	4	0.6	40
	2004-040-V0.4S04	0.20	0.4	4	0.4	40
	2004-040-V0.8S03	0.20	0.4	3	0.8	40
	2004-040-V0.8S04	0.20	0.4	4	0.8	40
	2005-040-V0.5S04	0.25	0.5	4	0.5	40
	2005-040-V1S03	0.25	0.5	3	1	40
	2005-040-V1S04	0.25	0.5	4	1	40
	2006-040-V0.6S04	0.30	0.6	4	0.6	40
	2006-040-V1.2S03	0.30	0.6	3	1.2	40
	2006-040-V1.2S04	0.30	0.6	4	1.2	40
	2007-040-V0.7S04	0.35	0.7	4	0.7	40
	2007-040-V1.4S03	0.35	0.7	3	1.4	40
	2007-040-V1.4S04	0.35	0.7	4	1.4	40
	2008-040-V0.8S04	0.40	0.8	4	0.8	40
	2008-040-V1.6S03	0.40	0.8	3	1.6	40
	2008-040-V1.6S04	0.40	0.8	4	1.6	40
	2009-040-V0.9S04	0.45	0.9	4	0.9	40
	2009-040-V1.8S03	0.45	0.9	3	1.8	40
	2009-040-V1.8S04	0.45	0.9	4	1.8	40
	2010-040-V1.5S06	0.50	1.0	6	1.5	40
	2010-050-V2.5S03	0.50	1.0	3	2.5	50
	2010-050-V2.5S04	0.50	1.0	4	2.5	50
	2010-050-V2.5S06	0.50	1.0	6	2.5	50
	2010-070-V2.5S06	0.50	1.0	6	2.5	70
	2010-100-V2.5S06	0.50	1.0	6	2.5	100

	Designation	R	ØD	Ød	ℓ	L
UPBE 2	2012-040-V2S06	0.60	1.2	6	2	40
	2012-050-V3S03	0.60	1.2	3	3	50
	2012-050-V3S04	0.60	1.2	4	3	50
	2012-050-V3S06	0.60	1.2	6	3	50
	2012-070-V3S06	0.60	1.2	6	3	70
	2012-100-V3S06	0.60	1.2	6	3	100
	2015-040-V2.5S06	0.75	1.5	6	2.5	40
	2015-050-V4S03	0.75	1.5	3	4	50
	2015-050-V4S04	0.75	1.5	4	4	50
	2015-050-V4S06	0.75	1.5	6	4	50
	2015-070-V4S06	0.75	1.5	6	4	70
	2015-100-V4S06	0.75	1.5	6	4	100
	2020-040-V3S06	1.00	2.0	6	3	40
	2020-050-V5S03	1.00	2.0	3	5	50
	2020-050-V5S04	1.00	2.0	4	5	50
	2020-050-V5S06	1.00	2.0	6	5	50
	2020-080-V5S06	1.00	2.0	6	5	80
	2020-100-V5S06	1.00	2.0	6	5	100
	2025-040-V4S06	1.25	2.5	6	4	40
	2025-060-V6S03	1.25	2.5	3	6	60
	2025-060-V6S04	1.25	2.5	4	6	60
	2025-060-V6S06	1.25	2.5	6	6	60
	2025-080-V6S06	1.25	2.5	6	6	80
	2025-100-V6S06	1.25	2.5	6	6	100
	2030-040-V4.5S06	1.50	3.0	6	4.5	40
	2030-060-V6S03	1.50	3.0	3	6	60
	2030-060-V6S04	1.50	3.0	4	6	60
	2030-060-V6S06	1.50	3.0	6	6	60
	2030-080-V6S06	1.50	3.0	6	6	80
	2030-100-V6S06	1.50	3.0	6	6	100
	2035-070-V8S06	1.75	3.5	6	8	70
	2040-050-V6S06	2.00	4.0	6	6	50
	2040-100-V8S04	2.00	4.0	4	8	100
	2040-120-V8S04	2.00	4.0	4	8	120
	2040-070-V8S04	2.00	4.0	4	8	70
	2040-070-V8S06	2.00	4.0	6	8	70

U+ Endmill

UPBE2000 (Ball)

General Ball



2 | H·A 30° | h6 shank | Substrate PC315W

Category	Range	Tolerance
ØD	Ø1.0 ~ Ø6.0 Ø6.5 ~ Ø25.0	0.000 ~ -0.012 0.000 ~ -0.015
R	~R3.0 R3.0~	±0.005 ±0.010

(mm)

	Designation	R	ØD	Ød	ℓ	L
UPBE 2	2040-100-V8S06	2.00	4.0	6	8	100
	2040-120-V8S06	2.00	4.0	6	8	120
	2045-080-V9S06	2.25	4.5	6	9	80
	2050-060-V7.5S06	2.50	5.0	6	7.5	60
	2050-080-V10S05	2.50	5.0	5	10	80
	2050-080-V10S06	2.50	5.0	6	10	80
	2055-090-V11S06	2.75	5.5	6	11	90
	2060-060-V9S06	3.00	6.0	6	9	60
	2060-080-V9S06	3.00	6.0	6	9	80
	2060-050-V9S06	3.00	6.0	6	9	50
	2060-090-V12S06	3.00	6.0	6	12	90
	2060-110-V12S06	3.00	6.0	6	12	110
	2060-130-V12S06	3.00	6.0	6	12	130
	2060-150-V12S06	3.00	6.0	6	12	150
	2065-090-V13S08	3.25	6.5	8	13	90
	2070-090-V14S08	3.50	7.0	8	14	90
	2080-060-V12S08	4.00	8.0	8	12	60
	2080-080-V12S08	4.00	8.0	8	12	80
	2080-090-V12S08	4.00	8.0	8	12	90
	2080-050-V12S08	4.00	8.0	8	12	50
	2080-100-V14S08	4.00	8.0	8	14	100
	2080-130-V14S08	4.00	8.0	8	14	130
	2080-150-V14S08	4.00	8.0	8	14	150
	2085-100-V16S10	4.25	8.5	10	16	100
	2090-100-V18S10	4.50	9.0	10	18	100
	2100-060-V15S10	5.00	10.0	10	15	60
	2100-080-V15S10	5.00	10.0	10	15	80
	2100-090-V15S10	5.00	10.0	10	15	90
	2100-050-V15S10	5.00	10.0	10	15	50
	2100-100-V18S10	5.00	10.0	10	18	100
	2100-130-V18S10	5.00	10.0	10	18	130

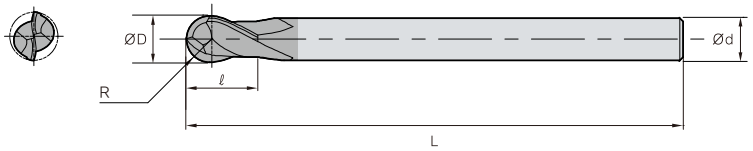
	Designation	R	ØD	Ød	ℓ	L
UPBE 2	2100-150-V18S10	5.00	10.0	10	18	150
	2100-180-V18S10	5.00	10.0	10	18	180
	2100-200-V18S10	5.00	10.0	10	18	200
	2110-100-V20S12	5.50	11.0	12	20	100
	2120-080-V18S12	6.00	12.0	12	18	80
	2120-090-V18S12	6.00	12.0	12	18	90
	2120-100-V18S12	6.00	12.0	12	18	100
	2120-060-V18S12	6.00	12.0	12	18	60
	2120-110-V22S12	6.00	12.0	12	22	110
	2120-130-V24S12	6.00	12.0	12	24	130
	2120-150-V24S12	6.00	12.0	12	24	150
	2120-180-V24S12	6.00	12.0	12	24	180
	2120-200-V24S12	6.00	12.0	12	24	200
	2130-100-V24S12	6.50	13.0	12	24	100
	2140-100-V26S12	7.00	14.0	12	26	100
	2140-100-V26S14	7.00	14.0	14	26	100
	2140-100-V26S16	7.00	14.0	16	26	100
	2150-140-V28S16	7.50	15.0	16	28	140
	2160-100-V24S16	8.00	16.0	16	24	100
	2160-130-V24S16	8.00	16.0	16	24	130
	2160-150-V30S16	8.00	16.0	16	30	150
	2160-180-V30S16	8.00	16.0	16	30	180
	2160-200-V30S16	8.00	16.0	16	30	200
	2180-150-V34S16	9.00	18.0	16	34	150
	2180-150-V34S18	9.00	18.0	18	34	150
	2200-100-V30S20	10.00	20.0	20	30	100
	2200-130-V30S20	10.00	20.0	20	30	130
	2200-150-V38S20	10.00	20.0	20	38	150
	2200-200-V38S20	10.00	20.0	20	38	200
	2250-120-V50S25	12.50	25.0	25	50	120
	2250-180-V50S25	12.50	25.0	25	50	180

UPBE2000-P (Ball)

General Ball/High precision ball

2 | H·A 30° | h6 shank | Substrate PC315W

Category	Range	Tolerance
ØD	Ø0.1 ~ Ø6.0 Ø8.0 ~ Ø12.0	0.000 ~ -0.012 0.000 ~ -0.015
R	~R3.0 R3.0~	±0.002 ±0.003



(mm)

	Designation	R	ØD	Ød	ℓ	L
UPBE 2	2001-040-S04-P	0.05	0.1	4	0.2	40
	20015-040-S04-P	0.075	0.15	4	0.3	40
	2002-040-S04-P	0.10	0.2	4	0.4	40
	2003-040-S04-P	0.15	0.3	4	0.6	40
	2004-040-S04-P	0.20	0.4	4	0.8	40
	2005-040-S04-P	0.25	0.5	4	1	40
	2006-040-S04-P	0.30	0.6	4	1.2	40
	2007-040-S04-P	0.35	0.7	4	1.4	40
	2008-040-S04-P	0.40	0.8	4	1.6	40
	2009-040-S04-P	0.45	0.9	4	1.8	40
	2010-050-S06-P	0.50	1.0	6	2.5	50
	2012-050-S06-P	0.60	1.2	6	3	50
	2015-050-S06-P	0.75	1.5	6	4	50
	2020-050-S06-P	1.00	2.0	6	5	50
	2025-060-S06-P	1.25	2.5	6	6	60
	2030-060-S06-P	1.50	3.0	6	6	60
	2040-070-S06-P	2.00	4.0	6	8	70
	2050-080-S06-P	2.50	5.0	6	10	80
	2060-090-S06-P	3.00	6.0	6	12	90
	2080-100-S08-P	4.00	8.0	8	14	100
	2100-100-S10-P	5.00	10.0	10	18	100
	2120-110-S12-P	6.00	12.0	12	24	110

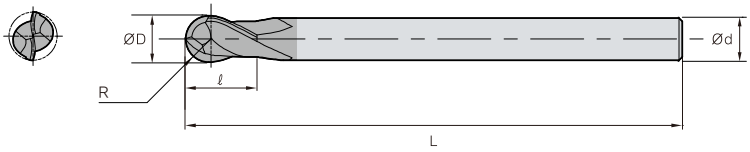
U+ Endmill

UPBE2000-H (Ball)

General Ball/High precision ball

2 | H·A 30° | h6 shank | Substrate PC315W

Category	Range	Tolerance
ØD	Ø0.1 ~ Ø6.0 Ø8.0 ~ Ø12.0	0.000 ~ -0.012 0.000 ~ -0.015
R	~ R1.5 R1.5 ~ R3.0 R3.0 ~	±0.0015 ±0.0025 ±0.0040

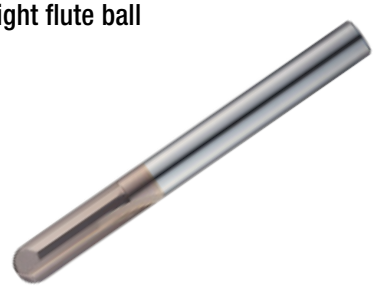


(mm)

	Designation	R	ØD	Ød	ℓ	L
UPBE	2001-040-V0.2S04-H	0.05	0.1	4	0.2	40
2	20015-040-V0.3S04-H	0.075	0.15	4	0.3	40
	2002-040-V0.4S04-H	0.10	0.2	4	0.4	40
	2003-040-V0.6S04-H	0.15	0.3	4	0.6	40
	2004-040-V0.8S04-H	0.20	0.4	4	0.8	40
	2005-040-V1S04-H	0.25	0.5	4	1	40
	2006-040-V1.2S04-H	0.30	0.6	4	1.2	40
	2007-040-V1.4S04-H	0.35	0.7	4	1.4	40
	2008-040-V1.6S04-H	0.40	0.8	4	1.6	40
	2009-040-V1.8S04-H	0.45	0.9	4	1.8	40
	2010-050-V2.5S06-H	0.50	1.0	6	2.5	50
	2012-050-V3S06-H	0.60	1.2	6	3	50
	2015-050-V4S06-H	0.75	1.5	6	4	50
	2020-050-V5S06-H	1.00	2.0	6	5	50
	2025-060-V6S06-H	1.25	2.5	6	6	60
	2030-060-V6S06-H	1.50	3.0	6	6	60
	2040-070-V8S06-H	2.00	4.0	6	8	70
	2050-080-V10S06-H	2.50	5.0	6	10	80
	2060-090-V12S06-H	3.00	6.0	6	12	90
	2080-100-V14S08-H	4.00	8.0	8	14	100
	2100-100-V18S10-H	5.00	10.0	10	18	100
	2120-110-V24S12-H	6.00	12.0	12	24	110

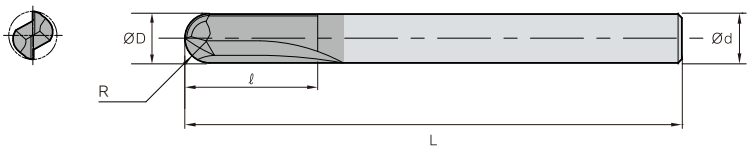
UPBE2000-ST (Ball)

Straight flute ball



2 | H·A 0° | h6 shank | Substrate PC315W

Category	Range	Tolerance
ØD	Ø3.0 ~ Ø6.0 Ø8.0 ~ Ø12.0	0.000 ~ -0.012 0.000 ~ -0.015
R	~ R3.0 R3.0 ~	±0.005 ±0.010



(mm)

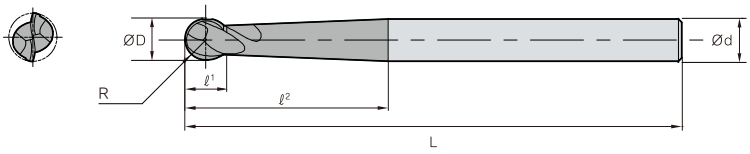
	Designation	R	ØD	Ød	ℓ	L
UPBE 2	2030-070-S06-ST	1.50	3.0	6	10	70
	2040-070-S06-ST	2.00	4.0	6	12	70
	2050-090-S06-ST	2.50	5.0	6	18	90
	2060-090-S06-ST	3.00	6.0	6	20	90
	2080-100-S08-ST	4.00	8.0	8	25	100
	2100-100-S10-ST	5.00	10.0	10	30	100
	2120-110-S12-ST	6.00	12.0	12	32	110
	2160-150-S16-ST	8.00	16.0	16	35	150
	2200-150-S20-ST	10.00	20.0	20	40	150

UPBE2000-SP (Ball)

Spear type ball

2 | H·A 30° | h6 shank | Substrate PC315W

Category	Range	Tolerance
ØD	All	0.00 ~ -0.03
R	-	±0.01



(mm)

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
UPBE 2	2030-080-S06-SP	1.50	3.0	6	2.3	16	80
	2040-080-S06-SP	2.00	4.0	6	3.1	20	80
	2050-080-S06-SP	2.50	5.0	6	3.9	25	80
	2060-100-S06-SP	3.00	6.0	6	4.9	30	100
	2080-100-S08-SP	4.00	8.0	8	6.3	35	100
	2100-100-S10-SP	5.00	10.0	10	7.9	40	100
	2120-100-S12-SP	6.00	12.0	12	9.5	50	100

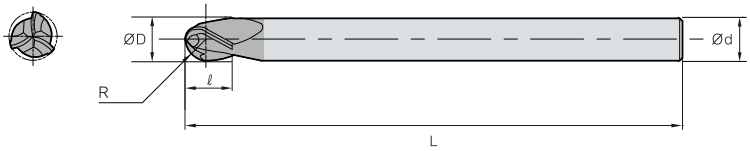
U+ Endmill

UPBE3000 (Ball)

General ball

3 | H·A 30° | h6 shank | Substrate PC315W

Category	Range	Tolerance
ØD	All	0.00 ~ -0.02
R	~ R3.0	±0.005
	R3.0 ~	±0.010



(mm)

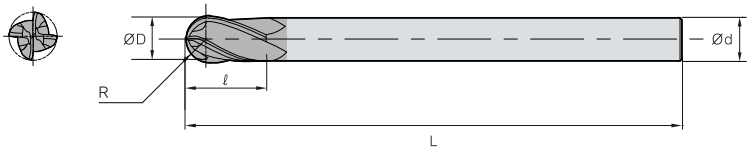
	Designation	R	ØD	Ød	ℓ	L
UPBE 3	3010-050-S06	0.50	1.0	6	1	50
	3015-050-S06	0.75	1.5	6	1.5	50
	3020-050-S06	1.00	2.0	6	2	50
	3030-060-S06	1.50	3.0	6	3	60
	3040-070-S06	2.00	4.0	6	4	70
	3050-080-S06	2.50	5.0	6	5	80
	3060-090-S06	3.00	6.0	6	6	90
	3080-100-S08	4.00	8.0	8	8	100
	3100-100-S10	5.00	10.0	10	10	100
	3120-110-S12	6.00	12.0	12	12	110

UPBE4000 (Ball)

General ball

4 | H·A 30° | h6 shank | Substrate PC315W

Category	Range	Tolerance
ØD	All	0.00 ~ -0.02
R	~ R3.0	±0.005
	R3.0 ~	±0.010

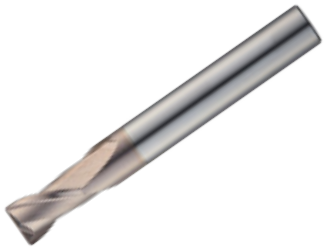


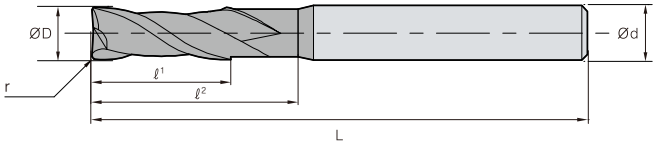
(mm)

	Designation	R	ØD	Ød	ℓ	L
UPBE 4	4010-050-S06	0.50	1.0	6	1	50
	4015-050-S06	0.75	1.5	6	1.5	50
	4020-050-S06	1.00	2.0	6	2	50
	4030-060-S06	1.50	3.0	6	3	60
	4040-070-S06	2.00	4.0	6	4	70
	4050-080-S06	2.50	5.0	6	5	80
	4060-090-S06	3.00	6.0	6	6	90
	4080-100-S08	4.00	8.0	8	8	100
	4100-100-S10	5.00	10.0	10	10	100
	4120-110-S12	6.00	12.0	12	12	110

UPRRE2000 (Radius)

Long neck radius





2 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
Ø0.2 ~ Ø6.0	0.000 ~ -0.015
Ø8.0 ~ Ø12.0	0.000 ~ -0.025

(mm)

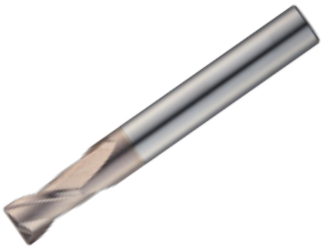
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2002-040-V0.3N0.5S4-R002	0.2	4	0.3	0.5	40	0.02
	2002-040-V0.3N1S4-R002	0.2	4	0.3	1	40	0.02
	2002-040-V0.3N1.5S4-R002	0.2	4	0.3	1.5	40	0.02
	2002-040-V0.3N2S4-R002	0.2	4	0.3	2	40	0.02
	2002-040-V0.3N0.5S4-R005	0.2	4	0.3	0.5	40	0.05
	2002-040-V0.3N1S4-R005	0.2	4	0.3	1	40	0.05
	2002-040-V0.3N1.5S4-R005	0.2	4	0.3	1.5	40	0.05
	2002-040-V0.3N2S4-R005	0.2	4	0.3	2	40	0.05
	2003-040-V0.5N1S4-R002	0.3	4	0.5	1	40	0.02
	2003-040-V0.5N2S4-R002	0.3	4	0.5	2	40	0.02
	2003-040-V0.5N3S4-R002	0.3	4	0.5	3	40	0.02
	2003-040-V0.5N1S4-R005	0.3	4	0.5	1	40	0.05
	2003-040-V0.5N2S4-R005	0.3	4	0.5	2	40	0.05
	2003-040-V0.5N3S4-R005	0.3	4	0.5	3	40	0.05
	2004-040-V0.6N1S4-R005	0.4	4	0.6	1	40	0.05
	2004-040-V0.6N1.5S4-R005	0.4	4	0.6	1.5	40	0.05
	2004-040-V0.6N2S4-R005	0.4	4	0.6	2	40	0.05
	2004-040-V0.6N2.5S4-R005	0.4	4	0.6	2.5	40	0.05
	2004-040-V0.6N3S4-R005	0.4	4	0.6	3	40	0.05
	2004-040-V0.6N4S4-R005	0.4	4	0.6	4	40	0.05
	2004-040-V0.6N1S4-R01	0.4	4	0.6	1	40	0.10
	2004-040-V0.6N1.5S4-R01	0.4	4	0.6	1.5	40	0.10
	2004-040-V0.6N2S4-R01	0.4	4	0.6	2	40	0.10
	2004-040-V0.6N2.5S4-R01	0.4	4	0.6	2.5	40	0.10
	2004-040-V0.6N3S4-R01	0.4	4	0.6	3	40	0.10
	2004-040-V0.6N4S4-R01	0.4	4	0.6	4	40	0.10
	2005-045-V0.7N1S4-R005	0.5	4	0.7	1	45	0.05
	2005-045-V0.7N1.5S4-R005	0.5	4	0.7	1.5	45	0.05
	2005-045-V0.7N2S4-R005	0.5	4	0.7	2	45	0.05
	2005-045-V0.7N2.5S4-R005	0.5	4	0.7	2.5	45	0.05
	2005-045-V0.7N3S4-R005	0.5	4	0.7	3	45	0.05
	2005-045-V0.7N4S4-R005	0.5	4	0.7	4	45	0.05
	2005-045-V0.7N5S4-R005	0.5	4	0.7	5	45	0.05
	2005-045-V0.7N6S4-R005	0.5	4	0.7	6	45	0.05
	2005-045-V0.7N1S4-R01	0.5	4	0.7	1	45	0.10
	2005-045-V0.7N1.5S4-R01	0.5	4	0.7	1.5	45	0.10
	2005-045-V0.7N2S4-R01	0.5	4	0.7	2	45	0.10

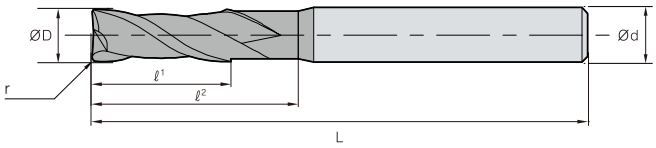
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2005-045-V0.7N2.5S4-R01	0.5	4	0.7	2.5	45	0.10
	2005-045-V0.7N3S4-R01	0.5	4	0.7	3	45	0.10
	2005-045-V0.7N4S4-R01	0.5	4	0.7	4	45	0.10
	2005-045-V0.7N5S4-R01	0.5	4	0.7	5	45	0.10
	2005-045-V0.7N6S4-R01	0.5	4	0.7	6	45	0.10
	2006-045-V0.9N2S4-R005	0.6	4	0.9	2	45	0.05
	2006-045-V0.9N3S4-R005	0.6	4	0.9	3	45	0.05
	2006-045-V0.9N4S4-R005	0.6	4	0.9	4	45	0.05
	2006-045-V0.9N6S4-R005	0.6	4	0.9	6	45	0.05
	2006-045-V0.9N8S4-R005	0.6	4	0.9	8	45	0.05
	2006-045-V0.9N10S4-R005	0.6	4	0.9	10	45	0.05
	2006-045-V0.9N2S4-R01	0.6	4	0.9	2	45	0.10
	2006-045-V0.9N3S4-R01	0.6	4	0.9	3	45	0.10
	2006-045-V0.9N4S4-R01	0.6	4	0.9	4	45	0.10
	2006-045-V0.9N6S4-R01	0.6	4	0.9	6	45	0.10
	2006-045-V0.9N8S4-R01	0.6	4	0.9	8	45	0.10
	2006-045-V0.9N10S4-R01	0.6	4	0.9	10	45	0.10
	2006-045-V0.9N2S4-R02	0.6	4	0.9	2	45	0.20
	2006-045-V0.9N3S4-R02	0.6	4	0.9	3	45	0.20
	2006-045-V0.9N4S4-R02	0.6	4	0.9	4	45	0.20
	2006-045-V0.9N6S4-R02	0.6	4	0.9	6	45	0.20
	2006-045-V0.9N8S4-R02	0.6	4	0.9	8	45	0.20
	2006-045-V0.9N10S4-R02	0.6	4	0.9	10	45	0.20
	2007-045-V1.2N2S4-R005	0.7	4	1.2	2	45	0.05
	2007-045-V1.2N4S4-R005	0.7	4	1.2	4	45	0.05
	2007-045-V1.2N6S4-R005	0.7	4	1.2	6	45	0.05
	2007-045-V1.2N8S4-R005	0.7	4	1.2	8	45	0.05
	2007-045-V1.2N10S4-R005	0.7	4	1.2	10	45	0.05
	2007-045-V1.2N2S4-R01	0.7	4	1.2	2	45	0.10
	2007-045-V1.2N4S4-R01	0.7	4	1.2	4	45	0.10
	2007-045-V1.2N6S4-R01	0.7	4	1.2	6	45	0.10
	2007-045-V1.2N8S4-R01	0.7	4	1.2	8	45	0.10
	2007-045-V1.2N10S4-R01	0.7	4	1.2	10	45	0.10
	2007-045-V1.2N2S4-R02	0.7	4	1.2	2	45	0.20
	2007-045-V1.2N4S4-R02	0.7	4	1.2	4	45	0.20
	2007-045-V1.2N6S4-R02	0.7	4	1.2	6	45	0.20
	2007-045-V1.2N8S4-R02	0.7	4	1.2	8	45	0.20

U+ Endmill

UPRRE2000 (Radius)

Long neck radius





2 | H-A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
Ø0.2 ~ Ø6.0	0.000 ~ -0.015
Ø8.0 ~ Ø12.0	0.000 ~ -0.025

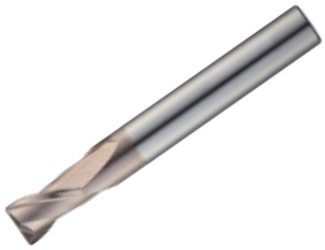
(mm)

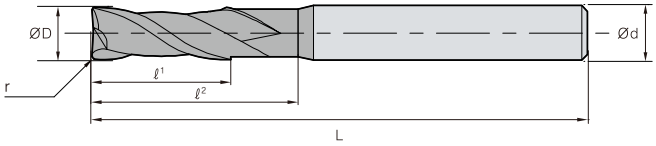
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2007-045-V1.2N10S4-R02	0.7	4	1.2	10	45	0.20
	2008-045-V1.2N2S4-R005	0.8	4	1.2	2	45	0.05
	2008-045-V1.2N3S4-R005	0.8	4	1.2	3	45	0.05
	2008-045-V1.2N4S4-R005	0.8	4	1.2	4	45	0.05
	2008-045-V1.2N6S4-R005	0.8	4	1.2	6	45	0.05
	2008-045-V1.2N8S4-R005	0.8	4	1.2	8	45	0.05
	2008-045-V1.2N10S4-R005	0.8	4	1.2	10	45	0.05
	2008-045-V1.2N2S4-R01	0.8	4	1.2	2	45	0.10
	2008-045-V1.2N3S4-R01	0.8	4	1.2	3	45	0.10
	2008-045-V1.2N4S4-R01	0.8	4	1.2	4	45	0.10
	2008-045-V1.2N6S4-R01	0.8	4	1.2	6	45	0.10
	2008-045-V1.2N8S4-R01	0.8	4	1.2	8	45	0.10
	2008-045-V1.2N10S4-R01	0.8	4	1.2	10	45	0.10
	2008-045-V1.2N2S4-R02	0.8	4	1.2	2	45	0.20
	2008-045-V1.2N3S4-R02	0.8	4	1.2	3	45	0.20
	2008-045-V1.2N4S4-R02	0.8	4	1.2	4	45	0.20
	2008-045-V1.2N6S4-R02	0.8	4	1.2	6	45	0.20
	2008-045-V1.2N8S4-R02	0.8	4	1.2	8	45	0.20
	2008-045-V1.2N10S4-R02	0.8	4	1.2	10	45	0.20
	2010-050-V1.5N3S4-R005	1.0	4	1.5	3	50	0.05
	2010-050-V1.5N4S4-R005	1.0	4	1.5	4	50	0.05
	2010-050-V1.5N6S4-R005	1.0	4	1.5	6	50	0.05
	2010-050-V1.5N8S4-R005	1.0	4	1.5	8	50	0.05
	2010-050-V1.5N10S4-R005	1.0	4	1.5	10	50	0.05
	2010-050-V1.5N12S4-R005	1.0	4	1.5	12	50	0.05
	2010-050-V1.5N14S4-R005	1.0	4	1.5	14	50	0.05
	2010-050-V1.5N16S4-R005	1.0	4	1.5	16	50	0.05
	2010-050-V1.5N20S4-R005	1.0	4	1.5	20	50	0.05
	2010-050-V1.5N3S4-R01	1.0	4	1.5	3	50	0.10
	2010-050-V1.5N4S4-R01	1.0	4	1.5	4	50	0.10
	2010-050-V1.5N6S4-R01	1.0	4	1.5	6	50	0.10
	2010-050-V1.5N8S4-R01	1.0	4	1.5	8	50	0.10
	2010-050-V1.5N10S4-R01	1.0	4	1.5	10	50	0.10
	2010-050-V1.5N12S4-R01	1.0	4	1.5	12	50	0.10
	2010-050-V1.5N14S4-R01	1.0	4	1.5	14	50	0.10
	2010-050-V1.5N16S4-R01	1.0	4	1.5	16	50	0.10
	2010-050-V1.5N20S4-R01	1.0	4	1.5	20	50	0.10

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2010-050-V1.5N3S4-R02	1.0	4	1.5	3	50	0.20
	2010-050-V1.5N4S4-R02	1.0	4	1.5	4	50	0.20
	2010-050-V1.5N6S4-R02	1.0	4	1.5	6	50	0.20
	2010-050-V1.5N8S4-R02	1.0	4	1.5	8	50	0.20
	2010-050-V1.5N10S4-R02	1.0	4	1.5	10	50	0.20
	2010-050-V1.5N12S4-R02	1.0	4	1.5	12	50	0.20
	2010-050-V1.5N14S4-R02	1.0	4	1.5	14	50	0.20
	2010-050-V1.5N16S4-R02	1.0	4	1.5	16	50	0.20
	2010-050-V1.5N20S4-R02	1.0	4	1.5	20	50	0.20
	2010-050-V1.5N3S4-R03	1.0	4	1.5	3	50	0.30
	2010-050-V1.5N4S4-R03	1.0	4	1.5	4	50	0.30
	2010-050-V1.5N6S4-R03	1.0	4	1.5	6	50	0.30
	2010-050-V1.5N8S4-R03	1.0	4	1.5	8	50	0.30
	2010-050-V1.5N10S4-R03	1.0	4	1.5	10	50	0.30
	2010-050-V1.5N12S4-R03	1.0	4	1.5	12	50	0.30
	2010-050-V1.5N14S4-R03	1.0	4	1.5	14	50	0.30
	2010-050-V1.5N16S4-R03	1.0	4	1.5	16	50	0.30
	2010-050-V1.5N20S4-R03	1.0	4	1.5	20	50	0.30
	2012-050-V1.8N3S4-R005	1.2	4	1.8	3	50	0.05
	2012-050-V1.8N4S4-R005	1.2	4	1.8	4	50	0.05
	2012-050-V1.8N6S4-R005	1.2	4	1.8	6	50	0.05
	2012-050-V1.8N8S4-R005	1.2	4	1.8	8	50	0.05
	2012-050-V1.8N10S4-R005	1.2	4	1.8	10	50	0.05
	2012-050-V1.8N12S4-R005	1.2	4	1.8	12	50	0.05
	2012-050-V1.8N16S4-R005	1.2	4	1.8	16	50	0.05
	2012-050-V1.8N20S4-R005	1.2	4	1.8	20	50	0.05
	2012-050-V1.8N3S4-R01	1.2	4	1.8	3	50	0.10
	2012-050-V1.8N4S4-R01	1.2	4	1.8	4	50	0.10
	2012-050-V1.8N6S4-R01	1.2	4	1.8	6	50	0.10
	2012-050-V1.8N8S4-R01	1.2	4	1.8	8	50	0.10
	2012-050-V1.8N10S4-R01	1.2	4	1.8	10	50	0.10
	2012-050-V1.8N12S4-R01	1.2	4	1.8	12	50	0.10
	2012-050-V1.8N16S4-R01	1.2	4	1.8	16	50	0.10
	2012-050-V1.8N20S4-R01	1.2	4	1.8	20	50	0.10
	2012-050-V1.8N3S4-R02	1.2	4	1.8	3	50	0.20
	2012-050-V1.8N4S4-R02	1.2	4	1.8	4	50	0.20
	2012-050-V1.8N6S4-R02	1.2	4	1.8	6	50	0.20

UPRRE2000 (Radius)

Long neck radius





2 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
Ø0.2 ~ Ø6.0	0.000 ~ -0.015
Ø8.0 ~ Ø12.0	0.000 ~ -0.025

(mm)

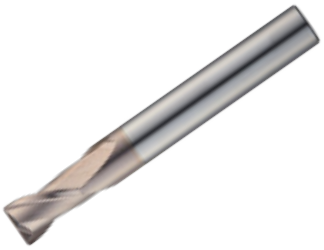
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2012-050-V1.8N8S4-R02	1.2	4	1.8	8	50	0.20
	2012-050-V1.8N10S4-R02	1.2	4	1.8	10	50	0.20
	2012-050-V1.8N12S4-R02	1.2	4	1.8	12	50	0.20
	2012-050-V1.8N16S4-R02	1.2	4	1.8	16	50	0.20
	2012-050-V1.8N20S4-R02	1.2	4	1.8	20	50	0.20
	2012-050-V1.8N3S4-R03	1.2	4	1.8	3	50	0.30
	2012-050-V1.8N4S4-R03	1.2	4	1.8	4	50	0.30
	2012-050-V1.8N6S4-R03	1.2	4	1.8	6	50	0.30
	2012-050-V1.8N8S4-R03	1.2	4	1.8	8	50	0.30
	2012-050-V1.8N10S4-R03	1.2	4	1.8	10	50	0.30
	2012-050-V1.8N12S4-R03	1.2	4	1.8	12	50	0.30
	2012-050-V1.8N16S4-R03	1.2	4	1.8	16	50	0.30
	2012-050-V1.8N20S4-R03	1.2	4	1.8	20	50	0.30
	2015-050-V2.3N4S4-R005	1.5	4	2.3	4	50	0.05
	2015-050-V2.3N6S4-R005	1.5	4	2.3	6	50	0.05
	2015-050-V2.3N8S4-R005	1.5	4	2.3	8	50	0.05
	2015-050-V2.3N10S4-R005	1.5	4	2.3	10	50	0.05
	2015-050-V2.3N12S4-R005	1.5	4	2.3	12	50	0.05
	2015-050-V2.3N14S4-R005	1.5	4	2.3	14	50	0.05
	2015-050-V2.3N16S4-R005	1.5	4	2.3	16	50	0.05
	2015-050-V2.3N20S4-R005	1.5	4	2.3	20	50	0.05
	2015-060-V2.3N22S4-R005	1.5	4	2.3	22	60	0.05
	2015-060-V2.3N26S4-R005	1.5	4	2.3	26	60	0.05
	2015-050-V2.3N4S4-R01	1.5	4	2.3	4	50	0.10
	2015-050-V2.3N6S4-R01	1.5	4	2.3	6	50	0.10
	2015-050-V2.3N8S4-R01	1.5	4	2.3	8	50	0.10
	2015-050-V2.3N10S4-R01	1.5	4	2.3	10	50	0.10
	2015-050-V2.3N12S4-R01	1.5	4	2.3	12	50	0.10
	2015-050-V2.3N14S4-R01	1.5	4	2.3	14	50	0.10
	2015-050-V2.3N16S4-R01	1.5	4	2.3	16	50	0.10
	2015-050-V2.3N20S4-R01	1.5	4	2.3	20	50	0.10
	2015-060-V2.3N22S4-R01	1.5	4	2.3	22	60	0.10
	2015-060-V2.3N26S4-R01	1.5	4	2.3	26	60	0.10
	2015-050-V2.3N4S4-R02	1.5	4	2.3	4	50	0.20
	2015-050-V2.3N6S4-R02	1.5	4	2.3	6	50	0.20
	2015-050-V2.3N8S4-R02	1.5	4	2.3	8	50	0.20
	2015-050-V2.3N10S4-R02	1.5	4	2.3	10	50	0.20

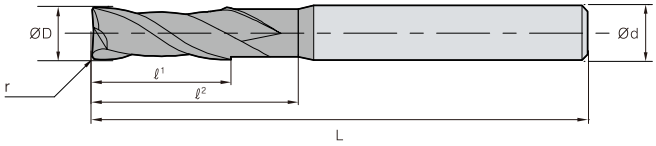
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2015-050-V2.3N12S4-R02	1.5	4	2.3	12	50	0.20
	2015-050-V2.3N14S4-R02	1.5	4	2.3	14	50	0.20
	2015-050-V2.3N16S4-R02	1.5	4	2.3	16	50	0.20
	2015-050-V2.3N20S4-R02	1.5	4	2.3	20	50	0.20
	2015-060-V2.3N22S4-R02	1.5	4	2.3	22	60	0.20
	2015-060-V2.3N26S4-R02	1.5	4	2.3	26	60	0.20
	2015-050-V2.3N4S4-R03	1.5	4	2.3	4	50	0.30
	2015-050-V2.3N6S4-R03	1.5	4	2.3	6	50	0.30
	2015-050-V2.3N8S4-R03	1.5	4	2.3	8	50	0.30
	2015-050-V2.3N10S4-R03	1.5	4	2.3	10	50	0.30
	2015-050-V2.3N12S4-R03	1.5	4	2.3	12	50	0.30
	2015-050-V2.3N14S4-R03	1.5	4	2.3	14	50	0.30
	2015-050-V2.3N16S4-R03	1.5	4	2.3	16	50	0.30
	2015-050-V2.3N20S4-R03	1.5	4	2.3	20	50	0.30
	2015-060-V2.3N22S4-R03	1.5	4	2.3	22	60	0.30
	2015-060-V2.3N26S4-R03	1.5	4	2.3	26	60	0.30
	2015-050-V2.3N4S4-R05	1.5	4	2.3	4	50	0.50
	2015-050-V2.3N6S4-R05	1.5	4	2.3	6	50	0.50
	2015-050-V2.3N8S4-R05	1.5	4	2.3	8	50	0.50
	2015-050-V2.3N10S4-R05	1.5	4	2.3	10	50	0.50
	2015-050-V2.3N12S4-R05	1.5	4	2.3	12	50	0.50
	2015-050-V2.3N14S4-R05	1.5	4	2.3	14	50	0.50
	2015-050-V2.3N16S4-R05	1.5	4	2.3	16	50	0.50
	2015-050-V2.3N20S4-R05	1.5	4	2.3	20	50	0.50
	2015-060-V2.3N22S4-R05	1.5	4	2.3	22	60	0.50
	2015-060-V2.3N26S4-R05	1.5	4	2.3	26	60	0.50
	2020-050-V3N6S4-R01	2.0	4	3	6	50	0.10
	2020-050-V3N8S4-R01	2.0	4	3	8	50	0.10
	2020-050-V3N10S4-R01	2.0	4	3	10	50	0.10
	2020-050-V3N12S4-R01	2.0	4	3	12	50	0.10
	2020-050-V3N14S4-R01	2.0	4	3	14	50	0.10
	2020-050-V3N16S4-R01	2.0	4	3	16	50	0.10
	2020-050-V3N20S4-R01	2.0	4	3	20	50	0.10
	2020-060-V3N22S4-R01	2.0	4	3	22	60	0.10
	2020-060-V3N26S4-R01	2.0	4	3	26	60	0.10
	2020-070-V3N30S4-R01	2.0	4	3	30	70	0.10
	2020-050-V3N6S4-R02	2.0	4	3	6	50	0.20

U+ Endmill

UPRRE2000 (Radius)

Long neck radius





2 | H-A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
Ø0.2 ~ Ø6.0	0.000 ~ -0.015
Ø8.0 ~ Ø12.0	0.000 ~ -0.025

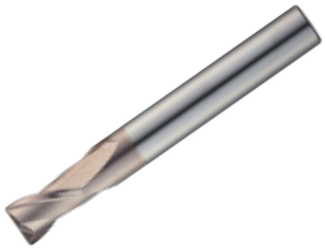
(mm)

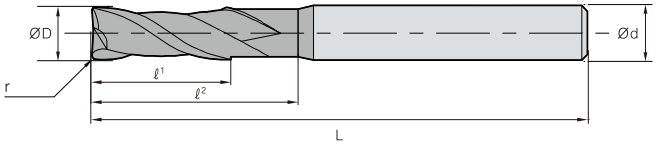
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2020-050-V3N8S4-R02	2.0	4	3	8	50	0.20
	2020-050-V3N10S4-R02	2.0	4	3	10	50	0.20
	2020-050-V3N12S4-R02	2.0	4	3	12	50	0.20
	2020-050-V3N14S4-R02	2.0	4	3	14	50	0.20
	2020-050-V3N16S4-R02	2.0	4	3	16	50	0.20
	2020-050-V3N20S4-R02	2.0	4	3	20	50	0.20
	2020-060-V3N22S4-R02	2.0	4	3	22	60	0.20
	2020-060-V3N26S4-R02	2.0	4	3	26	60	0.20
	2020-070-V3N30S4-R02	2.0	4	3	30	70	0.20
	2020-050-V3N6S4-R03	2.0	4	3	6	50	0.30
	2020-050-V3N8S4-R03	2.0	4	3	8	50	0.30
	2020-050-V3N10S4-R03	2.0	4	3	10	50	0.30
	2020-050-V3N12S4-R03	2.0	4	3	12	50	0.30
	2020-050-V3N14S4-R03	2.0	4	3	14	50	0.30
	2020-050-V3N16S4-R03	2.0	4	3	16	50	0.30
	2020-050-V3N20S4-R03	2.0	4	3	20	50	0.30
	2020-060-V3N22S4-R03	2.0	4	3	22	60	0.30
	2020-060-V3N26S4-R03	2.0	4	3	26	60	0.30
	2020-070-V3N30S4-R03	2.0	4	3	30	70	0.30
	2020-050-V3N6S4-R05	2.0	4	3	6	50	0.50
	2020-050-V3N8S4-R05	2.0	4	3	8	50	0.50
	2020-050-V3N10S4-R05	2.0	4	3	10	50	0.50
	2020-050-V3N12S4-R05	2.0	4	3	12	50	0.50
	2020-050-V3N14S4-R05	2.0	4	3	14	50	0.50
	2020-050-V3N16S4-R05	2.0	4	3	16	50	0.50
	2020-050-V3N20S4-R05	2.0	4	3	20	50	0.50
	2020-060-V3N22S4-R05	2.0	4	3	22	60	0.50
	2020-060-V3N26S4-R05	2.0	4	3	26	60	0.50
	2020-070-V3N30S4-R05	2.0	4	3	30	70	0.50
	2025-050-V4N8S4-R01	2.5	4	4	8	50	0.10
	2025-050-V4N10S4-R01	2.5	4	4	10	50	0.10
	2025-050-V4N12S4-R01	2.5	4	4	12	50	0.10
	2025-050-V4N14S4-R01	2.5	4	4	14	50	0.10
	2025-050-V4N16S4-R01	2.5	4	4	16	50	0.10
	2025-050-V4N20S4-R01	2.5	4	4	20	50	0.10
	2025-060-V4N26S4-R01	2.5	4	4	26	60	0.10
	2025-070-V4N30S4-R01	2.5	4	4	30	70	0.10

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2025-050-V4N8S4-R02	2.5	4	4	8	50	0.20
	2025-050-V4N10S4-R02	2.5	4	4	10	50	0.20
	2025-050-V4N12S4-R02	2.5	4	4	12	50	0.20
	2025-050-V4N14S4-R02	2.5	4	4	14	50	0.20
	2025-050-V4N16S4-R02	2.5	4	4	16	50	0.20
	2025-050-V4N20S4-R02	2.5	4	4	20	50	0.20
	2025-060-V4N26S4-R02	2.5	4	4	26	60	0.20
	2025-070-V4N30S4-R02	2.5	4	4	30	70	0.20
	2025-050-V4N8S4-R03	2.5	4	4	8	50	0.30
	2025-050-V4N10S4-R03	2.5	4	4	10	50	0.30
	2025-050-V4N12S4-R03	2.5	4	4	12	50	0.30
	2025-050-V4N14S4-R03	2.5	4	4	14	50	0.30
	2025-050-V4N16S4-R03	2.5	4	4	16	50	0.30
	2025-050-V4N20S4-R03	2.5	4	4	20	50	0.30
	2025-060-V4N26S4-R03	2.5	4	4	26	60	0.30
	2025-070-V4N30S4-R03	2.5	4	4	30	70	0.30
	2025-050-V4N8S4-R05	2.5	4	4	8	50	0.50
	2025-050-V4N10S4-R05	2.5	4	4	10	50	0.50
	2025-050-V4N12S4-R05	2.5	4	4	12	50	0.50
	2025-050-V4N14S4-R05	2.5	4	4	14	50	0.50
	2025-050-V4N16S4-R05	2.5	4	4	16	50	0.50
	2025-050-V4N20S4-R05	2.5	4	4	20	50	0.50
	2025-060-V4N26S4-R05	2.5	4	4	26	60	0.50
	2025-070-V4N30S4-R05	2.5	4	4	30	70	0.50
	2030-050-V4.5N8S6-R01	3.0	6	4.5	8	50	0.10
	2030-050-V4.5N10S6-R01	3.0	6	4.5	10	50	0.10
	2030-050-V4.5N12S6-R01	3.0	6	4.5	12	50	0.10
	2030-060-V4.5N14S6-R01	3.0	6	4.5	14	60	0.10
	2030-060-V4.5N16S6-R01	3.0	6	4.5	16	60	0.10
	2030-060-V4.5N20S6-R01	3.0	6	4.5	20	60	0.10
	2030-065-V4.5N26S6-R01	3.0	6	4.5	26	65	0.10
	2030-070-V4.5N30S6-R01	3.0	6	4.5	30	70	0.10
	2030-070-V4.5N35S6-R01	3.0	6	4.5	35	70	0.10
	2030-080-V4.5N40S6-R01	3.0	6	4.5	40	80	0.10
	2030-050-V4.5N8S6-R02	3.0	6	4.5	8	50	0.20
	2030-050-V4.5N10S6-R02	3.0	6	4.5	10	50	0.20
	2030-050-V4.5N12S6-R02	3.0	6	4.5	12	50	0.20

UPRRE2000 (Radius)

Long neck radius





2 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
Ø0.2 ~ Ø6.0	0.000 ~ -0.015
Ø8.0 ~ Ø12.0	0.000 ~ -0.025

(mm)

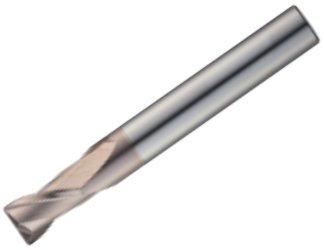
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2030-060-V4.5N14S6-R02	3.0	6	4.5	14	60	0.20
	2030-060-V4.5N16S6-R02	3.0	6	4.5	16	60	0.20
	2030-060-V4.5N20S6-R02	3.0	6	4.5	20	60	0.20
	2030-065-V4.5N26S6-R02	3.0	6	4.5	26	65	0.20
	2030-070-V4.5N30S6-R02	3.0	6	4.5	30	70	0.20
	2030-070-V4.5N35S6-R02	3.0	6	4.5	35	70	0.20
	2030-080-V4.5N40S6-R02	3.0	6	4.5	40	80	0.20
	2030-050-V4.5N8S6-R03	3.0	6	4.5	8	50	0.30
	2030-050-V4.5N10S6-R03	3.0	6	4.5	10	50	0.30
	2030-050-V4.5N12S6-R03	3.0	6	4.5	12	50	0.30
	2030-060-V4.5N14S6-R03	3.0	6	4.5	14	60	0.30
	2030-060-V4.5N16S6-R03	3.0	6	4.5	16	60	0.30
	2030-060-V4.5N20S6-R03	3.0	6	4.5	20	60	0.30
	2030-065-V4.5N26S6-R03	3.0	6	4.5	26	65	0.30
	2030-070-V4.5N30S6-R03	3.0	6	4.5	30	70	0.30
	2030-070-V4.5N35S6-R03	3.0	6	4.5	35	70	0.30
	2030-080-V4.5N40S6-R03	3.0	6	4.5	40	80	0.30
	2030-050-V4.5N8S6-R05	3.0	6	4.5	8	50	0.50
	2030-050-V4.5N10S6-R05	3.0	6	4.5	10	50	0.50
	2030-050-V4.5N12S6-R05	3.0	6	4.5	12	50	0.50
	2030-060-V4.5N14S6-R05	3.0	6	4.5	14	60	0.50
	2030-060-V4.5N16S6-R05	3.0	6	4.5	16	60	0.50
	2030-060-V4.5N20S6-R05	3.0	6	4.5	20	60	0.50
	2030-065-V4.5N26S6-R05	3.0	6	4.5	26	65	0.50
	2030-070-V4.5N30S6-R05	3.0	6	4.5	30	70	0.50
	2030-070-V4.5N35S6-R05	3.0	6	4.5	35	70	0.50
	2030-080-V4.5N40S6-R05	3.0	6	4.5	40	80	0.50
	2030-050-V4.5N8S6-R10	3.0	6	4.5	8	50	1.00
	2030-050-V4.5N10S6-R10	3.0	6	4.5	10	50	1.00
	2030-050-V4.5N12S6-R10	3.0	6	4.5	12	50	1.00
	2030-060-V4.5N14S6-R10	3.0	6	4.5	14	60	1.00
	2030-060-V4.5N16S6-R10	3.0	6	4.5	16	60	1.00
	2030-060-V4.5N20S6-R10	3.0	6	4.5	20	60	1.00
	2030-065-V4.5N26S6-R10	3.0	6	4.5	26	65	1.00
	2030-070-V4.5N30S6-R10	3.0	6	4.5	30	70	1.00
	2030-070-V4.5N35S6-R10	3.0	6	4.5	35	70	1.00
	2030-080-V4.5N40S6-R10	3.0	6	4.5	40	80	1.00

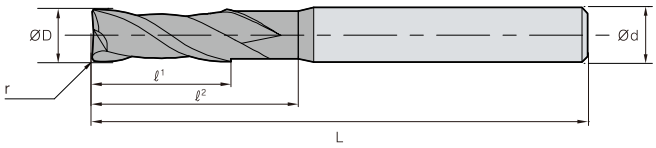
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2040-050-V6N10S6-R01	4.0	6	6	10	50	0.10
	2040-050-V6N12S6-R01	4.0	6	6	12	50	0.10
	2040-060-V6N14S6-R01	4.0	6	6	14	60	0.10
	2040-060-V6N16S6-R01	4.0	6	6	16	60	0.10
	2040-060-V6N20S6-R01	4.0	6	6	20	60	0.10
	2040-065-V6N26S6-R01	4.0	6	6	26	65	0.10
	2040-065-V6N30S6-R01	4.0	6	6	30	65	0.10
	2040-070-V6N35S6-R01	4.0	6	6	35	70	0.10
	2040-080-V6N40S6-R01	4.0	6	6	40	80	0.10
	2040-090-V6N45S6-R01	4.0	6	6	45	90	0.10
	2040-100-V6N50S6-R01	4.0	6	6	50	100	0.10
	2040-050-V6N10S6-R02	4.0	6	6	10	50	0.20
	2040-050-V6N12S6-R02	4.0	6	6	12	50	0.20
	2040-060-V6N14S6-R02	4.0	6	6	14	60	0.20
	2040-060-V6N16S6-R02	4.0	6	6	16	60	0.20
	2040-060-V6N20S6-R02	4.0	6	6	20	60	0.20
	2040-065-V6N26S6-R02	4.0	6	6	26	65	0.20
	2040-065-V6N30S6-R02	4.0	6	6	30	65	0.20
	2040-070-V6N35S6-R02	4.0	6	6	35	70	0.20
	2040-080-V6N40S6-R02	4.0	6	6	40	80	0.20
	2040-090-V6N45S6-R02	4.0	6	6	45	90	0.20
	2040-100-V6N50S6-R02	4.0	6	6	50	100	0.20
	2040-050-V6N10S6-R03	4.0	6	6	10	50	0.30
	2040-050-V6N12S6-R03	4.0	6	6	12	50	0.30
	2040-060-V6N14S6-R03	4.0	6	6	14	60	0.30
	2040-060-V6N16S6-R03	4.0	6	6	16	60	0.30
	2040-060-V6N20S6-R03	4.0	6	6	20	60	0.30
	2040-065-V6N26S6-R03	4.0	6	6	26	65	0.30
	2040-065-V6N30S6-R03	4.0	6	6	30	65	0.30
	2040-070-V6N35S6-R03	4.0	6	6	35	70	0.30
	2040-080-V6N40S6-R03	4.0	6	6	40	80	0.30
	2040-090-V6N45S6-R03	4.0	6	6	45	90	0.30
	2040-100-V6N50S6-R03	4.0	6	6	50	100	0.30
	2040-050-V6N10S6-R05	4.0	6	6	10	50	0.50
	2040-050-V6N12S6-R05	4.0	6	6	12	50	0.50
	2040-060-V6N14S6-R05	4.0	6	6	14	60	0.50
	2040-060-V6N16S6-R05	4.0	6	6	16	60	0.50

U+ Endmill

UPRRE2000 (Radius)

Long neck radius





2 | H-A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
Ø0.2 ~ Ø6.0	0.000 ~ -0.015
Ø8.0 ~ Ø12.0	0.000 ~ -0.025

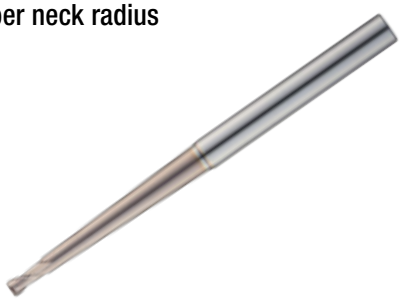
(mm)

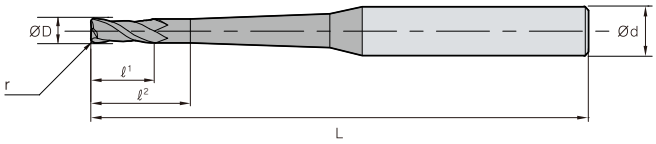
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2040-060-V6N20S6-R05	4.0	6	6	20	60	0.50
	2040-065-V6N26S6-R05	4.0	6	6	26	65	0.50
	2040-065-V6N30S6-R05	4.0	6	6	30	65	0.50
	2040-070-V6N35S6-R05	4.0	6	6	35	70	0.50
	2040-080-V6N40S6-R05	4.0	6	6	40	80	0.50
	2040-090-V6N45S6-R05	4.0	6	6	45	90	0.50
	2040-100-V6N50S6-R05	4.0	6	6	50	100	0.50
	2040-050-V6N10S6-R10	4.0	6	6	10	50	1.00
	2040-050-V6N12S6-R10	4.0	6	6	12	50	1.00
	2040-060-V6N14S6-R10	4.0	6	6	14	60	1.00
	2040-060-V6N16S6-R10	4.0	6	6	16	60	1.00
	2040-060-V6N20S6-R10	4.0	6	6	20	60	1.00
	2040-065-V6N26S6-R10	4.0	6	6	26	65	1.00
	2040-065-V6N30S6-R10	4.0	6	6	30	65	1.00
	2040-070-V6N35S6-R10	4.0	6	6	35	70	1.00
	2040-080-V6N40S6-R10	4.0	6	6	40	80	1.00
	2040-090-V6N45S6-R10	4.0	6	6	45	90	1.00
	2040-100-V6N50S6-R10	4.0	6	6	50	100	1.00
	2050-060-V8N15S6-R01	5.0	6	8	15	60	0.10
	2050-060-V8N15S6-R02	5.0	6	8	15	60	0.20
	2050-060-V8N15S6-R03	5.0	6	8	15	60	0.30
	2050-060-V8N15S6-R05	5.0	6	8	15	60	0.50
	2050-060-V8N15S6-R10	5.0	6	8	15	60	1.00
	2050-060-V8N15S6-R15	5.0	6	8	15	60	1.50
	2050-060-V8N15S6-R20	5.0	6	8	15	60	2.00
	2060-060-V9N20S6-R01	6.0	6	9	20	60	0.10
	2060-060-V9N20S6-R02	6.0	6	9	20	60	0.20
	2060-060-V9N20S6-R03	6.0	6	9	20	60	0.30
	2060-060-V9N20S6-R05	6.0	6	9	20	60	0.50
	2060-060-V9N20S6-R10	6.0	6	9	20	60	1.00
	2060-060-V9N20S6-R15	6.0	6	9	20	60	1.50
	2060-060-V9N20S6-R20	6.0	6	9	20	60	2.00
	2060-090-V15N30S6-R03	6.0	6	15	30	90	0.30
	2060-090-V15N30S6-R05	6.0	6	15	30	90	0.50
	2060-090-V15N30S6-R10	6.0	6	15	30	90	1.00
	2080-070-V12N25S8-R01	8.0	8	12	25	70	0.10

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2080-070-V12N25S8-R02	8.0	8	12	25	70	0.20
	2080-070-V12N25S8-R03	8.0	8	12	25	70	0.30
	2080-070-V12N25S8-R05	8.0	8	12	25	70	0.50
	2080-070-V12N25S8-R10	8.0	8	12	25	70	1.00
	2080-070-V12N25S8-R15	8.0	8	12	25	70	1.50
	2080-070-V12N25S8-R20	8.0	8	12	25	70	2.00
	2080-100-V20N35S8-R03	8.0	8	20	35	100	0.30
	2080-100-V20N35S8-R05	8.0	8	20	35	100	0.50
	2080-100-V20N35S8-R10	8.0	8	20	35	100	1.00
	2100-075-V15N30S10-R01	10.0	10	15	30	75	0.10
	2100-075-V15N30S10-R02	10.0	10	15	30	75	0.20
	2100-075-V15N30S10-R03	10.0	10	15	30	75	0.30
	2100-075-V15N30S10-R05	10.0	10	15	30	75	0.50
	2100-075-V15N30S10-R10	10.0	10	15	30	75	1.00
	2100-075-V15N30S10-R15	10.0	10	15	30	75	1.50
	2100-075-V15N30S10-R20	10.0	10	15	30	75	2.00
	2100-100-V25N40S10-R03	10.0	10	25	40	100	0.30
	2100-100-V25N40S10-R05	10.0	10	25	40	100	0.50
	2100-100-V25N40S10-R10	10.0	10	25	40	100	1.00
	2120-080-V18N32S12-R02	12.0	12	18	32	80	0.20
	2120-080-V18N32S12-R03	12.0	12	18	32	80	0.30
	2120-080-V18N32S12-R05	12.0	12	18	32	80	0.50
	2120-080-V18N32S12-R10	12.0	12	18	32	80	1.00
	2120-080-V18N32S12-R15	12.0	12	18	32	80	1.50
	2120-080-V18N32S12-R20	12.0	12	18	32	80	2.00
	2120-110-V30N45S12-R03	12.0	12	30	45	110	0.30
	2120-110-V30N45S12-R05	12.0	12	30	45	110	0.50
	2120-110-V30N45S12-R10	12.0	12	30	45	110	1.00
	2160-100-V20N35S16-R05	16.0	16	20	35	100	0.50
	2160-100-V20N35S16-R10	16.0	16	20	35	100	1.00
	2160-150-V35N50S16-R05	16.0	16	35	50	150	0.50
	2160-150-V35N50S16-R10	16.0	16	35	50	150	1.00
	2200-100-V25N40S20-R05	20.0	20	25	40	100	0.50
	2200-100-V25N40S20-R10	20.0	20	25	40	100	1.00
	2200-150-V40N55S20-R05	20.0	20	40	55	150	0.50
	2200-150-V40N55S20-R10	20.0	20	40	55	150	1.00

UPRRE2000-TN (Radius)

Taper neck radius





2 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.000 ~ -0.012

(mm)

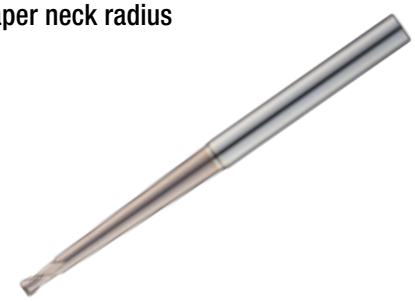
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2002-040-V0.3N1S4-R005-TN01	0.2	4	0.3	1	40	0.05
	2002-040-V0.3N2S4-R005-TN01	0.2	4	0.3	2	40	0.05
	2002-040-V0.3N3S4-R005-TN01	0.2	4	0.3	3	40	0.05
	2002-040-V0.3N1S4-R005-TN02	0.2	4	0.3	1	40	0.05
	2002-040-V0.3N2S4-R005-TN02	0.2	4	0.3	2	40	0.05
	2002-040-V0.3N3S4-R005-TN02	0.2	4	0.3	3	40	0.05
	2003-040-V0.5N2S4-R005-TN01	0.3	4	0.5	2	40	0.05
	2003-040-V0.5N3S4-R005-TN01	0.3	4	0.5	3	40	0.05
	2003-040-V0.5N4S4-R005-TN01	0.3	4	0.5	4	40	0.05
	2003-040-V0.5N5S4-R005-TN01	0.3	4	0.5	5	40	0.05
	2003-040-V0.5N2S4-R005-TN02	0.3	4	0.5	2	40	0.05
	2003-040-V0.5N3S4-R005-TN02	0.3	4	0.5	3	40	0.05
	2003-040-V0.5N4S4-R005-TN02	0.3	4	0.5	4	40	0.05
	2003-040-V0.5N5S4-R005-TN02	0.3	4	0.5	5	40	0.05
	2004-050-V0.6N2S4-R005-TN01	0.4	4	0.6	2	50	0.05
	2004-050-V0.6N3S4-R005-TN01	0.4	4	0.6	3	50	0.05
	2004-050-V0.6N4S4-R005-TN01	0.4	4	0.6	4	50	0.05
	2004-050-V0.6N5S4-R005-TN01	0.4	4	0.6	5	50	0.05
	2004-050-V0.6N6S4-R005-TN01	0.4	4	0.6	6	50	0.05
	2004-050-V0.6N2S4-R005-TN02	0.4	4	0.6	2	50	0.05
	2004-050-V0.6N3S4-R005-TN02	0.4	4	0.6	3	50	0.05
	2004-050-V0.6N4S4-R005-TN02	0.4	4	0.6	4	50	0.05
	2004-050-V0.6N5S4-R005-TN02	0.4	4	0.6	5	50	0.05
	2004-050-V0.6N6S4-R005-TN02	0.4	4	0.6	6	50	0.05
	2004-050-V0.6N2S4-R01-TN01	0.4	4	0.6	2	50	0.10
	2004-050-V0.6N3S4-R01-TN01	0.4	4	0.6	3	50	0.10
	2004-050-V0.6N4S4-R01-TN01	0.4	4	0.6	4	50	0.10
	2004-050-V0.6N5S4-R01-TN01	0.4	4	0.6	5	50	0.10
	2004-050-V0.6N6S4-R01-TN01	0.4	4	0.6	6	50	0.10
	2004-050-V0.6N2S4-R01-TN02	0.4	4	0.6	2	50	0.10
	2004-050-V0.6N3S4-R01-TN02	0.4	4	0.6	3	50	0.10
	2004-050-V0.6N4S4-R01-TN02	0.4	4	0.6	4	50	0.10
	2004-050-V0.6N5S4-R01-TN02	0.4	4	0.6	5	50	0.10
	2004-050-V0.6N6S4-R01-TN02	0.4	4	0.6	6	50	0.10
	2005-050-V0.7N4S4-R005-TN01	0.5	4	0.7	4	50	0.05
	2005-050-V0.7N6S4-R005-TN01	0.5	4	0.7	6	50	0.05

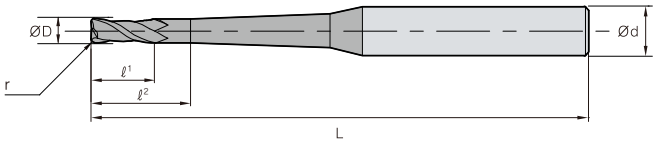
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2005-050-V0.7N8S4-R005-TN01	0.5	4	0.7	8	50	0.05
	2005-050-V0.7N10S4-R005-TN01	0.5	4	0.7	10	50	0.05
	2005-050-V0.7N4S4-R005-TN02	0.5	4	0.7	4	50	0.05
	2005-050-V0.7N6S4-R005-TN02	0.5	4	0.7	6	50	0.05
	2005-050-V0.7N8S4-R005-TN02	0.5	4	0.7	8	50	0.05
	2005-050-V0.7N10S4-R005-TN02	0.5	4	0.7	10	50	0.05
	2005-050-V0.7N4S4-R01-TN01	0.5	4	0.7	4	50	0.10
	2005-050-V0.7N6S4-R01-TN01	0.5	4	0.7	6	50	0.10
	2005-050-V0.7N8S4-R01-TN01	0.5	4	0.7	8	50	0.10
	2005-050-V0.7N10S4-R01-TN01	0.5	4	0.7	10	50	0.10
	2005-050-V0.7N4S4-R01-TN02	0.5	4	0.7	4	50	0.10
	2005-050-V0.7N6S4-R01-TN02	0.5	4	0.7	6	50	0.10
	2005-050-V0.7N8S4-R01-TN02	0.5	4	0.7	8	50	0.10
	2005-050-V0.7N10S4-R01-TN02	0.5	4	0.7	10	50	0.10
	2006-050-V0.9N4S4-R01-TN01	0.6	4	0.9	4	50	0.10
	2006-050-V0.9N6S4-R01-TN01	0.6	4	0.9	6	50	0.10
	2006-050-V0.9N8S4-R01-TN01	0.6	4	0.9	8	50	0.10
	2006-050-V0.9N10S4-R01-TN01	0.6	4	0.9	10	50	0.10
	2006-050-V0.9N12S4-R01-TN01	0.6	4	0.9	12	50	0.10
	2006-050-V0.9N4S4-R01-TN02	0.6	4	0.9	4	50	0.10
	2006-050-V0.9N6S4-R01-TN02	0.6	4	0.9	6	50	0.10
	2006-050-V0.9N8S4-R01-TN02	0.6	4	0.9	8	50	0.10
	2006-050-V0.9N10S4-R01-TN02	0.6	4	0.9	10	50	0.10
	2006-050-V0.9N12S4-R01-TN02	0.6	4	0.9	12	50	0.10
	2006-050-V0.9N4S4-R02-TN01	0.6	4	0.9	4	50	0.20
	2006-050-V0.9N6S4-R02-TN01	0.6	4	0.9	6	50	0.20
	2006-050-V0.9N8S4-R02-TN01	0.6	4	0.9	8	50	0.20
	2006-050-V0.9N10S4-R02-TN01	0.6	4	0.9	10	50	0.20
	2006-050-V0.9N12S4-R02-TN01	0.6	4	0.9	12	50	0.20
	2006-050-V0.9N4S4-R02-TN02	0.6	4	0.9	4	50	0.20
	2006-050-V0.9N6S4-R02-TN02	0.6	4	0.9	6	50	0.20
	2006-050-V0.9N8S4-R02-TN02	0.6	4	0.9	8	50	0.20
	2006-050-V0.9N10S4-R02-TN02	0.6	4	0.9	10	50	0.20
	2006-050-V0.9N12S4-R02-TN02	0.6	4	0.9	12	50	0.20
	2008-050-V1.2N4S4-R01-TN01	0.8	4	1.2	4	50	0.10
	2008-050-V1.2N6S4-R01-TN01	0.8	4	1.2	6	50	0.10

U+ Endmill

UPRRE2000-TN (Radius)

Taper neck radius





2 | H-A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.000 ~ -0.012

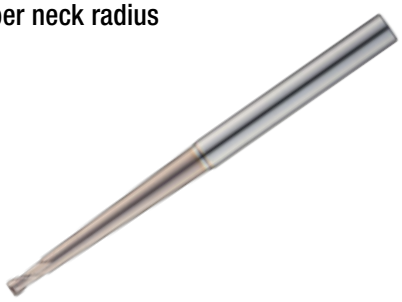
(mm)

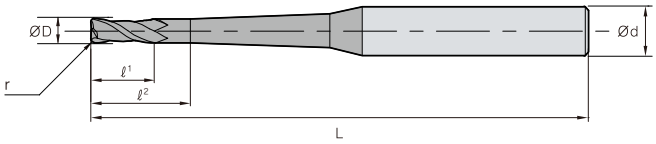
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2008-050-V1.2N8S4-R01-TN01	0.8	4	1.2	8	50	0.10
	2008-050-V1.2N10S4-R01-TN01	0.8	4	1.2	10	50	0.10
	2008-050-V1.2N12S4-R01-TN01	0.8	4	1.2	12	50	0.10
	2008-050-V1.2N16S4-R01-TN01	0.8	4	1.2	16	50	0.10
	2008-050-V1.2N4S4-R01-TN02	0.8	4	1.2	4	50	0.10
	2008-050-V1.2N6S4-R01-TN02	0.8	4	1.2	6	50	0.10
	2008-050-V1.2N8S4-R01-TN02	0.8	4	1.2	8	50	0.10
	2008-050-V1.2N10S4-R01-TN02	0.8	4	1.2	10	50	0.10
	2008-050-V1.2N12S4-R01-TN02	0.8	4	1.2	12	50	0.10
	2008-050-V1.2N16S4-R01-TN02	0.8	4	1.2	16	50	0.10
	2008-050-V1.2N4S4-R02-TN01	0.8	4	1.2	4	50	0.20
	2008-050-V1.2N6S4-R02-TN01	0.8	4	1.2	6	50	0.20
	2008-050-V1.2N8S4-R02-TN01	0.8	4	1.2	8	50	0.20
	2008-050-V1.2N10S4-R02-TN01	0.8	4	1.2	10	50	0.20
	2008-050-V1.2N12S4-R02-TN01	0.8	4	1.2	12	50	0.20
	2008-050-V1.2N16S4-R02-TN01	0.8	4	1.2	16	50	0.20
	2008-050-V1.2N4S4-R02-TN02	0.8	4	1.2	4	50	0.20
	2008-050-V1.2N6S4-R02-TN02	0.8	4	1.2	6	50	0.20
	2008-050-V1.2N8S4-R02-TN02	0.8	4	1.2	8	50	0.20
	2008-050-V1.2N10S4-R02-TN02	0.8	4	1.2	10	50	0.20
	2008-050-V1.2N12S4-R02-TN02	0.8	4	1.2	12	50	0.20
	2008-050-V1.2N16S4-R02-TN02	0.8	4	1.2	16	50	0.20
	2010-050-V1.5N6S4-R01-TN01	1.0	4	1.5	6	50	0.10
	2010-050-V1.5N8S4-R01-TN01	1.0	4	1.5	8	50	0.10
	2010-050-V1.5N10S4-R01-TN01	1.0	4	1.5	10	50	0.10
	2010-050-V1.5N12S4-R01-TN01	1.0	4	1.5	12	50	0.10
	2010-050-V1.5N16S4-R01-TN01	1.0	4	1.5	16	50	0.10
	2010-050-V1.5N20S4-R01-TN01	1.0	4	1.5	20	50	0.10
	2010-060-V1.5N25S4-R01-TN01	1.0	4	1.5	25	60	0.10
	2010-070-V1.5N30S4-R01-TN01	1.0	4	1.5	30	70	0.10
	2010-080-V1.5N40S4-R01-TN01	1.0	4	1.5	40	80	0.10
	2010-050-V1.5N6S4-R01-TN02	1.0	4	1.5	6	50	0.10
	2010-050-V1.5N8S4-R01-TN02	1.0	4	1.5	8	50	0.10
	2010-050-V1.5N10S4-R01-TN02	1.0	4	1.5	10	50	0.10
	2010-050-V1.5N12S4-R01-TN02	1.0	4	1.5	12	50	0.10
	2010-050-V1.5N16S4-R01-TN02	1.0	4	1.5	16	50	0.10

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2010-050-V1.5N20S4-R01-TN02	1.0	4	1.5	20	50	0.10
	2010-060-V1.5N25S4-R01-TN02	1.0	4	1.5	25	60	0.10
	2010-070-V1.5N30S4-R01-TN02	1.0	4	1.5	30	70	0.10
	2010-080-V1.5N40S4-R01-TN02	1.0	4	1.5	40	80	0.10
	2010-050-V1.5N6S4-R02-TN01	1.0	4	1.5	6	50	0.20
	2010-050-V1.5N8S4-R02-TN01	1.0	4	1.5	8	50	0.20
	2010-050-V1.5N10S4-R02-TN01	1.0	4	1.5	10	50	0.20
	2010-050-V1.5N12S4-R02-TN01	1.0	4	1.5	12	50	0.20
	2010-050-V1.5N16S4-R02-TN01	1.0	4	1.5	16	50	0.20
	2010-050-V1.5N20S4-R02-TN01	1.0	4	1.5	20	50	0.20
	2010-060-V1.5N25S4-R02-TN01	1.0	4	1.5	25	60	0.20
	2010-070-V1.5N30S4-R02-TN01	1.0	4	1.5	30	70	0.20
	2010-080-V1.5N40S4-R02-TN01	1.0	4	1.5	40	80	0.20
	2010-050-V1.5N6S4-R02-TN02	1.0	4	1.5	6	50	0.20
	2010-050-V1.5N8S4-R02-TN02	1.0	4	1.5	8	50	0.20
	2010-050-V1.5N10S4-R02-TN02	1.0	4	1.5	10	50	0.20
	2010-050-V1.5N12S4-R02-TN02	1.0	4	1.5	12	50	0.20
	2010-050-V1.5N16S4-R02-TN02	1.0	4	1.5	16	50	0.20
	2010-050-V1.5N20S4-R02-TN02	1.0	4	1.5	20	50	0.20
	2010-060-V1.5N25S4-R02-TN02	1.0	4	1.5	25	60	0.20
	2010-070-V1.5N30S4-R02-TN02	1.0	4	1.5	30	70	0.20
	2010-080-V1.5N40S4-R02-TN02	1.0	4	1.5	40	80	0.20
	2010-090-V1.5N50S6-R01-TN01	1.0	6	1.5	50	90	0.10
	2010-090-V1.5N50S6-R01-TN02	1.0	6	1.5	50	90	0.10
	2010-090-V1.5N50S6-R02-TN01	1.0	6	1.5	50	90	0.20
	2010-090-V1.5N50S6-R02-TN02	1.0	6	1.5	50	90	0.20
	2012-050-V1.8N8S4-R01-TN01	1.2	4	1.8	8	50	0.10
	2012-050-V1.8N12S4-R01-TN01	1.2	4	1.8	12	50	0.10
	2012-050-V1.8N16S4-R01-TN01	1.2	4	1.8	16	50	0.10
	2012-050-V1.8N20S4-R01-TN01	1.2	4	1.8	20	50	0.10
	2012-060-V1.8N25S4-R01-TN01	1.2	4	1.8	25	60	0.10
	2012-070-V1.8N30S4-R01-TN01	1.2	4	1.8	30	70	0.10
	2012-050-V1.8N8S4-R01-TN02	1.2	4	1.8	8	50	0.10
	2012-050-V1.8N12S4-R01-TN02	1.2	4	1.8	12	50	0.10
	2012-050-V1.8N16S4-R01-TN02	1.2	4	1.8	16	50	0.10
	2012-050-V1.8N20S4-R01-TN02	1.2	4	1.8	20	50	0.10

UPRRE2000-TN (Radius)

Taper neck radius





2 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.000 ~ -0.012

(mm)

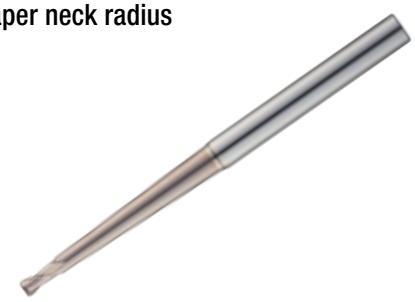
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2012-060-V1.8N25S4-R01-TN02	1.2	4	1.8	25	60	0.10
	2012-070-V1.8N30S4-R01-TN02	1.2	4	1.8	30	70	0.10
	2012-050-V1.8N8S4-R02-TN01	1.2	4	1.8	8	50	0.20
	2012-050-V1.8N12S4-R02-TN01	1.2	4	1.8	12	50	0.20
	2012-050-V1.8N16S4-R02-TN01	1.2	4	1.8	16	50	0.20
	2012-050-V1.8N20S4-R02-TN01	1.2	4	1.8	20	50	0.20
	2012-060-V1.8N25S4-R02-TN01	1.2	4	1.8	25	60	0.20
	2012-070-V1.8N30S4-R02-TN01	1.2	4	1.8	30	70	0.20
	2012-050-V1.8N8S4-R02-TN02	1.2	4	1.8	8	50	0.20
	2012-050-V1.8N12S4-R02-TN02	1.2	4	1.8	12	50	0.20
	2012-050-V1.8N16S4-R02-TN02	1.2	4	1.8	16	50	0.20
	2012-050-V1.8N20S4-R02-TN02	1.2	4	1.8	20	50	0.20
	2012-060-V1.8N25S4-R02-TN02	1.2	4	1.8	25	60	0.20
	2012-070-V1.8N30S4-R02-TN02	1.2	4	1.8	30	70	0.20
	2015-050-V2.3N8S4-R01-TN01	1.5	4	2.3	8	50	0.10
	2015-050-V2.3N10S4-R01-TN01	1.5	4	2.3	10	50	0.10
	2015-050-V2.3N12S4-R01-TN01	1.5	4	2.3	12	50	0.10
	2015-050-V2.3N16S4-R01-TN01	1.5	4	2.3	16	50	0.10
	2015-050-V2.3N20S4-R01-TN01	1.5	4	2.3	20	50	0.10
	2015-060-V2.3N25S4-R01-TN01	1.5	4	2.3	25	60	0.10
	2015-070-V2.3N30S4-R01-TN01	1.5	4	2.3	30	70	0.10
	2015-080-V2.3N40S4-R01-TN01	1.5	4	2.3	40	80	0.10
	2015-090-V2.3N50S4-R01-TN01	1.5	4	2.3	50	90	0.10
	2015-050-V2.3N8S4-R01-TN02	1.5	4	2.3	8	50	0.10
	2015-050-V2.3N10S4-R01-TN02	1.5	4	2.3	10	50	0.10
	2015-050-V2.3N12S4-R01-TN02	1.5	4	2.3	12	50	0.10
	2015-050-V2.3N16S4-R01-TN02	1.5	4	2.3	16	50	0.10
	2015-050-V2.3N20S4-R01-TN02	1.5	4	2.3	20	50	0.10
	2015-060-V2.3N25S4-R01-TN02	1.5	4	2.3	25	60	0.10
	2015-070-V2.3N30S4-R01-TN02	1.5	4	2.3	30	70	0.10
	2015-050-V2.3N8S4-R02-TN01	1.5	4	2.3	8	50	0.20
	2015-050-V2.3N10S4-R02-TN01	1.5	4	2.3	10	50	0.20
	2015-050-V2.3N12S4-R02-TN01	1.5	4	2.3	12	50	0.20
	2015-050-V2.3N16S4-R02-TN01	1.5	4	2.3	16	50	0.20
	2015-050-V2.3N20S4-R02-TN01	1.5	4	2.3	20	50	0.20
	2015-060-V2.3N25S4-R02-TN01	1.5	4	2.3	25	60	0.20

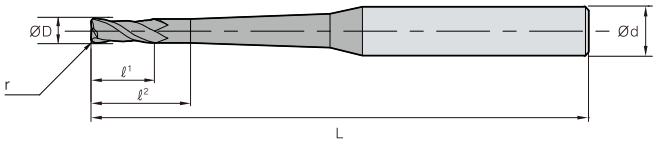
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2015-070-V2.3N30S4-R02-TN01	1.5	4	2.3	30	70	0.20
	2015-080-V2.3N40S4-R02-TN01	1.5	4	2.3	40	80	0.20
	2015-090-V2.3N50S4-R02-TN01	1.5	4	2.3	50	90	0.20
	2015-050-V2.3N8S4-R02-TN02	1.5	4	2.3	8	50	0.20
	2015-050-V2.3N10S4-R02-TN02	1.5	4	2.3	10	50	0.20
	2015-050-V2.3N12S4-R02-TN02	1.5	4	2.3	12	50	0.20
	2015-050-V2.3N16S4-R02-TN02	1.5	4	2.3	16	50	0.20
	2015-050-V2.3N20S4-R02-TN02	1.5	4	2.3	20	50	0.20
	2015-060-V2.3N25S4-R02-TN02	1.5	4	2.3	25	60	0.20
	2015-070-V2.3N30S4-R02-TN02	1.5	4	2.3	30	70	0.20
	2015-050-V2.3N8S4-R03-TN01	1.5	4	2.3	8	50	0.30
	2015-050-V2.3N10S4-R03-TN01	1.5	4	2.3	10	50	0.30
	2015-050-V2.3N12S4-R03-TN01	1.5	4	2.3	12	50	0.30
	2015-050-V2.3N16S4-R03-TN01	1.5	4	2.3	16	50	0.30
	2015-050-V2.3N20S4-R03-TN01	1.5	4	2.3	20	50	0.30
	2015-060-V2.3N25S4-R03-TN01	1.5	4	2.3	25	60	0.30
	2015-070-V2.3N30S4-R03-TN01	1.5	4	2.3	30	70	0.30
	2015-080-V2.3N40S4-R03-TN01	1.5	4	2.3	40	80	0.30
	2015-090-V2.3N50S4-R03-TN01	1.5	4	2.3	50	90	0.30
	2015-050-V2.3N8S4-R03-TN02	1.5	4	2.3	8	50	0.30
	2015-050-V2.3N10S4-R03-TN02	1.5	4	2.3	10	50	0.30
	2015-050-V2.3N12S4-R03-TN02	1.5	4	2.3	12	50	0.30
	2015-050-V2.3N16S4-R03-TN02	1.5	4	2.3	16	50	0.30
	2015-050-V2.3N20S4-R03-TN02	1.5	4	2.3	20	50	0.30
	2015-060-V2.3N25S4-R03-TN02	1.5	4	2.3	25	60	0.30
	2015-070-V2.3N30S4-R03-TN02	1.5	4	2.3	30	70	0.30
	2015-080-V2.3N40S6-R01-TN02	1.5	6	2.3	40	80	0.10
	2015-090-V2.3N50S6-R01-TN02	1.5	6	2.3	50	90	0.10
	2015-080-V2.3N40S6-R02-TN02	1.5	6	2.3	40	80	0.20
	2015-090-V2.3N50S6-R02-TN02	1.5	6	2.3	50	90	0.20
	2015-080-V2.3N40S6-R03-TN02	1.5	6	2.3	40	80	0.3
	2015-090-V2.3N50S6-R03-TN02	1.5	6	2.3	50	90	0.30
	2020-050-V2N10S4-R01-TN01	2.0	4	2	10	50	0.10
	2020-050-V2N12S4-R01-TN01	2.0	4	2	12	50	0.10
	2020-050-V2N16S4-R01-TN01	2.0	4	2	16	50	0.10
	2020-050-V2N20S4-R01-TN01	2.0	4	2	20	50	0.10

U+ Endmill

UPRRE2000-TN (Radius)

Taper neck radius





2 | H-A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.000 ~ -0.012

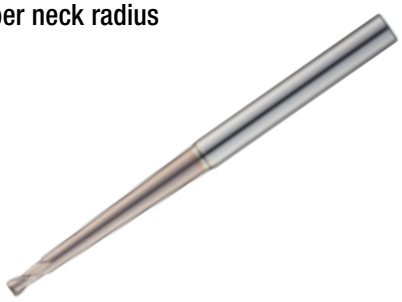
(mm)

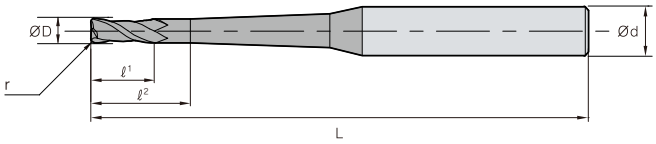
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2020-060-V2N25S4-R01-TN01	2.0	4	2	25	60	0.10
	2020-070-V2N30S4-R01-TN01	2.0	4	2	30	70	0.10
	2020-050-V2N10S4-R01-TN02	2.0	4	2	10	50	0.10
	2020-050-V2N12S4-R01-TN02	2.0	4	2	12	50	0.10
	2020-050-V2N16S4-R01-TN02	2.0	4	2	16	50	0.10
	2020-050-V2N20S4-R01-TN02	2.0	4	2	20	50	0.10
	2020-060-V2N25S4-R01-TN02	2.0	4	2	25	60	0.10
	2020-070-V2N30S4-R01-TN02	2.0	4	2	30	70	0.10
	2020-050-V2N10S4-R02-TN01	2.0	4	2	10	50	0.20
	2020-050-V2N12S4-R02-TN01	2.0	4	2	12	50	0.20
	2020-050-V2N16S4-R02-TN01	2.0	4	2	16	50	0.20
	2020-050-V2N20S4-R02-TN01	2.0	4	2	20	50	0.20
	2020-060-V2N25S4-R02-TN01	2.0	4	2	25	60	0.20
	2020-070-V2N30S4-R02-TN01	2.0	4	2	30	70	0.20
	2020-050-V2N10S4-R02-TN02	2.0	4	2	10	50	0.20
	2020-050-V2N12S4-R02-TN02	2.0	4	2	12	50	0.20
	2020-050-V2N16S4-R02-TN02	2.0	4	2	16	50	0.20
	2020-050-V2N20S4-R02-TN02	2.0	4	2	20	50	0.20
	2020-060-V2N25S4-R02-TN02	2.0	4	2	25	60	0.20
	2020-070-V2N30S4-R02-TN02	2.0	4	2	30	70	0.20
	2020-050-V2N10S4-R03-TN01	2.0	4	2	10	50	0.30
	2020-050-V2N12S4-R03-TN01	2.0	4	2	12	50	0.30
	2020-050-V2N16S4-R03-TN01	2.0	4	2	16	50	0.30
	2020-050-V2N20S4-R03-TN01	2.0	4	2	20	50	0.30
	2020-060-V2N25S4-R03-TN01	2.0	4	2	25	60	0.30
	2020-070-V2N30S4-R03-TN01	2.0	4	2	30	70	0.30
	2020-050-V2N10S4-R03-TN02	2.0	4	2	10	50	0.30
	2020-050-V2N12S4-R03-TN02	2.0	4	2	12	50	0.30
	2020-050-V2N16S4-R03-TN02	2.0	4	2	16	50	0.30
	2020-050-V2N20S4-R03-TN02	2.0	4	2	20	50	0.30
	2020-060-V2N25S4-R03-TN02	2.0	4	2	25	60	0.30
	2020-070-V2N30S4-R03-TN02	2.0	4	2	30	70	0.30
	2020-050-V2N10S4-R05-TN01	2.0	4	2	10	50	0.50
	2020-050-V2N12S4-R05-TN01	2.0	4	2	12	50	0.50
	2020-050-V2N16S4-R05-TN01	2.0	4	2	16	50	0.50
	2020-050-V2N20S4-R05-TN01	2.0	4	2	20	50	0.50

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2020-060-V2N25S4-R05-TN01	2.0	4	2	25	60	0.50
	2020-070-V2N30S4-R05-TN01	2.0	4	2	30	70	0.50
	2020-050-V2N10S4-R05-TN02	2.0	4	2	10	50	0.50
	2020-050-V2N12S4-R05-TN02	2.0	4	2	12	50	0.50
	2020-050-V2N16S4-R05-TN02	2.0	4	2	16	50	0.50
	2020-050-V2N20S4-R05-TN02	2.0	4	2	20	50	0.50
	2020-060-V2N25S4-R05-TN02	2.0	4	2	25	60	0.50
	2020-070-V2N30S4-R05-TN02	2.0	4	2	30	70	0.50
	2020-080-V2N40S6-R01-TN01	2.0	6	2	40	80	0.10
	2020-100-V2N50S6-R01-TN01	2.0	6	2	50	100	0.10
	2020-100-V2N60S6-R01-TN01	2.0	6	2	60	100	0.10
	2020-140-V2N80S6-R01-TN01	2.0	6	2	80	140	0.10
	2020-080-V2N40S6-R01-TN02	2.0	6	2	40	80	0.10
	2020-100-V2N50S6-R01-TN02	2.0	6	2	50	100	0.10
	2020-100-V2N60S6-R01-TN02	2.0	6	2	60	100	0.10
	2020-080-V2N40S6-R02-TN01	2.0	6	2	40	80	0.20
	2020-100-V2N50S6-R02-TN01	2.0	6	2	50	100	0.20
	2020-100-V2N60S6-R02-TN01	2.0	6	2	60	100	0.20
	2020-140-V2N80S6-R02-TN01	2.0	6	2	80	140	0.20
	2020-080-V2N40S6-R02-TN02	2.0	6	2	40	80	0.20
	2020-100-V2N50S6-R02-TN02	2.0	6	2	50	100	0.20
	2020-100-V2N60S6-R02-TN02	2.0	6	2	60	100	0.20
	2020-080-V2N40S6-R03-TN01	2.0	6	2	40	80	0.30
	2020-100-V2N50S6-R03-TN01	2.0	6	2	50	100	0.30
	2020-100-V2N60S6-R03-TN01	2.0	6	2	60	100	0.30
	2020-140-V2N80S6-R03-TN01	2.0	6	2	80	140	0.30
	2020-080-V2N40S6-R03-TN02	2.0	6	2	40	80	0.30
	2020-100-V2N50S6-R03-TN02	2.0	6	2	50	100	0.30
	2020-100-V2N60S6-R03-TN02	2.0	6	2	60	100	0.30
	2020-080-V2N40S6-R05-TN01	2.0	6	2	40	80	0.50
	2020-100-V2N50S6-R05-TN01	2.0	6	2	50	100	0.50
	2020-100-V2N60S6-R05-TN01	2.0	6	2	60	100	0.50
	2020-140-V2N80S6-R05-TN01	2.0	6	2	80	140	0.50
	2020-080-V2N40S6-R05-TN02	2.0	6	2	40	80	0.50
	2020-100-V2N50S6-R05-TN02	2.0	6	2	50	100	0.50
	2020-100-V2N60S6-R05-TN02	2.0	6	2	60	100	0.50

UPRRE2000-TN (Radius)

Taper neck radius





2 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.000 ~ -0.012

(mm)

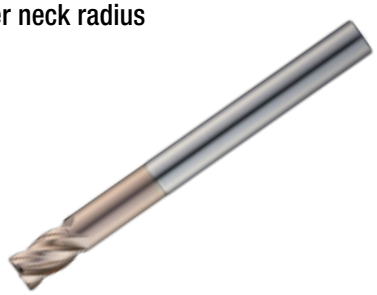
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2020-140-V2N80S8-R01-TN02	2.0	8	2	80	140	0.10
	2020-140-V2N80S8-R02-TN02	2.0	8	2	80	140	0.20
	2020-140-V2N80S8-R03-TN02	2.0	8	2	80	140	0.30
	2020-140-V2N80S8-R05-TN02	2.0	8	2	80	140	0.50
	2030-060-V4.5N16S6-R02-TN01	3.0	6	4.5	16	60	0.20
	2030-065-V4.5N20S6-R02-TN01	3.0	6	4.5	20	65	0.20
	2030-070-V4.5N30S6-R02-TN01	3.0	6	4.5	30	70	0.20
	2030-080-V4.5N40S6-R02-TN01	3.0	6	4.5	40	80	0.20
	2030-090-V4.5N50S6-R02-TN01	3.0	6	4.5	50	90	0.20
	2030-100-V4.5N60S6-R02-TN01	3.0	6	4.5	60	100	0.20
	2030-060-V4.5N16S6-R02-TN02	3.0	6	4.5	16	60	0.20
	2030-065-V4.5N20S6-R02-TN02	3.0	6	4.5	20	65	0.20
	2030-070-V4.5N30S6-R02-TN02	3.0	6	4.5	30	70	0.20
	2030-080-V4.5N40S6-R02-TN02	3.0	6	4.5	40	80	0.20
	2030-060-V4.5N16S6-R03-TN01	3.0	6	4.5	16	60	0.30
	2030-065-V4.5N20S6-R03-TN01	3.0	6	4.5	20	65	0.30
	2030-070-V4.5N30S6-R03-TN01	3.0	6	4.5	30	70	0.30
	2030-080-V4.5N40S6-R03-TN01	3.0	6	4.5	40	80	0.30
	2030-090-V4.5N50S6-R03-TN01	3.0	6	4.5	50	90	0.30
	2030-100-V4.5N60S6-R03-TN01	3.0	6	4.5	60	100	0.30
	2030-060-V4.5N16S6-R03-TN02	3.0	6	4.5	16	60	0.30
	2030-065-V4.5N20S6-R03-TN02	3.0	6	4.5	20	65	0.30
	2030-070-V4.5N30S6-R03-TN02	3.0	6	4.5	30	70	0.30
	2030-080-V4.5N40S6-R03-TN02	3.0	6	4.5	40	80	0.30
	2030-060-V4.5N16S6-R05-TN01	3.0	6	4.5	16	60	0.50
	2030-065-V4.5N20S6-R05-TN01	3.0	6	4.5	20	65	0.50
	2030-070-V4.5N30S6-R05-TN01	3.0	6	4.5	30	70	0.50
	2030-080-V4.5N40S6-R05-TN01	3.0	6	4.5	40	80	0.50
	2030-090-V4.5N50S6-R05-TN01	3.0	6	4.5	50	90	0.50
	2030-100-V4.5N60S6-R05-TN01	3.0	6	4.5	60	100	0.50
	2030-060-V4.5N16S6-R05-TN02	3.0	6	4.5	16	60	0.50
	2030-065-V4.5N20S6-R05-TN02	3.0	6	4.5	20	65	0.50
	2030-070-V4.5N30S6-R05-TN02	3.0	6	4.5	30	70	0.50
	2030-080-V4.5N40S6-R05-TN02	3.0	6	4.5	40	80	0.50

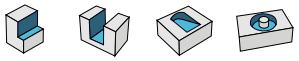
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 2	2030-090-V4.5N50S8-R02-TN02	3.0	8	4.5	50	90	0.20
	2030-100-V4.5N60S8-R02-TN02	3.0	8	4.5	60	100	0.20
	2030-120-V4.5N70S8-R02-TN02	3.0	8	4.5	70	120	0.20
	2030-090-V4.5N50S8-R03-TN02	3.0	8	4.5	50	90	0.30
	2030-100-V4.5N60S8-R03-TN02	3.0	8	4.5	60	100	0.30
	2030-120-V4.5N70S8-R03-TN02	3.0	8	4.5	70	120	0.30
	2030-090-V4.5N50S8-R05-TN02	3.0	8	4.5	50	90	0.50
	2030-100-V4.5N60S8-R05-TN02	3.0	8	4.5	60	100	0.50
	2030-120-V4.5N70S8-R05-TN02	3.0	8	4.5	70	120	0.50
	2040-090-V6N40S6-R02-TN01	4.0	6	6	40	90	0.20
	2040-100-V6N50S6-R02-TN01	4.0	6	6	50	100	0.20
	2040-110-V6N60S6-R02-TN01	4.0	6	6	60	110	0.20
	2040-090-V6N40S6-R03-TN01	4.0	6	6	40	90	0.30
	2040-100-V6N50S6-R03-TN01	4.0	6	6	50	100	0.30
	2040-110-V6N60S6-R03-TN01	4.0	6	6	60	110	0.30
	2040-090-V6N40S6-R05-TN01	4.0	6	6	40	90	0.50
	2040-100-V6N50S6-R05-TN01	4.0	6	6	50	100	0.50
	2040-110-V6N60S6-R05-TN01	4.0	6	6	60	110	0.50
	2040-120-V6N70S8-R02-TN01	4.0	8	6	70	120	0.20
	2040-090-V6N40S8-R02-TN02	4.0	8	6	40	90	0.20
	2040-100-V6N50S8-R02-TN02	4.0	8	6	50	100	0.20
	2040-110-V6N60S8-R02-TN02	4.0	8	6	60	110	0.20
	2040-120-V6N70S8-R03-TN01	4.0	8	6	70	120	0.30
	2040-090-V6N40S8-R03-TN02	4.0	8	6	40	90	0.30
	2040-100-V6N50S8-R03-TN02	4.0	8	6	50	100	0.30
	2040-110-V6N60S8-R03-TN02	4.0	8	6	60	110	0.30
	2040-120-V6N70S8-R05-TN01	4.0	8	6	70	120	0.50
	2040-090-V6N40S8-R05-TN02	4.0	8	6	40	90	0.50
	2040-100-V6N50S8-R05-TN02	4.0	8	6	50	100	0.50
	2040-110-V6N60S8-R05-TN02	4.0	8	6	60	110	0.50
	2040-120-V6N70S10-R02-TN02	4.0	10	6	70	120	0.20
	2040-120-V6N70S10-R03-TN02	4.0	10	6	70	120	0.30
	2040-120-V6N70S10-R05-TN02	4.0	10	6	70	120	0.50

U+ Endmill

UPRRE4000 (Radius)

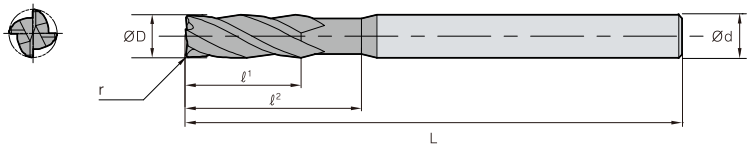
Taper neck radius





4 | H·A 38° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

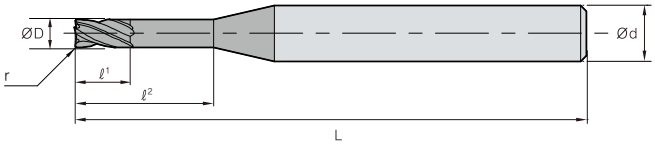


(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE	4060-090-V10N30S06-R05	6.0	6	10	30	90	0.50
4	4060-090-V10N30S06-R10	6.0	6	10	30	90	1.00
	4080-100-V12N35S08-R05	8.0	8	12	35	100	0.50
	4080-100-V12N35S08-R10	8.0	8	12	35	100	1.00
	4100-100-V15N40S10-R05	10.0	10	15	40	100	0.50
	4100-100-V15N40S10-R10	10.0	10	15	40	100	1.00
	4120-110-V20N45S12-R05	12.0	12	20	45	110	0.50
	4120-110-V20N45S12-R10	12.0	12	20	45	110	1.00

UPRRE4000-U (Radius)

Long neck irregular flute spacing and lead radius



4 | H·A Multi | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

(mm)

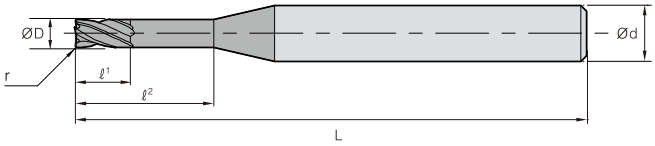
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4010-050-V1.5N3S04-R005-U	1.0	4	1.5	3	50	0.05
	4010-050-V1.5N4S04-R005-U	1.0	4	1.5	4	50	0.05
	4010-050-V1.5N6S04-R005-U	1.0	4	1.5	6	50	0.05
	4010-050-V1.5N8S04-R005-U	1.0	4	1.5	8	50	0.05
	4010-050-V1.5N10S04-R005-U	1.0	4	1.5	10	50	0.05
	4010-050-V1.5N12S04-R005-U	1.0	4	1.5	12	50	0.05
	4010-050-V1.5N14S04-R005-U	1.0	4	1.5	14	50	0.05
	4010-050-V1.5N16S04-R005-U	1.0	4	1.5	16	50	0.05
	4010-050-V1.5N20S04-R005-U	1.0	4	1.5	20	50	0.05
	4010-050-V1.5N3S04-R01-U	1.0	4	1.5	3	50	0.10
	4010-050-V1.5N4S04-R01-U	1.0	4	1.5	4	50	0.10
	4010-050-V1.5N6S04-R01-U	1.0	4	1.5	6	50	0.10
	4010-050-V1.5N8S04-R01-U	1.0	4	1.5	8	50	0.10
	4010-050-V1.5N10S04-R01-U	1.0	4	1.5	10	50	0.10
	4010-050-V1.5N12S04-R01-U	1.0	4	1.5	12	50	0.10
	4010-050-V1.5N14S04-R01-U	1.0	4	1.5	14	50	0.10
	4010-050-V1.5N16S04-R01-U	1.0	4	1.5	16	50	0.10
	4010-050-V1.5N20S04-R01-U	1.0	4	1.5	20	50	0.10
	4010-050-V1.5N3S04-R02-U	1.0	4	1.5	3	50	0.20
	4010-050-V1.5N4S04-R02-U	1.0	4	1.5	4	50	0.20
	4010-050-V1.5N6S04-R02-U	1.0	4	1.5	6	50	0.20
	4010-050-V1.5N8S04-R02-U	1.0	4	1.5	8	50	0.20
	4010-050-V1.5N10S04-R02-U	1.0	4	1.5	10	50	0.20
	4010-050-V1.5N12S04-R02-U	1.0	4	1.5	12	50	0.20
	4010-050-V1.5N14S04-R02-U	1.0	4	1.5	14	50	0.20
	4010-050-V1.5N16S04-R02-U	1.0	4	1.5	16	50	0.20
	4010-050-V1.5N20S04-R02-U	1.0	4	1.5	20	50	0.20
	4010-050-V1.5N3S04-R03-U	1.0	4	1.5	3	50	0.30
	4010-050-V1.5N4S04-R03-U	1.0	4	1.5	4	50	0.30
	4010-050-V1.5N6S04-R03-U	1.0	4	1.5	6	50	0.30
	4010-050-V1.5N8S04-R03-U	1.0	4	1.5	8	50	0.30
	4010-050-V1.5N10S04-R03-U	1.0	4	1.5	10	50	0.30
	4010-050-V1.5N12S04-R03-U	1.0	4	1.5	12	50	0.30
	4010-050-V1.5N14S04-R03-U	1.0	4	1.5	14	50	0.30
	4010-050-V1.5N16S04-R03-U	1.0	4	1.5	16	50	0.30

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4010-050-V1.5N20S04-R03-U	1.0	4	1.5	20	50	0.30
	4012-050-V1.8N3S04-R005-U	1.2	4	1.8	3	50	0.05
	4012-050-V1.8N4S04-R005-U	1.2	4	1.8	4	50	0.05
	4012-050-V1.8N6S04-R005-U	1.2	4	1.8	6	50	0.05
	4012-050-V1.8N8S04-R005-U	1.2	4	1.8	8	50	0.05
	4012-050-V1.8N10S04-R005-U	1.2	4	1.8	10	50	0.05
	4012-050-V1.8N12S04-R005-U	1.2	4	1.8	12	50	0.05
	4012-050-V1.8N16S04-R005-U	1.2	4	1.8	16	50	0.05
	4012-050-V1.8N20S04-R005-U	1.2	4	1.8	20	50	0.05
	4012-050-V1.8N3S04-R01-U	1.2	4	1.8	3	50	0.10
	4012-050-V1.8N4S04-R01-U	1.2	4	1.8	4	50	0.10
	4012-050-V1.8N6S04-R01-U	1.2	4	1.8	6	50	0.10
	4012-050-V1.8N8S04-R01-U	1.2	4	1.8	8	50	0.10
	4012-050-V1.8N10S04-R01-U	1.2	4	1.8	10	50	0.10
	4012-050-V1.8N12S04-R01-U	1.2	4	1.8	12	50	0.10
	4012-050-V1.8N16S04-R01-U	1.2	4	1.8	16	50	0.10
	4012-050-V1.8N20S04-R01-U	1.2	4	1.8	20	50	0.10
	4012-050-V1.8N3S04-R02-U	1.2	4	1.8	3	50	0.20
	4012-050-V1.8N4S04-R02-U	1.2	4	1.8	4	50	0.20
	4012-050-V1.8N6S04-R02-U	1.2	4	1.8	6	50	0.20
	4012-050-V1.8N8S04-R02-U	1.2	4	1.8	8	50	0.20
	4012-050-V1.8N10S04-R02-U	1.2	4	1.8	10	50	0.20
	4012-050-V1.8N12S04-R02-U	1.2	4	1.8	12	50	0.20
	4012-050-V1.8N16S04-R02-U	1.2	4	1.8	16	50	0.20
	4012-050-V1.8N20S04-R02-U	1.2	4	1.8	20	50	0.20
	4012-050-V1.8N3S04-R03-U	1.2	4	1.8	3	50	0.30
	4012-050-V1.8N4S04-R03-U	1.2	4	1.8	4	50	0.30
	4012-050-V1.8N6S04-R03-U	1.2	4	1.8	6	50	0.30
	4012-050-V1.8N8S04-R03-U	1.2	4	1.8	8	50	0.30
	4012-050-V1.8N10S04-R03-U	1.2	4	1.8	10	50	0.30
	4012-050-V1.8N12S04-R03-U	1.2	4	1.8	12	50	0.30
	4012-050-V1.8N16S04-R03-U	1.2	4	1.8	16	50	0.30
	4012-050-V1.8N20S04-R03-U	1.2	4	1.8	20	50	0.30
	4015-050-V2.3N4S04-R005-U	1.5	4	2.3	4	50	0.05
	4015-050-V2.3N6S04-R005-U	1.5	4	2.3	6	50	0.05

U+ Endmill

UPRRE4000-U (Radius)

Long neck irregular flute spacing and lead radius



4 | H·A Multi | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

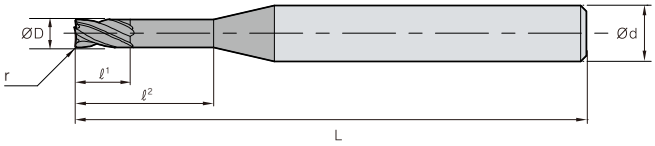
(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4015-050-V2.3N8S04-R005-U	1.5	4	2.3	8	50	0.05
	4015-050-V2.3N10S04-R005-U	1.5	4	2.3	10	50	0.05
	4015-050-V2.3N12S04-R005-U	1.5	4	2.3	12	50	0.05
	4015-050-V2.3N14S04-R005-U	1.5	4	2.3	14	50	0.05
	4015-050-V2.3N16S04-R005-U	1.5	4	2.3	16	50	0.05
	4015-050-V2.3N20S04-R005-U	1.5	4	2.3	20	50	0.05
	4015-060-V2.3N22S04-R005-U	1.5	4	2.3	22	60	0.05
	4015-060-V2.3N26S04-R005-U	1.5	4	2.3	26	60	0.05
	4015-050-V2.3N4S04-R01-U	1.5	4	2.3	4	50	0.10
	4015-050-V2.3N6S04-R01-U	1.5	4	2.3	6	50	0.10
	4015-050-V2.3N8S04-R01-U	1.5	4	2.3	8	50	0.10
	4015-050-V2.3N10S04-R01-U	1.5	4	2.3	10	50	0.10
	4015-050-V2.3N12S04-R01-U	1.5	4	2.3	12	50	0.10
	4015-050-V2.3N14S04-R01-U	1.5	4	2.3	14	50	0.10
	4015-050-V2.3N16S04-R01-U	1.5	4	2.3	16	50	0.10
	4015-050-V2.3N20S04-R01-U	1.5	4	2.3	20	50	0.10
	4015-060-V2.3N22S04-R01-U	1.5	4	2.3	22	60	0.10
	4015-060-V2.3N26S04-R01-U	1.5	4	2.3	26	60	0.10
	4015-050-V2.3N4S04-R02-U	1.5	4	2.3	4	50	0.20
	4015-050-V2.3N6S04-R02-U	1.5	4	2.3	6	50	0.20
	4015-050-V2.3N8S04-R02-U	1.5	4	2.3	8	50	0.20
	4015-050-V2.3N10S04-R02-U	1.5	4	2.3	10	50	0.20
	4015-050-V2.3N12S04-R02-U	1.5	4	2.3	12	50	0.20
	4015-050-V2.3N14S04-R02-U	1.5	4	2.3	14	50	0.20
	4015-050-V2.3N16S04-R02-U	1.5	4	2.3	16	50	0.20
	4015-050-V2.3N20S04-R02-U	1.5	4	2.3	20	50	0.20
	4015-060-V2.3N22S04-R02-U	1.5	4	2.3	22	60	0.20
	4015-060-V2.3N26S04-R02-U	1.5	4	2.3	26	60	0.20
	4015-050-V2.3N4S04-R03-U	1.5	4	2.3	4	50	0.30
	4015-050-V2.3N6S04-R03-U	1.5	4	2.3	6	50	0.30
	4015-050-V2.3N8S04-R03-U	1.5	4	2.3	8	50	0.30
	4015-050-V2.3N10S04-R03-U	1.5	4	2.3	10	50	0.30
	4015-050-V2.3N12S04-R03-U	1.5	4	2.3	12	50	0.30
	4015-050-V2.3N14S04-R03-U	1.5	4	2.3	14	50	0.30
	4015-050-V2.3N16S04-R03-U	1.5	4	2.3	16	50	0.30

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4015-050-V2.3N20S04-R03-U	1.5	4	2.3	20	50	0.30
	4015-060-V2.3N22S04-R03-U	1.5	4	2.3	22	60	0.30
	4015-060-V2.3N26S04-R03-U	1.5	4	2.3	26	60	0.30
	4015-050-V2.3N4S04-R05-U	1.5	4	2.3	4	50	0.50
	4015-050-V2.3N6S04-R05-U	1.5	4	2.3	6	50	0.50
	4015-050-V2.3N8S04-R05-U	1.5	4	2.3	8	50	0.50
	4015-050-V2.3N10S04-R05-U	1.5	4	2.3	10	50	0.50
	4015-050-V2.3N12S04-R05-U	1.5	4	2.3	12	50	0.50
	4015-050-V2.3N14S04-R05-U	1.5	4	2.3	14	50	0.50
	4015-050-V2.3N16S04-R05-U	1.5	4	2.3	16	50	0.50
	4015-050-V2.3N20S04-R05-U	1.5	4	2.3	20	50	0.50
	4015-060-V2.3N22S04-R05-U	1.5	4	2.3	22	60	0.50
	4015-060-V2.3N26S04-R05-U	1.5	4	2.3	26	60	0.50
	4020-050-V3N6S04-R01-U	2.0	4	3	6	50	0.10
	4020-050-V3N8S04-R01-U	2.0	4	3	8	50	0.10
	4020-050-V3N10S04-R01-U	2.0	4	3	10	50	0.10
	4020-050-V3N12S04-R01-U	2.0	4	3	12	50	0.10
	4020-050-V3N14S04-R01-U	2.0	4	3	14	50	0.10
	4020-050-V3N16S04-R01-U	2.0	4	3	16	50	0.10
	4020-050-V3N20S04-R01-U	2.0	4	3	20	50	0.10
	4020-060-V3N22S04-R01-U	2.0	4	3	22	60	0.10
	4020-060-V3N26S04-R01-U	2.0	4	3	26	60	0.10
	4020-070-V3N30S04-R01-U	2.0	4	3	30	70	0.10
	4020-050-V3N6S04-R02-U	2.0	4	3	6	50	0.20
	4020-050-V3N8S04-R02-U	2.0	4	3	8	50	0.20
	4020-050-V3N10S04-R02-U	2.0	4	3	10	50	0.20
	4020-050-V3N12S04-R02-U	2.0	4	3	12	50	0.20
	4020-050-V3N14S04-R02-U	2.0	4	3	14	50	0.20
	4020-050-V3N16S04-R02-U	2.0	4	3	16	50	0.20
	4020-050-V3N20S04-R02-U	2.0	4	3	20	50	0.20
	4020-060-V3N22S04-R02-U	2.0	4	3	22	60	0.20
	4020-060-V3N26S04-R02-U	2.0	4	3	26	60	0.20
	4020-070-V3N30S04-R02-U	2.0	4	3	30	70	0.20
	4020-050-V3N6S04-R03-U	2.0	4	3	6	50	0.30
	4020-050-V3N8S04-R03-U	2.0	4	3	8	50	0.30

UPRRE4000-U (Radius)

Long neck irregular flute spacing and lead radius



4 | H·A Multi | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

(mm)

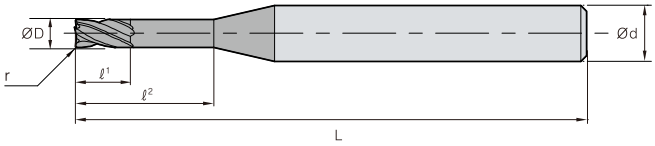
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4020-050-V3N10S04-R03-U	2.0	4	3	10	50	0.30
	4020-050-V3N12S04-R03-U	2.0	4	3	12	50	0.30
	4020-050-V3N14S04-R03-U	2.0	4	3	14	50	0.30
	4020-050-V3N16S04-R03-U	2.0	4	3	16	50	0.30
	4020-050-V3N20S04-R03-U	2.0	4	3	20	50	0.30
	4020-060-V3N22S04-R03-U	2.0	4	3	22	60	0.30
	4020-060-V3N26S04-R03-U	2.0	4	3	26	60	0.30
	4020-070-V3N30S04-R03-U	2.0	4	3	30	70	0.30
	4020-050-V3N6S04-R05-U	2.0	4	3	6	50	0.50
	4020-050-V3N8S04-R05-U	2.0	4	3	8	50	0.50
	4020-050-V3N10S04-R05-U	2.0	4	3	10	50	0.50
	4020-050-V3N12S04-R05-U	2.0	4	3	12	50	0.50
	4020-050-V3N14S04-R05-U	2.0	4	3	14	50	0.50
	4020-050-V3N16S04-R05-U	2.0	4	3	16	50	0.50
	4020-050-V3N20S04-R05-U	2.0	4	3	20	50	0.50
	4020-060-V3N22S04-R05-U	2.0	4	3	22	60	0.50
	4020-060-V3N26S04-R05-U	2.0	4	3	26	60	0.50
	4020-070-V3N30S04-R05-U	2.0	4	3	30	70	0.50
	4025-050-V4N8S04-R01-U	2.5	4	4	8	50	0.10
	4025-050-V4N10S04-R01-U	2.5	4	4	10	50	0.10
	4025-050-V4N12S04-R01-U	2.5	4	4	12	50	0.10
	4025-050-V4N14S04-R01-U	2.5	4	4	14	50	0.10
	4025-050-V4N16S04-R01-U	2.5	4	4	16	50	0.10
	4025-050-V4N20S04-R01-U	2.5	4	4	20	50	0.10
	4025-060-V4N26S04-R01-U	2.5	4	4	26	60	0.10
	4025-070-V4N30S04-R01-U	2.5	4	4	30	70	0.10
	4025-050-V4N8S04-R02-U	2.5	4	4	8	50	0.20
	4025-050-V4N10S04-R02-U	2.5	4	4	10	50	0.20
	4025-050-V4N12S04-R02-U	2.5	4	4	12	50	0.20
	4025-050-V4N14S04-R02-U	2.5	4	4	14	50	0.20
	4025-050-V4N16S04-R02-U	2.5	4	4	16	50	0.20
	4025-050-V4N20S04-R02-U	2.5	4	4	20	50	0.20
	4025-060-V4N26S04-R02-U	2.5	4	4	26	60	0.20
	4025-070-V4N30S04-R02-U	2.5	4	4	30	70	0.20
	4025-050-V4N8S04-R03-U	2.5	4	4	8	50	0.30

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4025-050-V4N10S04-R03-U	2.5	4	4	10	50	0.30
	4025-050-V4N12S04-R03-U	2.5	4	4	12	50	0.30
	4025-050-V4N14S04-R03-U	2.5	4	4	14	50	0.30
	4025-050-V4N16S04-R03-U	2.5	4	4	16	50	0.30
	4025-050-V4N20S04-R03-U	2.5	4	4	20	50	0.30
	4025-060-V4N26S04-R03-U	2.5	4	4	26	60	0.30
	4025-070-V4N30S04-R03-U	2.5	4	4	30	70	0.30
	4025-050-V4N8S04-R05-U	2.5	4	4	8	50	0.50
	4025-050-V4N10S04-R05-U	2.5	4	4	10	50	0.50
	4025-050-V4N12S04-R05-U	2.5	4	4	12	50	0.50
	4025-050-V4N14S04-R05-U	2.5	4	4	14	50	0.50
	4025-050-V4N16S04-R05-U	2.5	4	4	16	50	0.50
	4025-050-V4N20S04-R05-U	2.5	4	4	20	50	0.50
	4025-060-V4N26S04-R05-U	2.5	4	4	26	60	0.50
	4025-070-V4N30S04-R05-U	2.5	4	4	30	70	0.50
	4030-050-V4.5N8S06-R01-U	3.0	6	4.5	8	50	0.10
	4030-050-V4.5N10S06-R01-U	3.0	6	4.5	10	50	0.10
	4030-050-V4.5N12S06-R01-U	3.0	6	4.5	12	50	0.10
	4030-060-V4.5N14S06-R01-U	3.0	6	4.5	14	60	0.10
	4030-060-V4.5N16S06-R01-U	3.0	6	4.5	16	60	0.10
	4030-060-V4.5N20S06-R01-U	3.0	6	4.5	20	60	0.10
	4030-065-V4.5N26S06-R01-U	3.0	6	4.5	26	65	0.10
	4030-070-V4.5N30S06-R01-U	3.0	6	4.5	30	70	0.10
	4030-070-V4.5N35S06-R01-U	3.0	6	4.5	35	70	0.10
	4030-080-V4.5N40S06-R01-U	3.0	6	4.5	40	80	0.10
	4030-050-V4.5N8S06-R02-U	3.0	6	4.5	8	50	0.20
	4030-050-V4.5N10S06-R02-U	3.0	6	4.5	10	50	0.20
	4030-050-V4.5N12S06-R02-U	3.0	6	4.5	12	50	0.20
	4030-060-V4.5N14S06-R02-U	3.0	6	4.5	14	60	0.20
	4030-060-V4.5N16S06-R02-U	3.0	6	4.5	16	60	0.20
	4030-060-V4.5N20S06-R02-U	3.0	6	4.5	20	60	0.20
	4030-065-V4.5N26S06-R02-U	3.0	6	4.5	26	65	0.20
	4030-070-V4.5N30S06-R02-U	3.0	6	4.5	30	70	0.20
	4030-070-V4.5N35S06-R02-U	3.0	6	4.5	35	70	0.20
	4030-080-V4.5N40S06-R02-U	3.0	6	4.5	40	80	0.20

U+ Endmill

UPRRE4000-U (Radius)

Long neck irregular flute spacing and lead radius



4 | H·A Multi | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

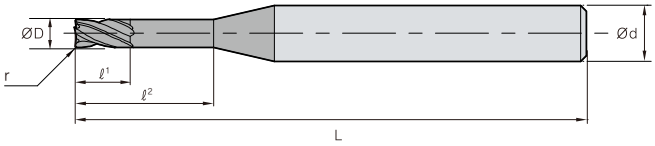
(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4030-050-V4.5N8S06-R03-U	3.0	6	4.5	8	50	0.30
	4030-050-V4.5N10S06-R03-U	3.0	6	4.5	10	50	0.30
	4030-050-V4.5N12S06-R03-U	3.0	6	4.5	12	50	0.30
	4030-060-V4.5N14S06-R03-U	3.0	6	4.5	14	60	0.30
	4030-060-V4.5N16S06-R03-U	3.0	6	4.5	16	60	0.30
	4030-060-V4.5N20S06-R03-U	3.0	6	4.5	20	60	0.30
	4030-065-V4.5N26S06-R03-U	3.0	6	4.5	26	65	0.30
	4030-070-V4.5N30S06-R03-U	3.0	6	4.5	30	70	0.30
	4030-070-V4.5N35S06-R03-U	3.0	6	4.5	35	70	0.30
	4030-080-V4.5N40S06-R03-U	3.0	6	4.5	40	80	0.30
	4030-050-V4.5N8S06-R05-U	3.0	6	4.5	8	50	0.50
	4030-050-V4.5N10S06-R05-U	3.0	6	4.5	10	50	0.50
	4030-050-V4.5N12S06-R05-U	3.0	6	4.5	12	50	0.50
	4030-060-V4.5N14S06-R05-U	3.0	6	4.5	14	60	0.50
	4030-060-V4.5N16S06-R05-U	3.0	6	4.5	16	60	0.50
	4030-060-V4.5N20S06-R05-U	3.0	6	4.5	20	60	0.50
	4030-065-V4.5N26S06-R05-U	3.0	6	4.5	26	65	0.50
	4030-070-V4.5N30S06-R05-U	3.0	6	4.5	30	70	0.50
	4030-070-V4.5N35S06-R05-U	3.0	6	4.5	35	70	0.50
	4030-080-V4.5N40S06-R05-U	3.0	6	4.5	40	80	0.50
	4030-050-V4.5N8S06-R10-U	3.0	6	4.5	8	50	1.00
	4030-050-V4.5N10S06-R10-U	3.0	6	4.5	10	50	1.00
	4030-050-V4.5N12S06-R10-U	3.0	6	4.5	12	50	1.00
	4030-060-V4.5N14S06-R10-U	3.0	6	4.5	14	60	1.00
	4030-060-V4.5N16S06-R10-U	3.0	6	4.5	16	60	1.00
	4030-060-V4.5N20S06-R10-U	3.0	6	4.5	20	60	1.00
	4030-065-V4.5N26S06-R10-U	3.0	6	4.5	26	65	1.00
	4030-070-V4.5N30S06-R10-U	3.0	6	4.5	30	70	1.00
	4030-070-V4.5N35S06-R10-U	3.0	6	4.5	35	70	1.00
	4030-080-V4.5N40S06-R10-U	3.0	6	4.5	40	80	1.00
	4040-050-V6N10S06-R01-U	4.0	6	6	10	50	0.10
	4040-050-V6N12S06-R01-U	4.0	6	6	12	50	0.10
	4040-060-V6N14S06-R01-U	4.0	6	6	14	60	0.10
	4040-060-V6N16S06-R01-U	4.0	6	6	16	60	0.10
	4040-060-V6N20S06-R01-U	4.0	6	6	20	60	0.10

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4040-065-V6N26S06-R01-U	4.0	6	6	26	65	0.10
	4040-070-V6N30S06-R01-U	4.0	6	6	30	70	0.10
	4040-070-V6N35S06-R01-U	4.0	6	6	35	70	0.10
	4040-080-V6N40S06-R01-U	4.0	6	6	40	80	0.10
	4040-090-V6N45S06-R01-U	4.0	6	6	45	90	0.10
	4040-100-V6N50S06-R01-U	4.0	6	6	50	100	0.10
	4040-050-V6N10S06-R02-U	4.0	6	6	10	50	0.20
	4040-050-V6N12S06-R02-U	4.0	6	6	12	50	0.20
	4040-060-V6N14S06-R02-U	4.0	6	6	14	60	0.20
	4040-060-V6N16S06-R02-U	4.0	6	6	16	60	0.20
	4040-060-V6N20S06-R02-U	4.0	6	6	20	60	0.20
	4040-065-V6N26S06-R02-U	4.0	6	6	26	65	0.20
	4040-070-V6N30S06-R02-U	4.0	6	6	30	70	0.20
	4040-070-V6N35S06-R02-U	4.0	6	6	35	70	0.20
	4040-080-V6N40S06-R02-U	4.0	6	6	40	80	0.20
	4040-090-V6N45S06-R02-U	4.0	6	6	45	90	0.20
	4040-100-V6N50S06-R02-U	4.0	6	6	50	100	0.20
	4040-050-V6N10S06-R03-U	4.0	6	6	10	50	0.30
	4040-050-V6N12S06-R03-U	4.0	6	6	12	50	0.30
	4040-060-V6N14S06-R03-U	4.0	6	6	14	60	0.30
	4040-060-V6N16S06-R03-U	4.0	6	6	16	60	0.30
	4040-060-V6N20S06-R03-U	4.0	6	6	20	60	0.30
	4040-065-V6N26S06-R03-U	4.0	6	6	26	65	0.30
	4040-070-V6N30S06-R03-U	4.0	6	6	30	70	0.30
	4040-070-V6N35S06-R03-U	4.0	6	6	35	70	0.30
	4040-080-V6N40S06-R03-U	4.0	6	6	40	80	0.30
	4040-090-V6N45S06-R03-U	4.0	6	6	45	90	0.30
	4040-100-V6N50S06-R03-U	4.0	6	6	50	100	0.30
	4040-050-V6N10S06-R05-U	4.0	6	6	10	50	0.50
	4040-050-V6N12S06-R05-U	4.0	6	6	12	50	0.50
	4040-060-V6N14S06-R05-U	4.0	6	6	14	60	0.50
	4040-060-V6N16S06-R05-U	4.0	6	6	16	60	0.50
	4040-060-V6N20S06-R05-U	4.0	6	6	20	60	0.50
	4040-065-V6N26S06-R05-U	4.0	6	6	26	65	0.50
	4040-070-V6N30S06-R05-U	4.0	6	6	30	70	0.50

UPRRE4000-U (Radius)

Long neck irregular flute spacing and lead radius



4 | H·A Multi | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

(mm)

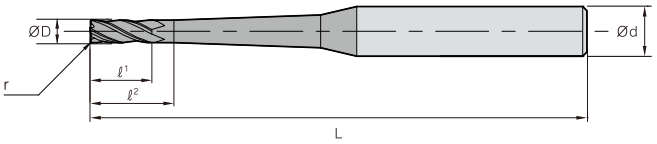
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4040-070-V6N35S06-R05-U	4.0	6	6	35	70	0.50
	4040-080-V6N40S06-R05-U	4.0	6	6	40	80	0.50
	4040-090-V6N45S06-R05-U	4.0	6	6	45	90	0.50
	4040-100-V6N50S06-R05-U	4.0	6	6	50	100	0.50
	4040-050-V6N10S06-R10-U	4.0	6	6	10	50	1.00
	4040-050-V6N12S06-R10-U	4.0	6	6	12	50	1.00
	4040-060-V6N14S06-R10-U	4.0	6	6	14	60	1.00
	4040-060-V6N16S06-R10-U	4.0	6	6	16	60	1.00
	4040-060-V6N20S06-R10-U	4.0	6	6	20	60	1.00
	4040-065-V6N26S06-R10-U	4.0	6	6	26	65	1.00
	4040-070-V6N30S06-R10-U	4.0	6	6	30	70	1.00
	4040-070-V6N35S06-R10-U	4.0	6	6	35	70	1.00
	4040-080-V6N40S06-R10-U	4.0	6	6	40	80	1.00
	4040-090-V6N45S06-R10-U	4.0	6	6	45	90	1.00
	4040-100-V6N50S06-R10-U	4.0	6	6	50	100	1.00
	4050-060-V8N15S06-R01-U	5.0	6	8	15	60	0.10
	4050-060-V8N15S06-R02-U	5.0	6	8	15	60	0.20
	4050-060-V8N15S06-R03-U	5.0	6	8	15	60	0.30
	4050-060-V8N15S06-R05-U	5.0	6	8	15	60	0.50
	4050-060-V8N15S06-R10-U	5.0	6	8	15	60	1.00
	4050-060-V8N15S06-R15-U	5.0	6	8	15	60	1.50
	4050-060-V8N15S06-R20-U	5.0	6	8	15	60	2.00
	4060-060-V9N20S06-R01-U	6.0	6	9	20	60	0.10
	4060-060-V9N20S06-R02-U	6.0	6	9	20	60	0.20
	4060-060-V9N20S06-R03-U	6.0	6	9	20	60	0.30
	4060-060-V9N20S06-R05-U	6.0	6	9	20	60	0.50
	4060-060-V9N20S06-R10-U	6.0	6	9	20	60	1.00
	4060-060-V9N20S06-R15-U	6.0	6	9	20	60	1.50
	4060-060-V9N20S06-R20-U	6.0	6	9	20	60	2.00
	4060-090-V15N30S06-R03-U	6.0	6	15	30	90	0.30
	4060-090-V15N30S06-R05-U	6.0	6	15	30	90	0.50
	4060-090-V15N30S06-R10-U	6.0	6	15	30	90	1.00
	4080-070-V12N25S08-R01-U	8.0	8	12	25	70	0.10
	4080-070-V12N25S08-R02-U	8.0	8	12	25	70	0.20
	4080-070-V12N25S08-R03-U	8.0	8	12	25	70	0.30

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4080-070-V12N25S08-R05-U	8.0	8	12	25	70	0.50
	4080-070-V12N25S08-R10-U	8.0	8	12	25	70	1.00
	4080-070-V12N25S08-R15-U	8.0	8	12	25	70	1.50
	4080-070-V12N25S08-R20-U	8.0	8	12	25	70	2.00
	4080-100-V20N35S08-R03-U	8.0	8	20	35	100	0.30
	4080-100-V20N35S08-R05-U	8.0	8	20	35	100	0.50
	4080-100-V20N35S08-R10-U	8.0	8	20	35	100	1.00
	4100-075-V15N30S10-R01-U	10.0	10	15	30	75	0.10
	4100-075-V15N30S10-R02-U	10.0	10	15	30	75	0.20
	4100-075-V15N30S10-R03-U	10.0	10	15	30	75	0.30
	4100-075-V15N30S10-R05-U	10.0	10	15	30	75	0.50
	4100-075-V15N30S10-R10-U	10.0	10	15	30	75	1.00
	4100-075-V15N30S10-R15-U	10.0	10	15	30	75	1.50
	4100-075-V15N30S10-R20-U	10.0	10	15	30	75	2.00
	4100-100-V25N40S10-R03-U	10.0	10	25	40	100	0.30
	4100-100-V25N40S10-R05-U	10.0	10	25	40	100	0.50
	4100-100-V25N40S10-R10-U	10.0	10	25	40	100	1.00
	4120-080-V18N32S12-R02-U	12.0	12	18	32	80	0.20
	4120-080-V18N32S12-R03-U	12.0	12	18	32	80	0.30
	4120-080-V18N32S12-R05-U	12.0	12	18	32	80	0.50
	4120-080-V18N32S12-R10-U	12.0	12	18	32	80	1.00
	4120-080-V18N32S12-R15-U	12.0	12	18	32	80	1.50
	4120-080-V18N32S12-R20-U	12.0	12	18	32	80	2.00
	4120-110-V30N45S12-R03-U	12.0	12	30	45	110	0.30
	4120-110-V30N45S12-R05-U	12.0	12	30	45	110	0.50
	4120-110-V30N45S12-R10-U	12.0	12	30	45	110	1.00
	4160-100-V20N35S16-R05-U	16.0	16	20	35	100	0.50
	4160-100-V20N35S16-R10-U	16.0	16	20	35	100	1.00
	4160-150-V35N50S20-R05-U	16.0	20	35	50	150	0.50
	4160-150-V35N50S20-R10-U	16.0	20	35	50	150	1.00
	4200-100-V25N40S20-R05-U	20.0	20	25	40	100	0.50
	4200-100-V25N40S20-R10-U	20.0	20	25	40	100	1.00
	4200-150-V40N55S20-R05-U	20.0	20	40	55	150	0.50
	4200-150-V40N55S20-R10-U	20.0	20	40	55	150	1.00

U+ Endmill

UPRRE4000-TN (Radius)

Long neck irregular flute spacing and lead radius



4 | H-A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.000 ~ -0.012

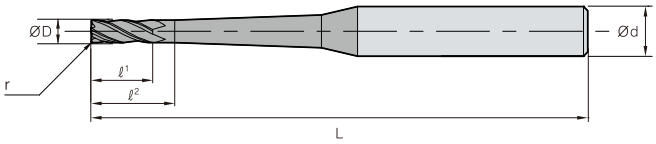
(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4010-050-V1.5N12S4-R01-TN02	1.0	4	1.5	12	50	0.10
	4010-050-V1.5N6S4-R01-TN01	1.0	4	1.5	6	50	0.10
	4010-050-V1.5N8S4-R01-TN01	1.0	4	1.5	8	50	0.10
	4010-050-V1.5N10S4-R01-TN01	1.0	4	1.5	10	50	0.10
	4010-050-V1.5N12S4-R01-TN01	1.0	4	1.5	12	50	0.10
	4010-050-V1.5N16S4-R01-TN01	1.0	4	1.5	16	50	0.10
	4010-050-V1.5N20S4-R01-TN01	1.0	4	1.5	20	50	0.10
	4010-060-V1.5N25S4-R01-TN01	1.0	4	1.5	25	60	0.10
	4010-070-V1.5N30S4-R01-TN01	1.0	4	1.5	30	70	0.10
	4010-080-V1.5N40S4-R01-TN01	1.0	4	1.5	40	80	0.10
	4010-090-V1.5N50S4-R01-TN01	1.0	4	1.5	50	90	0.10
	4010-050-V1.5N6S4-R01-TN02	1.0	4	1.5	6	50	0.10
	4010-050-V1.5N8S4-R01-TN02	1.0	4	1.5	8	50	0.10
	4010-050-V1.5N10S4-R01-TN02	1.0	4	1.5	10	50	0.10
	4010-050-V1.5N16S4-R01-TN02	1.0	4	1.5	16	50	0.10
	4010-050-V1.5N20S4-R01-TN02	1.0	4	1.5	20	50	0.10
	4010-060-V1.5N25S4-R01-TN02	1.0	4	1.5	25	60	0.10
	4010-070-V1.5N30S4-R01-TN02	1.0	4	1.5	30	70	0.10
	4010-080-V1.5N40S4-R01-TN02	1.0	4	1.5	40	80	0.10
	4010-050-V1.5N6S4-R02-TN01	1.0	4	1.5	6	50	0.20
	4010-050-V1.5N8S4-R02-TN01	1.0	4	1.5	8	50	0.20
	4010-050-V1.5N10S4-R02-TN01	1.0	4	1.5	10	50	0.20
	4010-050-V1.5N12S4-R02-TN01	1.0	4	1.5	12	50	0.20
	4010-050-V1.5N16S4-R02-TN01	1.0	4	1.5	16	50	0.20
	4010-050-V1.5N20S4-R02-TN01	1.0	4	1.5	20	50	0.20
	4010-060-V1.5N25S4-R02-TN01	1.0	4	1.5	25	60	0.20
	4010-070-V1.5N30S4-R02-TN01	1.0	4	1.5	30	70	0.20
	4010-080-V1.5N40S4-R02-TN01	1.0	4	1.5	40	80	0.20
	4010-090-V1.5N50S4-R02-TN01	1.0	4	1.5	50	90	0.20
	4010-050-V1.5N6S4-R02-TN02	1.0	4	1.5	6	50	0.20
	4010-050-V1.5N8S4-R02-TN02	1.0	4	1.5	8	50	0.20
	4010-050-V1.5N10S4-R02-TN02	1.0	4	1.5	10	50	0.20
	4010-050-V1.5N12S4-R02-TN02	1.0	4	1.5	12	50	0.20
	4010-050-V1.5N16S4-R02-TN02	1.0	4	1.5	16	50	0.20

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4010-050-V1.5N20S4-R02-TN02	1.0	4	1.5	20	50	0.20
	4010-060-V1.5N25S4-R02-TN02	1.0	4	1.5	25	60	0.20
	4010-070-V1.5N30S4-R02-TN02	1.0	4	1.5	30	70	0.20
	4010-080-V1.5N40S4-R02-TN02	1.0	4	1.5	40	80	0.20
	4010-090-V1.5N50S6-R01-TN02	1.0	6	1.5	50	90	0.10
	4010-090-V1.5N50S6-R02-TN02	1.0	6	1.5	50	90	0.20
	4012-050-V1.8N8S4-R01-TN01	1.2	4	1.8	8	50	0.10
	4012-050-V1.8N12S4-R01-TN01	1.2	4	1.8	12	50	0.10
	4012-050-V1.8N16S4-R01-TN01	1.2	4	1.8	16	50	0.10
	4012-050-V1.8N20S4-R01-TN01	1.2	4	1.8	20	50	0.10
	4012-060-V1.8N25S4-R01-TN01	1.2	4	1.8	25	60	0.10
	4012-070-V1.8N30S4-R01-TN01	1.2	4	1.8	30	70	0.10
	4012-050-V1.8N8S4-R01-TN02	1.2	4	1.8	8	50	0.10
	4012-050-V1.8N12S4-R01-TN02	1.2	4	1.8	12	50	0.10
	4012-050-V1.8N16S4-R01-TN02	1.2	4	1.8	16	50	0.10
	4012-050-V1.8N20S4-R01-TN02	1.2	4	1.8	20	50	0.10
	4012-060-V1.8N25S4-R01-TN02	1.2	4	1.8	25	60	0.10
	4012-070-V1.8N30S4-R01-TN02	1.2	4	1.8	30	70	0.10
	4012-050-V1.8N8S4-R02-TN01	1.2	4	1.8	8	50	0.20
	4012-050-V1.8N12S4-R02-TN01	1.2	4	1.8	12	50	0.20
	4012-050-V1.8N16S4-R02-TN01	1.2	4	1.8	16	50	0.20
	4012-050-V1.8N20S4-R02-TN01	1.2	4	1.8	20	50	0.20
	4012-060-V1.8N25S4-R02-TN01	1.2	4	1.8	25	60	0.20
	4012-070-V1.8N30S4-R02-TN01	1.2	4	1.8	30	70	0.20
	4012-050-V1.8N8S4-R02-TN02	1.2	4	1.8	8	50	0.20
	4012-050-V1.8N12S4-R02-TN02	1.2	4	1.8	12	50	0.20
	4012-050-V1.8N16S4-R02-TN02	1.2	4	1.8	16	50	0.20
	4012-050-V1.8N20S4-R02-TN02	1.2	4	1.8	20	50	0.20
	4012-060-V1.8N25S4-R02-TN02	1.2	4	1.8	25	60	0.20
	4012-070-V1.8N30S4-R02-TN02	1.2	4	1.8	30	70	0.20
	4015-050-V2.3N8S4-R01-TN01	1.5	4	2.3	8	50	0.10
	4015-050-V2.3N10S4-R01-TN01	1.5	4	2.3	10	50	0.10
	4015-050-V2.3N12S4-R01-TN01	1.5	4	2.3	12	50	0.10
	4015-050-V2.3N16S4-R01-TN01	1.5	4	2.3	16	50	0.10

UPRRE4000-TN (Radius)

Long neck irregular flute spacing and lead radius



4 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.000 ~ -0.012

(mm)

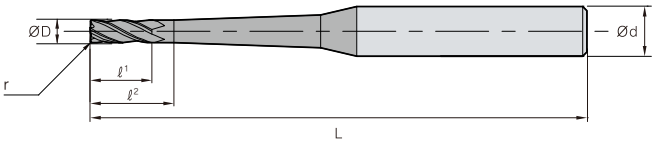
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4015-050-V2.3N20S4-R01-TN01	1.5	4	2.3	20	50	0.10
	4015-060-V2.3N25S4-R01-TN01	1.5	4	2.3	25	60	0.10
	4015-070-V2.3N30S4-R01-TN01	1.5	4	2.3	30	70	0.10
	4015-080-V2.3N40S4-R01-TN01	1.5	4	2.3	40	80	0.10
	4015-090-V2.3N50S4-R01-TN01	1.5	4	2.3	50	90	0.10
	4015-050-V2.3N8S4-R01-TN02	1.5	4	2.3	8	50	0.10
	4015-050-V2.3N10S4-R01-TN02	1.5	4	2.3	10	50	0.10
	4015-050-V2.3N12S4-R01-TN02	1.5	4	2.3	12	50	0.10
	4015-050-V2.3N16S4-R01-TN02	1.5	4	2.3	16	50	0.10
	4015-050-V2.3N20S4-R01-TN02	1.5	4	2.3	20	50	0.10
	4015-060-V2.3N25S4-R01-TN02	1.5	4	2.3	25	60	0.10
	4015-070-V2.3N30S4-R01-TN02	1.5	4	2.3	30	70	0.10
	4015-050-V2.3N8S4-R02-TN01	1.5	4	2.3	8	50	0.20
	4015-050-V2.3N10S4-R02-TN01	1.5	4	2.3	10	50	0.20
	4015-050-V2.3N12S4-R02-TN01	1.5	4	2.3	12	50	0.20
	4015-050-V2.3N16S4-R02-TN01	1.5	4	2.3	16	50	0.20
	4015-050-V2.3N20S4-R02-TN01	1.5	4	2.3	20	50	0.20
	4015-060-V2.3N25S4-R02-TN01	1.5	4	2.3	25	60	0.20
	4015-070-V2.3N30S4-R02-TN01	1.5	4	2.3	30	70	0.20
	4015-080-V2.3N40S4-R02-TN01	1.5	4	2.3	40	80	0.20
	4015-090-V2.3N50S4-R02-TN01	1.5	4	2.3	50	90	0.20
	4015-050-V2.3N8S4-R02-TN02	1.5	4	2.3	8	50	0.20
	4015-050-V2.3N10S4-R02-TN02	1.5	4	2.3	10	50	0.20
	4015-050-V2.3N12S4-R02-TN02	1.5	4	2.3	12	50	0.20
	4015-050-V2.3N16S4-R02-TN02	1.5	4	2.3	16	50	0.20
	4015-050-V2.3N20S4-R02-TN02	1.5	4	2.3	20	50	0.20
	4015-060-V2.3N25S4-R02-TN02	1.5	4	2.3	25	60	0.20
	4015-070-V2.3N30S4-R02-TN02	1.5	4	2.3	30	70	0.20
	4015-050-V2.3N8S4-R03-TN01	1.5	4	2.3	8	50	0.30
	4015-050-V2.3N10S4-R03-TN01	1.5	4	2.3	10	50	0.30
	4015-050-V2.3N12S4-R03-TN01	1.5	4	2.3	12	50	0.30
	4015-050-V2.3N16S4-R03-TN01	1.5	4	2.3	16	50	0.30
	4015-050-V2.3N20S4-R03-TN01	1.5	4	2.3	20	50	0.30
	4015-060-V2.3N25S4-R03-TN01	1.5	4	2.3	25	60	0.30

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4015-070-V2.3N30S4-R03-TN01	1.5	4	2.3	30	70	0.30
	4015-080-V2.3N40S4-R03-TN01	1.5	4	2.3	40	80	0.30
	4015-090-V2.3N50S4-R03-TN01	1.5	4	2.3	50	90	0.30
	4015-050-V2.3N8S4-R03-TN02	1.5	4	2.3	8	50	0.30
	4015-050-V2.3N10S4-R03-TN02	1.5	4	2.3	10	50	0.30
	4015-050-V2.3N12S4-R03-TN02	1.5	4	2.3	12	50	0.30
	4015-050-V2.3N16S4-R03-TN02	1.5	4	2.3	16	50	0.30
	4015-050-V2.3N20S4-R03-TN02	1.5	4	2.3	20	50	0.30
	4015-060-V2.3N25S4-R03-TN02	1.5	4	2.3	25	60	0.30
	4015-070-V2.3N30S4-R03-TN02	1.5	4	2.3	30	70	0.30
	4015-080-V2.3N40S6-R01-TN02	1.5	6	2.3	40	80	0.10
	4015-090-V2.3N50S6-R01-TN02	1.5	6	2.3	50	90	0.10
	4015-080-V2.3N40S6-R02-TN02	1.5	6	2.3	40	80	0.20
	4015-090-V2.3N50S6-R02-TN02	1.5	6	2.3	50	90	0.20
	4015-080-V2.3N40S6-R03-TN02	1.5	6	2.3	40	80	0.30
	4015-090-V2.3N50S6-R03-TN02	1.5	6	2.3	50	90	0.30
	4020-050-V2N10S4-R01-TN01	2.0	4	2	10	50	0.10
	4020-050-V2N12S4-R01-TN01	2.0	4	2	12	50	0.10
	4020-050-V2N16S4-R01-TN01	2.0	4	2	16	50	0.10
	4020-050-V2N20S4-R01-TN01	2.0	4	2	20	50	0.10
	4020-060-V2N25S4-R01-TN01	2.0	4	2	25	60	0.10
	4020-070-V2N30S4-R01-TN01	2.0	4	2	30	70	0.10
	4020-050-V2N10S4-R01-TN02	2.0	4	2	10	50	0.10
	4020-050-V2N12S4-R01-TN02	2.0	4	2	12	50	0.10
	4020-050-V2N16S4-R01-TN02	2.0	4	2	16	50	0.10
	4020-050-V2N20S4-R01-TN02	2.0	4	2	20	50	0.10
	4020-060-V2N25S4-R01-TN02	2.0	4	2	25	60	0.10
	4020-070-V2N30S4-R01-TN02	2.0	4	2	30	70	0.10
	4020-050-V2N10S4-R02-TN01	2.0	4	2	10	50	0.20
	4020-050-V2N12S4-R02-TN01	2.0	4	2	12	50	0.20
	4020-050-V2N16S4-R02-TN01	2.0	4	2	16	50	0.20
	4020-050-V2N20S4-R02-TN01	2.0	4	2	20	50	0.20
	4020-060-V2N25S4-R02-TN01	2.0	4	2	25	60	0.20
	4020-070-V2N30S4-R02-TN01	2.0	4	2	30	70	0.20

U+ Endmill

UPRRE4000-TN (Radius)

Long neck irregular flute spacing and lead radius



4 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.000 ~ -0.012

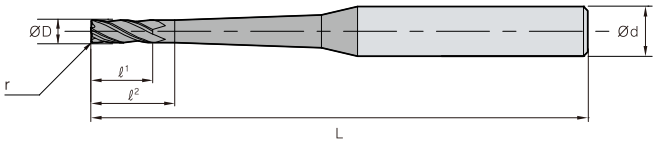
(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4020-050-V2N10S4-R02-TN02	2.0	4	2	10	50	0.20
	4020-050-V2N12S4-R02-TN02	2.0	4	2	12	50	0.20
	4020-050-V2N16S4-R02-TN02	2.0	4	2	16	50	0.20
	4020-050-V2N20S4-R02-TN02	2.0	4	2	20	50	0.20
	4020-060-V2N25S4-R02-TN02	2.0	4	2	25	60	0.20
	4020-070-V2N30S4-R02-TN02	2.0	4	2	30	70	0.20
	4020-050-V2N10S4-R03-TN01	2.0	4	2	10	50	0.30
	4020-050-V2N12S4-R03-TN01	2.0	4	2	12	50	0.30
	4020-050-V2N16S4-R03-TN01	2.0	4	2	16	50	0.30
	4020-050-V2N20S4-R03-TN01	2.0	4	2	20	50	0.30
	4020-060-V2N25S4-R03-TN01	2.0	4	2	25	60	0.30
	4020-070-V2N30S4-R03-TN01	2.0	4	2	30	70	0.30
	4020-050-V2N10S4-R03-TN02	2.0	4	2	10	50	0.30
	4020-050-V2N12S4-R03-TN02	2.0	4	2	12	50	0.30
	4020-050-V2N16S4-R03-TN02	2.0	4	2	16	50	0.30
	4020-050-V2N20S4-R03-TN02	2.0	4	2	20	50	0.30
	4020-060-V2N25S4-R03-TN02	2.0	4	2	25	60	0.30
	4020-070-V2N30S4-R03-TN02	2.0	4	2	30	70	0.30
	4020-050-V2N10S4-R05-TN01	2.0	4	2	10	50	0.50
	4020-050-V2N12S4-R05-TN01	2.0	4	2	12	50	0.50
	4020-050-V2N16S4-R05-TN01	2.0	4	2	16	50	0.50
	4020-050-V2N20S4-R05-TN01	2.0	4	2	20	50	0.50
	4020-060-V2N25S4-R05-TN01	2.0	4	2	25	60	0.50
	4020-070-V2N30S4-R05-TN01	2.0	4	2	30	70	0.50
	4020-050-V2N10S4-R05-TN02	2.0	4	2	10	50	0.50
	4020-050-V2N12S4-R05-TN02	2.0	4	2	12	50	0.50
	4020-050-V2N16S4-R05-TN02	2.0	4	2	16	50	0.50
	4020-050-V2N20S4-R05-TN02	2.0	4	2	20	50	0.50
	4020-060-V2N25S4-R05-TN02	2.0	4	2	25	60	0.50
	4020-070-V2N30S4-R05-TN02	2.0	4	2	30	70	0.50
	4020-080-V2N40S6-R01-TN01	2.0	6	2	40	80	0.10
	4020-100-V2N50S6-R01-TN01	2.0	6	2	50	100	0.10
	4020-100-V2N60S6-R01-TN01	2.0	6	2	60	100	0.10
	4020-140-V2N80S6-R01-TN01	2.0	6	2	80	140	0.10

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4020-080-V2N40S6-R01-TN02	2.0	6	2	40	80	0.10
	4020-100-V2N50S6-R01-TN02	2.0	6	2	50	100	0.10
	4020-100-V2N60S6-R01-TN02	2.0	6	2	60	100	0.10
	4020-080-V2N40S6-R02-TN01	2.0	6	2	40	80	0.20
	4020-100-V2N50S6-R02-TN01	2.0	6	2	50	100	0.20
	4020-100-V2N60S6-R02-TN01	2.0	6	2	60	100	0.20
	4020-140-V2N80S6-R02-TN01	2.0	6	2	80	140	0.20
	4020-080-V2N40S6-R02-TN02	2.0	6	2	40	80	0.20
	4020-100-V2N50S6-R02-TN02	2.0	6	2	50	100	0.20
	4020-100-V2N60S6-R02-TN02	2.0	6	2	60	100	0.20
	4020-080-V2N40S6-R03-TN01	2.0	6	2	40	80	0.30
	4020-100-V2N50S6-R03-TN01	2.0	6	2	50	100	0.30
	4020-100-V2N60S6-R03-TN01	2.0	6	2	60	100	0.30
	4020-140-V2N80S6-R03-TN01	2.0	6	2	80	140	0.30
	4020-080-V2N40S6-R03-TN02	2.0	6	2	40	80	0.30
	4020-100-V2N50S6-R03-TN02	2.0	6	2	50	100	0.30
	4020-100-V2N60S6-R03-TN02	2.0	6	2	60	100	0.30
	4020-080-V2N40S6-R05-TN01	2.0	6	2	40	80	0.50
	4020-100-V2N50S6-R05-TN01	2.0	6	2	50	100	0.50
	4020-100-V2N60S6-R05-TN01	2.0	6	2	60	100	0.50
	4020-140-V2N80S6-R05-TN01	2.0	6	2	80	140	0.50
	4020-080-V2N40S6-R05-TN02	2.0	6	2	40	80	0.50
	4020-100-V2N50S6-R05-TN02	2.0	6	2	50	100	0.50
	4020-100-V2N60S6-R05-TN02	2.0	6	2	60	100	0.50
	4020-140-V2N80S8-R01-TN02	2.0	8	2	80	140	0.10
	4020-140-V2N80S8-R02-TN02	2.0	8	2	80	140	0.20
	4020-140-V2N80S8-R03-TN02	2.0	8	2	80	140	0.30
	4020-140-V2N80S8-R05-TN02	2.0	8	2	80	140	0.50
	4030-060-V4.5N16S6-R02-TN01	3.0	6	4.5	16	60	0.20
	4030-065-V4.5N20S6-R02-TN01	3.0	6	4.5	20	65	0.20
	4030-070-V4.5N30S6-R02-TN01	3.0	6	4.5	30	70	0.20
	4030-080-V4.5N40S6-R02-TN01	3.0	6	4.5	40	80	0.20
	4030-090-V4.5N50S6-R02-TN01	3.0	6	4.5	50	90	0.20
	4030-100-V4.5N60S6-R02-TN01	3.0	6	4.5	60	100	0.20

UPRRE4000-TN (Radius)

Long neck irregular flute spacing and lead radius



4 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.000 ~ -0.012

(mm)

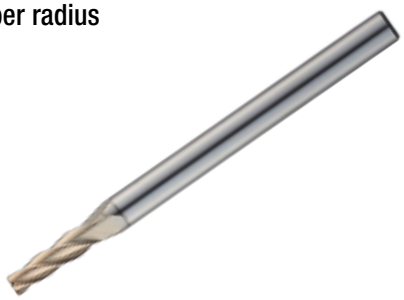
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4030-060-V4.5N16S6-R02-TN02	3.0	6	4.5	16	60	0.20
	4030-065-V4.5N20S6-R02-TN02	3.0	6	4.5	20	65	0.20
	4030-070-V4.5N30S6-R02-TN02	3.0	6	4.5	30	70	0.20
	4030-080-V4.5N40S6-R02-TN02	3.0	6	4.5	40	80	0.20
	4030-060-V4.5N16S6-R03-TN01	3.0	6	4.5	16	60	0.30
	4030-065-V4.5N20S6-R03-TN01	3.0	6	4.5	20	65	0.30
	4030-070-V4.5N30S6-R03-TN01	3.0	6	4.5	30	70	0.30
	4030-080-V4.5N40S6-R03-TN01	3.0	6	4.5	40	80	0.30
	4030-090-V4.5N50S6-R03-TN01	3.0	6	4.5	50	90	0.30
	4030-100-V4.5N60S6-R03-TN01	3.0	6	4.5	60	100	0.30
	4030-060-V4.5N16S6-R03-TN02	3.0	6	4.5	16	60	0.30
	4030-065-V4.5N20S6-R03-TN02	3.0	6	4.5	20	65	0.30
	4030-070-V4.5N30S6-R03-TN02	3.0	6	4.5	30	70	0.30
	4030-080-V4.5N40S6-R03-TN02	3.0	6	4.5	40	80	0.30
	4030-060-V4.5N16S6-R05-TN01	3.0	6	4.5	16	60	0.50
	4030-065-V4.5N20S6-R05-TN01	3.0	6	4.5	20	65	0.50
	4030-070-V4.5N30S6-R05-TN01	3.0	6	4.5	30	70	0.50
	4030-080-V4.5N40S6-R05-TN01	3.0	6	4.5	40	80	0.50
	4030-090-V4.5N50S6-R05-TN01	3.0	6	4.5	50	90	0.50
	4030-100-V4.5N60S6-R05-TN01	3.0	6	4.5	60	100	0.50
	4030-060-V4.5N16S6-R05-TN02	3.0	6	4.5	16	60	0.50
	4030-065-V4.5N20S6-R05-TN02	3.0	6	4.5	20	65	0.50
	4030-070-V4.5N30S6-R05-TN02	3.0	6	4.5	30	70	0.50
	4030-080-V4.5N40S6-R05-TN02	3.0	6	4.5	40	80	0.50
	4030-090-V4.5N50S8-R02-TN02	3.0	8	4.5	50	90	0.20
	4030-100-V4.5N60S8-R02-TN02	3.0	8	4.5	60	100	0.20
	4030-120-V4.5N70S8-R02-TN02	3.0	8	4.5	70	120	0.20
	4030-090-V4.5N50S8-R03-TN02	3.0	8	4.5	50	90	0.30
	4030-100-V4.5N60S8-R03-TN02	3.0	8	4.5	60	100	0.30

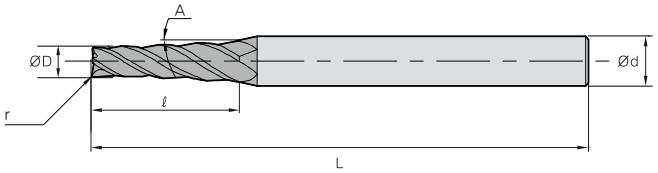
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRRE 4	4030-120-V4.5N70S8-R03-TN02	3.0	8	4.5	70	120	0.30
	4030-090-V4.5N50S8-R05-TN02	3.0	8	4.5	50	90	0.50
	4030-100-V4.5N60S8-R05-TN02	3.0	8	4.5	60	100	0.50
	4030-120-V4.5N70S8-R05-TN02	3.0	8	4.5	70	120	0.50
	4040-090-V6N40S6-R02-TN01	4.0	6	6	40	90	0.20
	4040-100-V6N50S6-R02-TN01	4.0	6	6	50	100	0.20
	4040-110-V6N60S6-R02-TN01	4.0	6	6	60	110	0.20
	4040-090-V6N40S6-R03-TN01	4.0	6	6	40	90	0.30
	4040-100-V6N50S6-R03-TN01	4.0	6	6	50	100	0.30
	4040-110-V6N60S6-R03-TN01	4.0	6	6	60	110	0.30
	4040-090-V6N40S6-R05-TN01	4.0	6	6	40	90	0.50
	4040-100-V6N50S6-R05-TN01	4.0	6	6	50	100	0.50
	4040-110-V6N60S6-R05-TN01	4.0	6	6	60	110	0.50
	4040-120-V6N70S8-R02-TN01	4.0	8	6	70	120	0.20
	4040-090-V6N40S8-R02-TN02	4.0	8	6	40	90	0.20
	4040-100-V6N50S8-R02-TN02	4.0	8	6	50	100	0.20
	4040-110-V6N60S8-R02-TN02	4.0	8	6	60	110	0.20
	4040-120-V6N70S8-R03-TN01	4.0	8	6	70	120	0.30
	4040-090-V6N40S8-R03-TN02	4.0	8	6	40	90	0.30
	4040-100-V6N50S8-R03-TN02	4.0	8	6	50	100	0.30
	4040-110-V6N60S8-R03-TN02	4.0	8	6	60	110	0.30
	4040-120-V6N70S8-R05-TN01	4.0	8	6	70	120	0.50
	4040-090-V6N40S8-R05-TN02	4.0	8	6	40	90	0.50
	4040-100-V6N50S8-R05-TN02	4.0	8	6	50	100	0.50
	4040-110-V6N60S8-R05-TN02	4.0	8	6	60	110	0.50
	4040-120-V6N70S10-R02-TN02	4.0	10	6	70	120	0.20
	4040-120-V6N70S10-R03-TN02	4.0	10	6	70	120	0.30
	4040-120-V6N70S10-R05-TN02	4.0	10	6	70	120	0.50

U+ Endmill

UPTRE4000 (Radius)

Taper radius





4 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

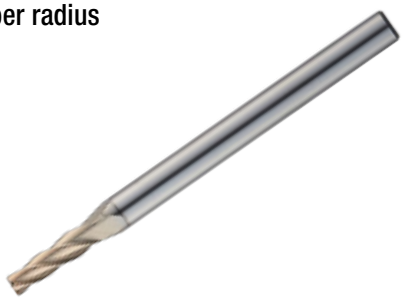
(mm)

	Designation	ØD	Ød	ℓ	L	r	A
UPTRE 4	4008-045-A1V4S04-R01	0.8	4	4	45	0.1	1°
	4008-045-A1.5V4S04-R01	0.8	4	4	45	0.1	1.5°
	4008-045-A1V4S04-R02	0.8	4	4	45	0.2	1°
	4008-045-A1.5V4S04-R02	0.8	4	4	45	0.2	1.5°
	4008-045-A1V6S04-R01	0.8	4	6	45	0.1	1°
	4008-045-A1.5V6S04-R01	0.8	4	6	45	0.1	1.5°
	4008-045-A1V6S04-R02	0.8	4	6	45	0.2	1°
	4008-045-A1.5V6S04-R02	0.8	4	6	45	0.2	1.5°
	4008-045-A1V8S04-R01	0.8	4	8	45	0.1	1°
	4008-045-A1.5V8S04-R01	0.8	4	8	45	0.1	1.5°
	4008-045-A1V8S04-R02	0.8	4	8	45	0.2	1°
	4008-045-A1.5V8S04-R02	0.8	4	8	45	0.2	1.5°
	4010-050-A1V4S04-R01	1.0	4	4	50	0.1	1°
	4010-050-A1.5V4S04-R01	1.0	4	4	50	0.1	1.5°
	4010-050-A2V4S04-R01	1.0	4	4	50	0.1	2°
	4010-050-A3V4S04-R01	1.0	4	4	50	0.1	3°
	4010-050-A1V4S04-R02	1.0	4	4	50	0.2	1°
	4010-050-A1.5V4S04-R02	1.0	4	4	50	0.2	1.5°
	4010-050-A2V4S04-R02	1.0	4	4	50	0.2	2°
	4010-050-A3V4S04-R02	1.0	4	4	50	0.2	3°
	4010-050-A1V4S04-R03	1.0	4	4	50	0.3	1°
	4010-050-A1.5V4S04-R03	1.0	4	4	50	0.3	1.5°
	4010-050-A2V4S04-R03	1.0	4	4	50	0.3	2°
	4010-050-A3V4S04-R03	1.0	4	4	50	0.3	3°
	4010-050-A1V6S04-R01	1.0	4	6	50	0.1	1°
	4010-050-A1.5V6S04-R01	1.0	4	6	50	0.1	1.5°
	4010-050-A2V6S04-R01	1.0	4	6	50	0.1	2°
	4010-050-A3V6S04-R01	1.0	4	6	50	0.1	3°
	4010-050-A1V6S04-R02	1.0	4	6	50	0.2	1°
	4010-050-A1.5V6S04-R02	1.0	4	6	50	0.2	1.5°
	4010-050-A2V6S04-R02	1.0	4	6	50	0.2	2°
	4010-050-A3V6S04-R02	1.0	4	6	50	0.2	3°
	4010-050-A1V6S04-R03	1.0	4	6	50	0.3	1°
	4010-050-A1.5V6S04-R03	1.0	4	6	50	0.3	1.5°

	Designation	ØD	Ød	ℓ	L	r	A
UPTRE 4	4010-050-A2V6S04-R03	1.0	4	6	50	0.30	2°
	4010-050-A3V6S04-R03	1.0	4	6	50	0.30	3°
	4010-050-A1V8S04-R01	1.0	4	8	50	0.10	1°
	4010-050-A1.5V8S04-R01	1.0	4	8	50	0.10	1.5°
	4010-050-A2V8S04-R01	1.0	4	8	50	0.10	2°
	4010-050-A3V8S04-R01	1.0	4	8	50	0.10	3°
	4010-050-A1V8S04-R02	1.0	4	8	50	0.20	1°
	4010-050-A1.5V8S04-R02	1.0	4	8	50	0.20	1.5°
	4010-050-A2V8S04-R02	1.0	4	8	50	0.20	2°
	4010-050-A3V8S04-R02	1.0	4	8	50	0.20	3°
	4010-050-A1V8S04-R03	1.0	4	8	50	0.30	1°
	4010-050-A1.5V8S04-R03	1.0	4	8	50	0.30	1.5°
	4010-050-A2V8S04-R03	1.0	4	8	50	0.30	2°
	4010-050-A3V8S04-R03	1.0	4	8	50	0.30	3°
	4010-050-A1V10S04-R01	1.0	4	10	50	0.10	1°
	4010-050-A1.5V10S04-R01	1.0	4	10	50	0.10	1.5°
	4010-050-A2V10S04-R01	1.0	4	10	50	0.10	2°
	4010-050-A3V10S04-R01	1.0	4	10	50	0.10	3°
	4010-050-A1V10S04-R02	1.0	4	10	50	0.20	1°
	4010-050-A1.5V10S04-R02	1.0	4	10	50	0.20	1.5°
	4010-050-A2V10S04-R02	1.0	4	10	50	0.20	2°
	4010-050-A3V10S04-R02	1.0	4	10	50	0.20	3°
	4010-050-A1V10S04-R03	1.0	4	10	50	0.30	1°
	4010-050-A1.5V10S04-R03	1.0	4	10	50	0.30	1.5°
	4010-050-A2V10S04-R03	1.0	4	10	50	0.30	2°
	4010-050-A3V10S04-R03	1.0	4	10	50	0.30	3°
	4010-050-A1V12S04-R01	1.0	4	12	50	0.10	1°
	4010-050-A1.5V12S04-R01	1.0	4	12	50	0.10	1.5°
	4010-050-A2V12S04-R01	1.0	4	12	50	0.10	2°
	4010-050-A3V12S04-R01	1.0	4	12	50	0.10	3°
	4010-050-A1V12S04-R02	1.0	4	12	50	0.20	1°
	4010-050-A1.5V12S04-R02	1.0	4	12	50	0.20	1.5°
	4010-050-A2V12S04-R02	1.0	4	12	50	0.20	2°
	4010-050-A3V12S04-R02	1.0	4	12	50	0.20	3°

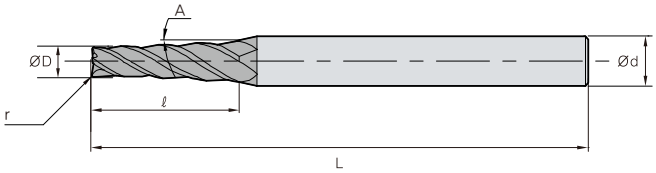
UPTRE4000 (Radius)

Taper radius



4 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03



(mm)

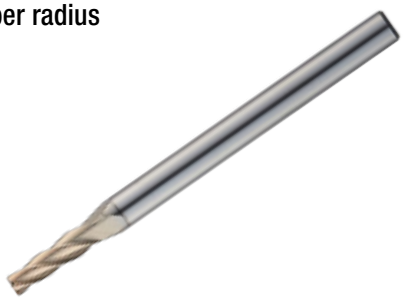
	Designation	ØD	Ød	ℓ	L	r	A
UPTRE 4	4010-050-A1V12S04-R03	1.0	4	12	50	0.30	1°
	4010-050-A1.5V12S04-R03	1.0	4	12	50	0.30	1.5°
	4010-050-A2V12S04-R03	1.0	4	12	50	0.30	2°
	4010-050-A3V12S04-R03	1.0	4	12	50	0.30	3°
	4012-050-A1V6S04-R01	1.2	4	6	50	0.10	1°
	4012-050-A2V6S04-R01	1.2	4	6	50	0.10	2°
	4012-050-A3V6S04-R01	1.2	4	6	50	0.10	3°
	4012-050-A1V6S04-R02	1.2	4	6	50	0.20	1°
	4012-050-A2V6S04-R02	1.2	4	6	50	0.20	2°
	4012-050-A3V6S04-R02	1.2	4	6	50	0.20	3°
	4012-050-A1V6S04-R03	1.2	4	6	50	0.30	1°
	4012-050-A2V6S04-R03	1.2	4	6	50	0.30	2°
	4012-050-A3V6S04-R03	1.2	4	6	50	0.30	3°
	4012-050-A1V8S04-R01	1.2	4	8	50	0.10	1°
	4012-050-A2V8S04-R01	1.2	4	8	50	0.10	2°
	4012-050-A3V8S04-R01	1.2	4	8	50	0.10	3°
	4012-050-A1V8S04-R02	1.2	4	8	50	0.20	1°
	4012-050-A2V8S04-R02	1.2	4	8	50	0.20	2°
	4012-050-A3V8S04-R02	1.2	4	8	50	0.20	3°
	4012-050-A1V8S04-R03	1.2	4	8	50	0.30	1°
	4012-050-A2V8S04-R03	1.2	4	8	50	0.30	2°
	4012-050-A3V8S04-R03	1.2	4	8	50	0.30	3°
	4012-050-A1V10S04-R01	1.2	4	10	50	0.10	1°
	4012-050-A2V10S04-R01	1.2	4	10	50	0.10	2°
	4012-050-A3V10S04-R01	1.2	4	10	50	0.10	3°
	4012-050-A1V10S04-R02	1.2	4	10	50	0.20	1°
	4012-050-A2V10S04-R02	1.2	4	10	50	0.20	2°
	4012-050-A3V10S04-R02	1.2	4	10	50	0.20	3°
	4012-050-A1V10S04-R03	1.2	4	10	50	0.30	1°
	4012-050-A2V10S04-R03	1.2	4	10	50	0.30	2°
	4012-050-A3V10S04-R03	1.2	4	10	50	0.30	3°
	4012-050-A1V12S04-R01	1.2	4	12	50	0.10	1°
	4012-050-A2V12S04-R01	1.2	4	12	50	0.10	2°
	4012-050-A3V12S04-R01	1.2	4	12	50	0.10	3°

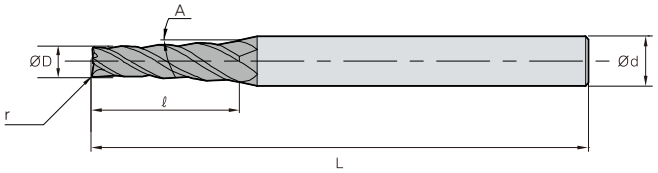
	Designation	ØD	Ød	ℓ	L	r	A
UPTRE 4	4012-050-A1V12S04-R02	1.2	4	12	50	0.20	1°
	4012-050-A2V12S04-R02	1.2	4	12	50	0.20	2°
	4012-050-A3V12S04-R02	1.2	4	12	50	0.20	3°
	4012-050-A1V12S04-R03	1.2	4	12	50	0.30	1°
	4012-050-A2V12S04-R03	1.2	4	12	50	0.30	2°
	4012-050-A3V12S04-R03	1.2	4	12	50	0.30	3°
	4015-050-A1V6S04-R01	1.5	4	6	50	0.10	1°
	4015-050-A2V6S04-R01	1.5	4	6	50	0.10	2°
	4015-050-A3V6S04-R01	1.5	4	6	50	0.10	3°
	4015-050-A1V6S04-R02	1.5	4	6	50	0.20	1°
	4015-050-A2V6S04-R02	1.5	4	6	50	0.20	2°
	4015-050-A3V6S04-R02	1.5	4	6	50	0.20	3°
	4015-050-A1V6S04-R03	1.5	4	6	50	0.30	1°
	4015-050-A2V6S04-R03	1.5	4	6	50	0.30	2°
	4015-050-A3V6S04-R03	1.5	4	6	50	0.30	3°
	4015-050-A1V8S04-R01	1.5	4	8	50	0.10	1°
	4015-050-A2V8S04-R01	1.5	4	8	50	0.10	2°
	4015-050-A3V8S04-R01	1.5	4	8	50	0.10	3°
	4015-050-A1V8S04-R02	1.5	4	8	50	0.20	1°
	4015-050-A2V8S04-R02	1.5	4	8	50	0.20	2°
	4015-050-A3V8S04-R02	1.5	4	8	50	0.20	3°
	4015-050-A1V8S04-R03	1.5	4	8	50	0.30	1°
	4015-050-A2V8S04-R03	1.5	4	8	50	0.30	2°
	4015-050-A3V8S04-R03	1.5	4	8	50	0.30	3°
	4015-050-A1V10S04-R01	1.5	4	10	50	0.10	1°
	4015-050-A2V10S04-R01	1.5	4	10	50	0.10	2°
	4015-050-A3V10S04-R01	1.5	4	10	50	0.10	3°
	4015-050-A1V10S04-R02	1.5	4	10	50	0.20	1°
	4015-050-A2V10S04-R02	1.5	4	10	50	0.20	2°
	4015-050-A3V10S04-R02	1.5	4	10	50	0.20	3°
	4015-050-A1V10S04-R03	1.5	4	10	50	0.30	1°
	4015-050-A2V10S04-R03	1.5	4	10	50	0.30	2°
	4015-050-A3V10S04-R03	1.5	4	10	50	0.30	3°
	4015-050-A1V12S04-R01	1.5	4	12	50	0.10	1°

U+ Endmill

UPTRE4000 (Radius)

Taper radius





4	H·A 30°	h6 shank	Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

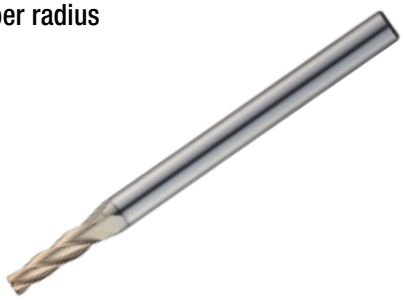
(mm)

	Designation	ØD	Ød	ℓ	L	r	A
UPTRE	4015-050-A2V12S04-R01	1.5	4	12	50	0.10	2°
4	4015-050-A3V12S04-R01	1.5	4	12	50	0.10	3°
	4015-050-A1V12S04-R02	1.5	4	12	50	0.20	1°
	4015-050-A2V12S04-R02	1.5	4	12	50	0.20	2°
	4015-050-A3V12S04-R02	1.5	4	12	50	0.20	3°
	4015-050-A1V12S04-R03	1.5	4	12	50	0.30	1°
	4015-050-A2V12S04-R03	1.5	4	12	50	0.30	2°
	4015-050-A3V12S04-R03	1.5	4	12	50	0.30	3°
	4015-050-A1V16S04-R01	1.5	4	16	50	0.10	1°
	4015-050-A2V16S04-R01	1.5	4	16	50	0.10	2°
	4015-050-A3V16S04-R01	1.5	4	16	50	0.10	3°
	4015-050-A1V16S04-R02	1.5	4	16	50	0.20	1°
	4015-050-A2V16S04-R02	1.5	4	16	50	0.20	2°
	4015-050-A3V16S04-R02	1.5	4	16	50	0.20	3°
	4015-050-A1V16S04-R03	1.5	4	16	50	0.30	1°
	4015-050-A2V16S04-R03	1.5	4	16	50	0.30	2°
	4015-050-A3V16S04-R03	1.5	4	16	50	0.30	3°
	4015-060-A1V20S04-R01	1.5	4	20	60	0.10	1°
	4015-060-A2V20S04-R01	1.5	4	20	60	0.10	2°
	4015-060-A3V20S04-R01	1.5	4	20	60	0.10	3°
	4015-060-A1V20S04-R02	1.5	4	20	60	0.20	1°
	4015-060-A2V20S04-R02	1.5	4	20	60	0.20	2°
	4015-060-A3V20S04-R02	1.5	4	20	60	0.20	3°
	4015-060-A1V20S04-R03	1.5	4	20	60	0.30	1°
	4015-060-A2V20S04-R03	1.5	4	20	60	0.30	2°
	4015-060-A3V20S04-R03	1.5	4	20	60	0.30	3°
	4020-050-A1V8S04-R01	2.0	4	8	50	0.10	1°
	4020-050-A2V8S04-R01	2.0	4	8	50	0.10	2°
	4020-050-A3V8S04-R01	2.0	4	8	50	0.10	3°
	4020-050-A1V8S04-R02	2.0	4	8	50	0.20	1°
	4020-050-A2V8S04-R02	2.0	4	8	50	0.20	2°
	4020-050-A3V8S04-R02	2.0	4	8	50	0.20	3°
	4020-050-A1V8S04-R03	2.0	4	8	50	0.30	1°
	4020-050-A2V8S04-R03	2.0	4	8	50	0.30	2°

	Designation	ØD	Ød	ℓ	L	r	A
UPTRE	4020-050-A3V8S04-R03	2.0	4	8	50	0.30	3°
4	4020-050-A1V10S04-R01	2.0	4	10	50	0.10	1°
	4020-050-A2V10S04-R01	2.0	4	10	50	0.10	2°
	4020-050-A3V10S04-R01	2.0	4	10	50	0.10	3°
	4020-050-A1V10S04-R02	2.0	4	10	50	0.20	1°
	4020-050-A2V10S04-R02	2.0	4	10	50	0.20	2°
	4020-050-A3V10S04-R02	2.0	4	10	50	0.20	3°
	4020-050-A1V10S04-R03	2.0	4	10	50	0.30	1°
	4020-050-A2V10S04-R03	2.0	4	10	50	0.30	2°
	4020-050-A3V10S04-R03	2.0	4	10	50	0.30	3°
	4020-050-A1V12S04-R01	2.0	4	12	50	0.10	1°
	4020-050-A2V12S04-R01	2.0	4	12	50	0.10	2°
	4020-050-A3V12S04-R01	2.0	4	12	50	0.10	3°
	4020-050-A1V12S04-R02	2.0	4	12	50	0.20	1°
	4020-050-A2V12S04-R02	2.0	4	12	50	0.20	2°
	4020-050-A3V12S04-R02	2.0	4	12	50	0.20	3°
	4020-050-A1V12S04-R03	2.0	4	12	50	0.30	1°
	4020-050-A2V12S04-R03	2.0	4	12	50	0.30	2°
	4020-050-A3V12S04-R03	2.0	4	12	50	0.30	3°
	4020-050-A1V16S04-R01	2.0	4	16	50	0.10	1°
	4020-050-A2V16S04-R01	2.0	4	16	50	0.10	2°
	4020-050-A3V16S04-R01	2.0	4	16	50	0.10	3°
	4020-050-A1V16S04-R02	2.0	4	16	50	0.20	1°
	4020-050-A2V16S04-R02	2.0	4	16	50	0.20	2°
	4020-050-A3V16S04-R02	2.0	4	16	50	0.20	3°
	4020-050-A1V16S04-R03	2.0	4	16	50	0.30	1°
	4020-050-A2V16S04-R03	2.0	4	16	50	0.30	2°
	4020-050-A3V16S04-R03	2.0	4	16	50	0.30	3°
	4020-060-A1V20S04-R01	2.0	4	20	60	0.10	1°
	4020-060-A2V20S04-R01	2.0	4	20	60	0.10	2°
	4020-060-A1V20S04-R02	2.0	4	20	60	0.20	1°
	4020-060-A2V20S04-R02	2.0	4	20	60	0.20	2°
	4020-060-A1V20S04-R03	2.0	4	20	60	0.30	1°
	4020-060-A2V20S04-R03	2.0	4	20	60	0.30	2°

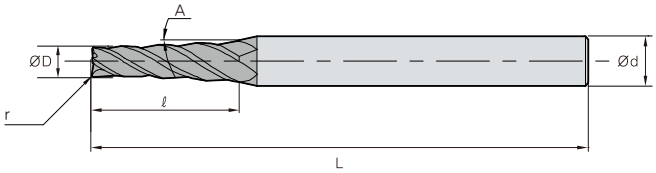
UPTRE4000 (Radius)

Taper radius



4 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03



(mm)

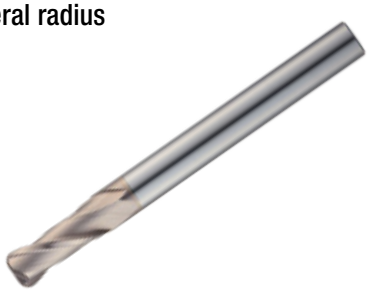
	Designation	ØD	Ød	ℓ	L	r	A
UPTRE 4	4020-060-A3V20S06-R01	2.0	6	20	60	0.10	3°
	4020-060-A3V20S06-R02	2.0	6	20	60	0.20	3°
	4020-060-A3V20S06-R03	2.0	6	20	60	0.30	3°
	4020-060-A1V25S04-R01	2.0	4	25	60	0.10	1°
	4020-060-A2V25S04-R01	2.0	4	25	60	0.10	2°
	4020-060-A1V25S04-R02	2.0	4	25	60	0.20	1°
	4020-060-A2V25S04-R02	2.0	4	25	60	0.20	2°
	4020-060-A1V25S04-R03	2.0	4	25	60	0.30	1°
	4020-060-A2V25S04-R03	2.0	4	25	60	0.30	2°
	4020-060-A3V25S06-R01	2.0	6	25	60	0.10	3°
	4020-060-A3V25S06-R02	2.0	6	25	60	0.20	3°
	4020-060-A3V25S06-R03	2.0	6	25	60	0.30	3°
	4025-050-A1V10S04-R01	2.5	4	10	50	0.10	1°
	4025-050-A2V10S04-R01	2.5	4	10	50	0.10	2°
	4025-050-A3V10S04-R01	2.5	4	10	50	0.10	3°
	4025-050-A1V10S04-R02	2.5	4	10	50	0.20	1°
	4025-050-A2V10S04-R02	2.5	4	10	50	0.20	2°
	4025-050-A3V10S04-R02	2.5	4	10	50	0.20	3°
	4025-050-A1V10S04-R03	2.5	4	10	50	0.30	1°
	4025-050-A2V10S04-R03	2.5	4	10	50	0.30	2°
	4025-050-A3V10S04-R03	2.5	4	10	50	0.30	3°
	4025-050-A1V12S04-R01	2.5	4	12	50	0.10	1°
	4025-050-A2V12S04-R01	2.5	4	12	50	0.10	2°
	4025-050-A3V12S04-R01	2.5	4	12	50	0.10	3°
	4025-050-A1V12S04-R02	2.5	4	12	50	0.20	1°
	4025-050-A2V12S04-R02	2.5	4	12	50	0.20	2°
	4025-050-A3V12S04-R02	2.5	4	12	50	0.20	3°
	4025-050-A1V12S04-R03	2.5	4	12	50	0.30	1°
	4025-050-A2V12S04-R03	2.5	4	12	50	0.30	2°
	4025-050-A3V12S04-R03	2.5	4	12	50	0.30	3°
	4025-050-A1V16S04-R01	2.5	4	16	50	0.10	1°
	4025-050-A2V16S04-R01	2.5	4	16	50	0.10	2°
	4025-050-A1V16S04-R02	2.5	4	16	50	0.20	1°

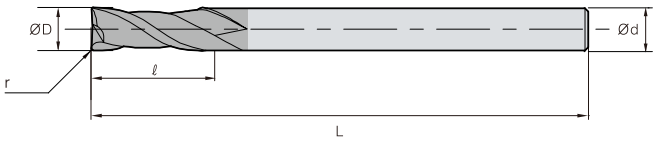
	Designation	ØD	Ød	ℓ	L	r	A
UPTRE 4	4025-050-A2V16S04-R02	2.5	4	16	50	0.20	2°
	4025-050-A1V16S04-R03	2.5	4	16	50	0.30	1°
	4025-050-A2V16S04-R03	2.5	4	16	50	0.30	2°
	4025-050-A3V16S06-R01	2.5	6	16	50	0.10	3°
	4025-050-A3V16S06-R02	2.5	6	16	50	0.20	3°
	4025-050-A3V16S06-R03	2.5	6	16	50	0.30	3°
	4025-060-A1V20S04-R01	2.5	4	20	60	0.10	1°
	4025-060-A2V20S04-R01	2.5	4	20	60	0.10	2°
	4025-060-A1V20S04-R02	2.5	4	20	60	0.20	1°
	4025-060-A2V20S04-R02	2.5	4	20	60	0.20	2°
	4025-060-A1V20S04-R03	2.5	4	20	60	0.30	1°
	4025-060-A2V20S04-R03	2.5	4	20	60	0.30	2°
	4025-060-A3V20S06-R01	2.5	6	20	60	0.10	3°
	4025-060-A3V20S06-R02	2.5	6	20	60	0.20	3°
	4025-060-A3V20S06-R03	2.5	6	20	60	0.30	3°
	4025-060-A1V25S04-R01	2.5	4	25	60	0.10	1°
	4025-060-A3V25S04-R01	2.5	4	25	60	0.10	3°
	4025-060-A1V25S04-R02	2.5	4	25	60	0.20	1°
	4025-060-A1V25S04-R03	2.5	4	25	60	0.30	1°
	4025-060-A2V25S06-R01	2.5	6	25	60	0.10	2°
	4025-060-A2V25S06-R02	2.5	6	25	60	0.20	2°
	4025-060-A3V25S06-R02	2.5	6	25	60	0.20	3°
	4025-060-A2V25S06-R03	2.5	6	25	60	0.30	2°
	4025-060-A3V25S06-R03	2.5	6	25	60	0.30	3°
	4025-060-A1V30S04-R01	2.5	4	30	60	0.10	1°
	4025-060-A1V30S04-R02	2.5	4	30	60	0.20	1°
	4025-060-A1V30S04-R03	2.5	4	30	60	0.30	1°
	4025-060-A2V30S06-R01	2.5	6	30	60	0.10	2°
	4025-060-A3V30S06-R01	2.5	6	30	60	0.10	3°
	4025-060-A2V30S06-R02	2.5	6	30	60	0.20	2°
	4025-060-A3V30S06-R02	2.5	6	30	60	0.20	3°
	4025-060-A2V30S06-R03	2.5	6	30	60	0.30	2°
	4025-060-A3V30S06-R03	2.5	6	30	60	0.30	3°

U+ Endmill

UPRE2000 (Radius)

General radius





2 | H-A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
Ø0.2 ~ Ø6.0	0.000 ~ -0.012
Ø7.0 ~ Ø20.0	0.000 ~ -0.015

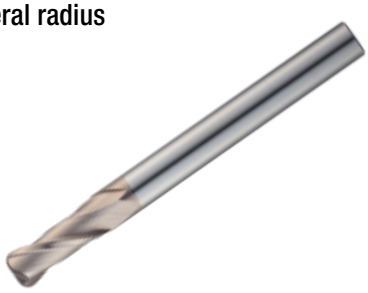
(mm)

	Designation	ØD	Ød	ℓ	L	r
UPRE 2	2002-040-S04-R002	0.2	4	0.4	40	0.02
	2002-040-S04-R005	0.2	4	0.4	40	0.05
	2003-040-S04-R002	0.3	4	0.6	40	0.02
	2003-040-S04-R005	0.3	4	0.6	40	0.05
	2004-040-S04-R005	0.4	4	0.8	40	0.05
	2004-040-S04-R01	0.4	4	0.8	40	0.10
	2005-040-S04-R005	0.5	4	1	40	0.05
	2005-040-S04-R01	0.5	4	1	40	0.10
	2006-040-S04-R005	0.6	4	1.2	40	0.05
	2006-040-S04-R01	0.6	4	1.2	40	0.10
	2006-040-S04-R02	0.6	4	1.2	40	0.20
	2007-040-S04-R005	0.7	4	1.4	40	0.05
	2007-040-S04-R01	0.7	4	1.4	40	0.10
	2007-040-S04-R02	0.7	4	1.4	40	0.20
	2008-040-S04-R005	0.8	4	1.6	40	0.05
	2008-040-S04-R01	0.8	4	1.6	40	0.10
	2008-040-S04-R02	0.8	4	1.6	40	0.20
	2009-040-S04-R005	0.9	4	1.8	40	0.05
	2009-040-S04-R01	0.9	4	1.8	40	0.10
	2010-050-S06-R005	1.0	6	2.5	50	0.05
	2010-050-S06-R01	1.0	6	2.5	50	0.10
	2010-050-S06-R02	1.0	6	2.5	50	0.20
	2010-050-S06-R03	1.0	6	2.5	50	0.30
	2012-050-S06-R005	1.2	6	3	50	0.05
	2012-050-S06-R01	1.2	6	3	50	0.10
	2012-050-S06-R02	1.2	6	3	50	0.20
	2012-050-S06-R03	1.2	6	3	50	0.30
	2015-050-S06-R005	1.5	6	4	50	0.05
	2015-050-S06-R01	1.5	6	4	50	0.10
	2015-050-S06-R02	1.5	6	4	50	0.20
	2015-050-S06-R03	1.5	6	4	50	0.30
	2015-050-S06-R05	1.5	6	4	50	0.50
	2020-050-S06-R01	2.0	6	6	50	0.10
	2020-050-S06-R02	2.0	6	6	50	0.20

	Designation	ØD	Ød	ℓ	L	r
UPRE 2	2020-050-S06-R03	2.0	6	6	50	0.30
	2020-050-S06-R05	2.0	6	6	50	0.50
	2025-060-S06-R01	2.5	6	7	60	0.10
	2025-060-S06-R02	2.5	6	7	60	0.20
	2025-060-S06-R03	2.5	6	7	60	0.30
	2025-060-S06-R05	2.5	6	7	60	0.50
	2030-060-S06-R01	3.0	6	8	60	0.10
	2030-060-S06-R02	3.0	6	8	60	0.20
	2030-060-S06-R03	3.0	6	8	60	0.30
	2030-060-S06-R05	3.0	6	8	60	0.50
	2030-060-S06-R10	3.0	6	8	60	1.00
	2035-070-S06-R01	3.5	6	10	70	0.10
	2035-070-S06-R02	3.5	6	10	70	0.20
	2035-070-S06-R03	3.5	6	10	70	0.30
	2035-070-S06-R05	3.5	6	10	70	0.50
	2040-100-S04-R01	4.0	4	10	100	0.10
	2040-070-S04-R01	4.0	4	10	70	0.10
	2040-100-S04-R02	4.0	4	10	100	0.20
	2040-070-S04-R02	4.0	4	10	70	0.20
	2040-100-S04-R03	4.0	4	10	100	0.30
	2040-070-S04-R03	4.0	4	10	70	0.30
	2040-100-S04-R05	4.0	4	10	100	0.50
	2040-070-S04-R05	4.0	4	10	70	0.50
	2040-100-S04-R10	4.0	4	10	100	1.00
	2040-070-S04-R10	4.0	4	10	70	1.00
	2040-070-S06-R01	4.0	6	10	70	0.10
	2040-070-S06-R02	4.0	6	10	70	0.20
	2040-070-S06-R03	4.0	6	10	70	0.30
	2040-070-S06-R05	4.0	6	10	70	0.50
	2040-070-S06-R10	4.0	6	10	70	1.00
	2045-080-S06-R01	4.5	6	11	80	0.10
	2045-080-S06-R02	4.5	6	11	80	0.20
	2045-080-S06-R03	4.5	6	11	80	0.30
	2045-080-S06-R05	4.5	6	11	80	0.50

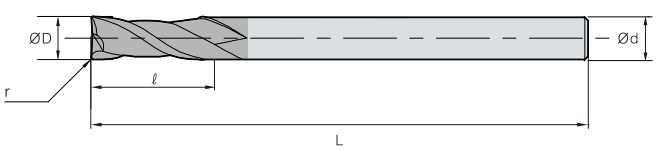
UPRE2000 (Radius)

General radius



2 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
Ø0.2 ~ Ø6.0	0.000 ~ -0.012
Ø7.0 ~ Ø20.0	0.000 ~ -0.015



(mm)

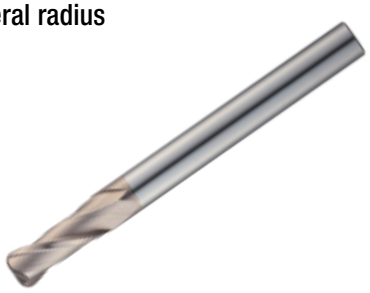
	Designation	ØD	Ød	ℓ	L	r
UPRE 2	2050-090-S06-R01	5.0	6	13	90	0.10
	2050-090-S06-R02	5.0	6	13	90	0.20
	2050-090-S06-R03	5.0	6	13	90	0.30
	2050-090-S06-R05	5.0	6	13	90	0.50
	2050-090-S06-R10	5.0	6	13	90	1.00
	2055-090-S06-R01	5.5	6	13	90	0.10
	2055-090-S06-R02	5.5	6	13	90	0.20
	2055-090-S06-R03	5.5	6	13	90	0.30
	2055-090-S06-R05	5.5	6	13	90	0.50
	2055-090-S06-R10	5.5	6	13	90	1.00
	2060-090-S06-R01	6.0	6	15	90	0.10
	2060-090-S06-R02	6.0	6	15	90	0.20
	2060-090-S06-R03	6.0	6	15	90	0.30
	2060-060-S06-R03	6.0	6	15	60	0.30
	2060-090-S06-R05	6.0	6	15	90	0.50
	2060-110-S06-R05	6.0	6	15	110	0.50
	2060-130-S06-R05	6.0	6	15	130	0.50
	2060-060-S06-R05	6.0	6	15	60	0.50
	2060-090-S06-R10	6.0	6	15	90	1.00
	2060-110-S06-R10	6.0	6	15	110	1.00
	2060-130-S06-R10	6.0	6	15	130	1.00
	2060-060-S06-R10	6.0	6	15	60	1.00
	2060-090-S06-R15	6.0	6	15	90	1.50
	2060-090-S06-R20	6.0	6	15	90	2.00
	2070-090-S08-R01	7.0	8	16	90	0.10
	2070-090-S08-R02	7.0	8	16	90	0.20
	2070-090-S08-R03	7.0	8	16	90	0.30
	2070-090-S08-R05	7.0	8	16	90	0.50
	2070-090-S08-R10	7.0	8	16	90	1.00
	2070-090-S08-R20	7.0	8	16	90	2.00
	2080-100-S08-R01	8.0	8	20	100	0.10
	2080-100-S08-R02	8.0	8	20	100	0.20
	2080-100-S08-R03	8.0	8	20	100	0.30
	2080-070-S08-R03	8.0	8	20	70	0.30

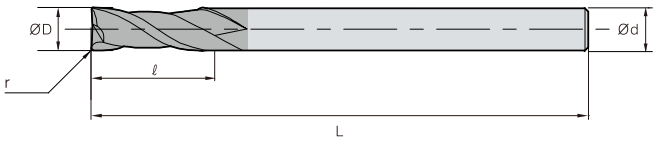
	Designation	ØD	Ød	ℓ	L	r
UPRE 2	2080-100-S08-R05	8.0	8	20	100	0.50
	2080-120-S08-R05	8.0	8	20	120	0.50
	2080-150-S08-R05	8.0	8	20	150	0.50
	2080-070-S08-R05	8.0	8	20	70	0.50
	2080-100-S08-R10	8.0	8	20	100	1.00
	2080-120-S08-R10	8.0	8	20	120	1.00
	2080-150-S08-R10	8.0	8	20	150	1.00
	2080-070-S08-R10	8.0	8	20	70	1.00
	2080-100-S08-R15	8.0	8	20	100	1.50
	2080-100-S08-R20	8.0	8	20	100	2.00
	2080-100-S08-R25	8.0	8	20	100	2.5
	2080-100-S08-R30	8.0	8	20	100	3.00
	2100-100-S10-R01	10.0	10	25	100	0.10
	2100-100-S10-R02	10.0	10	25	100	0.20
	2100-100-S10-R03	10.0	10	25	100	0.30
	2100-075-S10-R03	10.0	10	25	75	0.30
	2100-100-S10-R05	10.0	10	25	100	0.50
	2100-130-S10-R05	10.0	10	25	130	0.50
	2100-150-S10-R05	10.0	10	25	150	0.50
	2100-075-S10-R05	10.0	10	25	75	0.50
	2100-100-S10-R10	10.0	10	25	100	1.00
	2100-130-S10-R10	10.0	10	25	130	1.00
	2100-150-S10-R10	10.0	10	25	150	1.00
	2100-075-S10-R10	10.0	10	25	75	1.00
	2100-100-S10-R15	10.0	10	25	100	1.50
	2100-100-S10-R20	10.0	10	25	100	2.00
	2100-100-S10-R25	10.0	10	25	100	2.50
	2100-100-S10-R30	10.0	10	25	100	3.00
	2100-100-S10-R40	10.0	10	25	100	4.00
	2110-110-S12-R02	11.0	12	25	110	0.20
	2110-110-S12-R03	11.0	12	25	110	0.30
	2110-110-S12-R05	11.0	12	25	110	0.50
	2110-110-S12-R10	11.0	12	25	110	1.00
	2110-110-S12-R20	11.0	12	25	110	2.00

U+ Endmill

UPRE2000 (Radius)

General radius





2 | H·A 30° | h6 shank | Substrate PC315W

ØD	Tolerance
Ø0.2 ~ Ø6.0	0.000 ~ -0.012
Ø7.0 ~ Ø20.0	0.000 ~ -0.015

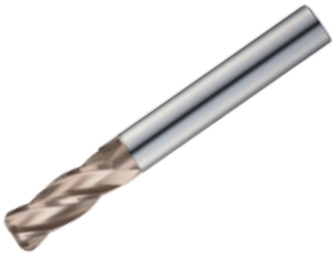
(mm)

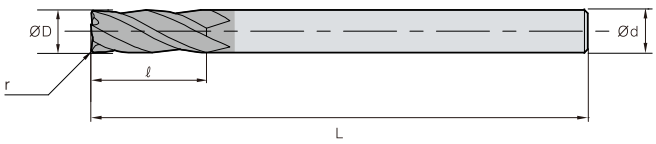
	Designation	ØD	Ød	ℓ	L	r
UPRE 2	2120-110-S12-R01	12.0	12	30	110	0.10
	2120-110-S12-R02	12.0	12	30	110	0.20
	2120-110-S12-R03	12.0	12	30	110	0.30
	2120-080-S12-R03	12.0	12	30	80	0.30
	2120-110-S12-R05	12.0	12	30	110	0.50
	2120-130-S12-R05	12.0	12	30	130	0.50
	2120-150-S12-R05	12.0	12	30	150	0.50
	2120-080-S12-R05	12.0	12	30	80	0.50
	2120-110-S12-R10	12.0	12	30	110	1.00
	2120-130-S12-R10	12.0	12	30	130	1.00
	2120-150-S12-R10	12.0	12	30	150	1.00
	2120-080-S12-R10	12.0	12	30	80	1.00
	2120-110-S12-R15	12.0	12	30	110	1.50
	2120-110-S12-R20	12.0	12	30	110	2.00
	2120-110-S12-R25	12.0	12	30	110	2.50

	Designation	ØD	Ød	ℓ	L	r
UPRE 2	2120-110-S12-R30	12.0	12	30	110	3.00
	2120-110-S12-R40	12.0	12	30	110	4.00
	2120-110-S12-R50	12.0	12	30	110	5.00
	2140-150-S16-R05	14.0	16	30	150	0.50
	2140-150-S16-R10	14.0	16	30	150	1.00
	2140-150-S16-R20	14.0	16	30	150	2.00
	2160-150-S16-R05	16.0	16	32	150	0.50
	2160-150-S16-R10	16.0	16	32	150	1.00
	2160-150-S16-R15	16.0	16	32	150	1.50
	2160-150-S16-R20	16.0	16	32	150	2.00
	2200-150-S20-R05	20.0	20	38	150	0.50
	2200-150-S20-R10	20.0	20	38	150	1.00
	2200-150-S20-R15	20.0	20	38	150	1.50
	2200-150-S20-R20	20.0	20	38	150	2.00

UPRE4000-U38 (Radius)

Long neck radius





4 | H·A 38° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

(mm)

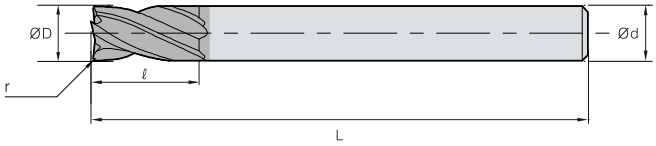
	Designation	ØD	Ød	ℓ	L	r
UPRE 4	4030-060-S06-R02-U38	3.0	6	8	60	0.20
	4030-060-S06-R03-U38	3.0	6	8	60	0.30
	4030-060-S06-R05-U38	3.0	6	8	60	0.50
	4040-070-S06-R02-U38	4.0	6	10	70	0.20
	4040-070-S06-R03-U38	4.0	6	10	70	0.30
	4040-070-S06-R05-U38	4.0	6	10	70	0.50
	4040-070-S06-R10-U38	4.0	6	10	70	1.00
	4050-090-S06-R03-U38	5.0	6	13	90	0.30
	4050-060-S06-R03-U38	5.0	6	13	60	0.30
	4050-090-S06-R05-U38	5.0	6	13	90	0.50
	4050-060-S06-R05-U38	5.0	6	13	60	0.50
	4060-090-S06-R03-U38	6.0	6	15	90	0.30
	4060-060-S06-R03-U38	6.0	6	15	60	0.30
	4060-090-S06-R05-U38	6.0	6	15	90	0.50
	4060-060-S06-R05-U38	6.0	6	15	60	0.50
	4060-090-S06-R10-U38	6.0	6	15	90	1.00
	4060-060-S06-R10-U38	6.0	6	15	60	1.00
	4080-100-S08-R03-U38	8.0	8	20	100	0.30
	4080-070-S08-R03-U38	8.0	8	20	70	0.30
	4080-100-S08-R05-U38	8.0	8	20	100	0.50
	4080-070-S08-R05-U38	8.0	8	20	70	0.50
	4080-100-S08-R10-U38	8.0	8	20	100	1.00
	4080-070-S08-R10-U38	8.0	8	20	70	1.00
	4100-100-S10-R03-U38	10.0	10	25	100	0.30
	4100-075-S10-R03-U38	10.0	10	25	75	0.30
	4100-100-S10-R05-U38	10.0	10	25	100	0.50

	Designation	ØD	Ød	ℓ	L	r
UPRE 4	4100-075-S10-R05-U38	10.0	10	25	75	0.50
	4100-100-S10-R10-U38	10.0	10	25	100	1.00
	4100-075-S10-R10-U38	10.0	10	25	75	1.00
	4120-110-S12-R03-U38	12.0	12	30	110	0.30
	4120-080-S12-R03-U38	12.0	12	30	80	0.30
	4120-110-S12-R05-U38	12.0	12	30	110	0.50
	4120-080-S12-R05-U38	12.0	12	30	80	0.50
	4120-110-S12-R10-U38	12.0	12	30	110	1.00
	4120-080-S12-R10-U38	12.0	12	30	80	1.00
	4160-150-S16-R05-U38	16.0	16	32	150	0.50
	4160-100-S16-R05-U38	16.0	16	32	100	0.50
	4160-150-S16-R10-U38	16.0	16	32	150	1.00
	4160-100-S16-R10-U38	16.0	16	32	100	1.00
	4160-150-S16-R15-U38	16.0	16	32	150	1.50
	4160-100-S16-R15-U38	16.0	16	32	100	1.50
	4160-150-S16-R20-U38	16.0	16	32	150	2.00
	4160-100-S16-R20-U38	16.0	16	32	100	2.00
	4200-150-S20-R05-U38	20.0	20	38	150	0.50
	4200-100-S20-R05-U38	20.0	20	38	100	0.50
	4200-150-S20-R10-U38	20.0	20	38	150	1.00
	4200-100-S20-R10-U38	20.0	20	38	100	1.00
	4200-150-S20-R15-U38	20.0	20	38	150	1.50
	4200-100-S20-R15-U38	20.0	20	38	100	1.50
	4200-150-S20-R20-U38	20.0	20	38	150	2.00
	4200-100-S20-R20-U38	20.0	20	38	100	2.00

U+ Endmill

UPRE4000-U (Radius)

Irregular flute spacing and lead radius



4 | H·A Multi | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

(mm)

	Designation	ØD	Ød	ℓ	L	r
UPRE 4	4010-050-S06-R005-U	1.0	6	2.5	50	0.05
	4010-050-S06-R01-U	1.0	6	2.5	50	0.10
	4010-050-S06-R02-U	1.0	6	2.5	50	0.20
	4010-050-S06-R03-U	1.0	6	2.5	50	0.30
	4012-050-S06-R005-U	1.2	6	3	50	0.05
	4012-050-S06-R01-U	1.2	6	3	50	0.10
	4012-050-S06-R02-U	1.2	6	3	50	0.20
	4012-050-S06-R03-U	1.2	6	3	50	0.30
	4015-050-S06-R005-U	1.5	6	4	50	0.05
	4015-050-S06-R01-U	1.5	6	4	50	0.10
	4015-050-S06-R02-U	1.5	6	4	50	0.20
	4015-050-S06-R03-U	1.5	6	4	50	0.30
	4015-050-S06-R05-U	1.5	6	4	50	0.50
	4020-050-S06-R01-U	2.0	6	6	50	0.10
	4020-050-S06-R02-U	2.0	6	6	50	0.20
	4020-050-S06-R03-U	2.0	6	6	50	0.30
	4020-050-S06-R05-U	2.0	6	6	50	0.50
	4025-060-S06-R01-U	2.5	6	7	60	0.10
	4025-060-S06-R02-U	2.5	6	7	60	0.20
	4025-060-S06-R03-U	2.5	6	7	60	0.30
	4025-060-S06-R05-U	2.5	6	7	60	0.50
	4030-060-S06-R01-U	3.0	6	8	60	0.10
	4030-060-S06-R02-U	3.0	6	8	60	0.20
	4030-060-S06-R03-U	3.0	6	8	60	0.30
	4030-060-S06-R05-U	3.0	6	8	60	0.50
	4030-060-S06-R10-U	3.0	6	8	60	1.00
	4035-070-S06-R01-U	3.5	6	10	70	0.10
	4035-070-S06-R02-U	3.5	6	10	70	0.20
	4035-070-S06-R03-U	3.5	6	10	70	0.30
	4035-070-S06-R05-U	3.5	6	10	70	0.50
	4040-100-S04-R01-U	4.0	4	10	100	0.10
	4040-070-S04-R01-U	4.0	4	10	70	0.10
	4040-100-S04-R02-U	4.0	4	10	100	0.20
	4040-070-S04-R02-U	4.0	4	10	70	0.20
	4040-100-S04-R03-U	4.0	4	10	100	0.30
	4040-070-S04-R03-U	4.0	4	10	70	0.30
	4040-100-S04-R05-U	4.0	4	10	100	0.50

	Designation	ØD	Ød	ℓ	L	r
UPRE 4	4040-070-S04-R05-U	4.0	4	10	70	0.50
	4040-100-S04-R10-U	4.0	4	10	100	1.00
	4040-070-S04-R10-U	4.0	4	10	70	1.00
	4040-070-S06-R01-U	4.0	6	10	70	0.10
	4040-070-S06-R02-U	4.0	6	10	70	0.20
	4040-070-S06-R03-U	4.0	6	10	70	0.30
	4040-070-S06-R05-U	4.0	6	10	70	0.50
	4040-070-S06-R10-U	4.0	6	10	70	1.00
	4045-080-S06-R01-U	4.5	6	11	80	0.10
	4045-080-S06-R02-U	4.5	6	11	80	0.20
	4045-080-S06-R03-U	4.5	6	11	80	0.30
	4045-080-S06-R05-U	4.5	6	11	80	0.50
	4050-090-S06-R01-U	5.0	6	13	90	0.10
	4050-090-S06-R02-U	5.0	6	13	90	0.20
	4050-090-S06-R03-U	5.0	6	13	90	0.30
	4050-090-S06-R05-U	5.0	6	13	90	0.50
	4050-090-S06-R10-U	5.0	6	13	90	1.00
	4055-090-S06-R01-U	5.5	6	13	90	0.10
	4055-090-S06-R02-U	5.5	6	13	90	0.20
	4055-090-S06-R03-U	5.5	6	13	90	0.30
	4055-090-S06-R05-U	5.5	6	13	90	0.50
	4055-090-S06-R10-U	5.5	6	13	90	1.00
	4060-090-S06-R01-U	6.0	6	15	90	0.10
	4060-060-S06-R01-U	6.0	6	15	60	0.10
	4060-090-S06-R02-U	6.0	6	15	90	0.20
	4060-060-S06-R02-U	6.0	6	15	60	0.20
	4060-090-S06-R03-U	6.0	6	15	90	0.30
	4060-090-S06-R05-U	6.0	6	15	90	0.50
	4060-110-S06-R05-U	6.0	6	15	110	0.50
	4060-130-S06-R05-U	6.0	6	15	130	0.50
	4060-090-S06-R10-U	6.0	6	15	90	1.00
	4060-110-S06-R10-U	6.0	6	15	110	1.00
	4060-130-S06-R10-U	6.0	6	15	130	1.00
	4060-090-S06-R15-U	6.0	6	15	90	1.50
	4060-090-S06-R20-U	6.0	6	15	90	2.00
	4070-090-S08-R01-U	7.0	8	16	90	0.10
	4070-090-S08-R02-U	7.0	8	16	90	0.20

UPRE4000-U (Radius)

Irregular flute spacing and lead radius

4 | H·A Multi | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

(mm)

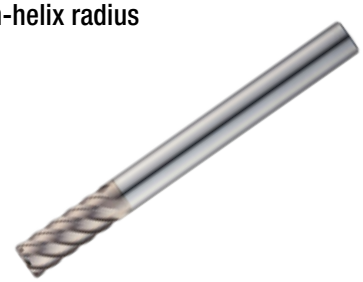
	Designation	ØD	Ød	ℓ	L	r
UPRE 4	4070-090-S08-R03-U	7.0	8	16	90	0.30
	4070-090-S08-R05-U	7.0	8	16	90	0.50
	4070-090-S08-R10-U	7.0	8	16	90	1.00
	4070-090-S08-R20-U	7.0	8	16	90	2.00
	4080-100-S08-R01-U	8.0	8	20	100	0.10
	4080-100-S08-R02-U	8.0	8	20	100	0.20
	4080-100-S08-R03-U	8.0	8	20	100	0.30
	4080-070-S08-R03-U	8.0	8	20	70	0.30
	4080-100-S08-R05-U	8.0	8	20	100	0.50
	4080-070-S08-R05-U	8.0	8	20	70	0.50
	4080-120-S08-R05-U	8.0	8	20	120	0.50
	4080-150-S08-R05-U	8.0	8	20	150	0.50
	4080-100-S08-R10-U	8.0	8	20	100	1.00
	4080-070-S08-R10-U	8.0	8	20	70	1.00
	4080-120-S08-R10-U	8.0	8	20	120	1.00
	4080-150-S08-R10-U	8.0	8	20	150	1.00
	4080-100-S08-R15-U	8.0	8	20	100	1.50
	4080-100-S08-R20-U	8.0	8	20	100	2.00
	4080-100-S08-R25-U	8.0	8	20	100	2.50
	4080-100-S08-R30-U	8.0	8	20	100	3.00
	4100-130-S10-R05-U	10.0	10	22	130	0.50
	4100-150-S10-R05-U	10.0	10	22	150	0.50
	4100-130-S10-R10-U	10.0	10	22	130	1.00
	4100-150-S10-R10-U	10.0	10	22	150	1.00
	4100-100-S10-R01-U	10.0	10	25	100	0.10
	4100-100-S10-R02-U	10.0	10	25	100	0.20
	4100-100-S10-R03-U	10.0	10	25	100	0.30
	4100-075-S10-R03-U	10.0	10	25	75	0.30
	4100-100-S10-R05-U	10.0	10	25	100	0.50
	4100-075-S10-R05-U	10.0	10	25	75	0.50
	4100-100-S10-R10-U	10.0	10	25	100	1.00
	4100-075-S10-R10-U	10.0	10	25	75	1.00
	4100-100-S10-R15-U	10.0	10	25	100	1.50
	4100-100-S10-R20-U	10.0	10	25	100	2.00
	4100-100-S10-R25-U	10.0	10	25	100	2.50
	4100-100-S10-R30-U	10.0	10	25	100	3.00

	Designation	ØD	Ød	ℓ	L	r
UPRE 4	4100-100-S10-R40-U	10.0	10	25	100	4.00
	4110-110-S12-R02-U	11.0	12	25	110	0.20
	4110-110-S12-R03-U	11.0	12	25	110	0.30
	4110-110-S12-R05-U	11.0	12	25	110	0.50
	4110-110-S12-R10-U	11.0	12	25	110	1.00
	4110-110-S12-R20-U	11.0	12	25	110	2.00
	4120-110-S12-R01-U	12.0	12	30	110	0.10
	4120-110-S12-R02-U	12.0	12	30	110	0.20
	4120-110-S12-R03-U	12.0	12	30	110	0.30
	4120-080-S12-R03-U	12.0	12	30	80	0.30
	4120-110-S12-R05-U	12.0	12	30	110	0.50
	4120-080-S12-R05-U	12.0	12	30	80	0.50
	4120-130-S12-R05-U	12.0	12	30	130	0.50
	4120-150-S12-R05-U	12.0	12	30	150	0.50
	4120-110-S12-R10-U	12.0	12	30	110	1.00
	4120-080-S12-R10-U	12.0	12	30	80	1.00
	4120-130-S12-R10-U	12.0	12	30	130	1.00
	4120-150-S12-R10-U	12.0	12	30	150	1.00
	4120-110-S12-R15-U	12.0	12	30	110	1.50
	4120-110-S12-R20-U	12.0	12	30	110	2.00
	4120-110-S12-R25-U	12.0	12	30	110	2.50
	4120-110-S12-R30-U	12.0	12	30	110	3.00
	4120-110-S12-R40-U	12.0	12	30	110	4.00
	4120-110-S12-R50-U	12.0	12	30	110	5.00
	4140-150-S16-R05-U	14.0	16	35	150	0.50
	4140-150-S16-R10-U	14.0	16	35	150	1.00
	4140-150-S16-R20-U	14.0	16	35	150	2.00
	4160-150-S16-R05-U	16.0	16	32	150	0.50
	4160-150-S16-R10-U	16.0	16	32	150	1.00
	4160-150-S16-R15-U	16.0	16	32	150	1.50
	4160-150-S16-R20-U	16.0	16	32	150	2.00
	4200-150-S20-R05-U	20.0	20	38	150	0.50
	4200-150-S20-R10-U	20.0	20	38	150	1.00
	4200-150-S20-R15-U	20.0	20	38	150	1.50
	4200-150-S20-R20-U	20.0	20	38	150	2.00

U+ Endmill

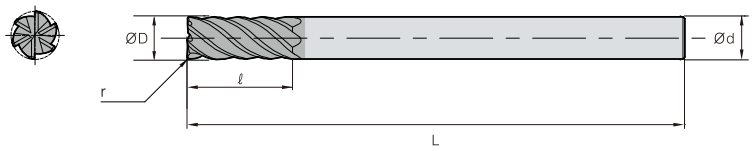
UPRE6000-A45 (Radius)

High-helix radius



6 | H-A 45° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

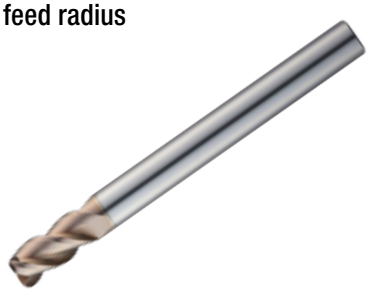


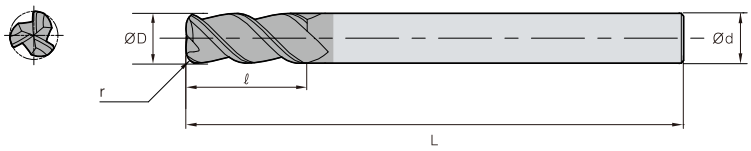
(mm)

	Designation	ØD	Ød	ℓ	L	r
UPRE	6060-090-S06-R03-A45	6.0	6	15	90	0.30
6	6060-090-S06-R05-A45	6.0	6	15	90	0.50
	6060-090-S06-R10-A45	6.0	6	15	90	1.00
	6080-100-S08-R03-A45	8.0	8	20	100	0.30
	6080-100-S08-R05-A45	8.0	8	20	100	0.50
	6080-100-S08-R10-A45	8.0	8	20	100	1.00
	6100-100-S10-R03-A45	10.0	10	25	100	0.30
	6100-100-S10-R05-A45	10.0	10	25	100	0.50
	6100-100-S10-R10-A45	10.0	10	25	100	1.00
	6120-110-S12-R03-A45	12.0	12	30	110	0.30
	6120-110-S12-R05-A45	12.0	12	30	110	0.50
	6120-110-S12-R10-A45	12.0	12	30	110	1.00
	6160-150-S16-R05-A45	16.0	16	32	150	0.50
	6160-150-S16-R10-A45	16.0	16	32	150	1.00
	6160-150-S16-R15-A45	16.0	16	32	150	1.50
	6160-150-S16-R20-A45	16.0	16	32	150	2.00
	6200-150-S20-R05-A45	20.0	20	38	150	0.50
	6200-150-S20-R10-A45	20.0	20	38	150	1.00
	6200-150-S20-R15-A45	20.0	20	38	150	1.50
	6200-150-S20-R20-A45	20.0	20	38	150	2.00

UPRE3000-HF (Radius)

High feed radius





3 | H·A 45° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.02

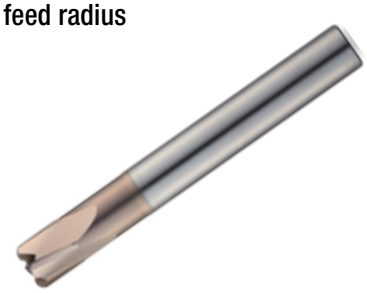
(mm)

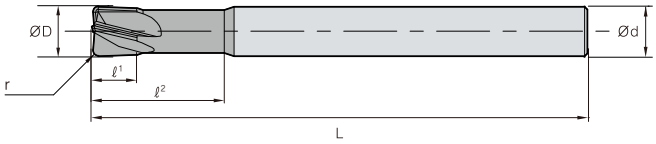
	Designation	ØD	Ød	ℓ	L	r
UPRE	3060-090-S06-R05-HF	6.0	6	10	90	0.50
	3060-090-S06-R10-HF	6.0	6	10	90	1.00
	3060-090-S06-R20-HF	6.0	6	10	90	2.00
	3080-100-S08-R05-HF	8.0	8	16	100	0.50
	3080-100-S08-R10-HF	8.0	8	16	100	1.00
	3080-100-S08-R20-HF	8.0	8	16	100	2.00
	3100-100-S10-R05-HF	10.0	10	20	100	0.50
	3100-100-S10-R10-HF	10.0	10	20	100	1.00
	3100-100-S10-R20-HF	10.0	10	20	100	2.00
	3120-110-S12-R05-HF	12.0	12	24	110	0.50
	3120-110-S12-R10-HF	12.0	12	24	110	1.00
	3120-110-S12-R20-HF	12.0	12	24	110	2.00
	3160-150-S16-R05-HF	16.0	16	32	150	0.50
	3160-150-S16-R10-HF	16.0	16	32	150	1.00
	3200-150-S20-R05-HF	20.0	20	40	150	0.50
	3200-150-S20-R10-HF	20.0	20	40	150	1.00

U+ Endmill

UPRE4000-HF (Radius)

High feed radius





4 | H·A 10° | h6 shank | Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.03

(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRE 4	4010-050-S06-R01-HF	1.0	6	1	2.5	50	0.10
	4010-050-S06-R02-HF	1.0	6	1	2.5	50	0.20
	4010-050-S06-R03-HF	1.0	6	1	2.5	50	0.30
	4015-050-S06-R02-HF	1.5	6	1.5	4	50	0.20
	4015-050-S06-R03-HF	1.5	6	1.5	4	50	0.30
	4015-050-S06-R05-HF	1.5	6	1.5	4	50	0.50
	4020-050-S06-R02-HF	2.0	6	2	6	50	0.20
	4020-050-S06-R03-HF	2.0	6	2	6	50	0.30
	4020-050-S06-R05-HF	2.0	6	2	6	50	0.50
	4030-050-S06-R02-HF	3.0	6	3	8	50	0.20
	4030-050-S06-R03-HF	3.0	6	3	8	50	0.30
	4030-050-S06-R05-HF	3.0	6	3	8	50	0.50
	4040-050-S06-R02-HF	4.0	6	4	10	50	0.20
	4040-050-S06-R03-HF	4.0	6	4	10	50	0.30
	4040-050-S06-R05-HF	4.0	6	4	10	50	0.50
	4040-050-S06-R10-HF	4.0	6	4	10	50	1.00
	4060-060-S06-R02-HF	6.0	6	6	15	60	0.20
	4060-090-S06-R02-HF	6.0	6	6	15	90	0.20
	4060-060-S06-R03-HF	6.0	6	6	15	60	0.30
	4060-090-S06-R03-HF	6.0	6	6	15	90	0.30
	4060-060-S06-R05-HF	6.0	6	6	15	60	0.50
	4060-090-S06-R05-HF	6.0	6	6	15	90	0.50
	4060-060-S06-R10-HF	6.0	6	6	15	60	1.00
	4060-090-S06-R10-HF	6.0	6	6	15	90	1.00
	4060-060-S06-R20-HF	6.0	6	6	15	60	2.00
	4060-090-S06-R20-HF	6.0	6	6	15	90	2.00
	4080-070-S08-R02-HF	8.0	8	8	20	70	0.20
	4080-100-S08-R02-HF	8.0	8	8	20	100	0.20
	4080-070-S08-R03-HF	8.0	8	8	20	70	0.30
	4080-100-S08-R03-HF	8.0	8	8	20	100	0.30
	4080-070-S08-R05-HF	8.0	8	8	20	70	0.50
	4080-100-S08-R05-HF	8.0	8	8	20	100	0.50
	4080-070-S08-R10-HF	8.0	8	8	20	70	1.00
	4080-100-S08-R10-HF	8.0	8	8	20	100	1.00
	4080-070-S08-R20-HF	8.0	8	8	20	70	2.00
	4080-100-S08-R20-HF	8.0	8	8	20	100	2.00

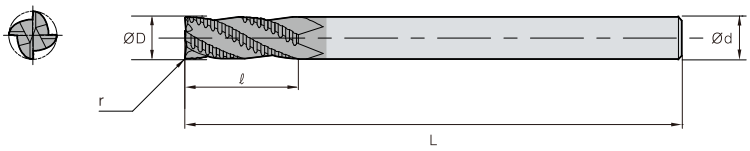
	Designation	ØD	Ød	ℓ1	ℓ2	L	r
UPRE 4	4100-075-S10-R02-HF	10.0	10	10	25	75	0.20
	4100-100-S10-R02-HF	10.0	10	10	25	100	0.20
	4100-075-S10-R03-HF	10.0	10	10	25	75	0.30
	4100-100-S10-R03-HF	10.0	10	10	25	100	0.30
	4100-075-S10-R05-HF	10.0	10	10	25	75	0.50
	4100-100-S10-R05-HF	10.0	10	10	25	100	0.50
	4100-075-S10-R10-HF	10.0	10	10	25	75	1.00
	4100-100-S10-R10-HF	10.0	10	10	25	100	1.00
	4100-075-S10-R15-HF	10.0	10	10	25	75	1.50
	4100-100-S10-R15-HF	10.0	10	10	25	100	1.50
	4100-075-S10-R20-HF	10.0	10	10	25	75	2.00
	4100-100-S10-R20-HF	10.0	10	10	25	100	2.00
	4120-080-S12-R03-HF	12.0	12	12	30	80	0.30
	4120-110-S12-R03-HF	12.0	12	12	30	110	0.30
	4120-080-S12-R05-HF	12.0	12	12	30	80	0.50
	4120-110-S12-R05-HF	12.0	12	12	30	110	0.50
	4120-080-S12-R10-HF	12.0	12	12	30	80	1.00
	4120-110-S12-R10-HF	12.0	12	12	30	110	1.00
	4120-080-S12-R15-HF	12.0	12	12	30	80	1.50
	4120-110-S12-R15-HF	12.0	12	12	30	110	1.50
	4120-080-S12-R20-HF	12.0	12	12	30	80	2.00
	4120-110-S12-R20-HF	12.0	12	12	30	110	2.00
	4120-080-S12-R30-HF	12.0	12	12	30	80	3.00
	4120-110-S12-R30-HF	12.0	12	12	30	110	3.00
	4160-100-S16-R05-HF	16.0	16	16	35	100	0.50
	4160-150-S16-R05-HF	16.0	16	16	35	150	0.50
	4160-100-S16-R10-HF	16.0	16	16	35	100	1.00
	4160-150-S16-R10-HF	16.0	16	16	35	150	1.00
	4160-100-S16-R20-HF	16.0	16	16	35	100	2.00
	4160-150-S16-R20-HF	16.0	16	16	35	150	2.00
	4200-100-S20-R05-HF	20.0	20	20	40	100	0.50
	4200-150-S20-R05-HF	20.0	20	20	40	150	0.50
	4200-100-S20-R10-HF	20.0	20	20	40	100	1.00
	4200-150-S20-R10-HF	20.0	20	20	40	150	1.00
	4200-100-S20-R20-HF	20.0	20	20	40	100	2.00
	4200-150-S20-R20-HF	20.0	20	20	40	150	2.00

UPRE-R (Roughing)

Roughing radius

3 4 5 H·A Multi h6 shank Substrate PC315W

ØD	Tolerance
All	0.00 ~ -0.05



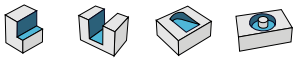
(mm)

	Designation	ØD	Ød	ℓ	L	r
UPRE 3	3030-050-V08S06-R	3.0	6	8	50	0.2
	3040-050-V10S06-R	4.0	6	10	50	0.2
UPRE 4	4050-050-V13S06-R	5.0	6	13	50	
	4060-050-V10S06-R	6.0	6	10	50	0.2
	4060-060-V15S06-R	6.0	6	15	60	0.2
	4070-070-V18S08-R	7.0	8	18	70	0.2
	4080-060-V12S08-R	8.0	8	12	60	0.2
	4080-070-V20S08-R	8.0	8	20	70	0.2
	4090-075-V22S10-R	9.0	10	22	75	0.3
	4100-065-V15S10-R	10.0	10	15	65	0.3
	4100-075-V25S10-R	10.0	10	25	75	0.3
	4110-080-V27S12-R	11.0	12	27	80	0.3
	4120-070-V20S12-R	12.0	12	20	70	0.3
	4120-080-V30S12-R	12.0	12	30	80	0.3
UPRE 5	5130-100-V35S12-R	13.0	12	35	100	0.5
	5140-100-V35S14-R	14.0	14	35	100	0.5
	5140-100-V35S16-R	14.0	16	35	100	0.5
	5160-080-V25S16-R	16.0	16	25	80	1.0
	5160-100-V40S16-R	16.0	16	40	100	1.0
	5180-100-V40S18-R	18.0	18	40	100	1.0
	5180-100-V40S20-R	18.0	20	40	100	1.0
	5200-080-V25S20-R	20.0	20	25	80	1.0
	5200-100-V45S20-R	20.0	20	45	100	1.0
	5250-100-V45S25-R	25.0	25	45	100	1.0

U+ Endmill

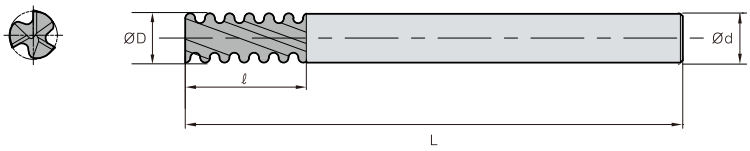
UPRE-C (Roughing)

General roughing



3 | 4 | 5 | H·A 20° | h6 shank | Substrate PC315W

ØD	Tolerance
~ Ø3.0	0.000 ~ -0.040
Ø4.0 ~ Ø6.0	0.000 ~ -0.048
Ø7.0 ~ Ø10.0	0.000 ~ -0.058
Ø12.0 ~ Ø18.0	0.000 ~ -0.070
Ø20.0 ~	0.000 ~ -0.084



(mm)

	Designation	ØD	Ød	ℓ	L
UPRE 3	3030-050-V08S06-C	3.0	6	8	50
	3040-050-V10S06-C	4.0	6	10	50
	3050-050-V13S06-C	5.0	6	13	50
	3060-060-V15S06-C	6.0	6	15	60
	3060-060-V20S06-C	6.0	6	20	60
	3070-070-V18S08-C	7.0	8	18	70
	3080-070-V20S08-C	8.0	8	20	70
	3080-070-V25S08-C	8.0	8	25	70
UPRE 4	4090-075-V22S10-C	9.0	10	22	75
	4100-075-V25S10-C	10.0	10	25	75
	4100-075-V30S10-C	10.0	10	30	75
	4110-080-V27S12-C	11.0	12	27	80
	4120-080-V30S12-C	12.0	12	30	80
	4120-080-V35S12-C	12.0	12	35	80
	4130-100-V35S12-C	13.0	12	35	100
	4140-100-V35S16-C	14.0	16	35	100
	4160-100-V40S16-C	16.0	16	40	100
	4180-100-V40S18-C	18.0	18	40	100
	4200-100-V50S20-C	20.0	20	50	100
UPRE 5	5250-100-V50S25	25.0	25	50	100

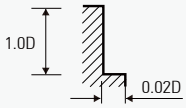
U+ Endmill

Recommended cutting conditions

UPRFE4000 (Flat)

Long neck flat

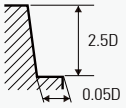
Workpiece / Conditions / Diameter(Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		Stainless Steels		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	22,000	310	13,500	180	10,750	140	8,500	50
1.5	17,000	320	10,700	190	8,500	150	6,500	50
2.0	13,900	330	9,070	200	7,560	165	6,000	60
2.5	12,000	350	7,600	220	6,000	180	4,500	60
3.0	10,700	380	6,670	240	5,110	200	4,030	70
4.0	9,070	680	5,540	420	4,650	330	3,530	70
5.0	7,560	720	4,530	430	3,800	360	2,780	85
6.0	6,670	790	4,030	490	3,400	390	2,400	95
8.0	5,040	850	3,020	450	2,520	420	2,010	130
10.0	3,910	730	2,400	360	2,010	360	1,630	105
12.0	3,300	620	2,010	300	1,630	280	1,400	95



UPTFE2000 (Flat)

Taper flat

Workpiece / Conditions / Diameter(Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened steels HRC30~45	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
0.3	45,000	135	35,000	105
0.4	36,000	144	27,900	113
0.6	25,200	144	18,900	113
0.8	18,000	144	13,950	108
1.0	14,850	149	11,250	113
2.0	7,560	153	5,670	113
3.0	3,969	108	3,213	90
4.0	3,213	126	2,556	104
6.0	2,367	189	1,890	153
8.0	1,800	225	1,422	162
10.0	1,440	225	1,170	167



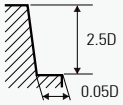
U+ Endmill

Recommended cutting conditions

UPTLFE4000 (Flat)

Taper flat

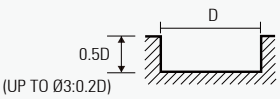
Workpiece / Conditions / Diameter (Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened steels HRC30~45	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
3.0	3,969	216	3,213	180
4.0	3,213	252	2,556	207
6.0	2,367	378	1,890	306
8.0	1,800	450	1,422	324
10.0	1,440	450	1,170	333

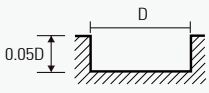


UPFE2000 (Flat)

General flat

Workpiece / Conditions / Diameter (Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		Stainless Steels		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
2.0	11,560	190	7,560	120	6,300	90	5,040	35
3.0	8,920	210	5,560	140	4,620	120	3,360	40
4.0	7,560	300	4,620	180	3,880	150	2,940	40
5.0	6,300	320	3,780	190	3,160	160	2,320	50
6.0	5,560	350	3,360	220	2,840	180	2,000	55
8.0	4,200	380	2,520	200	2,100	180	1,680	75
10.0	3,260	330	2,000	160	1,680	160	1,360	60
12.0	2,740	280	1,680	130	1,360	130	1,160	55
16.0	2,200	220	1,360	110	1,060	110	900	40
20.0	1,680	170	1,060	80	840	80	680	30
25.0	1,360	130	840	70	680	60	540	20

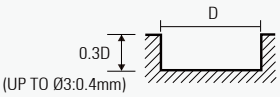


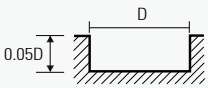


UPLFE2000 (Flat)

Long flat

Workpiece / Conditions / Diameter (Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
2.0	6,300	60	5,040	50	3,150	25
3.0	4,410	70	3,570	60	2,200	30
4.0	3,570	85	2,840	70	1,790	35
5.0	3,050	105	2,420	85	1,580	40
6.0	2,630	125	2,100	105	1,370	50
8.0	2,000	135	1,580	105	1,050	50
10.0	1,680	135	1,370	105	840	50
12.0	1,370	105	1,160	95	700	40
16.0	1,160	95	890	75	560	35
20.0	840	70	680	50	420	25

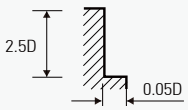


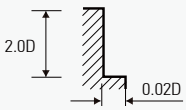


UPLFE4000 (Flat)

Long flat

Workpiece / Conditions / Diameter (Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
2.0	6,300	100	5,040	80	3,150	45
3.0	4,410	115	3,570	100	2,200	55
4.0	3,570	140	2,840	115	1,790	60
5.0	3,050	180	2,420	140	1,580	70
6.0	2,630	215	2,100	180	1,370	90
8.0	2,000	230	1,580	180	1,050	90
10.0	1,680	230	1,370	180	840	90
12.0	1,370	180	1,160	160	700	70
16.0	1,160	160	890	125	560	60
20.0	840	115	680	90	420	45





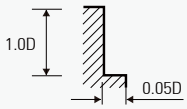
U+ Endmill

Recommended cutting conditions

UPFE4000-U/UF (Flat)

Irregular flute spacing and lead flat

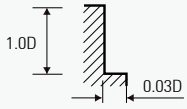
Workpiece / Conditions / Diameter(Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		Stainless Steels		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
2.0	11,560	280	7,560	170	6,300	140	5,040	50
3.0	8,920	320	5,560	200	4,620	170	3,360	60
4.0	7,560	570	4,620	350	3,880	280	2,940	60
5.0	6,300	600	3,780	360	3,160	300	2,320	70
6.0	5,560	660	3,360	410	2,840	330	2,000	80
8.0	4,200	710	2,520	380	2,100	350	1,680	110
10.0	3,260	610	2,000	300	1,680	300	1,360	90
12.0	2,740	520	1,680	250	1,360	240	1,160	80
16.0	2,200	410	1,360	200	1,100	300	900	60
20.0	1,680	320	1,060	160	840	150	680	40
25.0	1,360	250	840	130	680	120	540	30



UPFE4000-A45 (Flat)

High-helix flat

Workpiece / Conditions / Diameter(Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	45,000	750	37,000	560	23,000	300
2.0	23,500	800	18,000	540	12,000	360
3.0	15,750	810	12,600	580	8,280	380
4.0	12,150	830	9,540	600	6,345	400
6.0	9,450	900	7,470	640	4,950	440
8.0	7,110	860	5,625	620	3,780	410
10.0	5,580	800	4,410	570	2,925	380
12.0	4,770	800	3,780	570	2,520	380
16.0	3,600	810	2,900	570	2,000	400
20.0	3,000	810	2,300	570	1,600	400

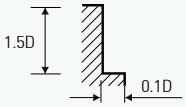


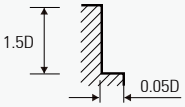
UPFE6000-A45 (Flat)

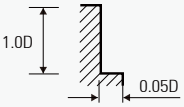
High-helix flat

• Normal Speed

Workpiece / Conditions / Diameter(Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
6.0	5,560	2,000	3,880	1,370	1,580	210
8.0	4,200	2,000	2,940	1,370	1,160	210
10.0	3,360	2,000	2,320	1,370	1,000	210
12.0	2,840	1,680	2,000	1,160	840	180
16.0	2,100	1,260	1,480	880	640	130
20.0	1,680	1,010	1,160	690	500	110
25.0	1,500	90	1,100	600	430	90

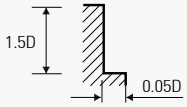


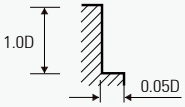




• High Speed

Workpiece / Conditions / Diameter(Ø)	Pre-hardened steels HRC30~45		High-hardened steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
6.0	16,800	6,090	8,400	3,050
8.0	12,600	6,090	6,300	3,050
10.0	9,980	5,990	5,040	3,050
12.0	8,400	5,040	4,200	2,520
16.0	6,300	3,780	3,160	1,890
20.0	5,040	3,050	2,520	1,470
25.0	4,500	2,700	2,200	1,300





U+ Endmill

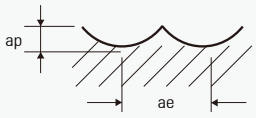
Recommended cutting conditions

UPRBE2000-TN (Ball)

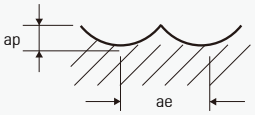
Taper neck ball

• Normal Speed

Workpiece / Conditions / Diameter (Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
0.1	16,500	80	25,500	185	25,500	160
0.2	16,500	90	25,500	220	25,500	200
0.3	15,300	112	24,000	260	24,000	220
0.4	15,300	112	24,000	260	24,000	220
0.5	13,300	128	20,800	300	20,800	250
0.6	11,200	144	17,600	330	17,600	280
0.8	11,200	144	17,600	330	17,600	280
1.0	10,180	160	16,000	370	16,000	320
1.5	9,500	220	13,000	500	12,800	400
2.0	9,250	260	11,500	640	11,300	590
3.0	8,000	370	10,200	880	9,800	850
4.0	6,720	420	8,500	880	8,200	850
5.0	5,840	460	7,500	880	7,200	850
6.0	5,500	660	6,900	920	6,500	880
8.0	4,600	740	5,600	840	5,300	800
10.0	4,070	820	4,850	800	4,650	770
12.0	3,700	890	4,350	800	4,150	770



ap : D1~D6=0.2mm
D8~D12=0.3mm
ae : 0.2×D

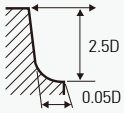


ap : D1~D4=0.05×D
D5~D8=0.25mm
D10~D12=0.3mm
ae : 0.1×D

UPTBE2000 (Ball)

Taper Ball

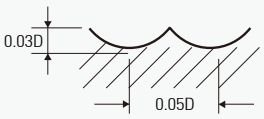
Workpiece / Conditions / Diameter (Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened steels HRC30~45	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
0.4	36,000	144	27,900	113
0.6	25,200	144	18,900	113
0.8	18,000	144	13,950	108
1.0	14,850	149	11,250	113
2.0	7,560	153	5,670	113
3.0	3,969	108	3,213	90
4.0	3,213	126	2,556	104



UPBE2000 (Ball), UPBE2000-P / H (Ball)

General Ball / High precision ball

Workpiece / Conditions / Diameter (Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
0.1	40,000	550	40,000	500	33,000	400
0.2	30,000	720	30,000	630	27,000	575
0.3	30,000	900	30,000	810	27,000	720
0.4	30,000	1,140	30,000	1,020	27,000	900
0.5	30,000	1,440	30,000	1,260	27,000	1,140
0.6	30,000	1,740	30,000	1,500	27,000	1,320
0.8	30,000	2,340	30,000	1,980	27,000	1,800
1.0	30,000	2,880	30,000	2,520	27,000	2,280
1.2	30,000	3,060	28,800	2,580	25,800	2,310
1.5	30,000	3,240	28,800	2,700	25,800	2,400
2.0	29,820	3,420	28,680	2,880	24,000	2,400
3.0	19,860	3,600	19,080	3,180	15,900	2,400
4.0	14,940	3,600	14,340	3,180	12,000	2,400
5.0	11,160	3,480	10,680	2,940	9,000	2,250
6.0	8,340	2,910	8,040	2,460	6,600	1,860
8.0	6,660	2,520	6,420	2,100	5,400	1,620
10.0	5,580	2,220	5,340	1,860	4,500	1,440
12.0	4,170	1,770	4,008	1,500	3,360	1,140
16.0	3,340	1,590	3,210	1,320	2,700	1,020
20.0	2,670	1,410	2,580	1,170	2,160	900
25.0	2,130	1,150	2,060	950	1,730	730



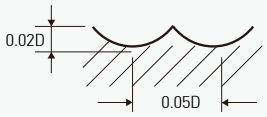
U+ Endmill

Recommended cutting conditions

UPBE2000-ST (Ball)

Straight flute ball

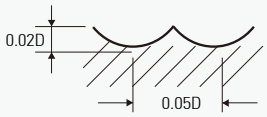
Workpiece / Conditions / Diameter(Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
3.0	13,500	1,700	13,200	1,620	12,500	860
4.0	10,600	1,700	10,300	1,620	9,800	860
5.0	9,400	1,650	9,050	1,570	8,600	860
6.0	8,600	1,750	8,250	1,670	7,850	865
8.0	7,000	1,550	6,700	1,460	6,350	890
10.0	6,050	1,450	5,800	1,360	5,450	870
12.0	5,450	1,420	5,200	1,330	4,900	785
16.0	4,300	1,200	4,000	1,100	3,700	650
20.0	3,600	1,050	3,200	900	3,000	550



UPBE2000-SP (Ball)

Spear type ball

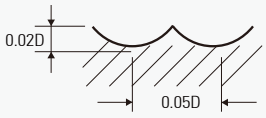
Workpiece / Conditions / Diameter(Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
3.0	35,000	2,800	33,000	2,600	12,000	900
4.0	26,000	2,300	25,000	2,200	9,000	800
5.0	21,000	2,100	20,000	2,000	7,000	700
6.0	17,000	1,900	16,000	1,800	6,000	650
8.0	13,000	1,700	12,000	1,600	4,500	550
10.0	10,500	1,450	10,000	1,400	3,500	500
12.0	9,000	1,400	8,000	1,300	3,000	450



UPBE3000 (Ball)

General ball

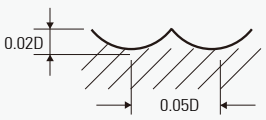
Workpiece / Conditions / Diameter(Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	50,000	4,150	44,000	3,000	33,000	2,100
1.5	40,000	5,100	35,000	3,660	36,400	2,600
2.0	33,000	5,890	29,000	4,150	21,700	3,000
3.0	25,000	6,930	22,000	4,880	16,500	3,490
4.0	21,670	6,930	18,120	4,880	13,400	3,490
5.0	18,000	6,520	15,100	4,880	11,160	3,320
6.0	16,200	7,710	13,680	5,590	10,980	4,050
8.0	12,150	6,610	10,170	4,720	8,280	3,580
10.0	9,720	5,870	8,190	4,130	6,620	3,100
12.0	8,150	5,490	4,130	3,830	5,520	2,870



UPBE4000 (Ball)

General ball

Workpiece / Conditions / Diameter(Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	48,000	3,300	35,000	2,350	32,000	2,200
1.5	38,400	4,100	28,000	2,900	25,600	2,700
2.0	31,680	4,600	23,100	3,300	21,000	3,100
3.0	24,000	5,430	17,500	3,880	16,000	3,650
4.0	20,130	5,430	14,880	3,880	14,220	3,650
5.0	16,780	5,430	12,400	3,690	11,670	3,470
6.0	15,200	6,220	12,200	4,500	11,100	3,830
8.0	11,300	5,250	9,200	3,980	8,320	3,350
10.0	9,100	4,590	7,350	3,450	6,660	2,870
12.0	7,590	4,260	6,130	3,190	5,530	2,400



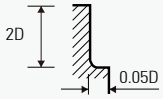
U+ Endmill

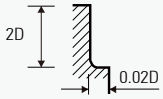
Recommended cutting conditions

UPRRE2000 / UPRE4000 (Radius)

Long neck radius

Workpiece / Conditions / Diameter (Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
3.0	4,410	115	3,570	100	2,200	55
4.0	3,570	140	2,840	115	1,790	60
5.0	3,050	180	2,420	140	1,580	70
6.0	2,630	215	2,100	180	1,370	85
8.0	2,000	230	1,580	180	1,050	85
10.0	1,680	230	1,370	180	840	85
12.0	1,370	180	1,160	160	700	70
16.0	1,160	160	890	125	560	60
20.0	840	115	680	90	420	45

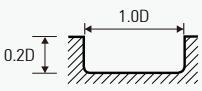


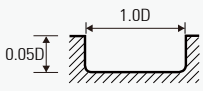


UPRRE2000-TN / UPRE4000 (Radius)

Taper neck radius

Workpiece / Conditions / Diameter (Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
0.2	50,000	170	34,500	75	21,150	45
0.3	50,000	200	32,000	85	20,000	50
0.4	50,000	200	32,000	85	20,000	50
0.5	43,000	220	28,000	95	17,100	60
0.6	36,400	250	24,000	110	14,500	65
0.8	36,400	250	24,000	110	14,500	65
1.0	33,100	280	21,600	120	13,200	70
1.5	26,400	300	16,200	130	10,200	70
2.0	21,600	310	13,800	140	8,640	80
2.5	18,000	320	11,400	150	7,320	80
3.0	15,900	330	10,300	160	6,300	80
4.0	12,800	400	8,200	200	5,150	95
5.0	11,000	500	7,000	240	4,560	120
6.0	9,500	600	6,000	300	3,930	140
8.0	7,200	640	4,550	300	3,020	140
10.0	6,000	640	4,000	300	2,420	140
12.0	5,000	500	3,340	270	2,000	120
16.0	3,720	450	2,520	210	1,540	95
20.0	3,000	330	1,950	140	1,200	70

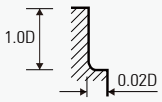




UPRRE4000-U/TN (Radius)

Long neck irregular flute spacing and lead radius

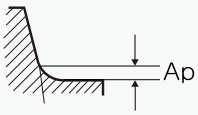
Workpiece / Conditions / Diameter(Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	33,100	360	21,600	260	13,200	140
1.5	26,400	370	16,200	270	10,200	140
2.0	21,600	380	13,800	280	8,640	150
2.5	18,000	390	11,400	300	7,320	150
3.0	15,900	400	10,300	310	6,300	150
4.0	12,800	500	8,200	360	5,150	160
5.0	11,000	510	7,000	430	4,560	200
6.0	9,500	510	6,000	430	3,930	200
8.0	7,200	550	4,550	430	3,020	200
10.0	6,000	550	4,000	430	2,420	200
12.0	5,000	430	3,340	380	2,000	160
16.0	3,720	330	2,520	280	1,540	135
20.0	3,000	270	1,950	210	1,200	100



UPTRE4000 (Radius)

Taper radius

Workpiece / Conditions / Diameter(Ø)	Alloy Steels, Carbon Steels under HRC30			Pre-hardened Steels HRC30~45			High-Hardened Steels HRC45~55		
	R.P.M n (min⁻¹)	Feed vf (mm/min)	Ap (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)	Ap (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)	Ap (mm)
0.4	40,000	630	0.008~0.016	32,000	450	0.008~0.012	22,000	270	0.004~0.008
0.6	30,000	630	0.012~0.024	23,000	450	0.012~0.018	15,000	270	0.006~0.012
0.8	22,500	630	0.016~0.032	17,000	450	0.016~0.024	11,500	270	0.008~0.016
1.0	18,000	630	0.020~0.040	13,500	450	0.020~0.030	9,000	270	0.010~0.020
1.2	14,400	630	0.025~0.050	11,700	450	0.025~0.040	7,200	270	0.012~0.025
1.5	11,700	630	0.030~0.060	9,000	450	0.030~0.050	5,850	270	0.015~0.030
2.0	9,000	630	0.040~0.080	7,200	450	0.040~0.060	4,500	270	0.020~0.040



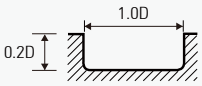
U+ Endmill

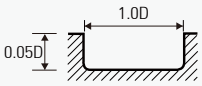
Recommended cutting conditions

UPRE2000 (Radius)

General radius

Workpiece / Conditions / Diameter (Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
0.2	44,000	145	28,800	60	17,600	40
0.3	41,000	170	27,000	70	16,500	45
0.4	41,000	170	27,000	70	16,500	45
0.5	36,000	190	23,400	80	14,300	50
0.6	30,000	210	19,800	90	12,100	55
0.8	30,000	210	19,800	90	12,100	55
1.0	27,600	240	18,000	100	11,000	60
1.5	22,000	250	13,500	110	8,500	60
2.0	18,000	260	11,560	120	7,200	70
2.5	15,000	270	9,500	130	6,100	70
3.0	13,240	280	8,560	140	5,280	70
4.0	10,720	340	6,820	170	4,300	80
5.0	9,160	420	5,800	200	3,800	100
6.0	7,900	500	5,040	250	3,280	120
8.0	6,000	540	3,800	250	2,520	120
10.0	5,040	540	3,280	250	2,020	120
12.0	4,120	420	2,780	230	1,680	100
16.0	3,100	360	2,100	170	1,280	80
20.0	2,520	280	1,640	120	1,000	60

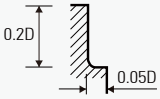


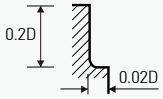


UPRE4000-U (Radius)

Irregular flute spacing and lead radius

Workpiece / Conditions / Diameter(Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	27,600	300	18,000	220	11,000	120
1.5	22,000	310	13,500	230	8,500	120
2.0	18,000	320	11,560	240	7,200	130
2.5	15,000	330	9,500	250	6,100	130
3.0	13,240	340	8,560	260	5,280	130
4.0	10,720	420	6,820	300	4,300	140
5.0	9,160	430	5,800	360	3,800	170
6.0	7,900	430	5,040	360	3,280	170
8.0	6,000	460	3,800	360	2,520	170
10.0	5,040	460	3,280	360	2,020	170
12.0	4,120	360	2,780	320	1,680	140
16.0	3,100	280	2,100	230	1,280	115
20.0	2,520	230	1,640	180	1,000	90

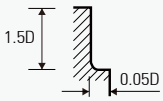


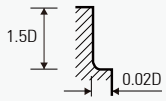


UPRE6000-45 (Radius)

High-helix radius

Workpiece / Conditions / Diameter(Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
6.0	14,880	3,210	14,100	2,940	9,600	2,940
8.0	12,000	3,300	11,400	3,000	7,200	2,760
10.0	9,600	2,940	9,300	2,700	5,700	2,460
12.0	7,800	2,700	7,500	2,460	4,800	2,280
16.0	6,000	2,400	5,820	2,220	3,600	2,040
20.0	4,800	2,010	4,680	2,040	2,880	1,920





U+ Endmill

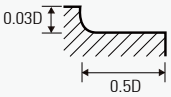
Recommended cutting conditions

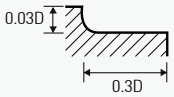
UPRE3000-HF (Radius)

High feed radius

- **Normal Speed**

Workpiece / Conditions / Diameter (Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
6.0	5,100	3,500	5,500	3,750	3,850	2,700
8.0	3,800	3,400	4,150	3,700	2,850	2,550
10.0	3,800	3,750	3,600	3,500	2,700	2,700
12.0	3,200	4,200	3,250	4,250	2,250	2,300
16.0	2,400	3,100	2,250	2,900	1,700	1,750
20.0	1,900	2,500	1,800	2,350	1,350	1,400

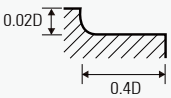


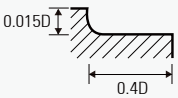


UPRE4000-HF (Radius)

High feed radius

Workpiece / Conditions / Diameter (Ø)	Alloy Steels, Carbon Steels under HRC30		Pre-hardened Steels HRC30~45		High-Hardened Steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	49000	7650	40000	6500	35000	5750
1.5	37000	8550	30000	7200	27000	6400
2.0	29700	9000	24300	7560	21600	6750
3.0	19800	9900	16200	8100	14400	7650
4.0	15300	10800	12600	8550	10800	7920
6.0	9900	11700	8100	9900	7200	8640
8.0	7380	11700	6300	9900	5400	8640
10.0	5850	10800	4950	9000	4320	8550
12.0	4950	10800	4140	9000	3690	8100
16.0	3690	9000	3060	7920	2700	7020
20.0	2970	7200	2430	6300	2160	5670

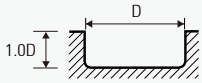


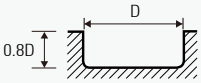


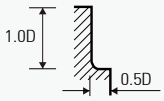
UPRE-R (Roughing)

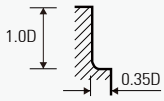
Roughing

Workpiece / Conditions / Diameter(Ø)	Alloy Steels, Carbon Steels under HRC25		Alloy Steels, Carbon Steels Pre-hardened Steels HRC25~40		Alloy Steels, Carbon Steels under HRC25		Alloy Steels, Carbon Steels Pre-hardened Steels HRC25~40	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
6.0	12,000	1,550	10,600	1,100	15,800	2,570	14,300	1,850
8.0	9,000	1,650	8,100	1,180	11,900	2,700	10,700	1,950
10.0	7,200	1,650	6,400	1,180	9,500	2,700	8,500	1,950
12.0	6,000	1,540	5,400	1,140	8,000	2,570	7,100	1,850
16.0	4,500	1,500	4,100	1,050	6,000	2,450	5,400	1,750
20.0	3,600	1,330	3,200	900	4,800	2,140	4,300	1,500



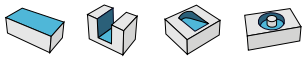






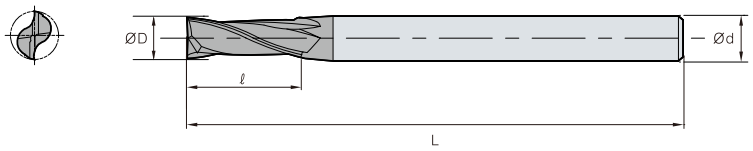
I+ Endmill

IPFE2000 (Flat)



2 | H A 35° | h6 shank | Substrate PC320

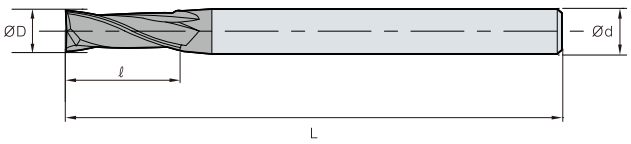
ØD	Tolerance
Ø1.0 ~ Ø12.0	0.00 ~ -0.02
Ø12.1 ~ Ø20.0	0.00 ~ -0.03



(mm)

	Designation	ØD	Ød	ℓ	L
IPFE 2	2010-050-S3	1.0	3	3	50
	2010-050-S4	1.0	4	3	50
	2010-050	1.0	6	3	50
	2015-050-S3	1.5	3	4	50
	2015-050-S4	1.5	4	4	50
	2015-050	1.5	6	4	50
	2020-050-S3	2.0	3	6	50
	2020-050-S4	2.0	4	6	50
	2020-050	2.0	6	6	50
	2025-050-S3	2.5	3	8	50
	2025-050-S4	2.5	4	8	50
	2025-050	2.5	6	8	50
	2030-050-S3	3.0	3	8	50
	2030-050-S4	3.0	4	8	50
	2030-050	3.0	6	8	50
	2035-050-S4	3.5	4	10	50
	2035-050	3.5	6	10	50
	2040-050-S4	4.0	4	11	50
	2040-050	4.0	6	11	50
	2045-050	4.5	6	13	50
	2050-050	5.0	6	13	50
	2055-050	5.5	6	13	50
	2060-050	6.0	6	16	50
	2065-060	6.5	8	16	60
	2070-060	7.0	8	16	60
	2075-060	7.5	8	19	60
	2080-060	8.0	8	20	60
	2085-075	8.5	10	20	75
	2090-075	9.0	10	20	75
	2095-075	9.5	10	25	75
	2100-075	10.0	10	25	75
	2105-075	10.5	12	25	75
	2110-075	11.0	12	30	75
	2115-075	11.5	12	30	75
	2120-075	12.0	12	32	75
	2140-100	14.0	16	40	100
	2160-100	16.0	16	40	100
	2180-100	18.0	20	45	100
	2200-100	20.0	20	45	100

IPLFE2000 (Long flat)



2 | H A 35° | h6 shank | Substrate PC320

ØD	Tolerance
Ø1.0 ~ Ø12.0	0.00 ~ -0.02
Ø12.1 ~ Ø20.0	0.00 ~ -0.03

Long shank type

(mm)

	Designation	ØD	Ød	ℓ	L
IPLFE 2	2060-075	6.0	6	16	75
	2060-100	6.0	6	16	100
	2080-075	8.0	8	20	75
	2080-100	8.0	8	20	100
	2100-100	10.0	10	25	100
	2100-150	10.0	10	25	150
	2120-100	12.0	12	32	100
	2120-150	12.0	12	32	150

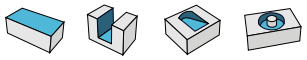
Long flute type

(mm)

	Designation	ØD	Ød	ℓ	L
IPLFE 2	2010-050-V7S4	1.0	4	7	50
	2015-050-V9S4	1.5	4	9	50
	2020-050-V12S4	2.0	4	12	50
	2025-050-V12S4	2.5	4	12	50
	2030-060-V15S6	3.0	6	15	60
	2035-060-V15S6	3.5	6	15	60
	2040-075-V20S6	4.0	6	20	75
	2045-075-V20S6	4.5	6	20	75
	2050-075-V25S6	5.0	6	25	75
	2055-075-V25S6	5.5	6	25	75
	2060-075-V30S6	6.0	6	30	75
	2070-100-V30S8	7.0	8	30	100
	2080-100-V40S8	8.0	8	40	100
	2090-100-V40S10	9.0	10	40	100
	2100-100-V40S10	10.0	10	40	100
	2110-100-V40S12	11.0	12	40	100
	2120-100-V50S12	12.0	12	50	100
	2140-150-V50S16	14.0	16	50	150
	2160-150-V60S16	16.0	16	60	150
	2200-200-V90S20	20.0	20	90	200

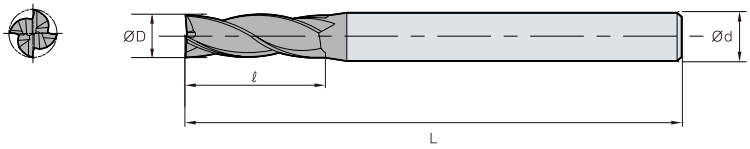
I+ Endmill

IPFE4000 (Flat)



4 | H A 35° | h6 shank | Substrate PC320

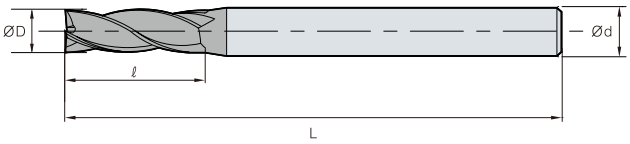
ØD	Tolerance
Ø1.0 ~ Ø12.0	0.00 ~ -0.02
Ø12.1 ~ Ø20.0	0.00 ~ -0.03



(mm)

	Designation	ØD	Ød	ℓ	L
IPFE 4	4010-050-S3	1.0	3	3	50
	4010-050-S4	1.0	4	3	50
	4010-050	1.0	6	3	50
	4015-050-S3	1.5	3	4	50
	4015-050-S4	1.5	4	4	50
	4015-050	1.5	6	4	50
	4020-050-S3	2.0	3	6	50
	4020-050-S4	2.0	4	6	50
	4020-050	2.0	6	6	50
	4025-050-S3	2.5	3	8	50
	4025-050-S4	2.5	4	8	50
	4025-050	2.5	6	8	50
	4030-050-S3	3.0	3	8	50
	4030-050-S4	3.0	4	8	50
	4030-050	3.0	6	8	50
	4035-050-S4	3.5	4	10	50
	4035-050	3.5	6	10	50
	4040-050-S4	4.0	4	11	50
	4040-050	4.0	6	11	50
	4045-050	4.5	6	13	50
	4050-050	5.0	6	13	50
	4055-050	5.5	6	13	50
	4060-050	6.0	6	16	50
	4065-060	6.5	8	16	60
	4070-060	7.0	8	16	60
	4075-060	7.5	8	19	60
	4080-060	8.0	8	20	60
	4085-075	8.5	10	20	75
	4090-075	9.0	10	20	75
	4095-075	9.5	10	25	75
	4100-075	10.0	10	30	75
	4105-075	10.5	12	30	75
	4110-075	11.0	12	30	75
	4115-075	11.5	12	30	75
	4120-075	12.0	12	32	75
	4140-100	14.0	16	40	100
	4160-100	16.0	16	40	100
	4180-100	18.0	20	45	100
	4200-100	20.0	20	45	100

IPLFE4000 (Long flat)



4 | H A 35° | h6 shank | Substrate PC320

ØD	Tolerance
Ø1.0 ~ Ø12.0	0.00 ~ -0.02
Ø12.1 ~ Ø20.0	0.00 ~ -0.03

Long shank type

(mm)

	Designation	ØD	Ød	ℓ	L
IPLFE 4	4060-075	6.0	6	16	75
	4060-100	6.0	6	16	100
	4080-075	8.0	8	20	75
	4080-100	8.0	8	20	100
	4100-100	10.0	10	30	100
	4100-150	10.0	10	30	150
	4120-100	12.0	12	32	100
	4120-150	12.0	12	32	150

Long flute type

(mm)

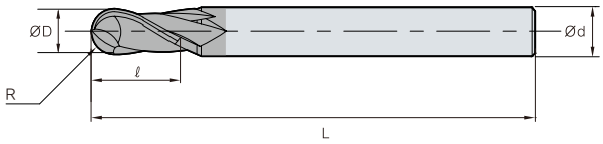
	Designation	ØD	Ød	ℓ	L
IPLFE 4	4010-050-V6S4	1.0	4	6	50
	4015-050-V9S4	1.5	4	9	50
	4020-050-V12S4	2.0	4	12	50
	4025-050-V12S4	2.5	4	12	50
	4030-060-V15S6	3.0	6	15	60
	4035-060-V15S6	3.5	6	15	60
	4040-075-V20S6	4.0	6	20	75
	4045-075-V20S6	4.5	6	20	75
	4050-075-V25S6	5.0	6	25	75
	4055-075-V25S6	5.5	6	25	75
	4060-075-V30S6	6.0	6	30	75
	4070-100-V30S8	7.0	8	30	100
	4080-100-V40S8	8.0	8	40	100
	4090-100-V40S10	9.0	10	40	100
	4100-100-V40S10	10.0	10	40	100
	4110-100-V40S12	11.0	12	40	100
	4120-100-V50S12	12.0	12	50	100
	4140-150-V50S16	14.0	16	50	150
	4160-150-V60S16	16.0	16	60	150
	4200-200-V90S20	20.0	20	90	200

I+ Endmill

IPBE2000 (Ball)

2 | H A 35° | h6 shank | Substrate PC320

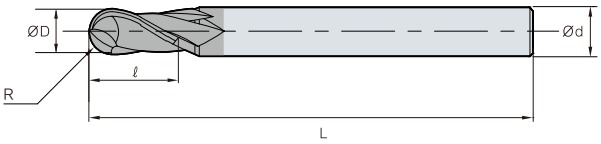
ØD	Tolerance
Ø1.0 ~ Ø12.0	0.00 ~ -0.02
Ø12.1 ~ Ø20.0	0.00 ~ -0.03



(mm)

	Designation	R	ØD	Ød	ℓ	L
IPBE	2010-050-S3	0.50	1.0	3	2	50
2	2010-050-S4	0.50	1.0	4	2	50
	2010-050	0.50	1.0	6	2	50
	2015-050-S3	0.75	1.5	3	3	50
	2015-050-S4	0.75	1.5	4	3	50
	2015-050	0.75	1.5	6	3	50
	2020-050-S3	1.00	2.0	3	4	50
	2020-050-S4	1.00	2.0	4	4	50
	2020-050	1.00	2.0	6	4	50
	2025-050-S3	1.25	2.5	3	5	50
	2025-050-S4	1.25	2.5	4	5	50
	2025-050	1.25	2.5	6	5	50
	2030-050-S3	1.50	3.0	3	6	50
	2030-050-S4	1.50	3.0	4	6	50
	2030-050	1.50	3.0	6	6	50
	2035-050-S4	1.75	3.5	4	7	50
	2035-050	1.75	3.5	6	7	50
	2040-050-S4	2.00	4.0	4	8	50
	2040-050	2.00	4.0	6	8	50
	2045-050	2.25	4.5	6	9	50
	2050-050	2.50	5.0	6	10	50
	2060-050	3.00	6.0	6	12	50
	2070-060	3.50	7.0	8	14	60
	2080-060	4.00	8.0	8	16	60
	2090-075	4.50	9.0	10	18	75
	2100-075	5.00	10.0	10	20	75
	2120-075	6.00	12.0	12	24	75
	2140-100	7.00	14.0	16	28	100
	2160-100	8.00	16.0	16	32	100
	2180-100	9.00	18.0	20	36	100
	2200-100	10.00	20.0	20	40	100

IPLBE2000 (Long Ball)



2 | H A 35° | h6 shank | Substrate PC320

ØD	Tolerance
Ø1.0 ~ Ø12.0	0.00 ~ -0.02
Ø12.1 ~ Ø20.0	0.00 ~ -0.03

(mm)

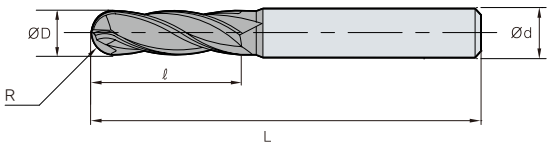
	Designation	R	ØD	Ød	ℓ	L
IPLBE 2	2010-075	0.50	1.0	6	2	75
	2010-100	0.50	1.0	6	2	100
	2015-075	0.75	1.5	6	3	75
	2015-100	0.75	1.5	6	3	100
	2020-075	1.00	2.0	6	4	75
	2020-100	1.00	2.0	6	4	100
	2025-075	1.25	2.5	6	5	75
	2025-100	1.25	2.5	6	5	100
	2030-075	1.50	3.0	6	6	75
	2030-100	1.50	3.0	6	6	100
	2035-100	1.75	3.5	6	7	100
	2040-075	2.00	4.0	6	8	75
	2040-100	2.00	4.0	6	8	100
	2050-075	2.50	5.0	6	10	75
	2050-100	2.50	5.0	6	10	100
	2060-075	3.00	6.0	6	12	75
	2060-100	3.00	6.0	6	12	100
	2060-150	3.00	6.0	6	12	150
	2080-075	4.00	8.0	8	16	75
	2080-100	4.00	8.0	8	16	100
	2080-150	4.00	8.0	8	16	150
	2100-100	5.00	10.0	10	20	100
	2100-150	5.00	10.0	10	20	150
	2100-200	5.00	10.0	10	20	200
	2120-100	6.00	12.0	12	24	100
	2120-150	6.00	12.0	12	24	150
	2120-200	6.00	12.0	12	24	200
	2160-150	8.00	16.0	16	32	150
	2160-200	8.00	16.0	16	32	200

I+ Endmill

IPBE4000 (Ball)

4 | H A 35° | h6 shank | Substrate PC320

ØD	Tolerance
Ø1.0 ~ Ø12.0	0.00 ~ -0.02
Ø12.1 ~ Ø20.0	0.00 ~ -0.03



(mm)

	Designation	R	ØD	Ød	ℓ	L
IPBE	4010-050-S4	0.50	1.0	4	2	50
4	4010-050	0.50	1.0	6	2	50
	4015-050-S4	0.75	1.5	4	3	50
	4015-050	0.75	1.5	6	3	50
	4020-050-S4	1.00	2.0	4	4	50
	4020-050	1.00	2.0	6	4	50
	4025-050-S4	1.25	2.5	4	5	50
	4025-050	1.25	2.5	6	5	50
	4030-050-S3	1.50	3.0	3	6	50
	4030-050-S4	1.50	3.0	4	6	50
	4030-050	1.50	3.0	6	6	50
	4035-050-S4	1.75	3.5	4	7	50
	4035-050	1.75	3.5	6	7	50
	4040-050-S4	2.00	4.0	4	8	50
	4040-050	2.00	4.0	6	8	50
	4045-050	2.25	4.5	6	9	50
	4050-050	2.50	5.0	6	10	50
	4060-050	3.00	6.0	6	12	50
	4070-060	3.50	7.0	8	14	60
	4080-060	4.00	8.0	8	16	60
	4090-075	4.50	9.0	10	18	75
	4100-075	5.00	10.0	10	20	75
	4120-075	6.00	12.0	12	24	75
	4140-100	7.00	14.0	16	28	100
	4160-100	8.00	16.0	16	32	100
	4180-100	9.00	18.0	20	36	100
	4200-100	10.00	20.0	20	40	100

IPRE2000 (Radius)

2 | H A 35° | h6 shank | Substrate PC320

ØD	Tolerance
Ø1.0 ~ Ø12.0	0.00 ~ -0.02

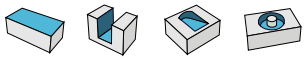
(mm)

	Designation	ØD	Ød	ℓ	L	r
IPRE 2	2010-050-R01	1.0	4	3	50	0.10
	2010-050-R02	1.0	4	3	50	0.20
	2010-050-R03	1.0	4	3	50	0.30
	2015-050-R02	1.5	4	4	50	0.20
	2015-050-R03	1.5	4	4	50	0.30
	2020-050-R02	2.0	4	6	50	0.20
	2020-050-R03	2.0	4	6	50	0.30
	2020-050-R05	2.0	4	6	50	0.50
	2025-050-R02	2.5	4	8	50	0.20
	2030-050-R02-S3	3.0	3	8	50	0.20
	2030-050-R03-S3	3.0	3	8	50	0.30
	2030-050-R05-S3	3.0	3	8	50	0.50
	2030-050-R10-S3	3.0	3	8	50	1.00
	2030-050-R02	3.0	4	8	50	0.20
	2030-050-R03	3.0	4	8	50	0.30
	2030-050-R05	3.0	4	8	50	0.50
	2030-050-R10	3.0	4	8	50	1.00
	2040-050-R02	4.0	4	10	50	0.20
	2040-050-R03	4.0	4	10	50	0.30
	2040-050-R05	4.0	4	10	50	0.50
	2040-050-R10	4.0	4	10	50	1.00
	2040-050-R15	4.0	4	10	50	1.50
	2050-050-R02	5.0	6	13	50	0.20
	2050-050-R03	5.0	6	13	50	0.30
	2050-050-R05	5.0	6	13	50	0.50
	2050-050-R10	5.0	6	13	50	1.00
	2060-050-R02	6.0	6	15	50	0.20

	Designation	ØD	Ød	ℓ	L	r
IPRE 2	2060-050-R03	6.0	6	15	50	0.30
	2060-050-R05	6.0	6	15	50	0.50
	2060-050-R10	6.0	6	15	50	1.00
	2060-050-R15	6.0	6	15	50	1.50
	2060-050-R20	6.0	6	15	50	2.00
	2080-060-R03	8.0	8	20	60	0.30
	2080-060-R05	8.0	8	20	60	0.50
	2080-060-R10	8.0	8	20	60	1.00
	2080-060-R15	8.0	8	20	60	1.50
	2080-060-R20	8.0	8	20	60	2.00
	2080-060-R25	8.0	8	20	60	2.50
	2080-060-R30	8.0	8	20	60	3.00
	2100-075-R03	10.0	10	25	75	0.30
	2100-075-R05	10.0	10	25	75	0.50
	2100-075-R10	10.0	10	25	75	1.00
	2100-075-R15	10.0	10	25	75	1.50
	2100-075-R20	10.0	10	25	75	2.00
	2100-075-R25	10.0	10	25	75	2.50
	2100-075-R30	10.0	10	25	75	3.00
	2120-075-R03	12.0	12	30	75	0.30
	2120-075-R05	12.0	12	30	75	0.50
	2120-075-R10	12.0	12	30	75	1.00
	2120-075-R15	12.0	12	30	75	1.50
	2120-075-R20	12.0	12	30	75	2.00
	2120-075-R25	12.0	12	30	75	2.50
	2120-075-R30	12.0	12	30	75	3.00

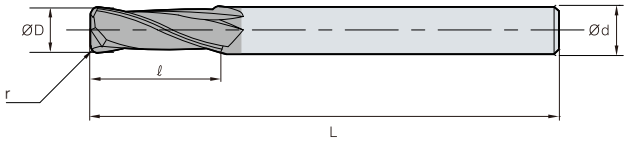
I+ Endmill

IPLRE2000 (Long radius)



2 | H A 35° | h6 shank | Substrate PC320

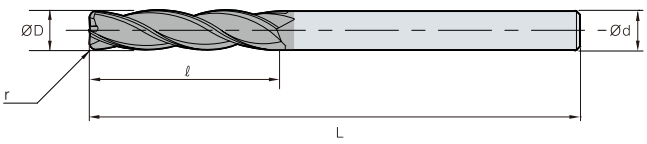
ØD	Tolerance
Ø3.0 ~ Ø12.0	0.00 ~ -0.02



(mm)

	Designation	ØD	Ød	ℓ	L	r
IPLRE 2	2030-075-R03	3.0	3	8	75	0.30
	2030-075-R05	3.0	3	8	75	0.50
	2030-075-R10	3.0	3	8	75	1.00
	2040-075-R03	4.0	4	10	75	0.30
	2040-075-R05	4.0	4	10	75	0.50
	2040-075-R10	4.0	4	10	75	1.00
	2040-075-R15	4.0	4	10	75	1.50
	2060-100-R03	6.0	6	15	100	0.30
	2060-100-R05	6.0	6	15	100	0.50
	2060-100-R10	6.0	6	15	100	1.00
	2060-100-R15	6.0	6	15	100	1.50
	2060-100-R20	6.0	6	15	100	2.00
	2080-100-R03	8.0	8	20	100	0.30
	2080-100-R05	8.0	8	20	100	0.50
	2080-100-R10	8.0	8	20	100	1.00
	2080-100-R15	8.0	8	20	100	1.50
	2080-100-R20	8.0	8	20	100	2.00
	2080-100-R25	8.0	8	20	100	2.50
	2080-100-R30	8.0	8	20	100	3.00
	2100-100-R03	10.0	10	25	100	0.30
	2100-100-R05	10.0	10	25	100	0.50
	2100-100-R10	10.0	10	25	100	1.00
	2100-100-R15	10.0	10	25	100	1.50
	2100-100-R20	10.0	10	25	100	2.00
	2100-100-R25	10.0	10	25	100	2.50
	2100-100-R30	10.0	10	25	100	3.00
	2120-100-R03	12.0	12	30	100	0.30
	2120-100-R05	12.0	12	30	100	0.50
	2120-100-R10	12.0	12	30	100	1.00
	2120-100-R15	12.0	12	30	100	1.50
	2120-100-R20	12.0	12	30	100	2.00
	2120-100-R25	12.0	12	30	100	2.50
	2120-100-R30	12.0	12	30	100	3.00

IPRE4000 (Radius)



4 | H A 35° | h6 shank | Substrate PC320

ØD	Tolerance
Ø2.0 ~ Ø12.0	0.00 ~ -0.02

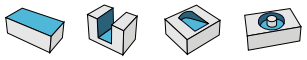
(mm)

	Designation	ØD	Ød	ℓ	L	r
IPRE 4	4020-050-R02	2.0	4	6	50	0.20
	4020-050-R03	2.0	4	6	50	0.30
	4020-050-R05	2.0	4	6	50	0.50
	4025-050-R02	2.5	4	8	50	0.20
	4030-050-R02-S3	3.0	3	8	50	0.20
	4030-050-R03-S3	3.0	3	8	50	0.30
	4030-050-R05-S3	3.0	3	8	50	0.50
	4030-050-R10-S3	3.0	3	8	50	1.00
	4030-050-R02	3.0	4	8	50	0.20
	4030-050-R03	3.0	4	8	50	0.30
	4030-050-R05	3.0	4	8	50	0.50
	4030-050-R10	3.0	4	8	50	1.00
	4040-050-R02	4.0	4	10	50	0.20
	4040-050-R03	4.0	4	10	50	0.30
	4040-050-R05	4.0	4	10	50	0.50
	4040-050-R10	4.0	4	10	50	1.00
	4040-050-R15	4.0	4	10	50	1.50
	4050-050-R02	5.0	6	13	50	0.20
	4050-050-R03	5.0	6	13	50	0.30
	4050-050-R05	5.0	6	13	50	0.50
	4050-050-R10	5.0	6	13	50	1.00
	4060-050-R02	6.0	6	15	50	0.20
	4060-050-R03	6.0	6	15	50	0.30
	4060-050-R05	6.0	6	15	50	0.50

	Designation	ØD	Ød	ℓ	L	r
IPRE 4	4060-050-R10	6.0	6	15	50	1.00
	4060-050-R15	6.0	6	15	50	1.50
	4060-050-R20	6.0	6	15	50	2.00
	4080-060-R03	8.0	8	20	60	0.30
	4080-060-R05	8.0	8	20	60	0.50
	4080-060-R10	8.0	8	20	60	1.00
	4080-060-R15	8.0	8	20	60	1.50
	4080-060-R20	8.0	8	20	60	2.00
	4080-060-R25	8.0	8	20	60	2.50
	4080-060-R30	8.0	8	20	60	3.00
	4100-075-R03	10.0	10	25	75	0.30
	4100-075-R05	10.0	10	25	75	0.50
	4100-075-R10	10.0	10	25	75	1.00
	4100-075-R15	10.0	10	25	75	1.50
	4100-075-R20	10.0	10	25	75	2.00
	4100-075-R25	10.0	10	25	75	2.50
	4100-075-R30	10.0	10	25	75	3.00
	4120-075-R03	12.0	12	30	75	0.30
	4120-075-R05	12.0	12	30	75	0.50
	4120-075-R10	12.0	12	30	75	1.00
	4120-075-R15	12.0	12	30	75	1.50
	4120-075-R20	12.0	12	30	75	2.00
	4120-075-R25	12.0	12	30	75	2.50
	4120-075-R30	12.0	12	30	75	3.00

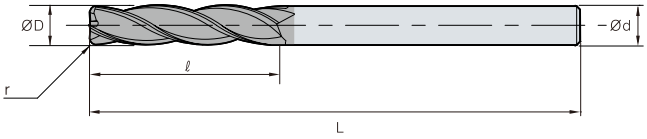
I+ Endmill

IPLRE4000 (Long radius)



4 | H A 35° | h6 shank | Substrate PC320

ØD	Tolerance
Ø3.0 ~ Ø12.0	0.00 ~ -0.02



(mm)

	Designation	ØD	Ød	ℓ	L	r
IPLRE	4030-075-R03	3.0	3	8	75	0.30
4	4030-075-R05	3.0	3	8	75	0.50
	4030-075-R10	3.0	3	8	75	1.00
	4040-075-R03	4.0	4	10	75	0.30
	4040-075-R05	4.0	4	10	75	0.50
	4040-075-R10	4.0	4	10	75	1.00
	4040-075-R15	4.0	4	10	75	1.50
	4060-100-R03	6.0	6	15	100	0.30
	4060-100-R05	6.0	6	15	100	0.50
	4060-100-R10	6.0	6	15	100	1.00
	4060-100-R15	6.0	6	15	100	1.50
	4060-100-R20	6.0	6	15	100	2.00
	4080-100-R03	8.0	8	20	100	0.30
	4080-100-R05	8.0	8	20	100	0.50
	4080-100-R10	8.0	8	20	100	1.00
	4080-100-R15	8.0	8	20	100	1.50
	4080-100-R20	8.0	8	20	100	2.00
	4080-100-R25	8.0	8	20	100	2.50
	4080-100-R30	8.0	8	20	100	3.00
	4100-100-R03	10.0	10	25	100	0.30
	4100-100-R05	10.0	10	25	100	0.50
	4100-100-R10	10.0	10	25	100	1.00
	4100-100-R15	10.0	10	25	100	1.50
	4100-100-R20	10.0	10	25	100	2.00
	4100-100-R25	10.0	10	25	100	2.50
	4100-100-R30	10.0	10	25	100	3.00
	4120-100-R03	12.0	12	30	100	0.30
	4120-100-R05	12.0	12	30	100	0.50
	4120-100-R10	12.0	12	30	100	1.00
	4120-100-R15	12.0	12	30	100	1.50
	4120-100-R20	12.0	12	30	100	2.00
	4120-100-R25	12.0	12	30	100	2.50
	4120-100-R30	12.0	12	30	100	3.00

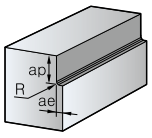
I+ Endmill

Recommended cutting conditions

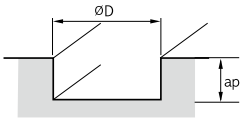
IPFE2000 (Flat)

Diameter (Ø)	Carbon steels, Alloy steels (SM50C, SCM, GC250, Cast iron) under HRC30			Alloy steels, High speed steels (Pre-hardened steels, STD61, NAK) HRC30~45			Stainless steel (STS304, STS316)		
	R.P.M n (min⁻¹)	Feed (mm/min)		R.P.M n (min⁻¹)	Feed (mm/min)		R.P.M n (min⁻¹)	Feed (mm/min)	
		Shouldering	Slotting		Shouldering	Slotting		Shouldering	Slotting
1.0	30,000	600	480	20,000	400	320	12,600	300	180
1.5	20,000	600	480	14,000	400	320	8,400	300	180
2.0	15,000	600	480	10,000	400	400	6,300	300	180
2.5	12,000	600	480	8,200	400	320	5,100	300	180
3.0	10,000	600	480	7,000	400	320	4,200	300	180
4.0	7,500	600	480	5,200	400	320	3,100	300	180
5.0	6,000	600	480	4,200	400	320	2,500	300	180
6.0	5,000	600	480	3,500	400	320	2,100	300	180
8.0	4,000	520	410	2,800	350	280	1,600	260	150
10.0	3,200	450	360	2,200	300	240	1,300	230	130
12.0	2,700	410	320	1,900	270	210	1,100	210	120
16.0	2,000	240	190	1,400	210	160	840	160	100
20.0	1,600	200	160	1,100	170	130	680	140	80

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**
- ap : ≤ 1.5 (All dia.)
- ae : ≤ 0.1D (D ≤ Ø3)
  ≤ 0.2D (D > Ø3)

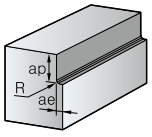


■ **Shouldering depth(ap)**
- ap : ≤ 0.1D (D ≤ Ø2)
  ≤ 0.2D (D > Ø2)

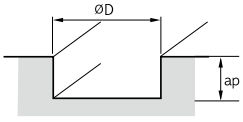
IPFE4000 (Flat)

Diameter (Ø)	Carbon steels, Alloy steels (SM50C, SCM, GC250, Cast iron) under HRC30			Alloy steels, High speed steels (Pre-hardened steels, STD61, NAK) HRC30~45			Stainless steel (STS304, STS316)		
	R.P.M n (min⁻¹)	Feed (mm/min)		R.P.M n (min⁻¹)	Feed (mm/min)		R.P.M n (min⁻¹)	Feed (mm/min)	
		Shouldering	Slotting		Shouldering	Slotting		Shouldering	Slotting
1.0	30,000	900	720	20,000	600	480	12,600	450	270
1.5	20,000	900	720	14,000	600	480	8,400	450	270
2.0	15,000	900	720	10,000	600	480	6,300	450	270
2.5	12,000	900	720	8,200	600	480	5,100	450	270
3.0	10,000	900	720	7,000	600	480	4,200	450	270
4.0	7,500	900	720	5,200	600	480	3,100	450	270
5.0	6,000	900	720	4,200	600	480	2,500	450	270
6.0	5,000	900	720	3,500	600	480	2,100	450	270
8.0	4,000	780	620	2,800	520	410	1,600	390	230
10.0	3,200	680	540	2,200	450	360	1,300	340	200
12.0	2,700	620	490	1,900	410	320	1,100	310	180
16.0	2,000	360	280	1,400	310	240	840	240	140
20.0	1,600	300	240	1,100	250	200	680	210	120

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**
- ap : ≤ 1.5 (All dia.)
- ae : ≤ 0.1D (D ≤ Ø3)
  ≤ 0.2D (D > Ø3)



■ **Shouldering depth(ap)**
- ap : ≤ 0.1D (D ≤ Ø2)
  ≤ 0.2D (D > Ø2)

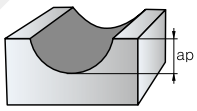
I+ Endmill

Recommended cutting conditions

IPBE2000 (Ball)

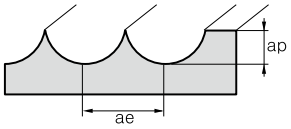
Diameter (Ø)	Carbon steel (SM50C)		Alloy steel (SCM, STD, STS, KP4M, NAK)		Mold steel (STD61) under HRC45		Non-ferrous metal (Aluminum)	
	R.P.M n (min⁻¹)	Feed (mm/min)	R.P.M n (min⁻¹)	Feed (mm/min)	R.P.M n (min⁻¹)	Feed (mm/min)	R.P.M n (min⁻¹)	Feed (mm/min)
1.0	40,000	1,200	38,000	1,200	29,000	900	40,000	1,000
1.5	30,000	1,270	25,500	1,100	19,000	700	40,000	1,360
2.0	24,000	1,160	19,000	800	14,300	600	40,000	2,000
2.5	19,000	1,000	15,300	670	11,500	510	38,000	2,400
3.0	16,000	930	13,000	600	9,600	460	32,000	2,400
3.5	13,700	930	11,400	580	8,200	450	27,300	2,400
4.0	12,000	930	10,000	570	7,200	450	24,000	2,400
5.0	9,600	930	8,000	560	5,700	450	19,000	2,400
6.0	8,000	930	6,400	540	4,800	450	16,000	2,400
8.0	6,000	900	4,800	540	3,600	450	12,000	2,400
10.0	4,800	900	3,800	540	2,900	450	9,600	2,300
12.0	4,000	900	3,200	540	2,400	450	8,000	2,100
14.0	3,400	900	2,750	540	2,050	450	6,800	2,000
16.0	3,000	900	2,400	540	1,800	450	6,000	2,000
20.0	2,400	900	1,900	520	1,450	450	4,800	2,000

Application tip



■ Slotting depth(ap)

• ap : 0.1×R (~HRC45)
0.08×R (~HRC50)



(R0.1~0.5=0.2×R)
0.3×R

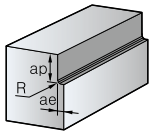
■ Shouldering depth(ap) and radial depth(ae)

~0.16×R R≦0.3 (~HRC45)
~0.25×R R≦3 (~HRC45)
~0.17×R R≦4 (~HRC45)
~0.05×R (~HRC50)

IPRE2000 (Radius)

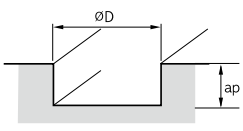
Diameter (Ø)	Carbon steels, Alloy steels (SM50C, SCM, GC250, Cast iron) under HRC30			Alloy steels, High speed steels (Pre-hardened steels, STD61, NAK) HRC30~45			Stainless steel (STS304, STS316)		
	R.P.M n (min⁻¹)	Feed (mm/min)		R.P.M n (min⁻¹)	Feed (mm/min)		R.P.M n (min⁻¹)	Feed (mm/min)	
		Shouldering	Slotting		Shouldering	Slotting		Shouldering	Slotting
2.0	11,000	180	180	7,200	110	110	6,000	90	90
3.0	8,500	200	160	5,300	130	100	4,400	110	66
4.0	7,200	360	290	4,400	220	180	3,000	180	110
5.0	6,000	380	300	3,600	230	180	2,400	190	110
6.0	5,300	420	340	3,200	240	190	2,200	210	130
8.0	4,000	450	360	2,400	240	190	1,600	220	130
10.0	3,200	390	310	1,900	190	150	1,300	190	110
12.0	2,700	330	260	1,600	160	130	1,000	150	90

Application tip



■ Shouldering depth(ap) and radial depth(ae)

• ap : ≤ 1.5D
• ap : ≤ 0.1D

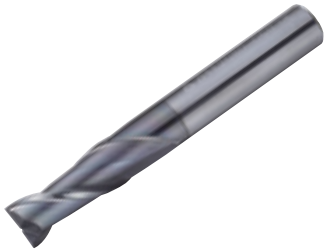


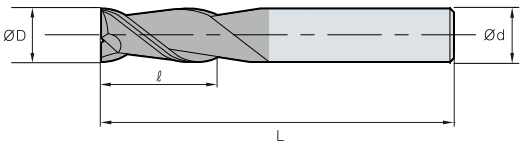
■ Shouldering depth(ap)

• ap : ≤ 0.3D

Z+ Endmill

ZPFE2000 (Flat)





2 | H·A 35° | h6 shank | Substrate PC320U

ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03

(mm)

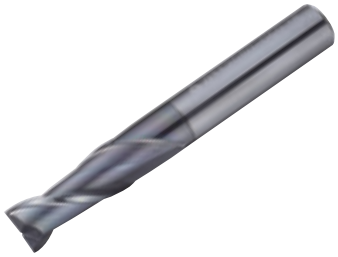
	Designation	ØD	Ød	ℓ	L
ZPFE	2010-050-S4	1.0	4	3	50
2	2015-050-S4	1.5	4	4	50
	2020-050-S4	2.0	4	6	50
	2025-050-V6S4	2.5	4	6	50
	2025-050-V8S4	2.5	4	8	50
	2030-050-S4	3.0	4	9	50
	2030-050	3.0	6	9	50
	2035-050-S4	3.5	4	9	50
	2035-050	3.5	6	9	50
	2040-050-S4	4.0	4	11	50
	2040-050	4.0	6	11	50
	2045-050	4.5	6	11	50
	2050-050	5.0	6	13	50
	2060-050	6.0	6	16	50
	2065-060	6.5	8	16	60
	2070-060	7.0	8	20	60
	2075-060	7.5	8	20	60
	2080-060	8.0	8	20	60
	2085-075	8.5	10	23	75
	2090-075	9.0	10	23	75
	2095-075	9.5	10	25	75
	2100-075	10.0	10	25	75
	2105-075	10.5	12	26	75
	2110-075	11.0	12	28	75
	2120-075	12.0	12	30	75
	2140-100	14.0	14	34	100
	2150-090	15.0	16	36	90
	2160-100	16.0	16	36	100
	2170-100	17.0	20	40	100
	2180-100	18.0	18	40	100
	2190-100	19.0	20	40	100
	2200-100	20.0	20	40	100

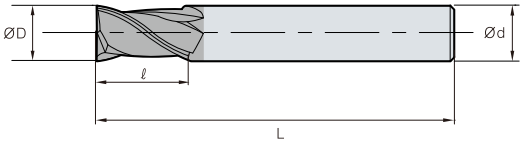
Z+ Endmill

ZPSFE2000 (Short flat)

2 | H-A 35° | h6 shank | Substrate PC320U

ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03





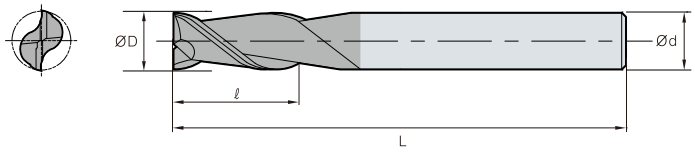
(mm)

	Designation	ØD	Ød	ℓ	L
ZPSFE 2	2010-050-S4	1.0	4	2	50
	2015-050-S4	1.5	4	2	50
	2020-050-S4	2.0	4	3	50
	2025-050-S4	2.5	4	4	50
	2030-050-S4	3.0	4	5	50
	2040-050-S4	4.0	4	6	50
	2050-050	5.0	6	8	50
	2060-050	6.0	6	9	50
	2070-050	7.0	8	10	50
	2080-050	8.0	8	12	50
	2100-075	10.0	10	15	75
	2120-075	12.0	12	18	75
	2160-100	16.0	16	24	100

ZPLFE2000 (Long flat)

2 | H·A 35° | h6 shank | Substrate PC320U

ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03



(mm)

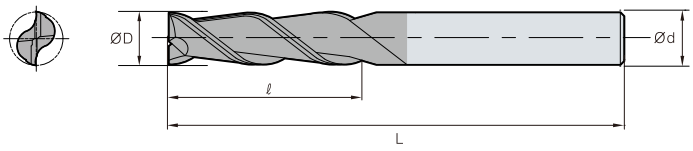
	Designation	ØD	Ød	ℓ	L
ZPLFE	2020-075-S4	2.0	4	6	75
2	2030-075-S4	3.0	4	9	75
	2030-075	3.0	6	12	75
	2040-075-S4	4.0	4	11	75
	2050-075	5.0	6	20	75
	2060-100	6.0	6	16	100
	2060-100-V20S6	6.0	6	20	100
	2080-075	8.0	8	20	75
	2080-100	8.0	8	25	100
	2100-100	10.0	10	30	100
	2120-100	12.0	12	35	100
	2160-150	16.0	16	36	150
	2200-150	20.0	20	45	150

Z+ Endmill

ZPLFE2000 (Long flute)

2 | H·A 35° | h6 shank | Substrate PC320U

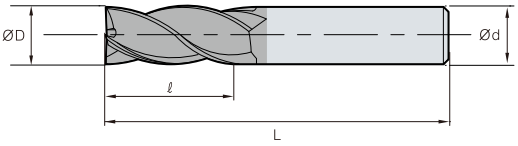
ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03



(mm)

	Designation	ØD	Ød	ℓ	L
ZPLFE 2	2020-075-V15S4	2.0	4	15	75
	2030-075-V25S4	3.0	4	25	75
	2040-075-V30S4	4.0	4	30	75
	2050-075-V30S6	5.0	6	30	75
	2060-075-V35S6	6.0	6	35	75
	2080-100-V40S8	8.0	8	40	100
	2100-100-V45S10	10.0	10	45	100
	2120-100-V50S12	12.0	12	50	100
	2140-100-V55S14	14.0	14	55	100
	2160-150-V50S16	16.0	16	50	150
	2160-150-V60S16	16.0	16	60	150
	2180-150-V65S18	18.0	18	65	150
	2200-150-V70S20	20.0	20	70	150

ZPFE4000 (Flat)



4 | H·A 35° | h6 shank | Substrate PC320U

ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03

(mm)

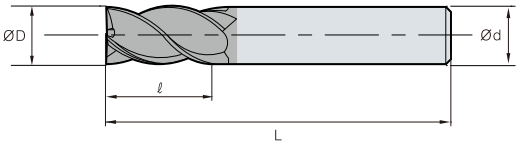
	Designation	ØD	Ød	ℓ	L
ZPFE 4	4010-050-S4	1.0	4	3	50
	4015-050-S4	1.5	4	5	50
	4015-050	1.5	6	5	50
	4020-050-S4	2.0	4	6	50
	4020-050	2.0	6	6	50
	4025-050-S4	2.5	4	8	50
	4025-050	2.5	6	8	50
	4030-050	3.0	6	6	50
	4030-050-S4	3.0	4	9	50
	4030-050-V9S6	3.0	6	9	50
	4035-050-S4	3.5	4	11	50
	4035-050	3.5	6	9	50
	4040-050-S4	4.0	4	11	50
	4040-050	4.0	6	11	50
	4045-050	4.5	6	11	50
	4050-050	5.0	6	8	50
	4050-050-V13S6	5.0	6	13	50
	4055-050	5.5	6	16	50
	4060-050	6.0	6	16	50
	4065-060	6.5	8	16	60
	4070-060	7.0	8	20	60
	4075-060	7.5	8	20	60
	4080-060	8.0	8	20	60
	4085-075	8.5	10	23	75
	4090-075	9.0	10	23	75
	4095-075	9.5	10	23	75
	4100-075	10.0	10	25	75
	4110-075	11.0	12	28	75
	4120-075	12.0	12	30	75
	4130-100	13.0	14	32	100
	4140-075	14.0	14	32	75
	4140-100	14.0	14	34	100
	4150-100	15.0	16	36	100
	4160-100	16.0	16	36	100
	4160-100-V40S16	16.0	16	40	100
	4160-100-V45S16	16.0	16	45	100
	4170-100-S18	17.0	18	38	100
	4180-100-S18	18.0	18	45	100
	4200-100-S20	20.0	20	45	100

Z+ Endmill

ZPSFE4000 (Short flat)

4 | H·A 35° | h6 shank | Substrate PC320U

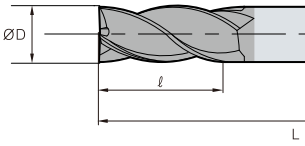
ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03



(mm)

	Designation	ØD	Ød	ℓ	L
ZPSFE 4	4010-050-S4	1.0	4	2	50
	4015-050-S4	1.5	4	2	50
	4020-050-S4	2.0	4	3	50
	4025-050-S4	2.5	4	4	50
	4030-050-S4	3.0	4	5	50
	4040-050-S4	4.0	4	6	50
	4050-050	5.0	6	8	50
	4060-050	6.0	6	9	50
	4070-050	7.0	8	10	50
	4080-050	8.0	8	12	50
	4100-075	10.0	10	15	75
	4120-075	12.0	12	18	75
	4160-100	16.0	16	24	100

ZPLFE4000 (Long flat)



4 | H·A 35° | h6 shank | Substrate PC320U

ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03

(mm)

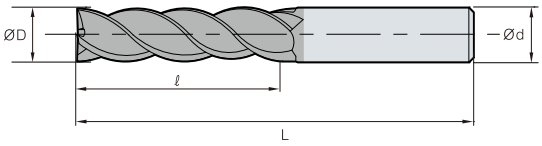
	Designation	ØD	Ød	ℓ	L
ZPLFE 4	4020-075-S4	2.0	4	10	75
	4030-075-S4	3.0	4	12	75
	4040-075-S4	4.0	4	11	75
	4040-050-V15S4	4.0	4	15	75
	4050-075	5.0	6	20	75
	4060-075	6.0	6	16	75
	4060-075-V20S6	6.0	6	20	75
	4080-075	8.0	8	20	75
	4080-100-S8	8.0	8	25	100
	4100-100	10.0	10	30	100
	4100-100-V35S10	10.0	10	35	100
	4120-100	12.0	12	35	100
	4160-150	16.0	16	36	150
	4200-150	20.0	20	45	150

Z+ Endmill

ZPLFE4000 (Long flute)

4 | H·A 35° | h6 shank | Substrate PC320U

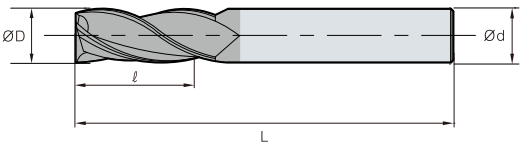
ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03



(mm)

	Designation	ØD	Ød	ℓ	L
ZPLFE 4	4010-050-V04S4	1.0	4	4	50
	4020-050-V10S4	2.0	4	10	50
	4030-060-V15S4	3.0	4	15	60
	4030-060-V16S6	3.0	6	16	60
	4040-060-V20S4	4.0	4	20	60
	4040-075-V20S6	4.0	6	20	75
	4040-075-V30S4	4.0	4	30	75
	4050-075-V25S6	5.0	6	25	75
	4050-075-V30S6	5.0	6	30	75
	4060-075-V30S6	6.0	6	30	75
	4060-075-V35S6	6.0	6	35	75
	4080-100-V35S8	8.0	8	35	100
	4080-100-V40S8	8.0	8	40	100
	4100-100-V45S10	10.0	10	45	100
	4100-100-V50S10	10.0	10	50	100
	4120-100-V45S12	12.0	12	45	100
	4120-100-V50S12	12.0	12	50	100
	4140-100-V45S14	14.0	14	45	100
	4160-150-V50S16	16.0	16	50	150
	4160-150-V60S16	16.0	16	60	150
	4160-150-V70S16	16.0	16	70	150
	4180-150-V70S18	18.0	18	70	150
	4200-150-V70S20	20.0	20	70	150

ZPFE3000 (Flat)



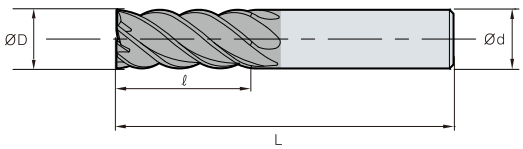
3 | H·A 35° | h6 shank | Substrate PC320U

ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03

(mm)

	Designation	ØD	Ød	ℓ	L
ZPFE 3	3020-050-S4	2.0	4	6	50
	3030-050-S4	3.0	4	9	50
	3040-050-S4	4.0	4	11	50
	3050-050	5.0	6	13	50
	3060-050	6.0	6	16	50
	3065-060	6.5	8	16	60
	3080-060	8.0	8	20	60
	3095-075	9.5	10	24	75
	3100-075	10.0	10	25	75
	3120-075	12.0	12	30	75
	3106-100	16.0	16	36	100
	3180-100	18.0	18	40	100
	3200-100	20.0	20	45	100
	3250-100	25.0	25	50	100

ZPFE6000 (Flat)



6 | H·A 35° | h6 shank | Substrate PC320U

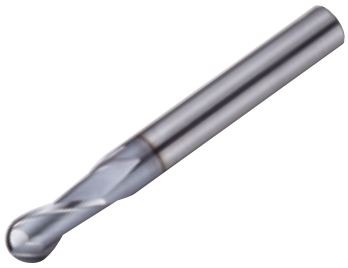
ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03

(mm)

	Designation	ØD	Ød	ℓ	L
ZPFE 6	6060-050	6.0	6	15	50
	6080-060	8.0	8	20	60
	6100-075	10.0	10	25	75
	6120-075	12.0	12	30	75
	6160-100	16.0	16	36	100
	6200-100	20.0	20	45	100

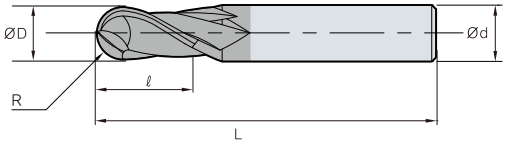
Z+ Endmill

ZPBE2000 (Ball)



2 | H·A 35° | h6 shank | Substrate PC320U

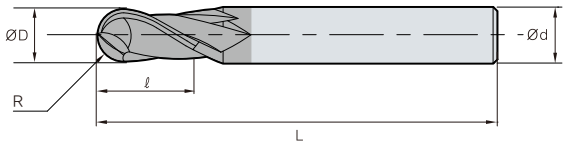
ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03



(mm)

	Designation	R	ØD	Ød	ℓ	L
ZPBE 2	2008-050-S4	0.4	0.8	4	1.6	50
	2009-050-S4	0.5	0.9	4	1.8	50
	2010-050-S4	0.5	1.0	4	2	50
	2015-050-S4	0.8	1.5	4	3	50
	2020-050-S4	1.0	2.0	4	4	50
	2020-050	1.0	2.0	6	4	50
	2025-050-S4	1.3	2.5	4	5	50
	2030-050-S4	1.5	3.0	4	6	50
	2030-050	1.5	3.0	6	6	50
	2040-050-S4	2.0	4.0	4	8	50
	2040-050	2.0	4.0	6	8	50
	2050-050	2.5	5.0	6	10	50
	2060-050	3.0	6.0	6	12	50
	2070-060	3.5	7.0	8	14	60
	2080-060	4.0	8.0	8	14	60
	2090-075	4.5	9.0	10	16	75
	2100-075	5.0	10.0	10	18	75
	2110-075	5.5	11.0	12	20	75
	2120-075	6.0	12.0	12	22	75
	2130-090	6.5	13.0	14	26	90
	2140-090	7.0	14.0	14	26	90
	2150-090	7.5	15.0	16	30	90
	2160-100	8.0	16.0	16	30	100
	2200-100	10.0	20.0	20	38	100

ZPLBE2000 (Long ball)



2 | H·A 35° | h6 shank | Substrate PC320U

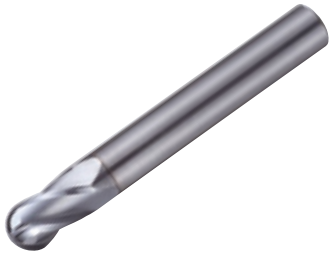
ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03

(mm)

	Designation	R	ØD	Ød	ℓ	L
ZPLBE	2020-075-S4	1.00	2.0	4	4	75
2	2030-075-S4	1.50	3.0	4	6	75
	2030-075	1.50	3.0	6	6	75
	2040-075-S4	2.00	4.0	4	8	75
	2040-075	2.00	4.0	6	8	75
	2050-075	2.50	5.0	6	10	75
	2060-075	3.00	6.0	6	12	75
	2080-100	4.00	8.0	8	14	100
	2100-100	5.00	10.0	10	18	100
	2120-100	6.00	12.0	12	20	100

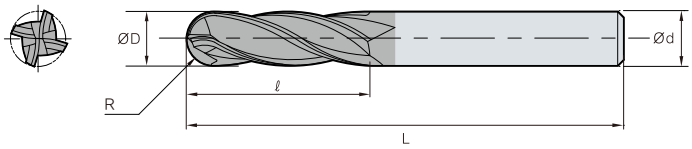
Z+ Endmill

ZPBE4000 (Ball)



4 | H·A 35° | h6 shank | Substrate PC320U

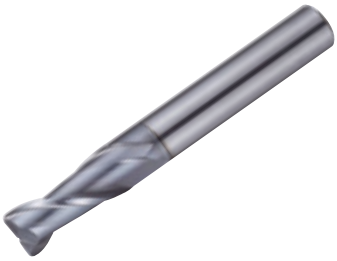
ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03

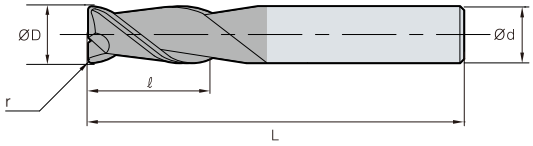


(mm)

	Designation	R	ØD	Ød	ℓ	L
ZPBE	4020-050-S4	1.00	2.0	4	4	50
4	4025-050-S4	1.30	2.5	4	5	50
	4030-050-S4	1.50	3.0	4	6	50
	4030-050	1.50	3.0	6	6	50
	4040-050-S4	2.00	4.0	4	8	50
	4040-050	2.00	4.0	6	8	50
	4050-050	2.50	5.0	6	10	50
	4060-050	3.00	6.0	6	12	50
	4070-060	3.50	7.0	8	14	60
	4080-060	4.00	8.0	8	14	60
	4090-075	4.50	9.0	10	16	75
	4100-075	5.00	10.0	10	18	75
	4110-075	5.50	11.0	12	20	75
	4120-075	6.00	12.0	12	22	75
	4140-075	7.00	14.0	14	24	75
	4160-100	8.00	16.0	16	30	100
	4200-100	10.00	20.0	20	38	100

ZPRE2000 (Radius)





2 | H·A 35° | h6 shank | Substrate PC320U

ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03

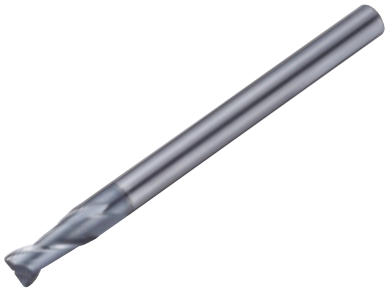
(mm)

	Designation	ØD	Ød	ℓ	L	r
ZPRE 2	2010-050-S4-R02	1.0	4	3	50	0.20
	2020-050-S4-R02	2.0	4	6	50	0.20
	2030-050-S4-R02	3.0	4	9	50	0.20
	2030-050-R02	3.0	6	9	50	0.20
	2030-050-S4-R03	3.0	4	9	50	0.30
	2030-050-R03	3.0	6	9	50	0.30
	2030-050-S4-R05	3.0	4	9	50	0.50
	2030-050-R05	3.0	6	9	50	0.50
	2040-050-S4-R02	4.0	4	11	50	0.20
	2040-050-R02	4.0	6	11	50	0.20
	2040-050-S4-R03	4.0	4	11	50	0.30
	2040-050-R03	4.0	6	11	50	0.30
	2040-050-S4-R05	4.0	4	11	50	0.50
	2040-050-R05	4.0	6	11	50	0.50
	2040-050-S4-R10	4.0	4	11	50	1.00
	2050-050-R02	5.0	6	13	50	0.20
	2050-050-R03	5.0	6	13	50	0.30
	2050-050-R05	5.0	6	13	50	0.50
	2050-050-R010	5.0	6	13	50	1.00
	2060-050-R05	6.0	6	16	50	0.50
	2060-050-R10	6.0	6	16	50	1.00

	Designation	ØD	Ød	ℓ	L	r
ZPRE 2	2060-050-R15	6.0	6	16	50	1.50
	2060-050-R20	6.0	6	16	50	2.00
	2080-060-R03	8.0	8	20	60	0.30
	2080-060-R05	8.0	8	20	60	0.50
	2080-060-R10	8.0	8	20	60	1.00
	2080-060-R15	8.0	8	20	60	1.50
	2080-060-R20	8.0	8	20	60	2.00
	2100-075-R03	10.0	10	25	75	0.30
	2100-075-R06	10.0	10	25	75	0.60
	2100-075-R10	10.0	10	25	75	1.00
	2100-075-R15	10.0	10	25	75	1.50
	2100-075-R20	10.0	10	25	75	2.00
	2100-075-R30	10.0	10	25	75	3.00
	2120-075-R05	12.0	12	30	75	0.50
	2120-075-R10	12.0	12	30	75	1.00
	2120-075-R15	12.0	12	30	75	1.50
	2120-075-R20	12.0	12	30	75	2.00
	2120-075-R30	12.0	12	30	75	3.00
	2160-100-R10	16.0	16	36	100	1.00
	2160-100-R20	16.0	16	36	100	2.00
	2160-100-R30	16.0	16	36	100	3.00

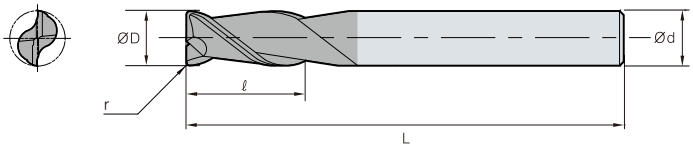
Z+ Endmill

ZPLRE2000 (Long radius)



2 | H·A 35° | h6 shank | Substrate PC320U

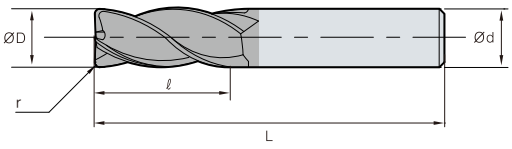
ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03



(mm)

	Designation	ØD	Ød	ℓ	L	r
ZPLRE 2	2060-075-R05	6.0	6	16	75	0.50
	2060-075-R10	6.0	6	16	75	1.00
	2060-075-R15	6.0	6	16	75	1.50
	2080-100-R05	8.0	8	20	100	0.50
	2080-100-R10	8.0	8	20	100	1.00
	2080-100-R15	8.0	8	20	100	1.50
	2100-100-R05	10.0	10	25	100	0.50
	2100-100-R10	10.0	10	25	100	1.00
	2100-100-R15	10.0	10	25	100	1.50
	2100-100-R20	10.0	10	25	100	2.00
	2120-100-R05	12.0	12	30	100	0.50
	2120-100-R10	12.0	12	30	100	1.00
	2120-100-R15	12.0	12	30	100	1.50
	2120-100-R20	12.0	12	30	100	2.00
	2160-150-R05	16.0	16	36	150	0.50
	2160-150-R10	16.0	16	36	150	1.00
	2160-150-R15	16.0	16	36	150	1.50
	2160-150-R20	16.0	16	36	150	2.00

ZPRE4000 (Radius)



4 | H·A 35° | h6 shank | Substrate PC320U

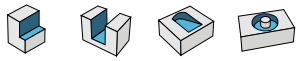
ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03

(mm)

	Designation	ØD	Ød	ℓ	L	r
ZPRE 4	4015-050-S4-R02	1.5	4	5	50	0.20
	4020-050-S4-R02	2.0	4	6	50	0.20
	4030-050-S4-R02	3.0	4	9	50	0.20
	4030-050-S4-R03	3.0	4	9	50	0.30
	4030-050-S4-R05	3.0	4	9	50	0.50
	4040-050-S4-R02	4.0	4	11	50	0.20
	4040-050-S4-R03	4.0	4	11	50	0.30
	4040-050-S4-R05	4.0	4	11	50	0.50
	4040-050-S4-R10	4.0	4	11	50	1.00
	4045-050-R10	4.5	6	12	50	1.00
	4050-050-R02	5.0	6	13	50	0.20
	4050-050-R05	5.0	6	13	50	0.50
	4050-050-R10	5.0	6	13	50	1.00
	4050-050-R15	5.0	6	13	50	1.50
	4060-050-R05	6.0	6	16	50	0.50
	4060-050-R10	6.0	6	16	50	1.00
	4060-050-R15	6.0	6	16	50	1.50
	4080-060-R03	8.0	8	20	60	0.30
	4080-060-R05	8.0	8	20	60	0.50
	4080-060-R10	8.0	8	20	60	1.00
	4080-060-R15	8.0	8	20	60	1.50
	4080-060-R20	8.0	8	20	60	2.00
	4100-075-R03	10.0	10	25	75	0.30
	4100-075-R05	10.0	10	25	75	0.50
	4100-075-R10	10.0	10	25	75	1.00
	4100-075-R15	10.0	10	25	75	1.50
	4100-075-R20	10.0	10	25	75	2.00
	4100-075-R25	10.0	10	25	75	2.50
	4100-075-R30	10.0	10	25	75	3.00
	4120-075-R05	12.0	12	30	75	0.50
	4120-075-R10	12.0	12	30	75	1.00
	4120-075-R15	12.0	12	30	75	1.50
	4120-075-R20	12.0	12	30	75	2.00
	4120-075-R25	12.0	12	30	75	2.50
	4120-075-R30	12.0	12	30	75	3.00
	4160-100-R05	16.0	16	36	100	0.50
	4160-100-R10	16.0	16	36	100	1.00
	4160-100-R20	16.0	16	36	100	2.00
	4160-100-R30	16.0	16	36	100	3.00

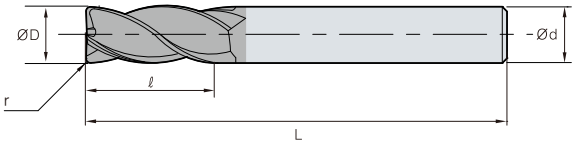
Z+ Endmill

ZPLRE4000 (Long radius)



4 | H·A 35° | h6 shank | Substrate PC320U

ØD	Tolerance
~ Ø11.9	0.00 ~ -0.02
Ø12.0 ~	0.00 ~ -0.03



(mm)

	Designation	ØD	Ød	ℓ	L	r
ZPLRE 4	4060-075-R05	6.0	6	16	75	0.50
	4060-075-R10	6.0	6	16	75	1.00
	4060-075-R15	6.0	6	16	75	1.50
	4080-100-R05	8.0	8	20	100	0.50
	4080-100-R10	8.0	8	20	100	1.00
	4080-100-R15	8.0	8	20	100	1.50
	4080-100-R20	8.0	8	20	100	2.00
	4100-100-R05	10.0	10	25	100	0.50
	4100-100-R10	10.0	10	25	100	1.00
	4100-100-R15	10.0	10	25	100	1.50
	4100-100-R20	10.0	10	25	100	2.00
	4120-100-R05	12.0	12	30	100	0.50
	4120-100-R10	12.0	12	30	100	1.00
	4120-100-R15	12.0	12	30	100	1.50
	4120-100-R20	12.0	12	30	100	2.00
	4120-100-R30	12.0	12	30	100	3.00
	4160-150-R05	16.0	16	36	150	0.50
	4160-150-R10	16.0	16	36	150	1.00
	4160-150-R15	16.0	16	36	150	1.50
	4160-150-R20	16.0	16	36	150	2.00
	4160-150-R30	16.0	16	36	150	3.00

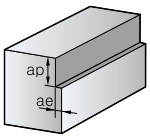
Z+ Endmill

Recommended cutting conditions

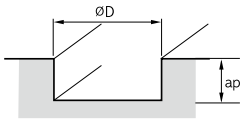
ZPFE2000/ZPSFE2000 (Flat)

Workpiece / Conditions / Diameter(Ø)	Alloy steels and Carbon steels (SCM, SNCM, SM45C etc) under HRC30		Pre-hardened steels (STD, KP4M, NAK etc) HRC30~47		Stainless steels (STS304, STS316 etc)	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	19,745	175	13,057	100	10,500	70
2.0	11,560	190	7,560	120	6,300	90
3.0	8,920	210	5,560	140	4,620	120
4.0	7,560	300	4,620	180	3,880	150
5.0	6,300	320	3,780	190	3,160	160
6.0	5,560	350	3,360	220	2,840	180
8.0	4,200	380	2,520	200	2,100	180
10.0	3,260	330	2,000	160	1,680	160
12.0	2,740	280	1,680	130	1,360	130
16.0	2,200	220	1,360	110	1,060	110

Application tip



■ **Shouldering depth(ap)**
- D ≤ Ø2.5 (ap = 1.3D, ae = 0.05D)
- D > Ø2.5 (ap = 1.5D, ae = 0.1D)



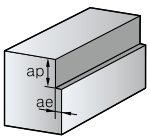
■ **Slotting depth(ap)**
- D ≤ Ø2.5 (ap = 0.3D)
- D > Ø2.5 (ap = 0.5D)

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

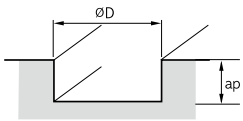
ZPFE4000/ZPSFE4000 (Flat)

Workpiece / Conditions / Diameter(Ø)	Alloy steels and Carbon steels (SCM, SNCM, SM45C etc) under HRC30		Pre-hardened steels (STD, KP4M, NAK etc) HRC30~47		Stainless steels (STS304, STS316 etc)	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
2.0	11,560	280	7,560	170	6,300	140
3.0	8,920	320	5,560	200	4,620	170
4.0	7,560	570	4,620	350	3,880	280
5.0	6,300	600	3,780	360	3,160	300
6.0	5,560	660	3,360	410	2,840	330
8.0	4,200	710	2,520	380	2,100	350
10.0	3,260	610	2,000	300	1,680	300
12.0	2,740	520	1,680	250	1,360	240
16.0	2,200	410	1,360	200	1,100	200

Application tip



■ **Shouldering depth(ap)**
- D ≤ Ø2.5 (ap = 1.3D, ae = 0.05D)
- D > Ø2.5 (ap = 1.5D, ae = 0.1D)



■ **Slotting depth(ap)**
- D ≤ Ø2.5 (ap = 0.3D)
- D > Ø2.5 (ap = 0.5D)

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

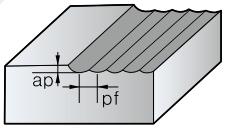
Z+ Endmill

Recommended cutting conditions

ZPBE2000 (Ball)

Workpiece / Conditions / Diameter(Ø)	Alloy steels and Carbon steels (SCM, SNCM, SM45C etc) under HRC30		Pre-hardened steels (STD, KP4M, CENA, NAK etc) HRC30~47	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	30,000	2,880	30,000	2,520
1.2	30,000	3,060	28,800	2,580
1.5	30,000	3,240	28,800	2,700
2.0	29,820	3,420	28,680	2,880
3.0	19,860	3,600	19,080	3,180
4.0	14,940	3,600	14,340	3,180
5.0	11,160	3,480	10,680	2,940
6.0	8,340	2,910	8,040	2,460
8.0	6,660	2,520	6,420	2,100
10.0	5,580	2,220	5,340	1,860
12.0	4,170	1,770	4,008	1,500

Application tip



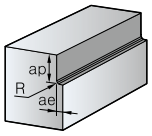
- ap = 0.03D
- pf = 0.05D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

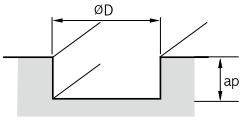
ZPRE2000 (Radius)

Workpiece / Conditions / Diameter(Ø)	Alloy steels and Carbon steels (SCM, SNCM, SM45C etc) under HRC30		Pre-hardened steels (STD, KP4M, NAK etc) HRC30~47		Stainless steels (STS304, STS316 etc)	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
6.0	5,300	420	3,200	240	2,400	180
8.0	4,000	450	2,700	210	2,040	150
10.0	3,200	390	2,400	180	1,600	120
12.0	2,700	330	2,040	150	1,300	100
14.0	2,400	270	1,600	120	1,000	70
16.0	2,040	200	1,300	100	1,300	60

Application tip



■ Shouldering depth(ap)
- ap : ≤ 1.5D
- ae : ≤ 0.1D



■ Slotting depth(ap)
- ap : ≤ 0.3D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

Notice

- Please adjust the recommended cutting conditions properly, according to the condition of your machines, the target shapes, and your purpose for machining
- Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio
- In case of overhang over 3D, reduce RPM and feed rate

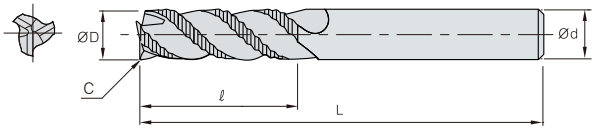
R+ Endmill

RPAE (Wave roughing endmill for Al)

• Carbide

3 | H·A 45° | h6 shank | Substrate FN30T

ØD	Tolerance
Ø6.0 ~ Ø25.0	0.00 ~ -0.05



(mm)

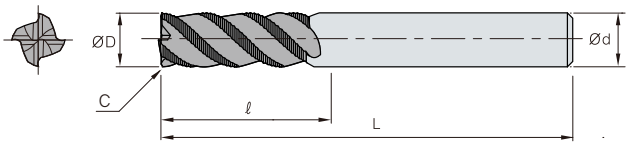
	Designation	ØD	Ød	ℓ	L	C
RPAE	3060-063	6.0	6	18	63	0.30
3	3070-063	7.0	8	23	63	0.30
	3080-063	8.0	8	23	63	0.30
	3090-080	9.0	10	30	80	0.30
	3100-080	10.0	10	30	80	0.30
	3110-080	11.0	12	32	80	0.50
	3120-080	12.0	12	32	80	0.50
	3140-080	14.0	14	32	80	0.50
	3160-105	16.0	16	48	105	0.50
	3180-105	18.0	18	48	105	0.50
	3200-105	20.0	20	50	105	0.50
	3250-105	25.0	25	50	105	0.50

RPE-FP-H (Fine pitch standard type roughing endmill)

• Carbide, High helix angle, irregular flute spacing and lead

4 | H·A 40°/42° | h6 shank | Substrate PC30T

ØD	Tolerance
Ø5.0 ~ Ø20.0	0.00 ~ -0.05

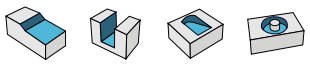


(mm)

	Designation	ØD	Ød	ℓ	L	C
RPE	4050-057-FP-H	5.0	6	13	57	0.30
4	4060-057-FP-H	6.0	6	13	57	0.50
	4080-063-FP-H	8.0	8	19	63	0.50
	4100-072-FP-H	10.0	10	22	72	0.50
	4120-082-FP-H	12.0	12	26	82	0.50
	4140-082-FP-H	14.0	16	26	82	0.60
	4160-092-FP-H	16.0	16	32	92	0.60
	4180-092-FP-H	18.0	20	32	92	0.60
	4200-0104-FP-H	20.0	20	38	104	0.60

R+ Endmill

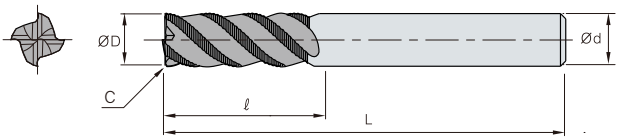
RPLE-FP-H (Fine pitch long type roughing endmill)



• Carbide, High helix angle, irregular flute spacing and lead

4 | H·A 40°/42° | h6 shank | Substrate PC30T

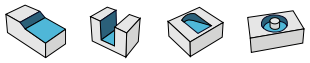
ØD	Tolerance
Ø5.0 ~ Ø20.0	0.00 ~ -0.05



(mm)

	Designation	ØD	Ød	ℓ	L	C
RPLE	4050-063-FP-H	5.0	6	19	63	0.30
4	4060-063-FP-H	6.0	8	19	63	0.50
	4080-072-FP-H	8.0	8	28	72	0.50
	4100-082-FP-H	10.0	10	34	82	0.50
	4120-097-FP-H	12.0	12	40	97	0.50
	4140-097-FP-H	14.0	16	40	97	0.60
	4160-108-F P-H	16.0	16	48	108	0.60
	4180-108-FP-H	18.0	20	48	108	0.60
	4200-122-FP-H	20.0	20	56	122	0.60

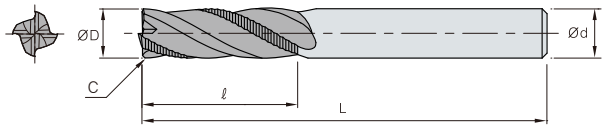
RPE-XG (Endmill for finishing and roughing)



• Carbide

4 | H·A 30° | h6 shank | Substrate PC30T

ØD	Tolerance
Ø6.0 ~ Ø20.0	0.00 ~ -0.05



(mm)

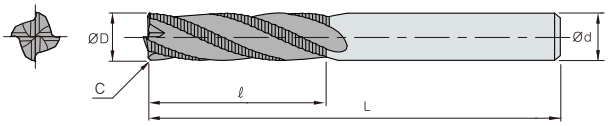
	Designation	ØD	Ød	ℓ	L	C
RPE	4060-052-XG	6.0	6	14	52	0.25
4	4070-063-XG	7.0	8	18	63	0.30
	4080-063-XG	8.0	8	18	63	0.30
	4090-080-XG	9.0	10	22	80	0.30
	4100-080-XG	10.0	10	22	80	0.30
	4110-080-XG	11.0	12	26	80	0.40
	4120-080-XG	12.0	12	26	80	0.40
	4140-080-XG	14.0	14	30	80	0.40
	4160-105-XG	16.0	16	34	105	0.60
	4180-105-XG	18.0	18	38	105	0.60
	4200-105-XG	20.0	20	42	105	0.60

RPE-FP-L (Roughing endmill for fine pitches)

• Carbide, irregular flute spacing and lead

4 | H·A 18°/23° | h6 shank | Substrate PC30T

ØD	Tolerance
Ø5.0 ~ Ø20.0	0.00 ~ -0.05



(mm)

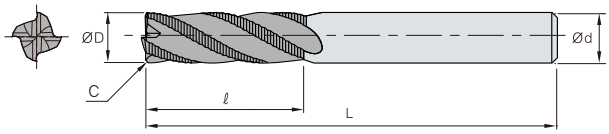
	Designation	ØD	Ød	ℓ	L	C
RPE	4050-060-FP-L	5.0	6	13	60	0.30
4	4060-080-FP-L	6.0	8	13	80	0.50
	4080-080-FP-L	8.0	8	19	80	0.50
	4100-080-FP-L	10.0	10	22	80	0.50
	4120-080-FP-L	12.0	12	26	80	0.50
	4140-085-FP-L	14.0	16	26	85	0.60
	4160-100-FP-L	16.0	16	32	100	0.60
	4180-100-FP-L	18.0	20	32	100	0.60
	4200-105-FP-L	20.0	20	38	105	0.60

RPE-RG (Standard roughing endmill)

• Carbide

4 | H·A 30° | h6 shank | Substrate PC40T

ØD	Tolerance
Ø5.0 ~ Ø20.0	0.00 ~ -0.05

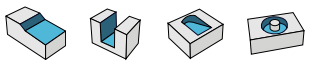


(mm)

	Designation	ØD	Ød	ℓ	L	C
RPE	4050-050-RG	5.0	6	13	50	0.30
4	4060-050-RG	6.0	6	16	50	0.30
	4080-060-RG	8.0	8	20	60	0.30
	4100-075-RG	10.0	10	25	75	0.30
	4120-080-RG	12.0	12	30	80	0.40
	4140-100-RG	14.0	16	35	100	0.60
	4160-100-RG	16.0	16	40	100	0.60
	4180-110-RG	18.0	20	40	110	0.60
	4200-110-RG	20.0	20	45	110	0.60

R+ Endmill

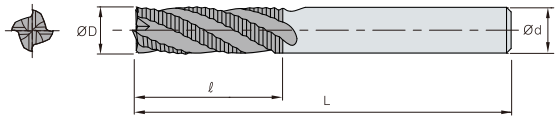
RPE-RG (4F roughing endmill)



• HSS PM

4 | H·A 30° | h6 shank | HSS PM | Substrate: HN30T HC30T

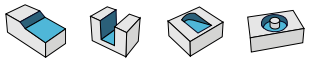
ØD	Tolerance
Ø6.0 ~ Ø20.0	±0.1



(mm)

	Designation	ØD	Ød	ℓ	L
RPE	4060-060-RG	6.0	6	20	60
4	4070-070-RG	7.0	10	20	70
	4080-075-RG	8.0	10	25	75
	4090-075-RG	9.0	10	30	75
	4100-085-RG	10.0	10	35	85
	4120-100-RG	12.0	12	40	100
	4140-100-RG	14.0	16	40	100
	4160-110-RG	16.0	16	50	110
	4180-110-RG	18.0	20	50	110
	4200-125-RG	20.0	20	60	125

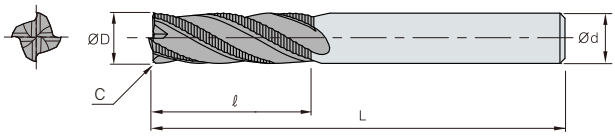
RPE-FF (Roughing endmill for fine pitches)



• HSS PM, Irregular flute spacing

4 | H·A 25°/30° | h6 shank | HSS PM | Substrate: HC30T

ØD	Tolerance
Ø6.0 ~ Ø20.0	±0.1



(mm)

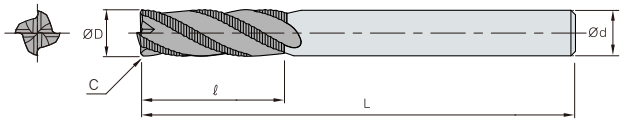
	Designation	ØD	Ød	ℓ	L	C
RPE	4060-060-FF	6.0	6	20	60	0.50
4	4070-070-FF	7.0	10	20	70	0.50
	4080-075-FF	8.0	10	25	75	0.50
	4090-075-FF	9.0	10	30	75	0.50
	4100-085-FF	10.0	10	35	85	0.50
	4120-100-FF	12.0	12	40	100	0.60
	4140-100-FF	14.0	12	40	100	0.60
	4160-110-FF	16.0	16	50	110	0.60
	4180-110-FF	18.0	16	50	110	0.60
	4200-125-FF	20.0	20	60	125	0.60

RPE-FP (Roughing endmill for fine pitches)

• HSS PM, irregular flute spacing and lead

4 | H·A 25°/30° | h6 shank | HSS PM | Substrate HC30T

ØD	Tolerance
Ø6.0 ~ Ø12.0	0.00 ~ -0.05
Ø12.1 ~ Ø20.0	0.00 ~ -0.10



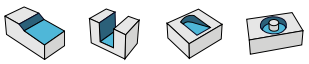
(mm)

	Designation	ØD	Ød	ℓ	L	C
RPE	4060-080-FP	6.0	6	13	80	0.50
4	4070-080-FP	7.0	10	16	80	0.50
	4080-085-FP	8.0	10	19	85	0.50
	4090-095-FP	9.0	10	19	95	0.50
	4100-100-FP	10.0	10	22	100	0.50
	4120-110-FP	12.0	12	26	110	0.60
	4140-110-FP	14.0	12	26	110	0.60
	4160-125-FP	16.0	16	32	125	0.60
	4180-125-FP	18.0	16	32	125	0.60
	4200-140-FP	20.0	20	38	140	0.60

R+ Endmill

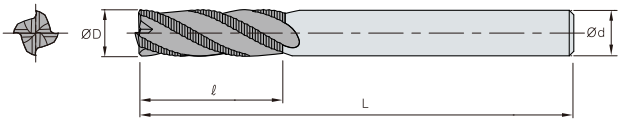
RPE-RG (Roughing endmill)

• HSS



4 | H·A 30° | h6 shank | HSS Co 8% | Substrate: HN20T HC20T HC10T

ØD	Tolerance
Ø6.0 ~ Ø50.0	±0.1



(mm)

	Designation	ØD	Ød	ℓ	L
RPE	4060-060-RG	6.0	6	15	60
4	4070-065-RG	7.0	8	20	65
	4080-065-RG	8.0	8	20	65
	4090-075-RG	9.0	10	25	75
	4100-075-RG	10.0	10	25	75
	4110-080-RG	11.0	12	30	80
	4120-080-RG	12.0	12	30	80
	4130-090-RG	13.0	12	35	90
	4140-090-RG	14.0	12	35	90
	4150-095-RG	15.0	12	40	95
	4160-095-RG	16.0	16	40	95
	4170-095-RG	17.0	16	40	95
	4180-105-RG	18.0	16	40	105
	4190-110-RG	19.0	16	45	110
	4200-110-RG	20.0	20	45	110
	4210-110-RG	21.0	20	45	110
	4220-110-RG	22.0	20	45	110
	4230-110-RG	23.0	20	45	110
	4240-120-RG	24.0	25	50	120
	4250-120-RG	25.0	25	50	120
	4260-120-RG	26.0	25	50	120
	4270-125-RG	27.0	25	55	125
	4280-125-RG	28.0	25	55	125
	4300-125-RG	30.0	25	55	125
	4320-145-RG	32.0	32	60	145
	4340-145-RG	34.0	32	60	145
	4350-145-RG	35.0	32	60	145
	4360-145-RG	36.0	32	60	145
	4380-150-RG	38.0	32	65	150
	4400-150-RG	40.0	32	65	150
	4420-155-RG	42.0	42	65	155
	4440-155-RG	44.0	42	65	155
	4450-160-RG	45.0	42	70	160
	4460-160-RG	46.0	42	70	160
	4500-160-RG	50.0	42	70	160

R+ Endmill

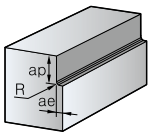
Recommended cutting conditions

RPAE

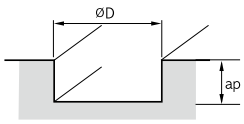
*For Carbide

Workpiece / Conditions / Diameter(Ø)	Aluminum, Non-ferrous metal		Aluminum, Non-ferrous metal	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
6.0	13,000	1,125	13,000	1,400
8.0	10,400	1,300	10,400	1,600
10.0	10,400	1,585	10,400	2,000
12.0	10,400	1,950	10,400	1,650
14.0	7,800	1,675	7,800	2,050
16.0	7,800	1,755	7,800	2,250
18.0	5,200	1,300	5,200	1,700
20.0	5,200	1,495	5,200	1,800
25.0	5,000	1,495	5,000	1,800

Application tip



■ **Shouldering depth(ap)**
- ap : ≤ 1.5D
- ae : ≤ 0.15D



■ **Slotting depth(ap)**
- ap : ≤ 0.2D

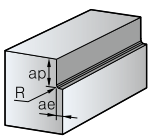
※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

RP(L)E-FP-H

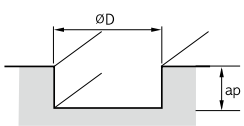
*For Carbide

Workpiece / Conditions / Diameter(Ø)	Alloy steels, Carbon steels ≤HRC25		Alloy steels, Carbon steels, Pre-hardened steels HRC25~40		Alloy steels, Carbon steels ≤HRC25		Alloy steels, Carbon steels, Pre-hardened steels HRC25~40	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
6.0	12,000	1,550	10,600	1,100	15,800	2,570	14,300	1,850
8.0	9,000	1,650	8,100	1,180	11,900	2,700	10,700	1,950
10.0	7,200	1,650	6,400	1,180	9,500	2,700	8,500	1,950
12.0	6,000	1,540	5,400	1,140	8,000	2,570	7,100	1,850
14.0	5,200	1,540	4,750	1,095	7,000	2,510	6,250	1,800
16.0	4,500	1,540	4,100	1,050	6,000	2,450	5,400	1,750
18.0	4,400	1,435	3,650	975	5,400	2,295	4,850	1,625
20.0	3,600	1,330	3,200	900	4,800	2,140	4,300	1,500
25.0	3,200	1,200	2,800	850	4,400	2,000	3,800	1,400

Application tip



■ **Shouldering depth(ap)**
- ap : ≤ 1.0D
- ae : ≤ 0.5D (≤HRC25)
  ≤ 0.35D (HRC25~40)



■ **Slotting depth(ap)**
- ap : ≤ 1.0D (≤HRC25)
  ≤ 0.8D (HRC25~40)

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

R+ Endmill

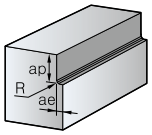
Recommended cutting conditions

RPE-XG

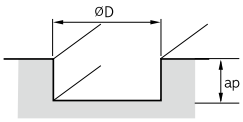
*For Carbide

Workpiece / Conditions / Diameter(Ø)	Alloy steels, Carbon steels ≤HRC25		Alloy steels, Carbon steels, Pre-hardened steels HRC25~40		Alloy steels, Carbon steels ≤HRC25		Alloy steels, Carbon steels, Pre-hardened steels HRC25~40	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
6.0	12,000	1,090	10,600	770	15,800	1,800	14,300	1,300
8.0	9,000	1,160	8,100	830	11,900	1,890	10,700	1,370
10.0	7,200	1,160	6,400	830	9,500	1,890	8,500	1,370
12.0	6,000	1,080	5,400	800	8,000	1,800	7,100	1,300
14.0	5,200	1,080	4,750	770	7,000	1,760	6,250	1,260
16.0	4,500	1,080	4,100	740	6,000	1,720	5,400	1,230
18.0	4,400	1,000	3,650	680	5,400	1,610	4,850	1,140
20.0	3,600	930	3,200	630	4,800	1,500	4,300	1,050
25.0	3,200	840	2,800	600	4,400	1,400	3,800	980

Application tip



■ **Shouldering depth(ap)**
- ap : ≤ 1.0D
- ae : ≤ 0.5D (≤HRC25)
  ≤ 0.35D (HRC25~40)



■ **Slotting depth(ap)**
- ap : ≤ 1.0D (≤HRC25)
  ≤ 0.8D (HRC25~40)

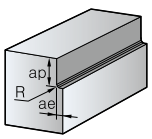
※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

RPE-FP-L

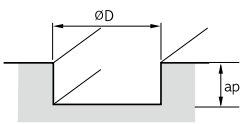
*For Carbide

Workpiece / Conditions / Diameter(Ø)	Alloy steel, Carbon steels ≤HRC35		Pre-hardened steels HRC35~45		High hardened steels HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
6.0	12,400	840	8,400	570	3,400	260
8.0	9,200	840	6,300	570	2,400	240
10.0	7,600	840	5,100	570	2,000	290
12.0	6,000	840	4,200	570	1,680	260
14.0	5,200	840	3,600	570	1,400	200
16.0	4,800	760	3,300	510	1,200	160
18.0	4,400	720	2,700	420	1,100	150
20.0	3,600	560	2,400	360	1,000	150
25.0	3,200	620	2,160	410	900	160

Application tip



■ **Shouldering depth(ap)**
- ap : ≤ 1.0D
- ae : ≤ 0.3D (≤HRC45)
  ≤ 0.05D (HRC45~55)



■ **Slotting depth(ap)**
- ap : ≤ 0.3D (≤HRC45)
  ≤ 0.05D (HRC45~55)

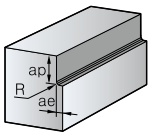
※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

RPE-RG

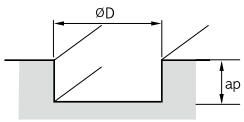
*For Carbide

Workpiece / Conditions / Diameter(Ø)	Alloy steels, Carbon steels ≤HRC25		Alloy steels, Carbon steels, Pre-hardened steels HRC25~40		Alloy steels, Carbon steels ≤HRC25		Alloy steels, Carbon steels, Pre-hardened steels HRC25~40	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
6.0	12,000	1,240	10,600	800	15,800	2,060	14,300	1,480
8.0	9,000	1,320	8,100	940	11,900	2,160	10,700	1,560
10.0	7,200	1,320	6,400	940	9,500	2,160	8,500	1,560
12.0	6,000	1,230	5,400	910	8,000	2,060	7,100	1,480
14.0	5,200	1,230	4,750	880	7,000	2,010	6,250	1,440
16.0	4,500	1,230	4,100	840	6,000	1,960	5,400	1,400
18.0	4,400	1,150	3,650	780	5,400	1,840	4,850	1,300
20.0	3,600	1,060	3,200	720	4,800	1,710	4,300	1,200
25.0	3,200	960	2,800	680	4,400	1,600	3,800	1,120

Application tip



■ **Shouldering depth(ap)**
- ap : ≤ 1.0D
- ae : ≤ 0.5D (≤HRC25)
  ≤ 0.35D (HRC25~40)



■ **Slotting depth(ap)**
- ap : ≤ 1.0D (≤HRC25)
  ≤ 0.8D (HRC25~40)

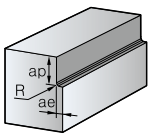
※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

RPE-FF, FP, RG

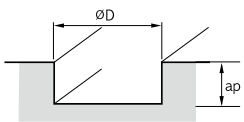
*For HSS PM

Workpiece / Conditions / Diameter(Ø)	Alloy steels, Carbon steels, Tool steels		Alloy steels, Carbon steels, Tool steels ≤HRC20		Alloy steels, Carbon steels, Tool steels HRC20~30		Alloy steels, Carbon steels, Tool steels HRC30~40	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
6.0	2,700	200	2,100	155	1,500	100	1,250	90
8.0	2,300	250	1,800	200	1,300	140	1,000	110
10.0	1,800	360	1,400	275	1,000	170	850	140
12.0	1,500	360	1,150	290	850	200	700	155
14.0	1,300	360	1,000	290	720	200	600	155
16.0	1,150	360	900	290	625	200	520	155
18.0	1,000	360	850	290	580	200	470	155
20.0	920	370	720	290	500	200	420	155
22.0	850	370	620	290	450	200	380	155
25.0	750	360	570	275	400	190	340	155

Application tip



■ **Shouldering depth(ap)**
- ap : ≤ 1.5D (All dia.)
- ae : ≤ 0.5D (All dia.)



■ **Slotting depth(ap)**
- ap : ≤ 0.15D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

R+ Endmill

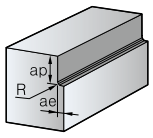
Recommended cutting conditions

RPE-RG

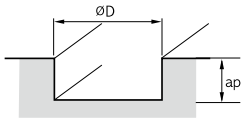
∗For HSS Co

Workpiece / Conditions / Diameter(Ø)	Alloy steels, Carbon steels, Tool steels		Alloy steels, Carbon steels, Tool steels ≤HRC20		Alloy steels, Carbon steels, Tool steels HRC20~30		Alloy steels, Carbon steels, Tool steels HRC30~40	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
6.0	1,800	80	1,600	60	1,200	55	800	30
8.0	1,400	105	1,100	75	900	65	560	45
10.0	1,100	150	900	120	800	110	450	60
12.0	900	180	800	140	630	110	400	70
14.0	800	180	700	140	560	110	350	70
16.0	700	180	560	140	450	110	280	70
18.0	630	180	500	140	400	110	250	70
20.0	560	180	450	140	400	110	220	70
22.0	500	220	450	170	350	140	220	70
25.0	450	220	400	170	310	140	180	85
28.0	400	210	350	160	280	130	160	85
30.0	350	210	310	160	250	130	160	85
32.0	350	210	280	160	220	130	140	85
36.0	310	210	250	160	200	130	120	85
40.0	280	200	220	150	180	120	110	80
50.0	220	200	180	170	160	140	90	80

Application tip



■ **Shouldering depth(ap)**
- ap : ≤ 1.5D
- ae : ≤ 0.1D



■ **Slotting depth(ap)**
- ap : ≤ 0.15D

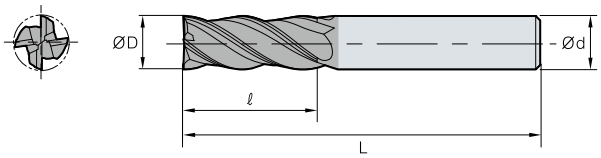
※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

S+ Endmill

SPFE4000 (Flat)

4 | H·A 37°/39° | h6 shank | Grade PC325

ØD	Tolerance
Ø1.0 ~ Ø20.0	0.00 ~ -0.03



(mm)

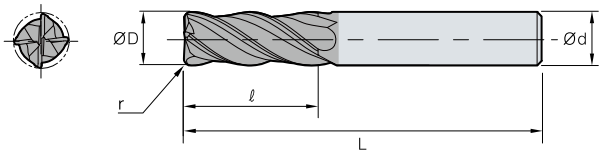
	Designation	ØD	Ød	ℓ	L
SPFE	4010-050	1.0	6	2.5	50
4	4012-050	1.2	6	3	50
	4015-050	1.5	6	4	50
	4020-050	2.0	6	6	50
	4025-050	2.5	6	7	50
	4030-055	3.0	6	8	55
	4030-060-V10	3.0	6	10	60
	4035-055	3.5	6	10	55
	4040-055	4.0	6	10	55
	4040-060-V12	4.0	6	12	60
	4045-055	4.5	6	12	55
	4050-055	5.0	6	15	55
	4055-060	5.5	6	15	60
	4060-060	6.0	6	15	60
	4060-065-V20	6.0	6	20	65
	4065-060	6.5	8	15	60
	4070-080	7.0	8	20	80
	4080-070	8.0	8	20	70
	4080-070-V25	8.0	8	25	70
	4080-080-V30	8.0	8	30	80
	4085-070	8.5	10	20	70
	4090-080	9.0	10	25	80
	4100-075	10.0	10	25	75
	4100-085-V35	10.0	10	35	85
	4120-080	12.0	12	30	80
	4120-090-V40	12.0	12	40	90
	4140-090	14.0	16	35	90
	4160-100	16.0	16	42	100
	4180-100	18.0	16	45	100
	4200-100	20.0	20	48	100

S+ Endmill

SPRE4000 (Radius)

4 | H·A 37°/39° | h6 shank | Grade PC325

ØD	Tolerance
Ø1.0 ~ Ø20.0	0.00 ~ -0.03



(mm)

	Designation	ØD	Ød	ℓ	L	r
SPRE 4	4010-050-R0.1	1.0	6	2.5	50	0.10
	4010-050-R0.2	1.0	6	2.5	50	0.20
	4012-050-R0.1	1.2	6	3	50	0.10
	4015-050-R0.1	1.5	6	4	50	0.10
	4015-050-R0.2	1.5	6	4	50	0.20
	4020-050-R0.1	2.0	6	6	50	0.10
	4020-050-R0.2	2.0	6	6	50	0.20
	4025-050-R0.2	2.5	6	7	50	0.20
	4030-055-R0.2	3.0	6	8	55	0.20
	4030-055-R0.3	3.0	6	8	55	0.30
	4030-055-R0.5	3.0	6	8	55	0.50
	4040-055-R0.2	4.0	6	10	55	0.20
	4040-055-R0.3	4.0	6	10	55	0.30
	4040-055-R0.5	4.0	6	10	55	0.50
	4050-055-R0.2	5.0	6	15	55	0.20
	4050-055-R0.3	5.0	6	15	55	0.30
	4050-055-R0.5	5.0	6	15	55	0.50
	4060-060-R0.3	6.0	6	15	60	0.30
	4060-060-R0.5	6.0	6	15	60	0.50
	4060-060-R1.0	6.0	6	15	60	1.00
	4080-070-R0.3	8.0	8	20	70	0.30

	Designation	ØD	Ød	ℓ	L	r
SPRE 4	4080-070-R0.5	8.0	8	20	70	0.50
	4080-070-R1.0	8.0	8	20	70	1.00
	4100-075-R0.3	10.0	10	25	75	0.30
	4100-075-R0.5	10.0	10	25	75	0.50
	4100-075-R1.0	10.0	10	25	75	1.00
	4100-075-R1.5	10.0	10	25	75	1.50
	4100-075-R2.0	10.0	10	25	75	2.00
	4100-075-R3.0	10.0	10	25	75	3.00
	4120-080-R0.5	12.0	12	30	80	0.50
	4120-080-R1.0	12.0	12	30	80	1.00
	4120-080-R1.5	12.0	12	30	80	1.50
	4120-080-R2.0	12.0	12	30	80	2.00
	4120-080-R3.0	12.0	12	30	80	3.00
	4120-080-R4.0	12.0	12	30	80	4.00
	4140-090-R0.5	14.0	16	35	90	0.50
	4140-090-R1.0	14.0	16	35	90	1.00
	4160-100-R0.5	16.0	16	42	100	0.50
	4160-100-R1.0	16.0	16	42	100	1.00
	4180-100-R0.5	18.0	16	45	100	0.50
	4200-100-R0.5	20.0	20	48	100	0.50
	4200-100-R1.0	20.0	20	48	100	1.00

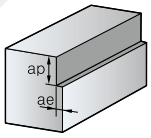
S+ Endmill

Recommended cutting conditions

SPFE4000 (Flat) / SPRE4000 (Radius)

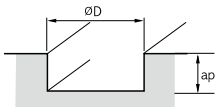
Workpiece / Conditions / Diameter (Ø)	Stainless steels		Titanium alloy /Inconel		Common steels under HRC25		Stainless steels HRC25~35		Tool steels HRC40~50	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
2.0	5,500	240	2,600	90	9,000	540	6,000	3,200	4,000	240
4.0	4,000	260	2,000	90	6,600	600	4,500	340	3,000	280
6.0	3,000	360	1,200	90	4,800	720	3,000	360	2,500	280
8.0	2,000	390	1,000	100	3,600	750	2,200	460	2,000	300
10.0	1,700	410	800	120	2,800	750	1,800	460	1,500	300
12.0	1,500	380	700	100	2,400	710	1,500	410	1,200	280
14.0	1,200	320	600	95	2,200	660	1,300	370	1,000	270
16.0	1,000	270	500	90	1,800	490	1,100	320	800	230
20.0	750	250	400	85	900	270	900	270	600	200

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**

- Common steel, Alloy steel, Stainless steel: ae = 0.1D, ap = 1.5D
- Titanium alloy, Inconel, Hardening steel: ae = 0.05D, ap = 1.5D



■ **Slotting depth(ap)**

- Common steel, Alloy steel: ap = 1.0D
- Stainless steel: ap = 0.3D
- Titanium alloy, Inconel, Hardening steel: ap = 0.2D

Stainless steel machining

- Low thermal conductivity of stainless steel alloy can cause conducted heat resulting fracture and chipping into the tool
- Stainless steel alloy machining can cause high wear and high cutting resistance
- High temperature in stainless steel alloy machining lowers cutting conditions and decrease the quality of surface roughness

Trouble shooting for stainless steel

- Getting low cutting conditions
- Getting deeper ap than the work hardened layer and use tools with sharp cutting edge
- Use coolant

A+ Endmill

APFE2000/3000 (Flat)

2 | 3 | H·A 50° | h6 shank | Substrate H05S

ØD	Tolerance
Ø1.0 ~ Ø6.0	0.000 ~ -0.020
Ø6.1 ~ Ø8.0	0.000 ~ -0.025
Ø8.1 ~ Ø20.0	0.000 ~ -0.030

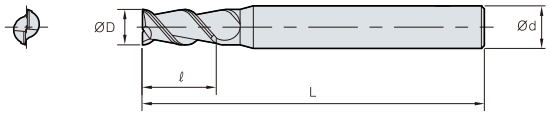


Fig. 1

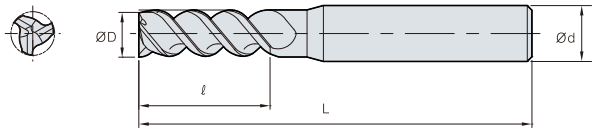


Fig. 2

(mm)

	Designation	ØD	Ød	ℓ	L	Fig
APFE 2	2010-050-S6	1.0	6	3	50	1
	2015-050-S6	1.5	6	4	50	1
	2020-050-S4	2.0	4	6	50	1
	2025-050	2.2	6	8	50	1
	2030-050	3.0	6	9	50	1
	2040-050	4.0	6	12	50	1
	2050-050	5.0	6	15	50	1
	2060-050	6.0	6	18	50	1
	2080-060	8.0	8	20	60	1
	2100-075	10.0	10	30	75	1
	2120-075	12.0	12	32	75	1
	2140-100	14.0	14	40	100	1
	2160-100	16.0	16	45	100	1
	2200-100	20.0	20	45	100	1
APFE 3	3010-050-S4	1.0	4	3	50	2
	3015-050-S4	1.5	4	4	50	2
	3020-050-S4	2.0	4	6	50	2
	3025-050	2.5	6	8	50	2
	3030-050	3.0	6	9	50	2
	3040-050	4.0	6	12	50	2
	3050-050	5.0	6	15	50	2
	3060-050	6.0	6	18	50	2
	3080-060	8.0	8	20	60	2
	3100-075	10.0	10	30	75	2
	3120-075	12.0	12	32	75	2
	3140-100	14.0	14	40	100	2
	3160-100	16.0	16	45	100	2
	3200-100	20.0	20	45	100	2

APMFE2000/3000 (Middle flat)

2 | 3 | H·A 50° | h6 shank | Substrate H05S

ØD	Tolerance
Ø1.0 ~ Ø6.0	0.000 ~ -0.020
Ø6.1 ~ Ø8.0	0.000 ~ -0.025
Ø8.1 ~ Ø20.0	0.000 ~ -0.030

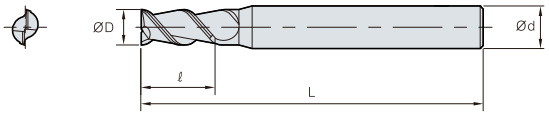


Fig. 1

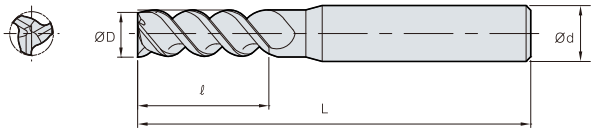


Fig. 2

(mm)

	Designation	ØD	Ød	ℓ	L	Fig
APMFE 2	2030-060	3.0	6	11	60	1
	2040-060	4.0	6	14	60	1
	2050-060	5.0	6	17	60	1
	2060-065	6.0	6	22	65	1
	2080-065	8.0	8	25	65	1
	2100-080	10.0	10	37	80	1
	2120-080	12.0	12	40	80	1
	2160-110	16.0	16	55	110	1
	2200-125	20.0	20	60	125	1
APMFE 3	3030-060	3.0	6	11	60	2
	3040-060	4.0	6	14	60	2
	3050-060	5.0	6	17	60	2
	3060-065	6.0	6	22	65	2
	3080-065	8.0	8	25	65	2
	3100-080	10.0	10	37	80	2
	3120-080	12.0	12	40	80	2
	3160-110	16.0	16	55	110	2
	3200-110	20.0	20	60	125	2

A+ Endmill

APLFE2000/3000 (Long flat)

2 | 3 | H-A 45° | h6 shank | Substrate H05S

ØD	Tolerance
Ø1.0 ~ Ø6.0	0.000 ~ -0.020
Ø6.1 ~ Ø8.0	0.000 ~ -0.025
Ø8.1 ~ Ø20.0	0.000 ~ -0.030

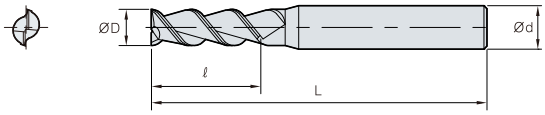


Fig. 1

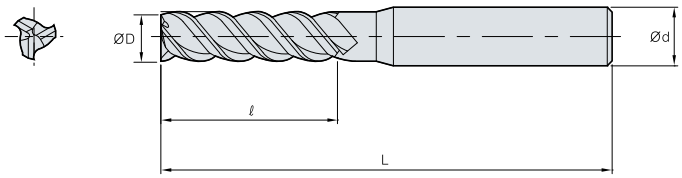


Fig. 2

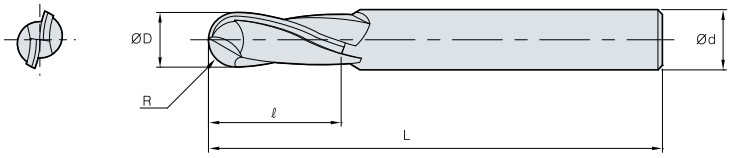
(mm)

	Designation	ØD	Ød	ℓ	L	Fig
APLFE 2	2030-060	3.0	6	12	60	1
	2040-060	4.0	6	16	60	1
	2050-060	5.0	6	20	60	1
	2060-075	6.0	6	25	75	1
	2080-075	8.0	8	32	75	1
	2100-100	10.0	10	45	100	1
	2120-100	12.0	12	45	100	1
	2160-150	16.0	16	65	150	1
	2200-150	20.0	20	75	150	1
APLFE 3	3030-060	3.0	6	12	60	2
	3040-060	4.0	6	16	60	2
	3050-060	5.0	6	20	60	2
	3060-075	6.0	6	25	75	2
	3080-075	8.0	8	32	75	2
	3100-100	10.0	10	45	100	2
	3120-100	12.0	12	45	100	2
	3160-150	16.0	16	65	150	2
	3200-150	20.0	20	75	150	2

APBE2000 (Ball)

2 | H·A 25° | h6 shank | Substrate H05S

ØD	Tolerance
Ø1.0 ~ Ø6.0	0.000 ~ -0.020
Ø6.1 ~ Ø8.0	0.000 ~ -0.025
Ø8.1 ~ Ø20.0	0.000 ~ -0.030



(mm)

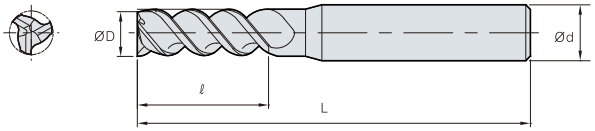
	Designation	R	ØD	Ød	ℓ	L
APBE 2	2010-050	0.50	1.0	4	2	50
	2015-050	0.75	1.5	4	3	50
	2020-050	1.00	2.0	4	4	50
	2025-050	1.25	2.5	4	5	50
	2030-050	1.50	3.0	4	6	50
	2035-050	1.75	3.5	4	7	50
	2040-050	2.00	4.0	4	8	50
	2045-050	2.25	4.5	6	9	50
	2050-050	2.50	5.0	6	10	50
	2055-050	2.75	5.5	6	11	50
	2060-050	3.00	6.0	6	12	50
	2080-060	4.00	8.0	8	16	60
	2100-075	5.00	10.0	10	20	75
	2120-075	6.00	12.0	12	24	75

A+ Endmill

AFE3000 (Short flat)

3 | H-A 45° | h6 shank | Substrate H05S

ØD	Tolerance
Ø1.0 ~ Ø12.0	0.000 ~ -0.020
Ø12.1 ~ Ø20.0	0.000 ~ -0.030



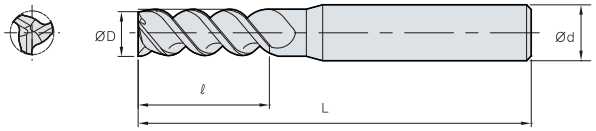
(mm)

	Designation	ØD	Ød	ℓ	L
AFE	3010-040-V2S6	1.0	6	2	40
3	3010-040-V2.5S6	1.0	6	2.5	40
	3015-040-V3S6	1.5	6	3	40
	3020-040-V3S6	2.0	6	3	40
	3030-045-V4S6	3.0	6	4	45
	3030-045-V8S6	3.0	6	8	45
	3040-045-V5S6	4.0	6	5	45
	3040-045-V8S6	4.0	6	8	45
	3040-045-V11S6	4.0	6	11	45
	3050-045-V6S6	5.0	6	6	45
	3060-050-V7S6	6.0	6	7	50
	3060-050-V13S6	6.0	6	13	50
	3080-060-V9S8	8.0	8	9	60
	3080-060-V19S8	8.0	8	19	60
	3100-065-V11S10	10.0	10	11	65
	3100-065-V22S10	10.0	10	22	65
	3120-070-V13S12	12.0	12	13	70
	3120-070-V26S12	12.0	12	26	70
	3160-090-V18S16	16.0	16	18	90
	3160-090-V32S16	16.0	16	32	90
	3200-090-V22S20	20.0	20	22	90
	3200-090-V38S20	20.0	20	38	90

AFE3000 (Flat)

3 | H·A 45° | h6 shank | Substrate H05S

ØD	Tolerance
Ø1.0 ~ Ø12.0	0.000 ~ -0.020
Ø12.1 ~ Ø20.0	0.000 ~ -0.030



(mm)

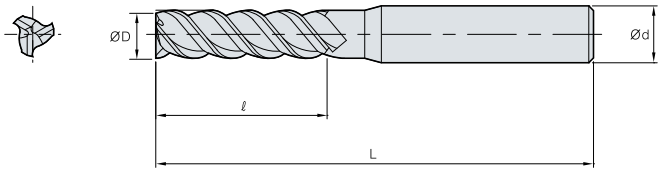
	Designation	ØD	Ød	ℓ	L
AFE	3010-050-V3S6	1.0	6	3	50
3	3015-050-V5S6	1.5	6	5	50
	3020-050-V6S6	2.0	6	6	50
	3030-055-V11S6	3.0	6	11	55
	3040-055-V13S6	4.0	6	13	55
	3050-055-V17S6	5.0	6	17	55
	3060-060-V17S6	6.0	6	17	60
	3080-070-V22S8	8.0	8	22	70
	3100-075-V27S10	10.0	10	27	75
	3120-080-V32S12	13.0	12	32	80
	3160-100-V42S16	16.0	16	42	100
	3200-100-V48S20	20.0	20	48	100

A+ Endmill

AFE3000 (Long flat)

3 | H-A 45° | h6 shank | Substrate H05S

ØD	Tolerance
Ø1.0 ~ Ø12.0	0.000 ~ -0.020
Ø12.1 ~ Ø20.0	0.000 ~ -0.030



(mm)

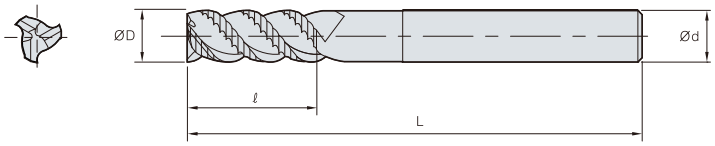
	Designation	ØD	Ød	ℓ	L
AFE 3	3010-060-V4S6	1.0	6	4	60
	3010-060-V6S6	1.0	6	6	60
	3015-060-V6S6	1.5	6	6	60
	3015-060-V8S6	1.5	6	8	60
	3015-060-V10S6	1.5	6	10	60
	3020-060-V8S6	2.0	6	8	60
	3020-060-V10S6	2.0	6	10	60
	3020-060-V12S6	2.0	6	12	60
	3030-065-V15S6	3.0	6	15	65
	3030-070-V20S6	3.0	6	20	70
	3030-075-V25S6	3.0	6	25	75
	3030-080-V30S6	3.0	6	30	80
	3040-065-V16S6	4.0	6	16	65
	3040-070-V20S6	4.0	6	20	70
	3040-075-V26S6	4.0	6	26	75
	3040-080-V30S6	4.0	6	30	80
	3060-060-V22S6	6.0	6	22	60
	3060-070-V25S6	6.0	6	25	70
	3060-075-V30S6	6.0	6	30	75
	3060-080-V35S6	6.0	6	35	80
	3060-090-V42S6	6.0	6	42	90
	3060-100-V50S6	6.0	6	50	100
	3080-080-V28S8	8.0	8	28	80
	3080-080-V30S8	8.0	8	30	80
	3080-085-V35S8	8.0	8	35	85
	3080-090-V40S8	8.0	8	40	90
	3080-095-V45S8	8.0	8	45	95
	3080-100-V50S8	8.0	8	50	100
	3080-105-V55S8	8.0	8	55	105
	3080-110-V65S8	8.0	8	65	110
	3100-090-V32S10	10.0	10	32	90

	Designation	ØD	Ød	ℓ	L
AFE 3	3100-090-V35S10	10.0	10	35	90
	3100-090-V40S10	10.0	10	40	90
	3100-100-V45S10	10.0	10	45	100
	3100-100-V50S10	10.0	10	50	100
	3100-110-V55S10	10.0	10	55	110
	3100-110-V60S10	10.0	10	60	110
	3100-120-V65S10	10.0	10	65	120
	3120-095-V40S12	12.0	12	40	95
	3120-100-V45S12	12.0	12	45	100
	3120-100-V50S12	12.0	12	50	100
	3120-110-V55S12	12.0	12	55	110
	3120-110-V60S12	12.0	12	60	110
	3120-120-V65S12	12.0	12	65	120
	3120-120-V70S12	12.0	12	70	120
	3120-135-V75S12	12.0	12	75	135
	3160-105-V52S16	16.0	16	52	105
	3160-110-V55S16	16.0	16	55	110
	3160-130-V65S16	16.0	16	65	130
	3160-150-V75S16	16.0	16	75	150
	3160-160-V85S16	16.0	16	85	160
	3160-180-V95S16	16.0	16	95	180
	3160-190-V105S16	16.0	16	105	190
	3160-200-V115S16	16.0	16	115	200
	3200-110-V55S20	20.0	20	55	110
	3200-130-V65S20	20.0	20	65	130
	3200-150-V75S20	20.0	20	75	150
	3200-160-V85S20	20.0	20	85	160
	3200-180-V95S20	20.0	20	95	180
	3200-190-V105S20	20.0	20	105	190
	3200-200-V115S20	20.0	20	115	200
	3200-220-V125S20	20.0	20	125	220

APRE3000 (Roughing)

3 | H·A 45° | h6 shank | Substrate H05S

ØD	Tolerance
Ø4.0 ~ Ø8.0	0.000 ~ -0.070
Ø8.1 ~ Ø25.0	0.000 ~ -0.100



(mm)

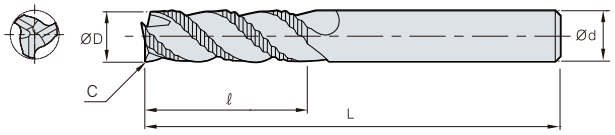
	Designation	ØD	Ød	ℓ	L
APRE	3040-050	4.0	6	8	50
3	3050-050	5.0	6	13	50
	3060-050	6.0	6	15	50
	3065-060	6.5	8	16	60
	3070-060	7.0	8	16	60
	3075-060	7.5	8	20	60
	3080-060	8.0	8	20	60
	3085-075	8.5	10	20	75
	3090-075	9.0	10	20	75
	3095-075	9.5	10	22	75
	3100-075	10.0	10	25	75
	3110-075	11.0	12	30	75
	3120-075	12.0	12	30	75
	3130-075	13.0	14	30	75
	3140-075	14.0	16	32	75
	3150-075	15.0	16	32	75
	3160-100	16.0	16	35	100
	3170-100	17.0	20	35	100
	3180-100	18.0	20	35	100
	3200-100	20.0	20	45	100
	3250-105	25.0	25	50	105

A+ Endmill

RPAE3000 (Wave roughing)

3 | H-A 45° | h6 shank | Substrate FN30T

ØD	Tolerance
Ø6.0 ~ Ø10.0	0.000 ~ -0.058
Ø10.0 ~ Ø18.0	0.000 ~ -0.070
Ø18.0 ~ Ø25.0	0.000 ~ -0.084



(mm)

	Designation	ØD	Ød	ℓ	L	C
RPAE	3060-063	6.0	6	18	63	0.3
3	3070-063	7.0	8	23	63	0.3
	3080-063	8.0	8	23	63	0.3
	3090-080	9.0	10	30	80	0.3
	3100-080	10.0	10	30	80	0.3
	3110-080	11.0	12	32	80	0.5
	3120-080	12.0	12	32	80	0.5
	3140-080	14.0	14	32	80	0.5
	3160-105	16.0	16	48	105	0.5
	3180-105	18.0	18	48	105	0.5
	3200-105	20.0	20	50	105	0.5
	3250-105	25.0	25	50	105	0.5

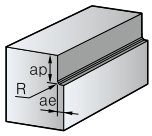
A+ Endmill

Recommended cutting conditions

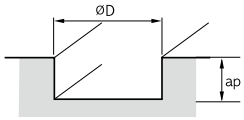
APFE/AFE

Type	Shouldering				Slotting			
Workpiece	Aluminum alloys (A7075)		Aluminum alloys (cast) (AC4B)		Aluminum alloys (A7075)		Aluminum alloys (cast) (AC4B)	
Conditions / Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	40,000	480	40,000	368	40,000	368	40,000	280
2.0	40,000	880	38,000	680	38,000	680	32,000	440
3.0	32,000	1,120	25,000	760	25,000	760	21,000	480
4.0	24,000	1,200	19,000	800	19,000	800	13,000	520
5.0	19,000	1,280	15,000	880	15,000	800	13,000	560
6.0	16,000	1,520	13,000	960	13,000	880	11,000	600
8.0	12,000	1,520	9,500	960	9,500	960	8,000	640
10.0	9,500	1,520	7,600	960	7,600	960	6,400	640
12.0	8,000	1,520	6,400	960	6,400	960	5,300	640
16.0	6,000	1,520	4,800	960	4,800	800	4,000	576
20.0	4,800	1,200	3,800	800	3,800	776	3,200	528

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**
- ap : ≤ 2.0D
- ae : ≤ 0.2D (D>Ø3)
  : ≤ 0.5D (D≥Ø3)



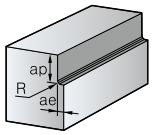
■ **Slotting depth(ap)**
- ap : ≤ D (max: 12mm)

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

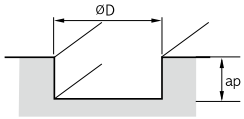
APRE

Type	Shouldering				Slotting			
Workpiece	Aluminum alloys (A7075)		Aluminum alloys (cast) (AC4B)		Aluminum alloys (A7075)		Aluminum alloys (cast) (AC4B)	
Conditions / Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
4.0	20,000	8,000	16,000	6,400	15,000	5,000	12,000	4,000
5.0	16,000	6,500	12,800	5,200	12,000	4,000	9,600	3,200
6.0	13,500	6,000	10,800	4,800	10,500	3,800	8,400	3,100
8.0	10,500	4,700	8,400	3,800	8,000	3,000	6,400	2,400
10.0	8,500	3,800	6,800	3,100	6,500	2,500	5,200	2,000
12.0	6,800	3,050	5,500	2,500	5,250	2,000	4,200	1,600
14.0	5,800	2,600	4,700	2,100	4,500	1,700	3,600	1,400
16.0	5,200	2,350	4,200	1,900	4,000	1,500	3,200	1,200
18.0	4,700	2,100	3,800	1,700	3,550	1,300	2,900	1,100
20.0	4,200	1,900	3,400	1,600	3,200	1,200	2,600	1,000
25.0	3,400	1,500	2,800	1,200	2,550	1,000	2,100	800

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**
- ap : ≤ 1.5D
- ae : ≤ 0.5D



■ **Slotting depth(ap)**
- ap : ≤ 1.5D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

Solid Endmill for Aluminum

SSEA2000/3000 (Flat)

ØD	Tolerance
Ø1.0 ~ Ø6.0	-0.010 ~ -0.030
Ø7.0 ~ Ø10.0	-0.015 ~ -0.040
Ø11.0 ~ Ø20.0	-0.020 ~ -0.050

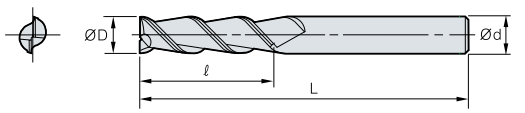


Fig. 1

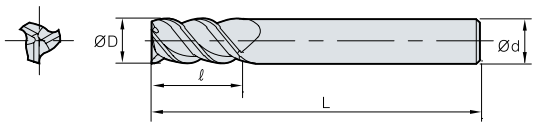


Fig. 2

(mm)

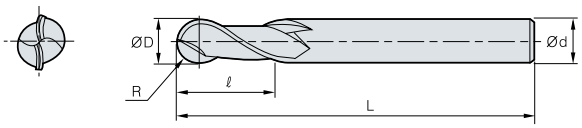
	Designation	ØD	Ød	ℓ	L	Fig.
SSEA 2	2010	1.0	6	3	40	1
	2015	1.5	6	4	40	1
	2020	2.0	6	6	40	1
	2025	2.5	6	7	40	1
	2030	3.0	6	10	45	1
	2035	3.5	6	10	45	1
	2040	4.0	6	12	45	1
	2050	5.0	6	15	50	1
	2060	6.0	6	15	50	1
	2070	7.0	8	20	60	1
	2080	8.0	8	20	60	1
	2090	9.0	10	20	70	1
	2100	10.0	10	25	70	1
	2110	11.0	12	25	75	1
	2120	12.0	12	30	75	1
	2130	13.0	16	30	90	1
	2140	14.0	16	35	90	1
	2150	15.0	16	40	90	1
	2160	16.0	16	40	90	1
	2180	18.0	18	45	100	1
	2200	20.0	20	45	100	1
SSEA 3	3020	2.0	6	6	40	2
	3030	3.0	6	10	45	2
	3035	3.5	6	10	45	2
	3040	4.0	6	12	45	2
	3050	5.0	6	15	50	2
	3060	6.0	6	15	50	2
	3070	7.0	8	20	60	2
	3080	8.0	8	20	60	2
	3090	9.0	10	20	70	2
	3100	10.0	10	25	70	2
	3110	11.0	12	25	75	2
	3120	12.0	12	30	75	2
	3130	13.0	16	30	90	2
	3140	14.0	16	35	90	2
	3150	15.0	16	40	90	2
	3160	16.0	16	40	90	2

Special Endmill order: SSEA◎◎◎◎I–L Ex.1) 3 flutes, diameter: 6.3,I: 17, L: 60 SSEA3063 17–60L Ex.2) 3 flutes, diameter: 6.3,standard type SSEA3063

SSBEA2000 (Ball)

2 | H·A 45° | Carbide DLC | Substrate H01 PD3000

ØD	Tolerance
All	0.00 ~ - 0.03



(mm)

	Designation	R	ØD	Ød	ℓ	L
SSBEA	2010	0.50	1.0	6	3	70
2	2015	0.75	1.5	6	4	70
	2020	1.00	2.0	6	6	70
	2025	1.25	2.5	6	8	70
	2030	1.50	3.0	6	10	70
	2035	1.75	3.5	6	10	70
	2040	2.00	4.0	6	12	70
	2045	2.25	4.5	6	15	80
	2050	2.50	5.0	6	15	80
	2055	2.75	5.5	6	15	80
	2060	3.00	6.0	6	15	80
	2065	3.25	6.5	8	20	90
	2070	3.50	7.0	8	20	90
	2075	3.75	7.5	8	20	90
	2080	4.00	8.0	8	20	90
	2085	4.25	8.5	10	25	100
	2090	4.50	9.0	10	25	100
	2100	5.00	10.0	10	25	100
	2110	5.50	11.0	12	30	110
	2120	6.00	12.0	12	30	110
	2130	6.50	13.0	16	35	120
	2140	7.00	14.0	16	35	120
	2150	7.50	15.0	16	40	120
	2160	8.00	16.0	16	40	120
	2170	8.50	17.0	20	40	130
	2180	9.00	18.0	20	45	130
	2190	9.50	19.0	20	45	130
	2200	10.00	20.0	20	45	130

Special Endmill order: SSBEA2◎◎◎◎ I-L

Ex.1) 2 flutes, diameter: 6.3,I: 17, L: 60 SSBEA3063 17-60L

Ex.2) 2 flutes, diameter: 6.3,standard type SSBEA3063

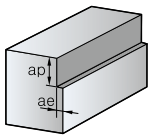
Solid Endmill for Aluminum

Recommended cutting conditions

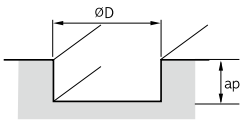
SSEA2000

Type	Shouldering				Slotting			
Workpiece	Aluminum alloys (A7075)		Aluminum alloys (cast) (AC4B)		Aluminum alloys (A7075)		Aluminum alloys (cast) (AC4B)	
Conditions / Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	40,000	480	40,000	368	40,000	368	40,000	280
2.0	40,000	880	38,000	680	38,000	680	32,000	440
3.0	32,000	1,120	25,000	760	25,000	760	21,000	480
4.0	24,000	1,200	19,000	800	19,000	800	13,000	520
5.0	19,000	1,280	15,000	880	15,000	800	13,000	560
6.0	16,000	1,520	13,000	960	13,000	880	11,000	600
8.0	12,000	1,520	9,500	960	9,500	960	8,000	640
10.0	9,500	1,520	7,600	960	7,600	960	6,400	640
12.0	8,000	1,520	6,400	960	6,400	960	5,300	640
16.0	6,000	1,520	4,800	960	4,800	800	4,000	576
20.0	4,800	1,200	3,800	800	3,800	776	3,200	528

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**
- ap : ≤ 2.0D
- ae : ≤ 0.2D (D<Ø3)
  : ≤ 0.5D (D≥Ø3)

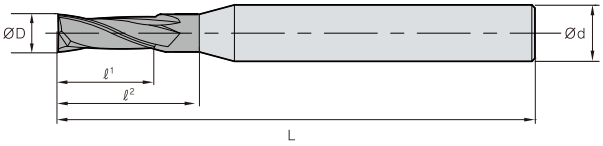


■ **Slotting depth(ap)**
- ap : ≤ D (max:12mm)

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

D Endmill

DFE2000 (Flat)



2 | H·A 30° | h6 shank | Substrate ND3000

ØD	Tolerance
~ Ø5.9	0.00 ~ -0.02
Ø6.0 ~	0.00 ~ -0.03

(mm)

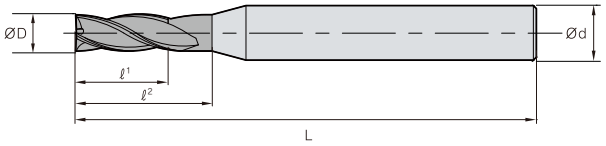
	Designation	ØD	Ød	ℓ1	ℓ2	L
DFE 2	2010-045-N050S04	1.0	4	3	5	45
	2010-060-N050S04	1.0	4	3	5	60
	2010-060-N100S04	1.0	4	3	10	60
	2010-060-N150S04	1.0	4	3	15	60
	2010-060-N200S04	1.0	4	3	20	60
	2010-060-N250S04	1.0	4	3	25	60
	2015-060-N050S04	1.5	4	4	5	60
	2015-060-N100S04	1.5	4	4	10	60
	2015-060-N150S04	1.5	4	4	15	60
	2015-060-N200S04	1.5	4	4	20	60
	2015-060-N250S04	1.5	4	4	25	60
	2020-045-N080S04	2.0	4	6	8	45
	2020-080-N080S04	2.0	4	6	8	80
	2020-080-N100S04	2.0	4	6	10	80
	2020-080-N150S04	2.0	4	6	15	80
	2020-080-N200S04	2.0	4	6	20	80
	2020-080-N250S04	2.0	4	6	25	80
	2020-080-N300S04	2.0	4	6	30	80
	2020-080-N400S04	2.0	4	6	40	80
	2030-050-N100S06	3.0	6	9	10	50
	2030-080-N100S04	3.0	4	9	10	80
	2030-080-N200S04	3.0	4	9	20	80
	2030-080-N250S04	3.0	4	9	25	80
	2030-080-N300S04	3.0	4	9	30	80
	2030-080-N400S04	3.0	4	9	40	80
	2040-050-N160S06	4.0	6	12	16	50
	2040-080-N160S04	4.0	4	12	16	80
	2050-060-N200S06	5.0	6	15	20	60
	2050-110-N200S06	5.0	6	15	20	110
	2060-060-N180S06	6.0	6	18	-	60
	2060-110-N250S06	6.0	6	18	25	110
	2060-150-N250S06	6.0	6	18	25	150
	2080-070-N250S08	8.0	8	25	-	70
	2080-150-N400S08	8.0	8	25	40	150
	2100-080-N300S10	10.0	10	30	-	80
	2100-150-N500S10	10.0	10	30	50	150
	2120-080-N350S12	12.0	12	35	-	80
	2120-150-N600S12	12.0	12	35	60	150

D Endmill

DFE4000 (Flat)

4 | H·A 30° | h6 shank | Substrate ND3000

ØD	Tolerance
~ Ø5.9	0.00 ~ -0.02
Ø6.0 ~	0.00 ~ -0.03

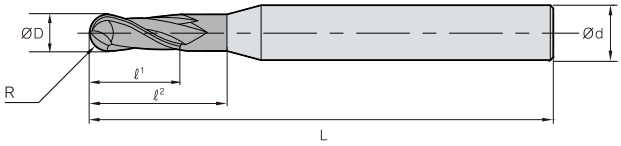


(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L
DFE	4020-045-N060S04	2.0	4	6	8	45
4	4020-060-N100S04	2.0	4	10	12	60
	4030-050-N100S06	3.0	6	10	12	50
	4030-060-N150S04	3.0	4	15	18	60
	4040-050-N150S06	4.0	6	15	18	50
	4040-080-N200S04	4.0	4	20	-	80
	4060-060-N180S06	6.0	6	18	-	60
	4060-110-N300S06	6.0	6	30	-	110
	4060-150-N300S06	6.0	6	30	-	150
	4080-070-N250S08	8.0	8	25	-	70
	4080-110-N400S08	8.0	8	40	-	110
	4080-150-N400S08	8.0	8	40	-	150
	4100-080-N250S10	10.0	10	25	-	80
	4100-110-N400S10	10.0	10	40	-	110
	4100-150-N500S10	10.0	10	50	-	150
	4120-080-N300S12	12.0	12	30	-	80
	4120-110-N400S12	12.0	12	40	-	110
	4120-150-N500S12	12.0	12	50	-	150

DBE2000 (Ball)

ØD	Tolerance
~ Ø5.9	0.00 ~ -0.02
Ø6.0 ~	0.00 ~ -0.03



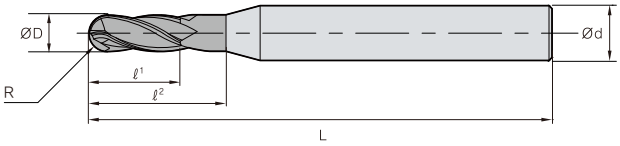
(mm)

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
DBE 2	2006-045-N020S04	0.30	0.6	4	2	2	45
	2006-045-N050S04	0.30	0.6	4	2	5	45
	2006-045-N080S04	0.30	0.6	4	2	8	45
	2006-045-N100S04	0.30	0.6	4	2	10	45
	2008-045-N030S04	0.40	0.8	4	2.5	3	45
	2008-045-N050S04	0.40	0.8	4	2.5	5	45
	2008-045-N100S04	0.40	0.8	4	2.5	10	45
	2010-060-N030S04	0.50	1.0	4	3	3	60
	2010-060-N050S04	0.50	1.0	4	3	5	60
	2010-060-N080S04	0.50	1.0	4	3	8	60
	2010-060-N100S04	0.50	1.0	4	3	10	60
	2010-060-N120S04	0.50	1.0	4	3	12	60
	2010-060-N150S04	0.50	1.0	4	3	15	60
	2010-060-N200S04	0.50	1.0	4	3	20	60
	2010-080-N250S04	0.50	1.0	4	3	25	80
	2010-080-N300S04	0.50	1.0	4	3	30	80
	2010-080-N350S04	0.50	1.0	4	3	35	80
	2010-080-N400S04	0.50	1.0	4	3	40	80
	2015-060-N050S04	0.75	1.5	4	4	5	60
	2015-080-N100S04	0.75	1.5	4	4	10	80
	2015-080-N150S04	0.75	1.5	4	4	15	80
	2015-080-N200S04	0.75	1.5	4	4	20	80
	2015-080-N250S04	0.75	1.5	4	4	25	80
	2015-080-N300S04	0.75	1.5	4	4	30	80
	2015-080-N350S04	0.75	1.5	4	4	35	80
	2015-080-N400S04	0.75	1.5	4	4	40	80
	2020-060-N080S04	1.00	2.0	4	6	8	60
	2020-080-N100S04	1.00	2.0	4	6	10	80
	2020-080-N150S04	1.00	2.0	4	6	15	80
	2020-080-N200S04	1.00	2.0	4	6	20	80
	2020-080-N250S04	1.00	2.0	4	6	25	80
	2020-080-N300S04	1.00	2.0	4	6	30	80
	2020-080-N350S04	1.00	2.0	4	6	35	80

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
DBE 2	2020-100-N400S04	1.00	2.0	4	6	40	100
	2020-100-N450S04	1.00	2.0	4	6	45	100
	2020-100-N500S04	1.00	2.0	4	6	50	100
	2030-060-N100S04	1.50	3.0	4	9	10	60
	2030-100-N150S04	1.50	3.0	4	9	15	100
	2030-100-N200S04	1.50	3.0	4	9	20	100
	2030-100-N250S04	1.50	3.0	4	9	25	100
	2030-100-N300S04	1.50	3.0	4	9	30	100
	2030-100-N350S04	1.50	3.0	4	9	35	100
	2030-100-N400S04	1.50	3.0	4	9	40	100
	2030-100-N500S04	1.50	3.0	4	9	50	100
	2040-060-N160S04	2.00	4.0	4	12	16	60
	2040-080-N160S04	2.00	4.0	4	12	16	80
	2040-080-N300S04	2.00	4.0	4	12	30	80
	2040-100-N160S04	2.00	4.0	4	12	16	100
	2040-100-N400S04	2.00	4.0	4	12	40	100
	2040-130-N160S04	2.00	4.0	4	12	16	130
	2040-130-N400S04	2.00	4.0	4	12	40	130
	2050-110-N200S06	2.50	5.0	6	15	20	110
	2060-080-N250S06	3.00	6.0	6	20	25	80
	2060-110-N250S06	3.00	6.0	6	20	25	110
	2060-150-N300S06	3.00	6.0	6	20	30	150
	2080-080-N300S08	4.00	8.0	8	25	30	80
	2080-110-N300S08	4.00	8.0	8	25	30	110
	2080-150-N500S08	4.00	8.0	8	25	50	150
	2080-200-N400S08	4.00	8.0	8	25	40	200
	2100-080-N400S10	5.00	10.0	10	30	40	80
	2100-110-N400S10	5.00	10.0	10	30	40	110
	2100-150-N600S10	5.00	10.0	10	30	60	150
	2100-200-N500S10	5.00	10.0	10	30	50	200
	2120-110-N500S12	6.00	12.0	12	35	50	110
	2120-150-N500S12	6.00	12.0	12	35	50	150
	2120-200-N600S12	6.00	12.0	12	35	60	200

D Endmill

DBE4000 (Ball)



4 | H·A 30° | h6 shank | Substrate ND3000

ØD	Tolerance
~ Ø5.9	0.00 ~ -0.02
Ø6.0 ~	0.00 ~ -0.03

(mm)

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
DBE	4020-060-N080S04	1.00	2.0	4	6	8	60
4	4020-080-N100S04	1.00	2.0	4	6	10	80
	4020-080-N200S04	1.00	2.0	4	6	20	80
	4020-080-N300S04	1.00	2.0	4	6	30	80
	4020-080-N400S04	1.00	2.0	4	6	40	80
	4030-060-N100S04	1.50	3.0	4	9	10	60
	4030-100-N150S04	1.50	3.0	4	9	15	100
	4030-100-N200S04	1.50	3.0	4	9	20	100
	4030-100-N300S04	1.50	3.0	4	9	30	100
	4030-100-N400S04	1.50	3.0	4	9	40	100
	4030-100-N500S04	1.50	3.0	4	9	50	100
	4040-060-N160S04	2.00	4.0	4	12	16	60
	4040-080-N160S04	2.00	4.0	4	12	16	80
	4040-100-N160S04	2.00	4.0	4	12	16	100
	4040-130-N160S04	2.00	4.0	4	12	16	130
	4060-080-N250S06	3.00	6.0	6	20	25	80
	4060-110-N250S06	3.00	6.0	6	20	25	110
	4060-150-N300S06	3.00	6.0	6	20	30	150
	4080-080-N300S08	4.00	8.0	8	25	30	80
	4080-110-N300S08	4.00	8.0	8	25	30	110
	4080-150-N350S08	4.00	8.0	8	25	35	150
	4080-200-N400S08	4.00	8.0	8	25	40	200
	4100-080-N350S10	5.00	10.0	10	30	35	80
	4100-110-N350S10	5.00	10.0	10	30	35	110
	4100-150-N400S10	5.00	10.0	10	30	40	150
	4100-200-N500S10	5.00	10.0	10	30	50	200
	4120-110-N500S12	6.00	12.0	12	35	50	110
	4120-150-N500S12	6.00	12.0	12	35	50	150
	4120-200-N600S12	6.00	12.0	12	35	60	200

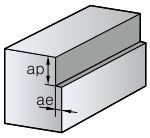
D Endmill

Recommended cutting conditions

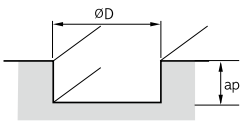
Flat type

Tool	DFE2000 (Slotting)		DFE2000 (Shouldering)		DFE4000 (Shouldering)	
Workpiece	Graphite					
Conditions / Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	40,000	500	40,000	700	-	-
2.0	25,000	570	25,000	800	25,000	1,600
3.0	20,000	570	20,000	800	20,000	1,600
4.0	18,000	680	18,000	950	18,000	1,900
5.0	14,000	960	14,000	1,200	14,000	2,400
6.0	11,000	1,000	11,000	1,400	11,000	2,800
8.0	8,000	930	8,000	1,300	8,000	2,600
10.0	6,500	860	6,500	1,200	6,500	2,400
12.0	5,500	860	5,500	1,200	5,500	2,400

Application tip



- D ≤ Ø2.5, ap = 1.5D, ae = 0.05D
- D > Ø2.5, ap = 1.5D, ae = 0.1D



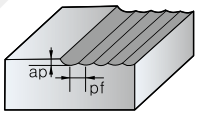
- D ≤ Ø2.5, ap = 0.3D
- D > Ø2.5, ap = 0.5D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

Ball type

Tool	DBE2000		DBE4000	
Workpiece	Graphite			
Conditions / Diameter(Ø)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
1.0	16,000	400	-	-
2.0	16,000	800	16,000	1,200
3.0	16,000	1,450	16,000	2,000
4.0	16,000	2,100	16,000	3,100
5.0	15,500	2,550	15,000	3,800
6.0	15,000	2,950	15,000	4,400
8.0	13,000	3,000	13,000	4,500
10.0	11,500	3,000	12,000	4,600
12.0	10,700	3,200	10,000	4,700

Application tip



- ap = 0.2D
- pf = 0.2D

※ Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio

Notice

- Cutting conditions are up to the machine's condition and the shape of cutting
- Workpiece should be clamped rigidly. In case of vibrations, reduce RPM and feed rate by the same ratio
- When the overhang is longer than 3D, reduce RPM and feed rate

Composite Router Endmill

CCDR4000/6000 (Flat)

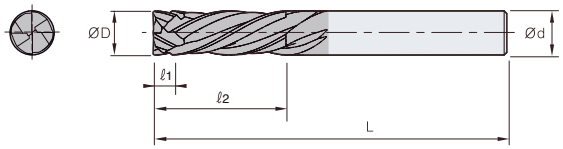


Fig. 1

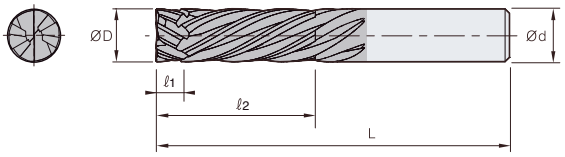


Fig. 2

4 | 6 | H·A 30°/-30° | h5 shank | Substrate ND2100

ØD	Tolerance
Ø6.0 ~ Ø12.0	0.00 ~ -0.03 (mm)

(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L	Fig.
CCDR 4	4060-065	6.0	6	3	18	65	1
	4080-075	8.0	8	4	24	75	1
CCDR 6	6100-085	10.0	10	5	30	85	2
	6120-100	12.0	12	6	36	100	2

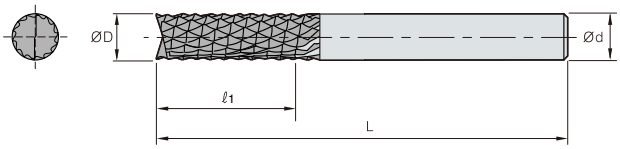
4 | 6 | H·A 30°/-30° | h5 shank | Substrate ND2100

ØD	Tolerance
Ø0.250 ~ Ø0.500	0.0000 ~ -0.0012 (inch)

(inch)

	Designation	ØD	Ød	ℓ1	ℓ2	L	Fig.
CCDR 4	402500	1/4 0.250	0.250	0.125	0.750	2.500	1
	402500L	1/4 0.250	0.250	0.125	1.500	4.000	1
CCDR 6	603750	3/8 0.375	0.375	0.125	1.000	3.250	2
	603750L	3/8 0.375	0.375	0.125	1.500	4.000	2
	605000	1/2 0.500	0.500	0.125	1.000	3.250	2
	605000L	1/2 0.500	0.500	0.125	1.500	4.000	2

CCR2000 (Flat)



2 | H·A -27° | h5 shank | Substrate ND2100

ØD	Tolerance
Ø4 ~ Ø12	-0.02 ~ -0.08 (mm)

(mm)

	Designation	ØD	Ød	ℓ1	L
CCR 2	2040-050	4.0	4	12	50
	2050-050	5.0	5	15	50
	2060-065	6.0	6	18	65
	2080-075	8.0	8	24	75
	2100-085	10.0	10	30	85
	2120-100	12.0	12	36	100

2 | H·A -27° | h5 shank | Substrate ND2100

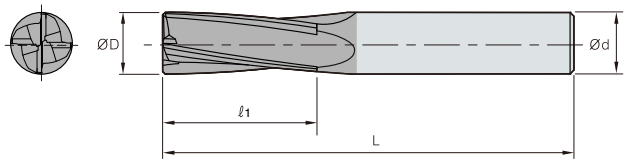
ØD	Tolerance
Ø0.250 ~ Ø0.500	-0.0008 ~ -0.0032 (inch)

(inch)

	Designation	ØD	Ød	ℓ1	L
CCR 2	202500	1/4 0.250	0.250	0.750	2.500
	202500L	1/4 0.250	0.250	1.500	4.000
	203750	3/8 0.375	0.375	1.000	3.250
	203750L	3/8 0.375	0.375	1.500	4.000
	205000	1/2 0.500	0.500	1.000	3.250
	205000L	1/2 0.500	0.500	1.500	4.000

Composite Router Endmill

CCLR4000 (Flat)



4 | H·A 15° | h5 shank | Substrate ND2100

ØD	Tolerance
Ø4 ~ Ø12	0.00 ~ -0.03

(mm)

	Designation	ØD	Ød	ℓ1	L
CCLR 4	4040-050	4.0	4	12	50
	4050-050	5.0	5	15	50
	4060-065	6.0	6	18	65
	4080-075	8.0	8	24	75
	4100-085	10.0	10	30	85
	4120-100	12.0	12	36	100

4 | H·A 15° | h5 shank | Substrate ND2100

ØD	Tolerance
Ø0.250 ~ Ø0.500	0.0000 ~ -0.0012 (inch)

(inch)

	Designation	ØD	Ød	ℓ1	L
CCLR 4	402500	1/4 0.250	0.250	0.750	2.500
	402500L	1/4 0.250	0.250	1.500	4.000
	403750	3/8 0.375	0.375	1.000	3.250
	403750L	3/8 0.375	0.375	1.500	4.000
	405000	1/2 0.500	0.500	1.000	3.250
	405000L	1/2 0.500	0.500	1.500	4.000

CCRR6000/8000 (Flat)

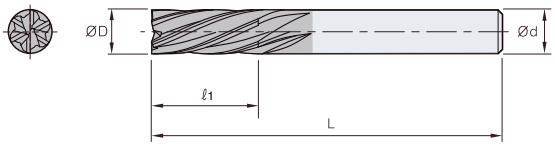


Fig. 1

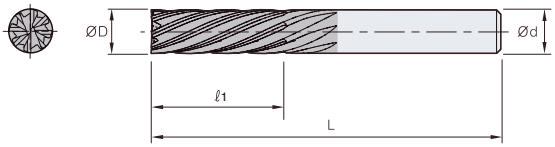


Fig. 2

6 | 8 | H·A -25° | h5 shank | Substrate ND2100

ØD	Tolerance
Ø6 ~ Ø12	0.00 ~ -0.03

(mm)

	Designation	ØD	Ød	ℓ1	L	Fig.
CCRR 6	6060-065	6.0	6	18	65	1
	6080-075	8.0	8	24	75	1
CCRR 8	8100-085	10.0	10	30	85	2
	8120-100	12.0	12	36	100	2

6 | 8 | H·A -25° | h5 shank | Substrate ND2100

ØD	Tolerance
Ø0.250 ~ Ø0.500	0.0000 ~ -0.0012 (inch)

(inch)

	Designation	ØD	Ød	ℓ1	L	Fig.
CCRR 6	602500	1/4 0.250	0.250	0.750	2.500	1
	602500L	1/4 0.250	0.250	1.500	4.000	1
CCRR 8	803750	3/8 0.375	0.375	1.000	3.250	2
	803750L	3/8 0.375	0.375	1.500	4.000	2
	805000	1/2 0.500	0.500	1.000	3.250	2
	805000L	1/2 0.500	0.500	1.500	4.000	2

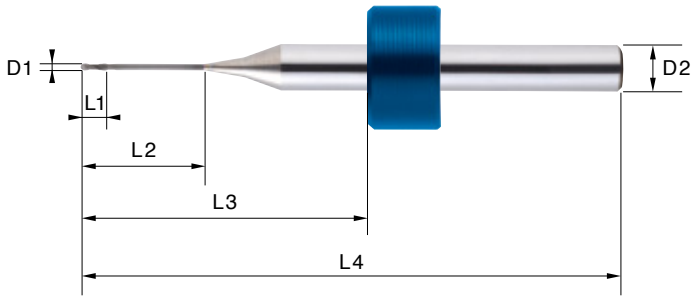
T Endmill

T Z BE 2 030 - 050 - N100 S04 (Z-MATCH)

- **T Endmill**
- **Workpiece**
  - Z : Zirconia
  - T : Ti/Co-Cr
  - W : Wax/PMMA
- **Type**
  - BE : Ball Endmill
  - FE : Flat Endmill
  - RE : Radius Endmill
- **No. of flutes**
  - 2 : 2Flute
- **Drill dia.**
  - 030 : 3mm
- **Overall length**
  - 050 : 50mm
- **Neck length**
  - N100 : 10mm
- **Shank dia.**
  - S04 : 4mm
- **Machine Maker**

Special T Endmill order form

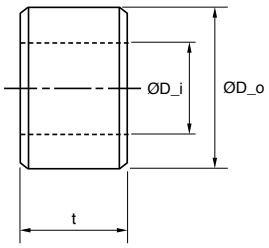
• Stop rings and other tool resources can be made to order



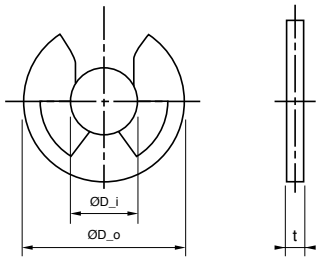
[Data Sheet]

Type of machine	
Workpiece	
Dental material	
Cutting diameter (D1)	
Shank diameter (D2)	
Cutting length (L1)	
Neck length (L2)	
Stop ring position	
Overall length (L4)	
Stop ring shape	

[Stop ring specification]



< Plastic ring >



< E type ring >

(mm)

Type	Stop ring			Shank diameter		
	ØD_o	ØD_i	t	Ø3	Ø4	Ø6
Plastic ring	Ø7.55	Ø3	4.45	●		
	Ø7.7	Ø4	5.0		●	
	Ø10.5	Ø6	6.5			●
E type ring	Ø6.0	Ø2.5	0.4	●		

※ Stop ring can be made to order when specified sizes are send to an adjacent KORLOY sales office

T Endmill

Recommended cutting conditions

Titanium/Co-Cr

Diameter (Ø)	Application	ap (mm)	ae (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)
3.0	Roughing	0.12	0.7	10,500	1,150
2.5	Medium	0.08	0.53	11,500	850
2.0	Medium	0.08	0.42	14,500	850
1.5	Finishing	0.04	0.32	19,000	850
1.0	Finishing	0.02	0.07	28,500	850
0.6	Finishing	0.02	0.07	28,500	850

Zirconia

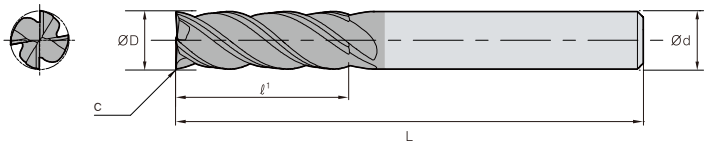
Diameter (Ø)	Application	ap (mm)	ae (mm)	R.P.M n (min⁻¹)	Feed vf (mm/min)
3.0	Roughing	0.5	1.5	23,500	1,600
2.5	Medium	0.3	1.25	28,000	1,200
2.0	Finishing	0.3	1.0	35,000	1,200
1.0	Finishing	0.1	0.2	38,500	1,050
0.6	Finishing	0.1	0.2	63,500	630

M+ Endmill

MPRE4000-A

4 | H·A 30°/41° | h6 shank | Substrate PC40T

ØD	Tolerance
Ø3.0 ~ 20.0	0.00 ~ -0.03



(mm)

	Designation	ØD	Ød	L	ℓ	C
MPRE	4030-054	3.0	6	54	5	-
4	4040-054	4.0	6	54	11	0.04
	4050-054	5.0	6	54	13	0.05
	4060-054	6.0	6	54	13	0.06
	4080-065(A)	8.0	8	65	19	0.08
	4100-075(A)	10.0	10	75	22	0.10
	4120-082(A)	12.0	12	82	26	0.12
	4140-082(A)	14.0	14	82	26	0.12
	4160-100(A)	16.0	16	100	32	0.16
	4200-105(A)	20.0	20	105	38	0.20

※A : Weldon type is applicable for more than Ø8

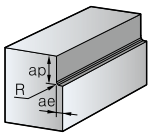
M+ Endmill

Recommended cutting conditions

Shouldering & Slotting

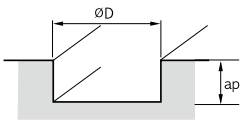
Workpiece / Conditions / Diameter(Ø)	Carbon steels, Alloy steels (AISI1049, Cast iron, S50C, SCM) under HRC30			Alloy steels, High Tool Steels (Pre-hardened steels, STD61, NAK) HRC30~45			Austenitic stainless Steels (AISI304, AISI31G, SUS304, SUS316)			Hardened Steels (SKD61, SKD11, NAK, STAVAX) HRC45~50		
	R.P.M n (min⁻¹)	Feed (mm/min)		R.P.M n (min⁻¹)	Feed (mm/min)		R.P.M n (min⁻¹)	Feed (mm/min)		R.P.M n (min⁻¹)	Feed (mm/min)	
		Shouldering	Slotting		Shouldering	Slotting		Shouldering	Slotting		Shouldering	Slotting
3.0	9,500	500	350	6,400	130	100	5,800	110	66	2,100	55	44
4.0	7,200	580	410	4,800	220	180	4,400	180	110	1,600	67	54
5.0	6,000	600	420	3,600	230	180	3,500	190	110	1,300	70	56
6.0	4,800	720	500	3,200	240	190	2,900	210	130	1,100	75	60
8.0	3,600	720	500	2,400	240	190	2,200	220	130	800	65	50
10.0	2,900	730	510	1,900	190	150	1,800	190	110	600	65	50
12.0	2,400	650	460	1,600	160	130	1,500	150	90	500	65	50
16.0	1,800	610	430	1,200	240	190	1,100	220	130	400	65	50
20.0	1,400	560	390	1,000	190	150	900	190	110	300	65	50

Application tip



■ **Shouldering depth(ap) and radial depth(ae)**

- ap : ≤ 1.5D
- ae : ≤ 0.1D



■ **Slotting depth(ap)**

- ap : ≤ 0.05D (D ≤ Ø2)
  ≤ 0.1D (D > Ø2)

Ramping, Helix

Workpiece / Ramping Max. angle / Conditions / Diameter(Ø)	Carbon steels, Alloy steels (AISI1049, Cast iron, S50C, SCM) under HRC30		Alloy steels, High Tool Steels (Pre-hardened steels, STD61, NAK) HRC30~45		Austenitic stainless Steels (AISI304, AISI31G, SUS304, SUS316)		Hardened Steels (SKD61, SKD11, NAK, STAVAX) HRC45~50	
	30°		20°		5°		5°	
	R.P.M n (min⁻¹)	Feed(mm/min) Slotting	R.P.M n (min⁻¹)	Feed(mm/min) Slotting	R.P.M n (min⁻¹)	Feed(mm/min) Slotting	R.P.M n (min⁻¹)	Feed(mm/min) Slotting
3.0	9,500	315	6,400	90	5,800	60	2,100	40
4.0	7,200	369	4,800	160	4,400	100	1,600	50
5.0	6,000	378	3,600	160	3,500	100	1,300	50
6.0	4,800	450	3,200	170	2,900	120	1,100	55
8.0	3,600	450	2,400	170	2,200	120	800	45
10.0	2,900	459	1,900	140	1,800	100	600	45
12.0	2,400	414	1,600	120	1,500	80	500	45
16.0	1,800	387	1,200	170	1,100	120	400	45
20.0	1,400	351	1,000	140	900	100	300	45

M+ Endmill

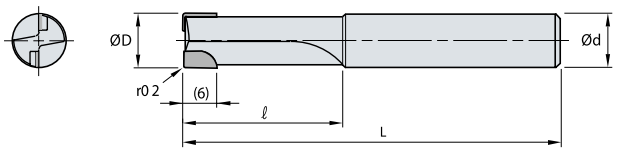
Recommended cutting conditions

Drilling

Workpiece / Conditions / Diameter(Ø)	Carbon steels, Alloy steels (AISI1049, Cast iron, S50C, SCM) under HRC30		Alloy steels, High Tool Steels (Pre-hardened steels, STD61, NAK) HRC30~45		Cast iron (Grey cast iron, Spher, Graphite/malleable cast iron)	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
3.0	9,500	280	6,400	80	5,700	320
4.0	7,200	330	4,800	140	4,320	240
5.0	6,000	340	3,600	140	3,600	200
6.0	4,800	400	3,200	150	2,880	160
8.0	3,600	400	2,400	150	2,160	120
10.0	2,900	410	1,900	120	1,740	100
12.0	2,400	370	1,600	100	1,440	80
16.0	1,800	340	1,200	150	1,080	60
20.0	1,400	310	1,000	120	840	50

PCD Endmill

PDE1000/2000 (Flat)



(mm)

	Designation	ØD	Ød	ℓ	L
PDE 1	1040	4.0	6	15	45
	1050	5.0	6	15	50
	1060	6.0	6	20	60
PDE 2	2060	6.0	8	20	60
	2070	7.0	8	20	60
	2080	8.0	8	20	60
	2090	9.0	10	25	70
	2100	10.0	10	25	70
	2120	12.0	12	25	75

Special endmill order form

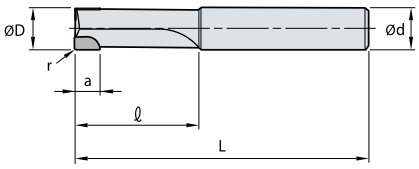


Fig. 1

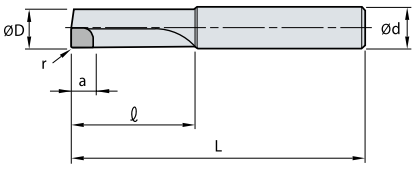


Fig 2

Designation	Fig.	No. of Flute	Dimension (mm)					
			ØD	Ød	r	a	ℓ	L
PDES								

※ Depending on customer requests, we can make special Endmill

Recommended cutting conditions

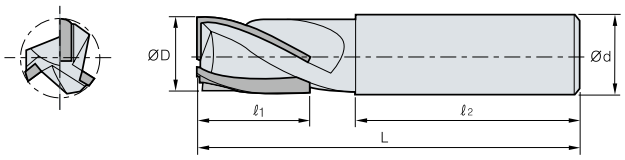
Workpiece	vc (m/min)	n (min^{-1})	fz (mm/t)
Aluminum Alloy, Copper	30~300	2,000~12,000	0.02~0.07
Reinforced Plastic	35~300	2,800~16,000	0.04~0.12
Carbon steel, Graphite	10~100	5,300~16,000	0.04~0.2

Brazed Endmill

ZSE200/300 (Flat)

2 | 3 | H·A 24°~26° | Carbide | Substrate FCC PC221F

ØD	Tolerance
All	0.00 ~ -0.05



(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L
ZSE 2	214	14.0	16	28	57	95
	215	15.0	16	28	57	95
	216(Q)	16.0	16	28	55	95
	217	17.0	20	30	70	115
	218	18.0	20	30	70	115
	219	19.0	20	30	70	115
	220(Q)	20.0	20	30	70	115
	221	21.0	20	35	65	115
	222	22.0	20	35	65	115
	223	23.0	25	35	75	125
	224	24.0	25	35	75	125
	225	25.0	25	35	75	125
	226(Q)	26.0	25	35	75	125
	227	27.0	25	35	75	125
	228	28.0	25	35	75	125
	229	29.0	32	40	95	150
	230(Q)	30.0	32	40	95	150
	231	31.0	32	40	95	150
	232	32.0	32	45	90	150
	233	33.0	32	45	90	150
	234	34.0	32	50	85	150
	235	35.0	32	50	85	150
	236	36.0	32	50	85	150
	237	37.0	32	55	80	150
	238	38.0	32	55	80	150

	Designation	ØD	Ød	ℓ1	ℓ2	L
	238S	38.0	42	55	80	150
	240(Q)	40.0	32	60	75	150
	240S	40.0	42	60	75	150
	242	42.0	32	60	75	150
	244	44.0	32	65	80	160
	245	45.0	32	65	80	160
	245S	45.0	42	65	80	160
	247	47.0	32	65	80	160
	248	48.0	32	65	80	160
	248S	48.0	42	65	80	160
	250	50.0	32	65	80	160
	250S	50.0	42	65	80	160
ZSE 3	314	14.0	16	28	57	95
	315	15.0	16	28	57	95
	316	16.0	16	28	55	95
	317	17.0	20	30	70	115
	318	18.0	20	30	70	115
	319	19.0	20	30	70	115
	320	20.0	20	30	70	115
	322	22.0	20	35	65	115
	325	25.0	25	35	75	125
	326	26.0	25	35	75	125
	328	28.0	25	35	75	125
	330	30.0	32	40	95	150
	331	31.0	32	40	95	150

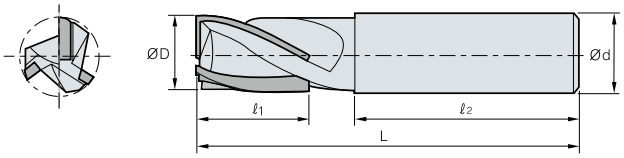
Special Endmill order: ZSE○○○○I–L

Ex.1) 2 flutes, diameter: 6.3, I: 10, L: 60 ZSBE206310–60L Ex.2) 2 flutes, diameter: 6.3, standard type ZSE2063

ZSE300/400/600 (Flat)

3 | 4 | 6 | H·A 24°-26° | Carbide | Substrate FCC PC221F

ØD	Tolerance
All	0.00 ~ -0.05



(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L
ZSE 3	332	32.0	32	45	90	150
	333	33.0	32	45	90	150
	334	34.0	32	50	85	150
	335	35.0	32	50	85	150
	338	38.0	32	55	80	150
	338S	38.0	42	55	80	150
	340	40.0	32	60	75	150
	340S	40.0	42	60	75	150
	342	42.0	32	60	75	150
	345	45.0	32	65	80	160
	345S	45.0	42	65	80	160
	350	50.0	32	65	80	160
	350S	50.0	42	65	80	160
ZSE 4	414	14.0	16	28	57	95
	415	15.0	16	28	57	95
	416 (Q)	16.0	16	28	55	95
	417	17.0	20	30	70	115
	418	18.0	20	30	70	115
	419	19.0	20	30	70	115
	420 (Q)	20.0	20	30	70	115
	421	21.0	20	35	65	115
	422	22.0	20	35	65	115
	423	23.0	25	35	75	125
	424	24.0	25	35	75	125
	425 (Q)	25.0	25	35	75	125

	Designation	ØD	Ød	ℓ1	ℓ2	L
	426	26.0	25	35	75	125
	427	27.0	25	35	75	125
	428	28.0	25	35	75	125
	429	29.0	32	40	95	150
	430	30.0	32	40	95	150
	432 (Q)	32.0	32	45	90	150
	435	35.0	32	50	80	150
	438	38.0	32	55	85	150
	438S	38.0	42	55	85	150
	440 (Q)	40.0	32	60	75	150
	440S	40.0	42	60	75	150
	445	45.0	32	65	80	160
	445S	45.0	42	65	80	160
	450	50.0	32	65	80	160
	450S	50.0	42	65	80	160
ZSE 6	634	34.0	32	50	85	150
	635	35.0	32	50	85	150
	638	38.0	32	55	80	150
	638S	38.0	42	55	80	150
	640	40.0	32	60	75	150
	640S	40.0	42	60	75	150
	645	45.0	32	65	80	160
	645S	45.0	42	65	80	160
	650	50.0	32	65	80	160
	650S	50.0	42	65	80	160

Special Endmill order: ZSE○○○○I–L

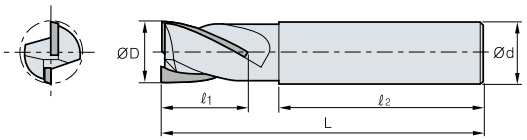
Ex.1) 2 flutes, diameter: 6.3, I: 10, L: 60 ZSBE206310–60L Ex.2) 2 flutes, diameter: 6.3, standard type ZSBE2063

Brazed Endmill

ZSEA200 (Flat)

2 | H·A 24°-26° | Carbide | Substrate FCC

ØD	Tolerance
All	0.00 ~ -0.05



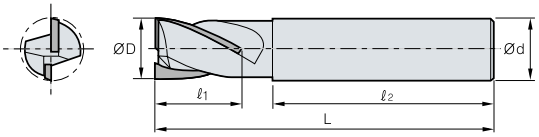
(mm)

	Designation	ØD	Ød	ℓ1	ℓ2	L
ZSEA 2	215	15.0	16	28	57	95
	216	16.0	16	28	55	95
	218	18.0	20	30	70	115
	219	19.0	20	30	70	115
	220	20.0	20	30	70	115
	221	21.0	20	35	65	115
	222	22.0	20	35	65	115
	223	23.0	25	35	75	125
	224	24.0	25	35	75	125
	225	25.0	25	35	75	125
	228	28.0	25	35	75	125
	230	30.0	32	40	95	150
	232	32.0	32	45	90	150
	238	38.0	32	55	80	150
	240	40.0	32	60	75	150
	250	50.0	32	65	80	160

ZSEL200/400, ZSEXL200 (Long ball)

2 | 4 | H·A 24°-26° | Carbide | Substrate FCC PC221F

ØD	Tolerance
All	0.00 ~ -0.05



(mm)

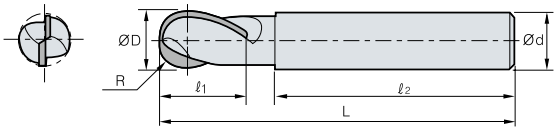
	Designation	ØD	Ød	ℓ1	ℓ2	L
ZSEL 2	214	14.0	16	50	55	120
	216	16.0	16	50	55	120
	218	18.0	20	60	65	140
	220	20.0	20	60	65	140
	222	22.0	20	60	65	140
	225	25.0	25	70	65	150
	230	30.0	32	80	85	180
	232	32.0	32	90	85	190
	235	35.0	32	100	85	200
	240	40.0	42	100	105	220
	245	45.0	42	120	95	230
	250	50.0	42	120	95	230
ZSEL 4	416	16.0	16	50	55	120
	420	20.0	20	60	65	140
	425	25.0	25	70	65	150
	430	30.0	32	80	85	180
	435	35.0	32	100	85	200
	440	40.0	42	100	105	220
ZSEXL 2	220	20.0	20	120	65	200
	222	22.0	20	120	65	200
	225	25.0	25	140	65	220

Brazed Endmill

ZSBE200 (Ball)

2 | H·A 24°~26° | Carbide | Substrate FCC PC221F

ØD	Tolerance
All	0.00 ~ -0.05



(mm)

	Designation	R	ØD	Ød	ℓ1	ℓ2	L
ZSBE 2	213	6.50	13.0	16	30	60	100
	214	7.00	14.0	16	30	65	100
	215	7.50	15.0	16	35	55	100
	216Q	8.00	16.0	16	35	55	100
	217	8.50	17.0	20	35	65	110
	218	9.00	18.0	20	35	65	110
	219	9.50	19.0	20	35	65	110
	220Q	10.00	20.0	20	35	65	110
	221	10.50	21.0	20	35	65	110
	222	11.00	22.0	20	35	65	110
	223	11.50	23.0	25	40	65	120
	224	12.00	24.0	25	40	70	120
	225	12.50	25.0	25	40	70	120
	230	15.00	30.0	32	40	70	130
	231	15.50	31.0	32	40	80	130
	232	16.00	32.0	32	50	75	140
	233	16.50	33.0	32	50	75	140
	234	17.00	34.0	32	50	85	150
	235	17.50	35.0	32	50	85	150
	235S	17.50	35.0	42	50	85	150
	236	18.00	36.0	32	50	85	150
	236S	18.00	36.0	42	50	85	150
	237	18.50	37.0	32	50	95	160
	237S	18.50	37.0	42	50	95	160
	238	19.00	38.0	32	50	95	160
	238S	19.00	38.0	42	50	95	160
	239	19.50	39.0	32	50	95	160
	239S	19.50	39.0	42	50	95	160
	240	20.00	40.0	32	50	95	160
	240S	20.00	40.0	42	50	95	160
	245	22.50	45.0	32	50	105	170
	245S	22.50	45.0	42	50	105	170
	250	25.00	50.0	32	50	105	170
	250S	25.00	50.0	42	50	105	170

- ZSBE200 Special Endmill order: ZSBE2 I-L
  Ex 1) 2 flutes diameter: 6 3 I: 10 L: 60 ZSBE 206310-60L Ex.2) 2 flutes, diameter: 6.3, standard type ZSBE2063
- ZSEA200 Special Endmill order : ZSEA2 I-L
  Ex.1) 2 flutes, diameter: 16.3, I: 28, L: 95 ZSEA2163 28-95L Ex.2) 2 flutes, diameter: 17.0, standard type ZSEA2170
- ZSEL200/400, ZSEXL200 Special Endmill orde r: ZSEL I-L

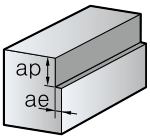
Brazed Endmill

Recommended cutting conditions

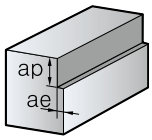
ZSE200 Flat

Workpiece / Conditions / Diameter(Ø)	SM50C,SCM,GC under HRC30		STD61,STD11 HRC30~45		STD61 HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
20.0	1,600	152	950	88	560	44
25.0	1,300	136	750	72	450	36
30.0	1,100	120	650	64	370	32
40.0	800	96	500	56	280	24
50.0	650	88	400	48	220	20

Application tip



■ **Side milling(under HRC45)**
- ap : ≤1.5D
- ae : ≤0.1D



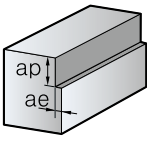
■ **Side milling(over HRC45)**
- ap : ≤1D (Max : 1mm)

※ Above table based on side milling, when it enters to ae direction, you should apply reduced cutting condition
※ When it enters to ae direction, for finishing you should increase revolution speed and feed in the table

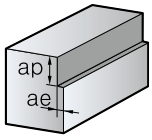
ZSE400 Flat

Workpiece / Conditions / Diameter(Ø)	SM50C,SCM,GC under HRC30		STD61,STD11 HRC30~45		STD61 HRC45~55	
	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)	R.P.M n (min⁻¹)	Feed vf (mm/min)
20.0	1,600	230	950	133	560	66
25.0	1,300	205	750	109	450	54
30.0	1,100	180	650	96	370	48
40.0	800	145	500	85	280	36
50.0	650	135	400	72	220	30

Application tip



■ **Side milling(under HRC45)**
- ap : ≤ 1.5D
- ae : ≤ 0.1D



■ **Side milling(over HRC45)**
- ap : ≤ 1D (Max : 1mm)

※ Above table based on side milling, when it enters to ae direction, you should apply reduced cutting condition
※ When it enters to ae direction, for finishing you should increase revolution speed and feed in the table

Technical information for
Drill / Reamer / Chamfer / Thread

Drill / Reamer / Chamfer / Thread

Product details / Recommended cutting conditions

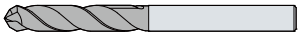
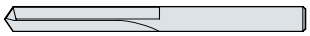
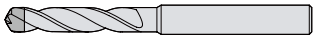
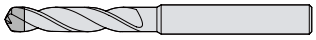
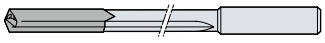
Drill

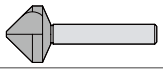
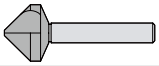
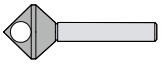
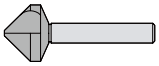
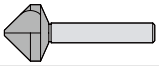
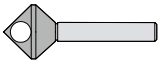
Reamer

Chamfer

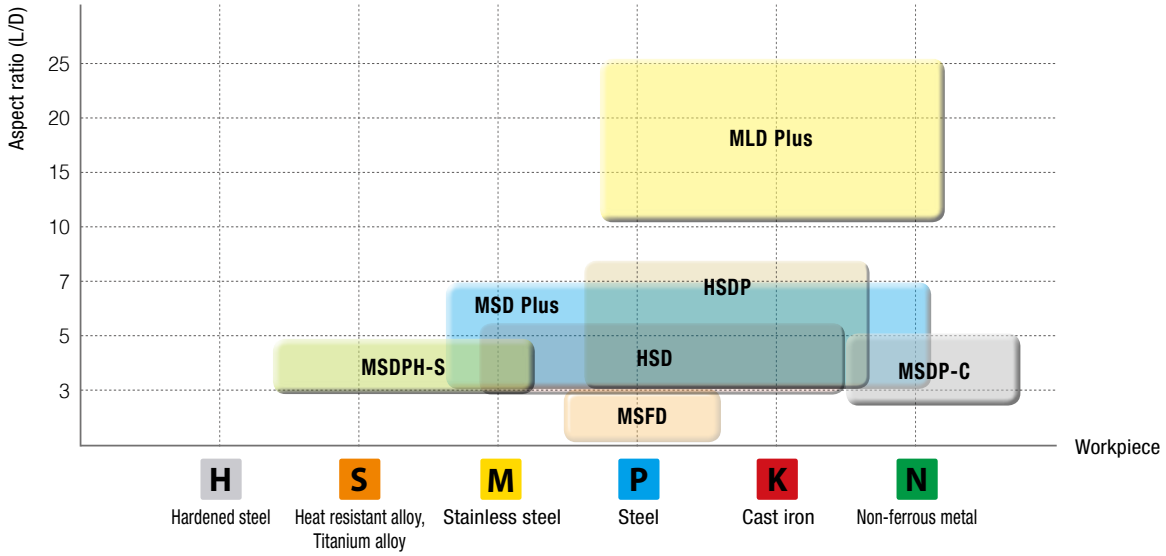
Thread

KORLOY Drill / Reamer / Chamfer

Type	Designation		Shape	Drills dia.	Aspect ratio	Page
Solid Drills	Mach Solid Drill Plus	MSDP		Ø1.0~Ø20.0	3D~7D	254~258
		MSDPH		Ø2.5~Ø20.0	3D~7D	255~258
	Mach Solid Drill Plus-S	MSDPH-S		Ø3.0~Ø16.0	3D~5D	260~263
	Mach Long Drill Plus	MLD□□□□N		Ø3.0~Ø10.0	10D~25D	265~267
	Mach Solid Drill Plus CFRP	MSDP-C		Ø3.0~Ø12.7	5D	269
	Mach Solid Flat Drill	MSFD		Ø2.5~Ø12.0	2D	270~271
		MSFDH		Ø2.5~Ø12.0	3D	272~273
	HSD Plus new	HSD		Ø3.0~Ø20.0	3D~5D	274~276
		HSDP		Ø3.0~Ø20.0	3D~8D	277~281
	ECO Solid Drill Plus	ESDP-P		Ø1.0~Ø20.0	3D~5D	283~287
	Carbide Drill new	SSD-N		Ø1.0~Ø13.0	-	289~290
	Vulcan Drill	VZD		Ø12.6~Ø40.5	-	291~292
	Burnishing Drill	BDS		Ø4.0~Ø16.0	5D~7D	294
		BDT		Ø4.2~Ø10.3	2D~4D	294
	Top solid Drill	TSDM		Ø8.0~Ø25.0	5D~8D	296
	PCD Drill new	PDD		Ø5.0~Ø12.0	5D	297
		CPD		Ø2.0~Ø8.0	3D~5D	298
		CPDL		Ø2.0~Ø8.0	12D~45D	298
		SPD		Ø4.0~Ø16.0	4D~5D	299
	Gun Drill	KGDS		Ø2.0~Ø33.0	50D~100D	300
		KGDT		Ø6.0~Ø26.5	50D~100D	301
Reamer	Chucking / Machine Reamer	SCRS	 Available Insert : RI	Ø5.0~Ø20.0	2D~3D	303
		SCRH		Ø5.0~Ø20.0	2D~3D	303
		TCRS		Ø7.0~Ø30.0	2D~3D	304
		TMRS		Ø7.0~Ø30.0	3D~5D	304

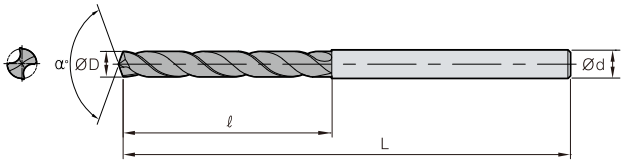
Type	Designation		Shape	Drills dia.	Aspect ratio	Page
Reamer	PCD Reamer	PDR		Ø5.0~Ø20.0	3D~5D	305
	Cermet Reamer	KCR		Ø6.0~Ø30.0	3D~7D	306
	Broach Reamer	HBRE		Ø3.0~Ø25.0	3D~7D	307
Chamfer	Chamfer Tool	CET		Ø3.0~Ø16.0	-	308
		CCT		Ø3.0~Ø12.0	-	309~310
	Counter Sink new	CSPC		Ø6.0~Ø20.0	-	311
		CSNC3		Ø10.0~Ø30.0	-	311
		CSNC1		Ø10.0~Ø30.0	-	312
		CSHC		Ø10.0~Ø30.0	-	312
		CSPH		Ø6.3~Ø25.0	-	313
		CSNH3		Ø10.0~Ø50.0	-	313
		CSNH1		Ø10.0~Ø50.0	-	314
		CSHH		Ø10.0~Ø50.0	-	314

Application area



MSD Plus

MSDP - □ (P/M/K/N)



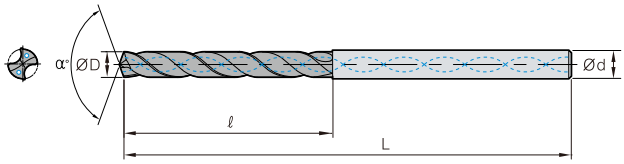
Terminology	P	M	K	N
Grade	PC325U			FG2
Tolerance (drill Dia.)	h7			
Tolerance (shank Dia.)	h6			
Point angle	140°			135°
Twist angle	30°			
Thinning	X type			
Coolant	External			

P Steel M Stainless steel K Cast iron N Non-ferrous metal

(mm)

Designation		ØD	Ød	3P,M,K,N		5P,M,K,N	
				ℓ	L	ℓ	L
MSDP	010 - □ P,M,K,N	1.0	3	6	45	12	66
	011 - □ P,M,K,N	1.1	3	7	45	12	66
	012 - □ P,M,K,N	1.2	3	8	45	12	66
	013 - □ P,M,K,N	1.3	3	8	45	12	66
	014 - □ P,M,K,N	1.4	3	9	45	12	66
	015 - □ P,M,K,N	1.5	3	9	45	12	66
	016 - □ P,M,K,N	1.6	3	10	45	15	66
	017 - □ P,M,K,N	1.7	3	10	45	15	66
	018 - □ P,M,K,N	1.8	3	11	45	15	66
	019 - □ P,M,K,N	1.9	3	11	45	15	66
	020 - □ P,M,K,N	2.0	3	14	53	20	66
	021 - □ P,M,K,N	2.1	3	14	53	20	66
	022 - □ P,M,K,N	2.2	3	14	53	20	66
	023 - □ P,M,K,N	2.3	3	14	53	20	66
	024 - □ P,M,K,N	2.4	3	14	53	20	66

MSDP(H) - □(P/M/K/N)



Terminology	P	M	K	N
Grade	PC325U			FG2
Tolerance (drill Dia.)	h7			
Tolerance (shank Dia.)	h6			
Point angle	140°			135°
Twist angle	30°			
Thinning	X type			
Coolant	Through/External			

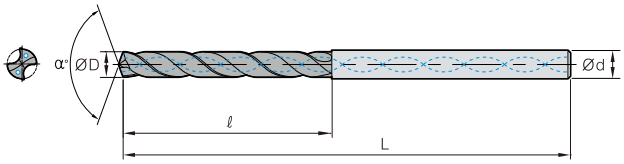
P Steel M Stainless steel K Cast iron N Non-ferrous metal

(mm)

	Designation	ØD	Ød	3P,M,K,N		5P,M,K,N		7P,M,K,N	
				ℓ	L	ℓ	L	ℓ	L
MSDP (H)	025 - □ P,M,K,N	2.5	3	14	53	20	66	30	70
	026 - □ P,M,K,N	2.6	3	17	53	20	66	30	70
	027 - □ P,M,K,N	2.7	3	17	53	20	66	30	70
	028 - □ P,M,K,N	2.8	3	17	53	20	66	30	70
	029 - □ P,M,K,N	2.9	3	17	53	20	66	30	70
	030 - □ P,M,K,N	3.0	3	17	53	20	66	30	70
	031 - □ P,M,K,N	3.1	4	20	58	28	74	30	70
	032 - □ P,M,K,N	3.2	4	20	58	28	74	30	70
	033 - □ P,M,K,N	3.3	4	20	58	28	74	30	70
	034 - □ P,M,K,N	3.4	4	20	58	28	74	37.5	75
	035 - □ P,M,K,N	3.5	4	20	58	28	74	37.5	75
	036 - □ P,M,K,N	3.6	4	22	58	32	74	37.5	75
	037 - □ P,M,K,N	3.7	4	22	58	32	74	37.5	75
	038 - □ P,M,K,N	3.8	4	22	58	32	74	37.5	75
	039 - □ P,M,K,N	3.9	4	22	58	32	74	37.5	75
	040 - □ P,M,K,N	4.0	4	22	58	32	74	37.5	75
	041 - □ P,M,K,N	4.1	5	24	62	36	82	37.5	75
	042 - □ P,M,K,N	4.2	5	24	62	36	82	37.5	75
	043 - □ P,M,K,N	4.3	5	24	62	36	82	45	85
	044 - □ P,M,K,N	4.4	5	24	62	36	82	45	85
	045 - □ P,M,K,N	4.5	5	24	62	36	82	45	85
	046 - □ P,M,K,N	4.6	5	26	62	38	82	45	85
	047 - □ P,M,K,N	4.7	5	26	62	38	82	45	85
	048 - □ P,M,K,N	4.8	5	26	62	38	82	50	90
	049 - □ P,M,K,N	4.9	5	26	62	38	82	50	90
	050 - □ P,M,K,N	5.0	5	26	62	38	82	50	90
	051 - □ P,M,K,N	5.1	6	28	66	44	82	50	90
	052 - □ P,M,K,N	5.2	6	28	66	44	82	50	90
	053 - □ P,M,K,N	5.3	6	28	66	44	82	50	90
	054 - □ P,M,K,N	5.4	6	28	66	44	82	50	90
	055 - □ P,M,K,N	5.5	6	28	66	44	82	57	97
	056 - □ P,M,K,N	5.6	6	28	66	44	82	57	97
	057 - □ P,M,K,N	5.7	6	28	66	44	82	57	97
	058 - □ P,M,K,N	5.8	6	28	66	44	82	57	97
	059 - □ P,M,K,N	5.9	6	28	66	44	82	57	97
	060 - □ P,M,K,N	6.0	6	28	66	44	82	57	97
	061 - □ P,M,K,N	6.1	7	34	74	50	91	66	106
	062 - □ P,M,K,N	6.2	7	34	74	50	91	66	106
	063 - □ P,M,K,N	6.3	7	34	74	50	91	66	106
	064 - □ P,M,K,N	6.4	7	34	74	50	91	66	106
	065 - □ P,M,K,N	6.5	7	34	74	50	91	66	106
	066 - □ P,M,K,N	6.6	7	34	74	50	91	66	106
	067 - □ P,M,K,N	6.7	7	34	74	50	91	66	106
	068 - □ P,M,K,N	6.8	7	34	74	50	91	66	106
	069 - □ P,M,K,N	6.9	7	34	74	50	91	76	116
	070 - □ P,M,K,N	7.0	7	34	74	50	91	76	116
	071 - □ P,M,K,N	7.1	8	41	79	53	91	76	116
	072 - □ P,M,K,N	7.2	8	41	79	53	91	76	116

MSD Plus

MSDP(H) - ☐(P/M/K/N)



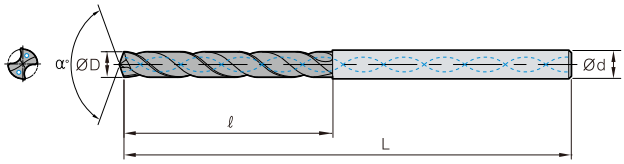
Terminology	P	M	K	N
Grade	PC325U			FG2
Tolerance (drill Dia.)	h7			
Tolerance (shank Dia.)	h6			
Point angle	140°			135°
Twist angle	30°			
Thinning	X type			
Coolant	Through/External			

P Steel M Stainless steel K Cast iron N Non-ferrous metal

(mm)

Designation		ØD	Ød	3P,M,K,N		5P,M,K,N		7P,M,K,N	
				ℓ	L	ℓ	L	ℓ	L
MSDP (H)	073 - ☐ P,M,K,N	7.3	8	41	79	53	91	76	116
	074 - ☐ P,M,K,N	7.4	8	41	79	53	91	76	116
	075 - ☐ P,M,K,N	7.5	8	41	79	53	91	76	116
	076 - ☐ P,M,K,N	7.6	8	41	79	53	91	76	116
	077 - ☐ P,M,K,N	7.7	8	41	79	53	91	76	116
	078 - ☐ P,M,K,N	7.8	8	41	79	53	91	76	116
	079 - ☐ P,M,K,N	7.9	8	41	79	53	91	76	116
	080 - ☐ P,M,K,N	8.0	8	43	84	58	98	87	131
	081 - ☐ P,M,K,N	8.1	9	43	84	58	98	87	131
	082 - ☐ P,M,K,N	8.2	9	43	84	58	98	87	131
	083 - ☐ P,M,K,N	8.3	9	43	84	58	98	87	131
	084 - ☐ P,M,K,N	8.4	9	43	84	58	98	87	131
	085 - ☐ P,M,K,N	8.5	9	43	84	58	98	87	131
	086 - ☐ P,M,K,N	8.6	9	43	84	58	98	87	131
	087 - ☐ P,M,K,N	8.7	9	43	84	58	98	87	131
	088 - ☐ P,M,K,N	8.8	9	43	84	58	98	87	131
	089 - ☐ P,M,K,N	8.9	9	43	84	58	98	87	131
	090 - ☐ P,M,K,N	9.0	9	43	84	58	98	87	131
	091 - ☐ P,M,K,N	9.1	10	47	89	61	105	95	139
	092 - ☐ P,M,K,N	9.2	10	47	89	61	105	95	139
	093 - ☐ P,M,K,N	9.3	10	47	89	61	105	95	139
	094 - ☐ P,M,K,N	9.4	10	47	89	61	105	95	139
	095 - ☐ P,M,K,N	9.5	10	47	89	61	105	95	139
	096 - ☐ P,M,K,N	9.6	10	47	89	61	105	95	139
	097 - ☐ P,M,K,N	9.7	10	47	89	61	105	95	139
	098 - ☐ P,M,K,N	9.8	10	47	89	61	105	95	139
	099 - ☐ P,M,K,N	9.9	10	47	89	61	105	95	139
	100 - ☐ P,M,K,N	10.0	10	47	89	61	105	95	139
	101 - ☐ P,M,K,N	10.1	11	55	95	68	114	106	155
	102 - ☐ P,M,K,N	10.2	11	55	95	68	114	106	155
	103 - ☐ P,M,K,N	10.3	11	55	95	68	114	106	155
	104 - ☐ P,M,K,N	10.4	11	55	95	68	114	106	155
	105 - ☐ P,M,K,N	10.5	11	55	95	68	114	106	155
	106 - ☐ P,M,K,N	10.6	11	55	95	68	114	106	155
	107 - ☐ P,M,K,N	10.7	11	55	95	68	114	106	155
	108 - ☐ P,M,K,N	10.8	11	55	95	68	114	106	155
	109 - ☐ P,M,K,N	10.9	11	55	95	68	114	106	155
	110 - ☐ P,M,K,N	11.0	11	55	95	68	114	106	155
	111 - ☐ P,M,K,N	11.1	12	55	102	71	120	114	163
	112 - ☐ P,M,K,N	11.2	12	55	102	71	120	114	163
	113 - ☐ P,M,K,N	11.3	12	55	102	71	120	114	163
	114 - ☐ P,M,K,N	11.4	12	55	102	71	120	114	163
	115 - ☐ P,M,K,N	11.5	12	55	102	71	120	114	163
	116 - ☐ P,M,K,N	11.6	12	55	102	71	120	114	163
	117 - ☐ P,M,K,N	11.7	12	55	102	71	120	114	163
	118 - ☐ P,M,K,N	11.8	12	55	102	71	120	114	163
	119 - ☐ P,M,K,N	11.9	12	55	102	71	120	114	163
	120 - ☐ P,M,K,N	12.0	12	55	102	71	120	114	163

MSDP(H) - □(P/M/K/N)



Terminology	P	M	K	N
Grade	PC325U			FG2
Tolerance (drill Dia.)	h7			
Tolerance (shank Dia.)	h6			
Point angle	140°			135°
Twist angle	30°			
Thinning	X type			
Coolant	Through/External			

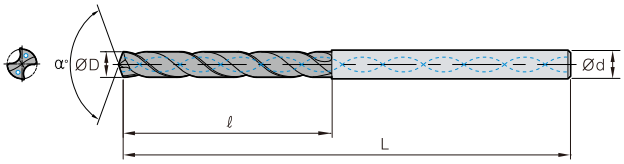
P Steel M Stainless steel K Cast iron N Non-ferrous metal

(mm)

	Designation	ØD	Ød	3P,M,K,N		5P,M,K,N		7P,M,K,N	
				ℓ	L	ℓ	L	ℓ	L
MSDP (H)	121 - □ P,M,K,N	12.1	13	60	107	77	124	133	182
	122 - □ P,M,K,N	12.2	13	60	107	77	124	133	182
	123 - □ P,M,K,N	12.3	13	60	107	77	124	133	182
	124 - □ P,M,K,N	12.4	13	60	107	77	124	133	182
	125 - □ P,M,K,N	12.5	13	60	107	77	124	133	182
	126 - □ P,M,K,N	12.6	13	60	107	77	124	133	182
	127 - □ P,M,K,N	12.7	13	60	107	77	124	133	182
	128 - □ P,M,K,N	12.8	13	60	107	77	124	133	182
	129 - □ P,M,K,N	12.9	13	60	107	77	124	133	182
	130 - □ P,M,K,N	13.0	13	60	107	77	124	133	182
	131 - □ P,M,K,N	13.1	14	62	107	80	133	133	182
	132 - □ P,M,K,N	13.2	14	62	107	80	133	133	182
	133 - □ P,M,K,N	13.3	14	62	107	80	133	133	182
	134 - □ P,M,K,N	13.4	14	62	107	80	133	133	182
	135 - □ P,M,K,N	13.5	14	62	107	80	133	133	182
	136 - □ P,M,K,N	13.6	14	62	107	80	133	133	182
	137 - □ P,M,K,N	13.7	14	62	107	80	133	133	182
	138 - □ P,M,K,N	13.8	14	62	107	80	133	133	182
	139 - □ P,M,K,N	13.9	14	62	107	80	133	133	182
	140 - □ P,M,K,N	14.0	14	62	107	80	133	133	182
	141 - □ P,M,K,N	14.1	15	65	115	85	143	152	204
	142 - □ P,M,K,N	14.2	15	65	115	85	143	152	204
	143 - □ P,M,K,N	14.3	15	65	115	85	143	152	204
	144 - □ P,M,K,N	14.4	15	65	115	85	143	152	204
	145 - □ P,M,K,N	14.5	15	65	115	85	143	152	204
	146 - □ P,M,K,N	14.6	15	65	115	85	143	152	204
	147 - □ P,M,K,N	14.7	15	65	115	85	143	152	204
	148 - □ P,M,K,N	14.8	15	65	115	85	143	152	204
	149 - □ P,M,K,N	14.9	15	65	115	85	143	152	204
	150 - □ P,M,K,N	15.0	15	65	115	85	143	152	204
	151 - □ P,M,K,N	15.1	16	68	115	88	143	152	204
	152 - □ P,M,K,N	15.2	16	68	115	88	143	152	204
	153 - □ P,M,K,N	15.3	16	68	115	88	143	152	204
	154 - □ P,M,K,N	15.4	16	68	115	88	143	152	204
	155 - □ P,M,K,N	15.5	16	68	115	88	143	152	204
	156 - □ P,M,K,N	15.6	16	68	115	88	143	152	204
	157 - □ P,M,K,N	15.7	16	68	115	88	143	152	204
	158 - □ P,M,K,N	15.8	16	68	115	88	143	152	204
	159 - □ P,M,K,N	15.9	16	68	115	88	143	152	204
	160 - □ P,M,K,N	16.0	16	68	115	88	143	152	204
	161 - □ P,M,K,N	16.1	17	73	123	93	153	171	223
	162 - □ P,M,K,N	16.2	17	73	123	93	153	171	223
	163 - □ P,M,K,N	16.3	17	73	123	93	153	171	223
	164 - □ P,M,K,N	16.4	17	73	123	93	153	171	223
	165 - □ P,M,K,N	16.5	17	73	123	93	153	171	223
	166 - □ P,M,K,N	16.6	17	73	123	93	153	171	223
	167 - □ P,M,K,N	16.7	17	73	123	93	153	171	223
	168 - □ P,M,K,N	16.8	17	73	123	93	153	171	223

MSD Plus

MSDP(H) - □(P/M/K/N)



Terminology	P	M	K	N
Grade	PC325U			FG2
Tolerance (drill Dia.)	h7			
Tolerance (shank Dia.)	h6			
Point angle	140°			135°
Twist angle	30°			
Thinning	X type			
Coolant	Through/External			

P Steel M Stainless steel K Cast iron N Non-ferrous metal

(mm)

Designation		ØD	Ød	3P,M,K,N		5P,M,K,N		7P,M,K,N	
				ℓ	L	ℓ	L	ℓ	L
MSDP (H)	169 - □ P,M,K,N	16.9	17	73	123	93	153	171	223
	170 - □ P,M,K,N	17.0	17	73	123	93	153	171	223
	171 - □ P,M,K,N	17.1	18	73	123	98	153	171	223
	172 - □ P,M,K,N	17.2	18	73	123	98	153	171	223
	173 - □ P,M,K,N	17.3	18	73	123	98	153	171	223
	174 - □ P,M,K,N	17.4	18	73	123	98	153	171	223
	175 - □ P,M,K,N	17.5	18	73	123	98	153	171	223
	176 - □ P,M,K,N	17.6	18	73	123	98	153	171	223
	177 - □ P,M,K,N	17.7	18	73	123	98	153	171	223
	178 - □ P,M,K,N	17.8	18	73	123	98	153	171	223
	179 - □ P,M,K,N	17.9	18	73	123	98	153	171	223
	180 - □ P,M,K,N	18.0	18	73	123	98	153	171	223
	181 - □ P,M,K,N	18.1	19	79	131	103	153	190	244
	182 - □ P,M,K,N	18.2	19	79	131	103	153	190	244
	183 - □ P,M,K,N	18.3	19	79	131	103	153	190	244
	184 - □ P,M,K,N	18.4	19	79	131	103	153	190	244
	185 - □ P,M,K,N	18.5	19	79	131	103	153	190	244
	186 - □ P,M,K,N	18.6	19	79	131	103	153	190	244
	187 - □ P,M,K,N	18.7	19	79	131	103	153	190	244
	188 - □ P,M,K,N	18.8	19	79	131	103	153	190	244
	189 - □ P,M,K,N	18.9	19	79	131	103	153	190	244
	190 - □ P,M,K,N	19.0	19	79	131	103	153	190	244
	191 - □ P,M,K,N	19.1	20	79	131	107	153	190	244
	192 - □ P,M,K,N	19.2	20	79	131	107	153	190	244
	193 - □ P,M,K,N	19.3	20	79	131	107	153	190	244
	194 - □ P,M,K,N	19.4	20	79	131	107	153	190	244
	195 - □ P,M,K,N	19.5	20	79	131	107	153	190	244
	196 - □ P,M,K,N	19.6	20	79	131	107	153	190	244
	197 - □ P,M,K,N	19.7	20	79	131	107	153	190	244
	198 - □ P,M,K,N	19.8	20	79	131	107	153	190	244
	199 - □ P,M,K,N	19.9	20	79	131	107	153	190	244
	200 - □ P,M,K,N	20.0	20	79	131	107	153	190	244

MSD Plus

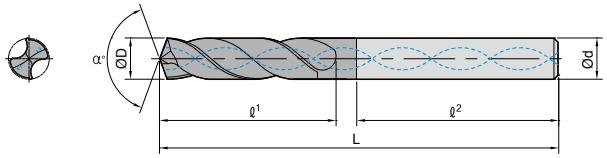
Recommended cutting conditions

Workpiece				Grade	vc (m/min)	Depth of cut = 10D~25D Feed rate (mm/rev) per drill dia. (mm)				
ISO		Workpiece	HB			Ø1.0~Ø4.0	Ø4.1~Ø8.0	Ø8.1~Ø12.0	Ø12.1~Ø16.0	Ø16.1~Ø20.0
P	Carbon steel	Low carbon steel	80~120	PC325U	90 (80~150)	0.10~0.15	0.16~0.24	0.20~0.30	0.25~0.36	0.30~0.40
		High carbon steel	Over 250	PC325U	50 (40~80)	0.08~0.20	0.08~0.20	0.10~0.25	0.15~0.25	0.15~0.30
	Alloy steel	Low alloy steel	140~260	PC325U	90 (80~150)	0.10~0.15	0.16~0.24	0.20~0.30	0.25~0.36	0.30~0.40
		Hardened low alloy steel	200~400	PC325U	60 (50~100)	0.10~0.15	0.16~0.24	0.20~0.30	0.25~0.36	0.30~0.40
		High alloy steel	50~260	PC325U	50 (40~80)	0.08~0.20	0.08~0.20	0.10~0.25	0.15~0.25	0.15~0.30
		Hardened high alloy steel	over 250	PC325U	50 (40~80)	0.08~0.20	0.08~0.20	0.10~0.25	0.15~0.25	0.15~0.30
M	Stainless steel	Austenite series	135~275	PC325U	45 (25~80)	0.05~0.20	0.05~0.20	0.10~0.25	0.10~0.25	0.15~0.30
		Ferrite series Martensite series	135~275	PC325U	50 (30~80)	0.05~0.20	0.05~0.20	0.10~0.25	0.10~0.25	0.15~0.30
K	Cast iron	Gray cast iron	150~230	PC325U	100 (80~150)	0.10~0.15	0.16~0.24	0.20~0.30	0.25~0.36	0.30~0.40
		Ductile cast iron	160~260	PC325U	90 (70~140)	0.10~0.15	0.16~0.24	0.20~0.30	0.25~0.36	0.30~0.40
N	Aluminum	Aluminum alloy	30~150	FG2	150 (125~220)	0.24~0.38	0.38~0.53	0.53~0.75	0.61~0.85	0.68~0.98
	Copper alloy	Copper alloy	150~160	FG2	150 (125~220)	0.10~0.15	0.16~0.24	0.20~0.30	0.25~0.36	0.30~0.40

- Cutting conditions above are for the case of less than 5D depth of cut and through coolant system applied
- In case of external coolant system, reduce the above feed values by 20%

MSD Plus-S

MSDPH-S



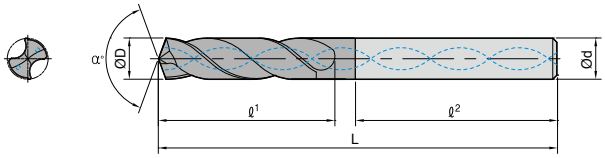
Terminology	S
Grade	PC325T
Tolerance (drill Dia.)	h7
Tolerance (shank Dia.)	h6
Point angle	140°
Twist angle	30°
Thinning	X Type
Coolant	Through
International standard	DIN 6537
Shank type	DIN 6535 HA

S Heat resistant alloy, Titanium alloy

(mm)

Designation		ØD		Ød	3S		5S		ℓ2
		mm	inch		ℓ1	L	ℓ1	L	
MSDPH	030-□S	3.00	-	6	20	62	28	66	36
	031-□S	3.10	-	6	20	62	28	66	36
	0318-□S	3.18	1/8	6	20	62	28	66	36
	032-□S	3.20	-	6	20	62	28	66	36
	033-□S	3.30	-	6	20	62	28	66	36
	034-□S	3.40	-	6	20	62	28	66	36
	035-□S	3.50	-	6	20	62	28	66	36
	0357-□S	3.57	9/64	6	20	62	28	66	36
	036-□S	3.60	-	6	20	62	28	66	36
	037-□S	3.70	-	6	20	62	28	66	36
	038-□S	3.80	-	6	24	66	36	74	36
	039-□S	3.90	-	6	24	66	36	74	36
	0397-□S	3.97	5/32	6	24	66	36	74	36
	040-□S	4.00	-	6	24	66	36	74	36
	041-□S	4.10	-	6	24	66	36	74	36
	042-□S	4.20	-	6	24	66	36	74	36
	043-□S	4.30	-	6	24	66	36	74	36
	0437-□S	4.37	11/64	6	24	66	36	74	36
	044-□S	4.40	-	6	24	66	36	74	36
	045-□S	4.50	-	6	24	66	36	74	36
	046-□S	4.60	-	6	24	66	36	74	36
	047-□S	4.70	-	6	24	66	36	74	36
	0476-□S	4.76	3/16	6	28	66	44	82	36
	048-□S	4.80	-	6	28	66	44	82	36
	049-□S	4.90	-	6	28	66	44	82	36
	050-□S	5.00	-	6	28	66	44	82	36
	051-□S	5.10	-	6	28	66	44	82	36
	0516-□S	5.16	13/64	6	28	66	44	82	36
	052-□S	5.20	-	6	28	66	44	82	36
	053-□S	5.30	-	6	28	66	44	82	36
	054-□S	5.40	-	6	28	66	44	82	36
	055-□S	5.50	-	6	28	66	44	82	36
	0556-□S	5.56	7/32	6	28	66	44	82	36
	056-□S	5.60	-	6	28	66	44	82	36
	057-□S	5.70	-	6	28	66	44	82	36
	058-□S	5.80	-	6	28	66	44	82	36
	059-□S	5.90	-	6	28	66	44	82	36
	0595-□S	5.95	15/64	6	28	66	44	82	36
	060-□S	6.00	-	6	28	66	44	82	36

MSDPH-S



Terminology	S
Grade	PC325T
Tolerance (drill Dia.)	h7
Tolerance (shank Dia.)	h6
Point angle	140°
Twist angle	30°
Thinning	X Type
Coolant	Through
International standard	DIN 6537
Shank type	DIN 6535 HA

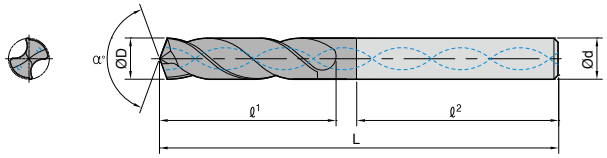
S Heat resistant alloy, Titanium alloy

(mm)

Designation		ØD		Ød	3S		5S		ℓ2
		mm	inch		ℓ1	L	ℓ1	L	
MSDPH	061 - □S	6.10	-	8	34	79	53	91	36
	062 - □S	6.20	-	8	34	79	53	91	36
	063 - □S	6.30	-	8	34	79	53	91	36
	0635 - □S	6.35	1/4	8	34	79	53	91	36
	064 - □S	6.40	-	8	34	79	53	91	36
	065 - □S	6.50	-	8	34	79	53	91	36
	066 - □S	6.60	-	8	34	79	53	91	36
	067 - □S	6.70	-	8	34	79	53	91	36
	0675 - □S	6.75	17/64	8	34	79	53	91	36
	068 - □S	6.80	-	8	34	79	53	91	36
	069 - □S	6.90	-	8	34	79	53	91	36
	070 - □S	7.00	-	8	34	79	53	91	36
	071 - □S	7.10	-	8	41	79	53	91	36
	0714 - □S	7.14	9/32	8	41	79	53	91	36
	072 - □S	7.20	-	8	41	79	53	91	36
	073 - □S	7.30	-	8	41	79	53	91	36
	074 - □S	7.40	-	8	41	79	53	91	36
	075 - □S	7.50	-	8	41	79	53	91	36
	0754 - □S	7.54	19/64	8	41	79	53	91	36
	076 - □S	7.60	-	8	41	79	53	91	36
	077 - □S	7.70	-	8	41	79	53	91	36
	078 - □S	7.80	-	8	41	79	53	91	36
	079 - □S	7.90	-	8	41	79	53	91	36
	0794 - □S	7.94	5/16	8	41	79	53	91	36
	080 - □S	8.00	-	8	41	79	53	91	36
	081 - □S	8.10	-	10	47	89	61	103	40
	082 - □S	8.20	-	10	47	89	61	103	40
	083 - □S	8.30	-	10	47	89	61	103	40
	0833 - □S	8.33	21/64	10	47	89	61	103	40
	084 - □S	8.40	-	10	47	89	61	103	40
	085 - □S	8.50	-	10	47	89	61	103	40
	086 - □S	8.60	-	10	47	89	61	103	40
	087 - □S	8.70	-	10	47	89	61	103	40
	0873 - □S	8.73	11/32	10	47	89	61	103	40
	088 - □S	8.80	-	10	47	89	61	103	40
	089 - □S	8.90	-	10	47	89	61	103	40
	090 - □S	9.00	-	10	47	89	61	103	40
	091 - □S	9.10	-	10	47	89	61	103	40
	0913 - □S	9.13	23/64	10	47	89	61	103	40

MSD Plus-S

MSDPH-S



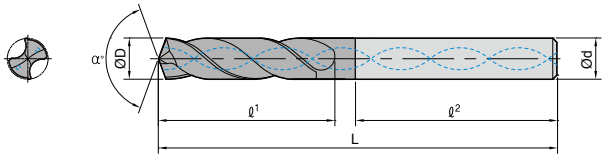
Terminology	S
Grade	PC325T
Tolerance (drill Dia.)	h7
Tolerance (shank Dia.)	h6
Point angle	140°
Twist angle	30°
Thinning	X Type
Coolant	Through
International standard	DIN 6537
Shank type	DIN 6535 HA

S Heat resistant alloy, Titanium alloy

(mm)

Designation		ØD		Ød	3S		5S		ℓ2
		mm	inch		ℓ1	L	ℓ1	L	
MSDPH	092-□S	9.20	-	10	47	89	61	103	40
	093-□S	9.30	-	10	47	89	61	103	40
	094-□S	9.40	-	10	47	89	61	103	40
	095-□S	9.50	-	10	47	89	61	103	40
	0953-□S	9.53	3/8	10	47	89	61	103	40
	096-□S	9.60	-	10	47	89	61	103	40
	097-□S	9.70	-	10	47	89	61	103	40
	098-□S	9.80	-	10	47	89	61	103	40
	099-□S	9.90	-	10	47	89	61	103	40
	0992-□S	9.92	25/64	10	47	89	61	103	40
	100-□S	10.00	-	10	47	89	61	103	40
	101-□S	10.10	-	12	55	102	71	118	45
	102-□S	10.20	-	12	55	102	71	118	45
	103-□S	10.30	-	12	55	102	71	118	45
	1032-□S	10.32	13/32	12	55	102	71	118	45
	104-□S	10.40	-	12	55	102	71	118	45
	105-□S	10.50	-	12	55	102	71	118	45
	106-□S	10.60	-	12	55	102	71	118	45
	107-□S	10.70	-	12	55	102	71	118	45
	1072-□S	10.72	27/64	12	55	102	71	118	45
	108-□S	10.80	-	12	55	102	71	118	45
	109-□S	10.90	-	12	55	102	71	118	45
	110-□S	11.00	-	12	55	102	71	118	45
	111-□S	11.10	-	12	55	102	71	118	45
	1111-□S	11.11	7/16	12	55	102	71	118	45
	112-□S	11.20	-	12	55	102	71	118	45
	113-□S	11.30	-	12	55	102	71	118	45
	114-□S	11.40	-	12	55	102	71	118	45
	115-□S	11.50	-	12	55	102	71	118	45
	1151-□S	11.51	29/64	12	55	102	71	118	45
	116-□S	11.60	-	12	55	102	71	118	45
	117-□S	11.70	-	12	55	102	71	118	45
	118-□S	11.80	-	12	55	102	71	118	45
	119-□S	11.90	-	12	55	102	71	118	45
	1191-□S	11.91	15/32	12	55	102	71	118	45
	120-□S	12.00	-	12	55	102	71	118	45
	121-□S	12.10	-	14	60	107	77	124	45
	122-□S	12.20	-	14	60	107	77	124	45
	123-□S	12.30	31/64	14	60	107	77	124	45
	124-□S	12.40	-	14	60	107	77	124	45

MSDPH-S



Terminology	S
Grade	PC325T
Tolerance (drill Dia.)	h7
Tolerance (shank Dia.)	h6
Point angle	140°
Twist angle	30°
Thinning	X Type
Coolant	Through
International standard	DIN 6537
Shank type	DIN 6535 HA

S Heat resistant alloy, Titanium alloy

(mm)

Designation		ØD		Ød	3S		5S		ℓ2
		mm	inch		ℓ1	L	ℓ1	L	
MSDPH	125 - □S	12.50	-	14	60	107	77	124	45
	126 - □S	12.60	-	14	60	107	77	124	45
	127 - □S	12.70	1/2	14	60	107	77	124	45
	128 - □S	12.80	-	14	60	107	77	124	45
	129 - □S	12.90	-	14	60	107	77	124	45
	130 - □S	13.00	-	14	60	107	77	124	45
	131 - □S	13.10	-	14	60	107	77	124	45
	132 - □S	13.20	-	14	60	107	77	124	45
	133 - □S	13.30	-	14	60	107	77	124	45
	134 - □S	13.40	-	14	60	107	77	124	45
	1349 - □S	13.49	17/32	14	60	107	77	124	45
	135 - □S	13.50	-	14	60	107	77	124	45
	136 - □S	13.60	-	14	60	107	77	124	45
	137 - □S	13.70	-	14	60	107	77	124	45
	138 - □S	13.80	-	14	60	107	77	124	45
	139 - □S	13.90	-	14	60	107	77	124	45
	140 - □S	14.00	-	14	60	107	77	124	45
	141 - □S	14.10	-	16	65	115	83	133	48
	142 - □S	14.20	-	16	65	115	83	133	48
	1429 - □S	14.29	9/16	16	65	115	83	133	48
	143 - □S	14.30	-	16	65	115	83	133	48
	144 - □S	14.40	-	16	65	115	83	133	48
	145 - □S	14.50	-	16	65	115	83	133	48
	146 - □S	14.60	-	16	65	115	83	133	48
	147 - □S	14.70	-	16	65	115	83	133	48
	148 - □S	14.80	-	16	65	115	83	133	48
	149 - □S	14.90	-	16	65	115	83	133	48
	150 - □S	15.00	-	16	65	115	83	133	48
	151 - □S	15.10	-	16	65	115	83	133	48
	152 - □S	15.20	-	16	65	115	83	133	48
	153 - □S	15.30	-	16	65	115	83	133	48
	154 - □S	15.40	-	16	65	115	83	133	48
	155 - □S	15.50	-	16	65	115	83	133	48
	156 - □S	15.60	-	16	65	115	83	133	48
	157 - □S	15.70	-	16	65	115	83	133	48
	158 - □S	15.80	-	16	65	115	83	133	48
	1587 - □S	15.87	5/8	16	65	115	83	133	48
	159 - □S	15.90	-	16	65	115	83	133	48
	160 - □S	16.00	-	16	65	115	83	133	48

MSD Plus-S

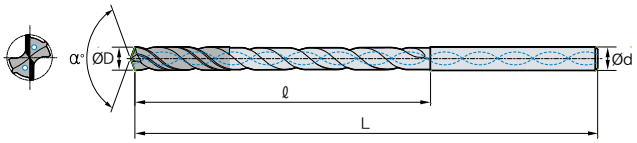
Recommended cutting conditions

Workpiece			HB	Grade	vc (m/min)	Depth of cut = 3D~5D			
						Feed rate (mm/rev) per drill dia. (mm)			
ISO		Workpiece				Ø2.5~Ø5.0	Ø5.1~Ø8.0	Ø8.1~Ø12.0	Ø12.1~Ø16.0
S	Heat resistant alloy	Fe-base	25~35	PC325T	25~30	0.055~0.07	0.07~0.10	0.08~0.13	0.10~0.15
		Ni or Co base	35~45	PC325T	20~25	0.045~0.06	0.06~0.09	0.07~0.12	0.09~0.14
	Titanium	Pure titanium	10~15	PC325T	40~50	0.07~0.11	0.09~0.14	0.12~0.18	0.16~0.23
		α and β alloys	35~45	PC325T	30~40	0.05~0.09	0.07~0.12	0.10~0.16	0.14~0.21

• Cutting conditions above are for the case of less than 5D depth of cut and through coolant system applied.

MLD Plus

MLD - □□(P/K/N)



Terminology	P	K	N
Grade	PC215G PC315G		FG2
Tolerance (drill Dia.)	h7		
Tolerance (shank Dia.)	h6		
Point angle	135°		
Twist angle	30°		
Thinning	X type		
Coolant	Through		

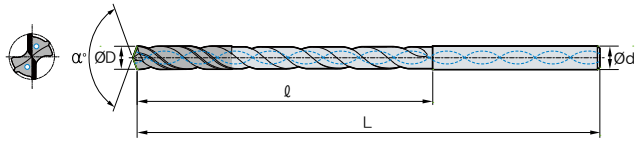
P Steel K Cast iron N Non-ferrous metal

(mm)

	Designation	ØD	Ød	10 P,M,K		15 P,M,K		20 P,M,K		25 P,M,K	
				ℓ	L	ℓ	L	ℓ	L	ℓ	L
MLD	0300N - □□P,K,N	3.0	3	40	90	55	105	70	120	-	-
	0310N - □□P,K,N	3.1	4	45	100	60	125	80	140	-	-
	0320N - □□P,K,N	3.2	4	45	100	60	125	80	140	-	-
	0330N - □□P,K,N	3.3	4	45	100	60	125	80	140	-	-
	0340N - □□P,K,N	3.4	4	50	100	65	125	85	140	-	-
	0350N - □□P,K,N	3.5	4	50	100	65	125	85	140	-	-
	0360N - □□P,K,N	3.6	4	50	100	65	125	85	140	-	-
	0370N - □□P,K,N	3.7	4	50	100	65	125	85	140	-	-
	0380N - □□P,K,N	3.8	4	50	100	75	125	90	140	-	-
	0390N - □□P,K,N	3.9	4	50	100	75	125	90	140	-	-
	0400N - □□P,K,N	4.0	4	50	100	75	125	90	140	115	165
	0410N - □□P,K,N	4.1	5	55	115	75	140	100	165	120	190
	0420N - □□P,K,N	4.2	5	55	115	75	140	100	165	120	190
	0430N - □□P,K,N	4.3	5	60	115	85	140	110	165	135	190
	0440N - □□P,K,N	4.4	5	60	115	85	140	110	165	135	190
	0450N - □□P,K,N	4.5	5	60	115	85	140	110	165	135	190
	0460N - □□P,K,N	4.6	5	60	115	85	140	110	165	135	190
	0470N - □□P,K,N	4.7	5	60	115	85	140	110	165	135	190
	0480N - □□P,K,N	4.8	5	65	115	90	140	115	165	140	190
	0490N - □□P,K,N	4.9	5	65	115	90	140	115	165	140	190

MLD Plus

MLD - □□(P/K/N)



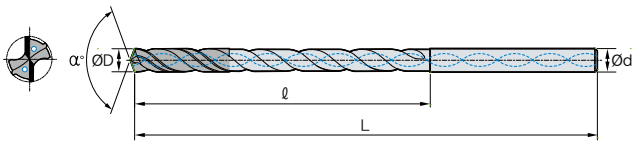
Terminology	P	K	N
Grade	PC215G PC315G		FG2
Tolerance (drill Dia.)	h7		
Tolerance (shank Dia.)	h6		
Point angle	135°		
Twist angle	30°		
Thinning	X type		
Coolant	Through		

P Steel K Cast iron N Non-ferrous metal

(mm)

Designation		ØD	Ød	10 P,M,K		15 P,M,K		20 P,M,K		25 P,M,K	
				ℓ	L	ℓ	L	ℓ	L	ℓ	L
MLD	0500N - □□P,K,N	5.0	5	65	115	90	140	115	165	140	190
	0510N - □□P,K,N	5.1	6	70	128	95	160	120	190	150	220
	0520N - □□P,K,N	5.2	6	70	128	95	160	120	190	150	220
	0530N - □□P,K,N	5.3	6	70	128	95	160	120	190	150	220
	0540N - □□P,K,N	5.4	6	78	128	110	160	140	190	170	220
	0550N - □□P,K,N	5.5	6	78	128	110	160	140	190	170	220
	0560N - □□P,K,N	5.6	6	78	128	110	160	140	190	170	220
	0570N - □□P,K,N	5.7	6	78	128	110	160	140	190	170	220
	0580N - □□P,K,N	5.8	6	78	128	110	160	140	190	170	220
	0590N - □□P,K,N	5.9	6	78	128	110	160	140	190	170	220
	0600N - □□P,K,N	6.0	6	78	128	110	160	140	190	170	220
	0610N - □□P,K,N	6.1	7	87	140	120	175	155	210	190	250
	0620N - □□P,K,N	6.2	7	87	140	120	175	155	210	190	250
	0630N - □□P,K,N	6.3	7	87	140	120	175	155	210	190	250
	0640N - □□P,K,N	6.4	7	87	140	120	175	155	210	190	250
	0650N - □□P,K,N	6.5	7	87	140	120	175	155	210	190	250
	0660N - □□P,K,N	6.6	7	87	140	120	175	155	210	190	250
	0670N - □□P,K,N	6.7	7	87	140	120	175	155	210	190	250
	0680N - □□P,K,N	6.8	7	90	140	125	175	160	210	200	250
	0690N - □□P,K,N	6.9	7	90	140	125	175	160	210	200	250

MLD - □□(P/K/N)



Terminology	P	K	N
Grade	PC215G PC315G		FG2
Tolerance (drill Dia.)	h7		
Tolerance (shank Dia.)	h6		
Point angle	135°		
Twist angle	30°		
Thinning	X type		
Coolant	Through		

P Steel K Cast iron N Non-ferrous metal

(mm)

	Designation	ØD	Ød	10 P,M,K		15 P,M,K		20 P,M,K		25 P,M,K	
				ℓ	L	ℓ	L	ℓ	L	ℓ	L
MLD	0700N - □□P,K,N	7.0	7	90	140	125	175	160	210	200	250
	0710N - □□P,K,N	7.1	8	100	155	135	195	170	230	-	-
	0720N - □□P,K,N	7.2	8	100	155	135	195	170	230	-	-
	0730N - □□P,K,N	7.3	8	100	155	135	195	170	230	-	-
	0740N - □□P,K,N	7.4	8	100	155	135	195	170	230	-	-
	0750N - □□P,K,N	7.5	8	100	155	135	195	170	230	-	-
	0760N - □□P,K,N	7.6	8	105	155	145	195	180	230	-	-
	0770N - □□P,K,N	7.7	8	105	155	145	195	180	230	-	-
	0780N - □□P,K,N	7.8	8	105	155	145	195	180	230	-	-
	0790N - □□P,K,N	7.9	8	105	155	145	195	180	230	-	-
	0800N - □□P,K,N	8.0	8	105	155	145	195	180	230	-	-
	0810N - □□P,K,N	8.1	9	110	165	155	210	195	260	-	-
	0820N - □□P,K,N	8.2	9	110	165	155	210	195	260	-	-
	0830N - □□P,K,N	8.3	9	110	165	155	210	195	260	-	-
	0840N - □□P,K,N	8.4	9	110	165	155	210	195	260	-	-
	0850N - □□P,K,N	8.5	9	110	165	155	210	195	260	-	-
	0860N - □□P,K,N	8.6	9	115	165	160	210	210	260	-	-
	0870N - □□P,K,N	8.7	9	115	165	160	210	210	260	-	-
	0880N - □□P,K,N	8.8	9	115	165	160	210	210	260	-	-
	0890N - □□P,K,N	8.9	9	115	165	160	210	210	260	-	-
	0900N - □□P,K,N	9.0	9	115	165	160	210	210	260	-	-
	0910N - □□P,K,N	9.1	10	125	190	170	240	-	-	-	-
	0920N - □□P,K,N	9.2	10	125	190	170	240	-	-	-	-
	0930N - □□P,K,N	9.3	10	125	190	170	240	-	-	-	-
	0940N - □□P,K,N	9.4	10	125	190	170	240	-	-	-	-
	0950N - □□P,K,N	9.5	10	125	190	170	240	-	-	-	-
	0960N - □□P,K,N	9.6	10	130	190	180	240	-	-	-	-
	0970N - □□P,K,N	9.7	10	130	190	180	240	-	-	-	-
	0980N - □□P,K,N	9.8	10	130	190	180	240	-	-	-	-
	0990N - □□P,K,N	9.9	10	130	190	180	240	-	-	-	-
	1000N - □□P,K,N	10.0	10	130	190	180	240	-	-	-	-

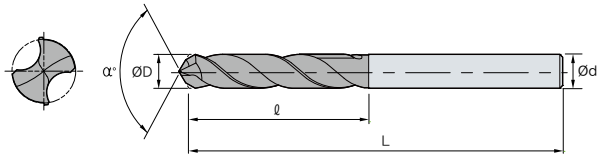
MLD Plus

Recommended cutting conditions

Workpiece				Grade	vc (m/min)	Depth of cut = 10D~25D		
						Feed rate (mm/rev) per drill dia. (mm)		
ISO		Workpiece	HB	Recommended		Ø3.0~Ø5.0	Ø5.1~Ø8.0	Ø8.1~Ø10.0
P	Carbon steel	Low carbon steel	80~120	PC315G	80 (60~90)	0.10~0.15	0.15~0.20	0.20~0.25
		High carbon steel	180~280	PC315G	70 (60~80)	0.10~0.15	0.15~0.20	0.20~0.25
	Alloy steel	Low alloy steel	140~260	PC215G	80 (60~90)	0.10~0.15	0.12~0.17	0.15~0.20
		Low carbon steel	50-260	PC215G	70 (60~80)	0.08~0.15	0.10~0.15	0.15~0.20
K	Cast iron	Gray cast iron	150-230	PC215G	80 (60~100)	0.10~0.20	0.15~0.20	0.15~0.20
		Ductile cast iron	160-260	PC215G	70 (60~80)	0.10~0.20	0.15~0.20	0.15~0.20
N	Aluminum	Aluminum alloy	30-150	FG2	120 (100~150)	0.12~0.17	0.15~0.20	0.20~0.25
	Copper lloy	Copper alloy	150-160	FG2	120 (100~150)	0.12~0.17	0.15~0.20	0.20~0.25

MSD Plus CFRP

MSDP-5C



Terminology	C
Grade	ND2100
Tolerance (drill Dia.)	m7
Tolerance (shank Dia.)	h6
Point angle	118°
Twist angle	30°
Thinning	X type
Coolant	External

C CFRP

(mm)

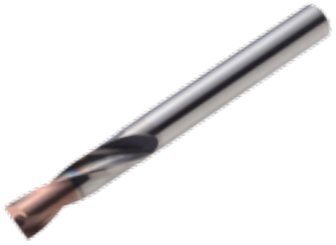
Designation		ØD	Ød	5C	
				ℓ	L
MSDP	030-5C	3.00	6	28	66
	040-5C	4.00	6	36	74
	0476-5C	4.76	6	44	82
	050-5C	5.00	6	44	82
	060-5C	6.00	6	44	82
	0635-5C	6.35	8	53	91
	070-5C	7.00	8	53	91
	0794-5C	7.94	8	53	91
	080-5C	8.00	8	53	91
	090-5C	9.00	10	61	103
	0952-5C	9.52	10	61	103
	100-5C	10.00	10	61	103
	110-5C	11.00	12	71	118
	1111-5C	11.11	12	71	118
	120-5C	12.00	12	71	118
	127-5C	12.70	14	71	124

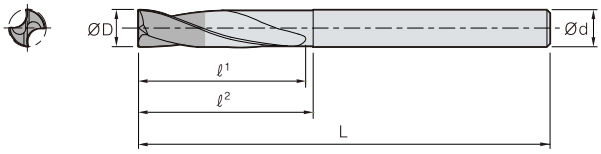
Recommended cutting conditions

Workpiece	Grade	vc (m/min)	Depth of cut = 5D		
			Feed rate (mm/rev) per drill dia. (mm)		
			Ø2.5~Ø4.0	Ø4.1~Ø8.0	Ø8.1~Ø12.0
CFRP	ND2100	100 (100~150)	0.03 ~ 0.07	0.03 ~ 0.07	0.03 ~ 0.07

MSFD

MSFD-2P





Terminology	P
Grade	PC325U
Tolerance (drill Dia.)	H7
Tolerance (shank Dia.)	h6
Point angle	180°
Twist angle	20°
Thinning	R type
Coolant	External

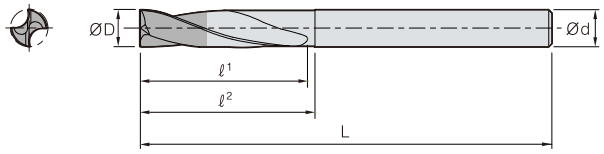
P Steel

(mm)

Designation		ØD	Ød	2P		
				ℓ1	ℓ2	L
MSFD	025-2P	2.5	4	10.5	11.5	50
	026-2P	2.6	4	10.9	11.9	50
	027-2P	2.7	4	11.3	12.3	50
	028-2P	2.8	4	11.8	12.8	50
	029-2P	2.9	4	12.2	13.2	50
	030-2P	3.0	6	12.6	13.6	50
	031-2P	3.1	6	13.0	14.0	50
	032-2P	3.2	6	13.4	14.4	50
	033-2P	3.3	6	13.9	14.9	50
	034-2P	3.4	6	14.3	15.3	50
	035-2P	3.5	6	14.7	15.7	50
	036-2P	3.6	6	15.1	16.1	50
	037-2P	3.7	6	15.5	16.5	50
	038-2P	3.8	6	16.0	17.0	50
	039-2P	3.9	6	16.4	17.4	50
	040-2P	4.0	6	16.8	17.8	50
	041-2P	4.1	6	17.2	18.2	60
	042-2P	4.2	6	17.6	18.6	60
	043-2P	4.3	6	18.1	19.1	60
	044-2P	4.4	6	18.5	19.5	60
	045-2P	4.5	6	18.9	19.9	60
	046-2P	4.6	6	19.3	20.3	60
	047-2P	4.7	6	19.7	20.7	60
	048-2P	4.8	6	20.2	21.2	60
	049-2P	4.9	6	20.6	21.6	60
	050-2P	5.0	6	21.0	22.0	60
	051-2P	5.1	6	21.4	22.4	60
	052-2P	5.2	6	21.8	22.8	60
	053-2P	5.3	6	22.3	23.3	60
	054-2P	5.4	6	22.7	23.7	60
	055-2P	5.5	6	23.1	24.1	60
	056-2P	5.6	6	23.5	24.5	60
	057-2P	5.7	6	23.9	24.9	60
	058-2P	5.8	6	24.4	25.4	60
	059-2P	5.9	6	24.8	25.8	60
	060-2P	6.0	6	25.2	26.2	60
	061-2P	6.1	8	25.6	26.6	70

Designation		ØD	Ød	2P		
				ℓ1	ℓ2	L
MSFD	062-2P	6.2	8	26.0	27.0	70
	063-2P	6.3	8	26.5	27.5	70
	064-2P	6.4	8	26.9	27.9	70
	065-2P	6.5	8	27.3	28.3	70
	066-2P	6.6	8	27.7	28.7	70
	067-2P	6.7	8	28.1	29.1	70
	068-2P	6.8	8	28.6	29.6	70
	069-2P	6.9	8	29.0	30.0	70
	070-2P	7.0	8	29.4	30.4	70
	071-2P	7.1	8	29.8	30.8	70
	072-2P	7.2	8	30.2	31.2	70
	073-2P	7.3	8	30.7	31.7	70
	074-2P	7.4	8	31.1	32.1	70
	075-2P	7.5	8	31.5	32.5	70
	076-2P	7.6	8	31.9	32.9	70
	077-2P	7.7	8	32.3	33.3	70
	078-2P	7.8	8	32.8	33.8	70
	079-2P	7.9	8	33.2	34.2	70
	080-2P	8.0	8	33.6	34.6	70
	081-2P	8.1	10	34.0	35.0	80
	082-2P	8.2	10	34.4	35.4	80
	083-2P	8.3	10	34.9	35.9	80
	084-2P	8.4	10	35.3	36.3	80
	085-2P	8.5	10	35.7	36.7	80
	086-2P	8.6	10	36.1	37.1	80
	087-2P	8.7	10	36.5	37.5	80
	088-2P	8.8	10	37.0	38.0	80
	089-2P	8.9	10	37.4	38.4	80
	090-2P	9.0	10	37.8	38.8	80
	091-2P	9.1	10	38.2	39.2	80
	092-2P	9.2	10	38.6	39.6	80
	093-2P	9.3	10	39.1	40.1	80
	094-2P	9.4	10	39.5	40.5	80
	095-2P	9.5	10	39.9	40.9	80
	096-2P	9.6	10	40.3	41.3	80
	097-2P	9.7	10	40.7	41.7	80
	098-2P	9.8	10	41.2	42.2	80

MSFD-2P



Terminology	P
Grade	PC325U
Tolerance (drill Dia.)	H7
Tolerance (shank Dia.)	h6
Point angle	180°
Twist angle	20°
Thinning	R type
Coolant	External

P Steel

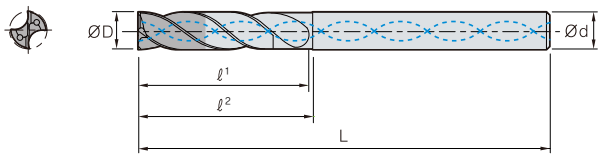
(mm)

Designation		ØD	Ød	2P		
				ℓ1	ℓ2	L
MSFD	099-2P	9.9	10	41.6	42.6	80
	100-2P	10.0	10	42.0	43.0	80
	101-2P	10.1	12	42.4	43.4	90
	102-2P	10.2	12	42.8	43.8	90
	103-2P	10.3	12	43.3	44.3	90
	104-2P	10.4	12	43.7	44.7	90
	105-2P	10.5	12	44.1	45.1	90
	106-2P	10.6	12	44.5	45.5	90
	107-2P	10.7	12	44.9	45.9	90
	108-2P	10.8	12	45.4	46.4	90
	109-2P	10.9	12	45.8	46.8	90
	110-2P	11.0	12	46.2	47.2	90
	111-2P	11.1	12	46.6	47.6	90
	112-2P	11.2	12	47.0	48.0	90
	113-2P	11.3	12	47.5	48.5	90
	114-2P	11.4	12	47.9	48.9	90
	115-2P	11.5	12	48.3	49.3	90
	116-2P	11.6	12	48.7	49.7	90
	117-2P	11.7	12	49.1	50.1	90
	118-2P	11.8	12	49.6	50.6	90
	119-2P	11.9	12	50.0	51.0	90
	120-2P	12.0	12	50.4	51.4	90
	121-2P	12.1	14	50.8	51.8	100
	122-2P	12.2	14	51.2	52.2	100
	123-2P	12.3	14	51.7	52.7	100
	124-2P	12.4	14	52.1	53.1	100
	125-2P	12.5	14	52.5	53.5	100
	126-2P	12.6	14	52.9	53.9	100
	127-2P	12.7	14	53.3	54.3	100
	128-2P	12.8	14	53.8	54.8	100
	129-2P	12.9	14	54.2	55.2	100

Designation		ØD	Ød	2P		
				ℓ1	ℓ2	L
MSFD	130-2P	13.0	14	54.6	55.6	100
	131-2P	13.1	14	55.0	56.0	100
	132-2P	13.2	14	55.4	56.4	100
	133-2P	13.3	14	55.9	56.9	100
	134-2P	13.4	14	56.3	57.3	100
	135-2P	13.5	14	56.7	57.7	110
	136-2P	13.6	14	57.1	58.1	110
	137-2P	13.7	14	57.5	58.5	110
	138-2P	13.8	14	58.0	59.0	110
	139-2P	13.9	14	58.4	59.4	110
	140-2P	14.0	14	58.8	59.8	110
	141-2P	14.1	16	59.2	60.2	110
	142-2P	14.2	16	59.6	60.6	110
	143-2P	14.3	16	60.1	61.1	110
	144-2P	14.4	16	60.5	61.5	110
	145-2P	14.5	16	60.9	61.9	110
	146-2P	14.6	16	61.3	62.3	110
	147-2P	14.7	16	61.7	62.7	110
	148-2P	14.8	16	62.2	63.2	110
	149-2P	14.9	16	62.6	63.6	110
	150-2P	15.0	16	63.0	64.0	110
	151-2P	15.1	16	65.0	66.0	115
	152-2P	15.2	16	65.0	66.0	115
	153-2P	15.3	16	65.1	66.1	115
	154-2P	15.4	16	65.1	66.1	115
	155-2P	15.5	16	65.1	66.1	115
	156-2P	15.6	16	67.1	68.1	115
	157-2P	15.7	16	67.1	68.1	115
	158-2P	15.8	16	67.2	68.2	115
	159-2P	15.9	16	67.2	68.2	115
	160-2P	16.0	16	67.2	68.2	115

MSFD

MSFDH-3P



Terminology	P
Grade	PC325U
Tolerance (drill Dia.)	H7
Tolerance (shank Dia.)	h6
Point angle	180°
Twist angle	30°
Thinning	R type
Coolant	Through

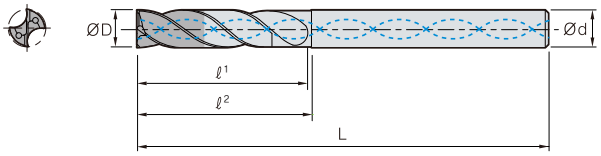
P Steel

(mm)

Designation		ØD	Ød	3P		
				ℓ1	ℓ2	L
MSFDH	025-3P	2.5	3	17	18	58
	026-3P	2.6	3	17	18	58
	027-3P	2.7	3	17	18	58
	028-3P	2.8	3	17	18	58
	029-3P	2.9	3	17	18	58
	030-3P	3.0	6	20	21	62
	031-3P	3.1	6	20	21	62
	032-3P	3.2	6	20	21	62
	033-3P	3.3	6	20	21	62
	034-3P	3.4	6	20	21	62
	035-3P	3.5	6	20	21	62
	036-3P	3.6	6	20	21	62
	037-3P	3.7	6	20	21	62
	038-3P	3.8	6	24	25	66
	039-3P	3.9	6	24	25	66
	040-3P	4.0	6	24	25	66
	041-3P	4.1	6	24	25	66
	042-3P	4.2	6	24	25	66
	043-3P	4.3	6	24	25	66
	044-3P	4.4	6	24	25	66
	045-3P	4.5	6	24	25	66
	046-3P	4.6	6	24	25	66
	047-3P	4.7	6	24	25	66
	048-3P	4.8	6	28	29	66
	049-3P	4.9	6	28	29	66
	050-3P	5.0	6	28	29	66
	051-3P	5.1	6	28	29	66
	052-3P	5.2	6	28	29	66
	053-3P	5.3	6	28	29	66
	054-3P	5.4	6	28	29	66
	055-3P	5.5	6	28	29	66
	056-3P	5.6	6	28	29	66
	057-3P	5.7	6	28	29	66
	058-3P	5.8	6	28	29	66
	059-3P	5.9	6	28	29	66
	060-3P	6.0	6	28	29	66
	061-3P	6.1	8	34	35	79
	062-3P	6.2	8	34	35	79
	063-3P	6.3	8	34	35	79
	064-3P	6.4	8	34	35	79
	065-3P	6.5	8	34	35	79

Designation		ØD	Ød	3P		
				ℓ1	ℓ2	L
MSFDH	066-3P	6.6	8	34	35	79
	067-3P	6.7	8	34	35	79
	068-3P	6.8	8	34	35	79
	069-3P	6.9	8	34	35	79
	070-3P	7.0	8	34	35	79
	071-3P	7.1	8	41	42	79
	072-3P	7.2	8	41	42	79
	073-3P	7.3	8	41	42	79
	074-3P	7.4	8	41	42	79
	075-3P	7.5	8	41	42	79
	076-3P	7.6	8	41	42	79
	077-3P	7.7	8	41	42	79
	078-3P	7.8	8	41	42	79
	079-3P	7.9	8	41	42	79
	080-3P	8.0	8	41	42	79
	081-3P	8.1	10	47	48	89
	082-3P	8.2	10	47	48	89
	083-3P	8.3	10	47	48	89
	084-3P	8.4	10	47	48	89
	085-3P	8.5	10	47	48	89
	086-3P	8.6	10	47	48	89
	087-3P	8.7	10	47	48	89
	088-3P	8.8	10	47	48	89
	089-3P	8.9	10	47	48	89
	090-3P	9.0	10	47	48	89
	091-3P	9.1	10	47	48	89
	092-3P	9.2	10	47	48	89
	093-3P	9.3	10	47	48	89
	094-3P	9.4	10	47	48	89
	095-3P	9.5	10	47	48	89
	096-3P	9.6	10	47	48	89
	097-3P	9.7	10	47	48	89
	098-3P	9.8	10	47	48	89
	099-3P	9.9	10	47	48	89
	100-3P	10.0	10	47	48	89
	101-3P	10.1	12	55	56	102
	102-3P	10.2	12	55	56	102
	103-3P	10.3	12	55	56	102
	104-3P	10.4	12	55	56	102
	105-3P	10.5	12	55	56	102
	106-3P	10.6	12	55	56	102

MSFDH-3P



Terminology	P
Grade	PC325U
Tolerance (drill Dia.)	H7
Tolerance (shank Dia.)	h6
Point angle	180°
Twist angle	30°
Thinning	R type
Coolant	Through

P Steel

(mm)

Designation		ØD	Ød	3P		
				ℓ1	ℓ2	L
MSFDH	107-3P	10.7	12	55	56	102
	108-3P	10.8	12	55	56	102
	109-3P	10.9	12	55	56	102
	110-3P	11.0	12	55	56	102
	111-3P	11.1	12	55	56	102
	112-3P	11.2	12	55	56	102
	113-3P	11.3	12	55	56	102
	114-3P	11.4	12	55	56	102
	115-3P	11.5	12	55	56	102
	116-3P	11.6	12	55	56	102
	117-3P	11.7	12	55	56	102
	118-3P	11.8	12	55	56	102
	119-3P	11.9	12	55	56	102
	120-3P	12.0	12	55	56	102
	121-3P	12.1	14	60	61	107
	122-3P	12.2	14	60	61	107
	123-3P	12.3	14	60	61	107
	124-3P	12.4	14	60	61	107
	125-3P	12.5	14	60	61	107
	126-3P	12.6	14	60	61	107
	127-3P	12.7	14	60	61	107
	128-3P	12.8	14	60	61	107
	129-3P	12.9	14	60	61	107
	130-3P	13.0	14	60	61	107
	131-3P	13.1	14	60	61	107
	132-3P	13.2	14	60	61	107
	133-3P	13.3	14	60	61	107

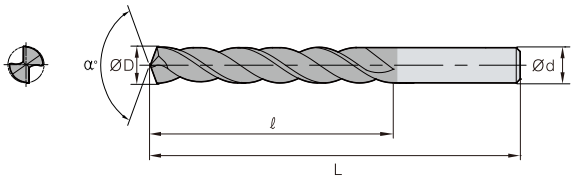
Designation		ØD	Ød	3P		
				ℓ1	ℓ2	L
MSFDH	134-3P	13.4	14	60	61	107
	135-3P	13.5	14	60	61	107
	136-3P	13.6	14	60	61	107
	137-3P	13.7	14	60	61	107
	138-3P	13.8	14	60	61	107
	139-3P	13.9	14	60	61	107
	140-3P	14.0	14	60	61	107
	141-3P	14.1	16	65	66	115
	142-3P	14.2	16	65	66	115
	143-3P	14.3	16	65	66	115
	144-3P	14.4	16	65	66	115
	145-3P	14.5	16	65	66	115
	146-3P	14.6	16	65	66	115
	147-3P	14.7	16	65	66	115
	148-3P	14.8	16	65	66	115
	149-3P	14.9	16	65	66	115
	150-3P	15.0	16	65	66	115
	151-3P	15.1	16	65	66	115
	152-3P	15.2	16	65	66	115
	153-3P	15.3	16	65	66	115
	154-3P	15.4	16	65	66	115
	155-3P	15.5	16	65	66	115
	156-3P	15.6	16	65	66	115
	157-3P	15.7	16	65	66	115
	158-3P	15.8	16	65	66	115
	159-3P	15.9	16	65	66	115
	160-3P	16.0	16	65	66	115

Recommended cutting conditions

Workpiece				Grade	Cutting speed, vc (m/min)	Feed (Depth of cut = 2D~3D)		
						Feed rate (mm/rev) per drill dia. (mm)		
ISO		Workpiece	HB	Recommended		Ø2.5~Ø4.0	Ø4.1~Ø8.0	Ø8.1~Ø12.0
P	Carbon steel	Low carbon steel	80~120	PC325U	75 (60~90)	0.03~0.10	0.05~0.15	0.10~0.20
		High carbon steel	180~280	PC325U	75 (60~80)	0.03~0.10	0.05~0.15	0.10~0.20
	Alloy steel	Low alloy steel	140~260	PC325U	65 (50~80)	0.03~0.10	0.05~0.15	0.10~0.20
		High alloy steel	50~260	PC325U	65 (50~80)	0.03~0.10	0.05~0.15	0.10~0.20

HSD Plus

HSD(H) - □D



Terminology	P	M	K
Grade	PC325W		
Tolerance (drill Dia.)	m7		
Tolerance (shank Dia.)	h6		
Point angle	140°		
Twist angle	30°		
Thinning	X type		
Coolant	Through/External		
International standard	DIN 6537		

P Steel M Stainless steel K Cast iron

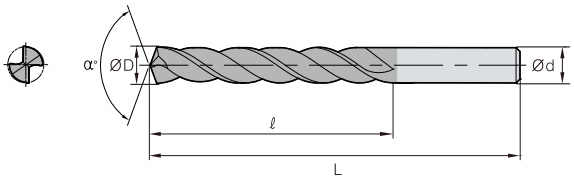
(mm)

Designation		ØD	Ød	3D		5D	
				ℓ	L	ℓ	L
HSD (H)	030-□D(-A)	3.0	6	20	62	30	66
	031-□D(-A)	3.1	6	20	62	30	66
	032-□D(-A)	3.2	6	20	62	30	66
	033-□D(-A)	3.3	6	20	62	30	66
	034-□D(-A)	3.4	6	20	62	30	66
	035-□D(-A)	3.5	6	20	62	30	66
	036-□D(-A)	3.6	6	20	62	30	66
	037-□D(-A)	3.7	6	20	62	30	66
	038-□D(-A)	3.8	6	24	66	36	74
	039-□D(-A)	3.9	6	24	66	36	74
	040-□D(-A)	4.0	6	24	66	36	74
	041-□D(-A)	4.1	6	24	66	36	74
	042-□D(-A)	4.2	6	24	66	36	74
	043-□D(-A)	4.3	6	24	66	36	74
	044-□D(-A)	4.4	6	24	66	36	74
	045-□D(-A)	4.5	6	24	66	36	74
	046-□D(-A)	4.6	6	24	66	36	74
	047-□D(-A)	4.7	6	24	66	36	74
	048-□D(-A)	4.8	6	28	66	44	82
	049-□D(-A)	4.9	6	28	66	44	82
	050-□D(-A)	5.0	6	28	66	44	82
	051-□D(-A)	5.1	6	28	66	44	82
	052-□D(-A)	5.2	6	28	66	44	82
	053-□D(-A)	5.3	6	28	66	44	82
	054-□D(-A)	5.4	6	28	66	44	82
	055-□D(-A)	5.5	6	28	66	44	82
	056-□D(-A)	5.6	6	28	66	44	82
	057-□D(-A)	5.7	6	28	66	44	82
	058-□D(-A)	5.8	6	28	66	44	82
	059-□D(-A)	5.9	6	28	66	44	82
	060-□D(-A)	6.0	6	28	66	44	82
	061-□D(-A)	6.1	8	34	79	53	91
	062-□D(-A)	6.2	8	34	79	53	91
	063-□D(-A)	6.3	8	34	79	53	91
	064-□D(-A)	6.4	8	34	79	53	91

Designation		ØD	Ød	3D		5D	
				ℓ	L	ℓ	L
HSD (H)	065-□D(-A)	6.5	8	34	79	53	91
	066-□D(-A)	6.6	8	34	79	53	91
	067-□D(-A)	6.7	8	34	79	53	91
	068-□D(-A)	6.8	8	34	79	53	91
	069-□D(-A)	6.9	8	34	79	53	91
	070-□D(-A)	7.0	8	34	79	53	91
	071-□D(-A)	7.1	8	41	79	53	91
	072-□D(-A)	7.2	8	41	79	53	91
	073-□D(-A)	7.3	8	41	79	53	91
	074-□D(-A)	7.4	8	41	79	53	91
	075-□D(-A)	7.5	8	41	79	53	91
	076-□D(-A)	7.6	8	41	79	53	91
	077-□D(-A)	7.7	8	41	79	53	91
	078-□D(-A)	7.8	8	41	79	53	91
	079-□D(-A)	7.9	8	41	79	53	91
	080-□D(-A)	8.0	8	41	79	53	91
	081-□D(-A)	8.1	10	47	89	61	103
	082-□D(-A)	8.2	10	47	89	61	103
	083-□D(-A)	8.3	10	47	89	61	103
	084-□D(-A)	8.4	10	47	89	61	103
	085-□D(-A)	8.5	10	47	89	61	103
	086-□D(-A)	8.6	10	47	89	61	103
	087-□D(-A)	8.7	10	47	89	61	103
	088-□D(-A)	8.8	10	47	89	61	103
	089-□D(-A)	8.9	10	47	89	61	103
	090-□D(-A)	9.0	10	47	89	61	103
	091-□D(-A)	9.1	10	47	89	61	103
	092-□D(-A)	9.2	10	47	89	61	103
	093-□D(-A)	9.3	10	47	89	61	103
	094-□D(-A)	9.4	10	47	89	61	103
	095-□D(-A)	9.5	10	47	89	61	103
	096-□D(-A)	9.6	10	47	89	61	103
	097-□D(-A)	9.7	10	47	89	61	103
	098-□D(-A)	9.8	10	47	89	61	103
	099-□D(-A)	9.9	10	47	89	61	103

※(H): In case of oil hole is applied, mark 'H' / (-A): In case of Weldon shank is applied, mark '-A'
※5D depth of cut, only through coolant type is available

HSD(H) - □D



Terminology	P	M	K
Grade	PC325W		
Tolerance (drill Dia.)	m7		
Tolerance (shank Dia.)	h6		
Point angle	140°		
Twist angle	30°		
Thinning	X type		
Coolant	Through/External		
International standard	DIN 6537		

P Steel M Stainless steel K Cast iron

(mm)

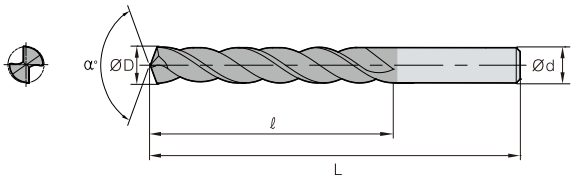
Designation		ØD	Ød	3D		5D	
				ℓ	L	ℓ	L
HSD (H)	100-□D(-A)	10.0	10	47	89	61	103
	101-□D(-A)	10.1	12	55	102	71	118
	102-□D(-A)	10.2	12	55	102	71	118
	103-□D(-A)	10.3	12	55	102	71	118
	104-□D(-A)	10.4	12	55	102	71	118
	105-□D(-A)	10.5	12	55	102	71	118
	106-□D(-A)	10.6	12	55	102	71	118
	107-□D(-A)	10.7	12	55	102	71	118
	108-□D(-A)	10.8	12	55	102	71	118
	109-□D(-A)	10.9	12	55	102	71	118
	110-□D(-A)	11.0	12	55	102	71	118
	111-□D(-A)	11.1	12	55	102	71	118
	112-□D(-A)	11.2	12	55	102	71	118
	113-□D(-A)	11.3	12	55	102	71	118
	114-□D(-A)	11.4	12	55	102	71	118
	115-□D(-A)	11.5	12	55	102	71	118
	116-□D(-A)	11.6	12	55	102	71	118
	117-□D(-A)	11.7	12	55	102	71	118
	118-□D(-A)	11.8	12	55	102	71	118
	119-□D(-A)	11.9	12	55	102	71	118
	120-□D(-A)	12.0	12	55	102	71	118
	121-□D(-A)	12.1	14	60	107	77	124
	122-□D(-A)	12.2	14	60	107	77	124
	123-□D(-A)	12.3	14	60	107	77	124
	124-□D(-A)	12.4	14	60	107	77	124
	125-□D(-A)	12.5	14	60	107	77	124
	126-□D(-A)	12.6	14	60	107	77	124
	127-□D(-A)	12.7	14	60	107	77	124
	128-□D(-A)	12.8	14	60	107	77	124
	129-□D(-A)	12.9	14	60	107	77	124
	130-□D(-A)	13.0	14	60	107	77	124
	131-□D(-A)	13.1	14	60	107	77	124
	132-□D(-A)	13.2	14	60	107	77	124
	133-□D(-A)	13.3	14	60	107	77	124
	134-□D(-A)	13.4	14	60	107	77	124

Designation		ØD	Ød	3D		5D	
				ℓ	L	ℓ	L
HSD (H)	135-□D(-A)	13.5	14	60	107	77	124
	136-□D(-A)	13.6	14	60	107	77	124
	137-□D(-A)	13.7	14	60	107	77	124
	138-□D(-A)	13.8	14	60	107	77	124
	139-□D(-A)	13.9	14	60	107	77	124
	140-□D(-A)	14.0	14	60	107	77	124
	141-□D(-A)	14.1	16	65	115	83	133
	142-□D(-A)	14.2	16	65	115	83	133
	143-□D(-A)	14.3	16	65	115	83	133
	144-□D(-A)	14.4	16	65	115	83	133
	145-□D(-A)	14.5	16	65	115	83	133
	146-□D(-A)	14.6	16	65	115	83	133
	147-□D(-A)	14.7	16	65	115	83	133
	148-□D(-A)	14.8	16	65	115	83	133
	149-□D(-A)	14.9	16	65	115	83	133
	150-□D(-A)	15.0	16	65	115	83	133
	151-□D(-A)	15.1	16	65	115	83	133
	152-□D(-A)	15.2	16	65	115	83	133
	153-□D(-A)	15.3	16	65	115	83	133
	154-□D(-A)	15.4	16	65	115	83	133
	155-□D(-A)	15.5	16	65	115	83	133
	156-□D(-A)	15.6	16	65	115	83	133
	157-□D(-A)	15.7	16	65	115	83	133
	158-□D(-A)	15.8	16	65	115	83	133
	159-□D(-A)	15.9	16	65	115	83	133
	160-□D(-A)	16.0	16	65	115	83	133
	161-□D(-A)	16.1	18	73	123	93	143
	162-□D(-A)	16.2	18	73	123	93	143
	163-□D(-A)	16.3	18	73	123	93	143
	164-□D(-A)	16.4	18	73	123	93	143
	165-□D(-A)	16.5	18	73	123	93	143
	166-□D(-A)	16.6	18	73	123	93	143
	167-□D(-A)	16.7	18	73	123	93	143
	168-□D(-A)	16.8	18	73	123	93	143
	169-□D(-A)	16.9	18	73	123	93	143

※(H): In case of oil hole is applied, mark 'H' / (-A): In case of Weldon shank is applied, mark '-A'
※5D depth of cut, only through coolant type is available

HSD Plus

HSD(H) - □D



Terminology	P	M	K
Grade	PC325W		
Tolerance (drill Dia.)	m7		
Tolerance (shank Dia.)	h6		
Point angle	140°		
Twist angle	30°		
Thinning	X type		
Coolant	Through/External		
International standard	DIN 6537		

P Steel M Stainless steel K Cast iron

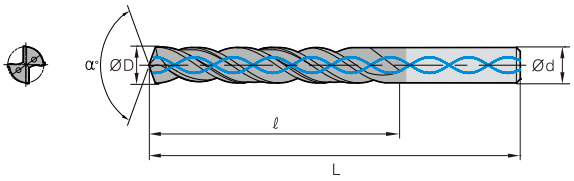
(mm)

Designation		ØD	Ød	3D		5D	
				ℓ	L	ℓ	L
HSD (H)	170-□D(-A)	17.0	18	73	123	93	143
	171-□D(-A)	17.1	18	73	123	93	143
	172-□D(-A)	17.2	18	73	123	93	143
	173-□D(-A)	17.3	18	73	123	93	143
	174-□D(-A)	17.4	18	73	123	93	143
	175-□D(-A)	17.5	18	73	123	93	143
	176-□D(-A)	17.6	18	73	123	93	143
	177-□D(-A)	17.7	18	73	123	93	143
	178-□D(-A)	17.8	18	73	123	93	143
	179-□D(-A)	17.9	18	73	123	93	143
	180-□D(-A)	18.0	18	73	123	93	143
	181-□D(-A)	18.1	20	79	131	101	153
	182-□D(-A)	18.2	20	79	131	101	153
	183-□D(-A)	18.3	20	79	131	101	153
	184-□D(-A)	18.4	20	79	131	101	153
	185-□D(-A)	18.5	20	79	131	101	153

Designation		ØD	Ød	3D		5D	
				ℓ	L	ℓ	L
HSD (H)	186-□D(-A)	18.6	20	79	131	101	153
	187-□D(-A)	18.7	20	79	131	101	153
	188-□D(-A)	18.8	20	79	131	101	153
	189-□D(-A)	18.9	20	79	131	101	153
	190-□D(-A)	19.0	20	79	131	101	153
	191-□D(-A)	19.1	20	79	131	101	153
	192-□D(-A)	19.2	20	79	131	101	153
	193-□D(-A)	19.3	20	79	131	101	153
	194-□D(-A)	19.4	20	79	131	101	153
	195-□D(-A)	19.5	20	79	131	101	153
	196-□D(-A)	19.6	20	79	131	101	153
	197-□D(-A)	19.7	20	79	131	101	153
	198-□D(-A)	19.8	20	79	131	101	153
	199-□D(-A)	19.9	20	79	131	101	153
	200-□D(-A)	20.0	20	79	131	101	153

※(H): In case of oil hole is applied, mark 'H' / (-A): In case of Weldon shank is applied, mark '-A'
※5D depth of cut, only through coolant type is available

HSDP(H) - □D



Terminology	P	K
Grade	PC325W	
Tolerance (drill Dia.)	m7	
Tolerance (shank Dia.)	h6	
Point angle	140°	
Twist angle	30°	
Thinning	X type	
Coolant	Through/External	
International standard	DIN 6537	

P Steel K Cast iron

(mm)

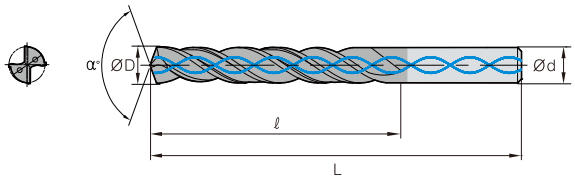
Designation		ØD	Ød	3D		5D		8D	
				ℓ	L	ℓ	L	ℓ	L
HSDP (H)	030 - □D(-A)	3.0	6	20	62	30	66	43	80
	031 - □D(-A)	3.1	6	20	62	30	66	43	80
	032 - □D(-A)	3.2	6	20	62	30	66	43	80
	033 - □D(-A)	3.3	6	20	62	30	66	43	80
	034 - □D(-A)	3.4	6	20	62	30	66	43	80
	035 - □D(-A)	3.5	6	20	62	30	66	43	80
	036 - □D(-A)	3.6	6	20	62	30	66	43	80
	037 - □D(-A)	3.7	6	20	62	30	66	43	80
	038 - □D(-A)	3.8	6	24	66	36	74	49	87
	039 - □D(-A)	3.9	6	24	66	36	74	49	87
	040 - □D(-A)	4.0	6	24	66	36	74	49	87
	041 - □D(-A)	4.1	6	24	66	36	74	49	87
	042 - □D(-A)	4.2	6	24	66	36	74	49	87
	043 - □D(-A)	4.3	6	24	66	36	74	49	87
	044 - □D(-A)	4.4	6	24	66	36	74	49	87
	045 - □D(-A)	4.5	6	24	66	36	74	49	87
	046 - □D(-A)	4.6	6	24	66	36	74	49	87
	047 - □D(-A)	4.7	6	24	66	36	74	49	87
	048 - □D(-A)	4.8	6	28	66	44	82	56	94
	049 - □D(-A)	4.9	6	28	66	44	82	56	94
	050 - □D(-A)	5.0	6	28	66	44	82	56	94
	051 - □D(-A)	5.1	6	28	66	44	82	56	94
	052 - □D(-A)	5.2	6	28	66	44	82	56	94
	053 - □D(-A)	5.3	6	28	66	44	82	56	94
	054 - □D(-A)	5.4	6	28	66	44	82	56	94
	055 - □D(-A)	5.5	6	28	66	44	82	56	94
	056 - □D(-A)	5.6	6	28	66	44	82	56	94
	057 - □D(-A)	5.7	6	28	66	44	82	56	94
	058 - □D(-A)	5.8	6	28	66	44	82	56	94
	059 - □D(-A)	5.9	6	28	66	44	82	56	94
	060 - □D(-A)	6.0	6	28	66	44	82	60	94
	061 - □D(-A)	6.1	8	34	79	53	91	67	105
	062 - □D(-A)	6.2	8	34	79	53	91	67	105
	063 - □D(-A)	6.3	8	34	79	53	91	67	105
	064 - □D(-A)	6.4	8	34	79	53	91	67	105

※(H): In case of oil hole is applied, mark 'H' / (-A): In case of Weldon shank is applied, mark '-A'

※ 5D and 8D depth of cut, only through coolant type is available

HSD Plus

HSDP(H) - □D



Terminology	P	K
Grade	PC325W	
Tolerance (drill Dia.)	m7	
Tolerance (shank Dia.)	h6	
Point angle	140°	
Twist angle	30°	
Thinning	X type	
Coolant	Through/External	
International standard	DIN 6537	

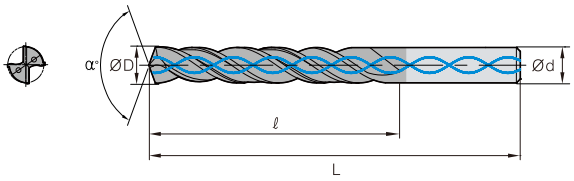
P Steel K Cast iron

(mm)

Designation		ØD	Ød	3D		5D		8D	
				ℓ	L	ℓ	L	ℓ	L
HSDP (H)	065 - □D(-A)	6.5	8	34	79	53	91	67	105
	066 - □D(-A)	6.6	8	34	79	53	91	67	105
	067 - □D(-A)	6.7	8	34	79	53	91	67	105
	068 - □D(-A)	6.8	8	34	79	53	91	67	105
	069 - □D(-A)	6.9	8	34	79	53	91	67	105
	070 - □D(-A)	7.0	8	34	79	53	91	76	116
	071 - □D(-A)	7.1	8	41	79	53	91	76	116
	072 - □D(-A)	7.2	8	41	79	53	91	76	116
	073 - □D(-A)	7.3	8	41	79	53	91	76	116
	074 - □D(-A)	7.4	8	41	79	53	91	76	116
	075 - □D(-A)	7.5	8	41	79	53	91	76	116
	076 - □D(-A)	7.6	8	41	79	53	91	76	116
	077 - □D(-A)	7.7	8	41	79	53	91	76	116
	078 - □D(-A)	7.8	8	41	79	53	91	76	116
	079 - □D(-A)	7.9	8	41	79	53	91	76	116
	080 - □D(-A)	8.0	8	41	79	53	91	76	116
	081 - □D(-A)	8.1	10	47	89	61	103	87	131
	082 - □D(-A)	8.2	10	47	89	61	103	87	131
	083 - □D(-A)	8.3	10	47	89	61	103	87	131
	084 - □D(-A)	8.4	10	47	89	61	103	87	131
	085 - □D(-A)	8.5	10	47	89	61	103	87	131
	086 - □D(-A)	8.6	10	47	89	61	103	87	131
	087 - □D(-A)	8.7	10	47	89	61	103	87	131
	088 - □D(-A)	8.8	10	47	89	61	103	87	131
	089 - □D(-A)	8.9	10	47	89	61	103	87	131
	090 - □D(-A)	9.0	10	47	89	61	103	87	131
	091 - □D(-A)	9.1	10	47	89	61	103	95	139
	092 - □D(-A)	9.2	10	47	89	61	103	95	139
	093 - □D(-A)	9.3	10	47	89	61	103	95	139
	094 - □D(-A)	9.4	10	47	89	61	103	95	139
	095 - □D(-A)	9.5	10	47	89	61	103	95	139
	096 - □D(-A)	9.6	10	47	89	61	103	95	139
	097 - □D(-A)	9.7	10	47	89	61	103	95	139
	098 - □D(-A)	9.8	10	47	89	61	103	95	139
	099 - □D(-A)	9.9	10	47	89	61	103	95	139

※(H): In case of oil hole is applied, mark 'H' / (-A): In case of Weldon shank is applied, mark '-A'
※ 5D and 8D depth of cut, only through coolant type is available

HSDP(H) - □D



Terminology	P	K
Grade	PC325W	
Tolerance (drill Dia.)	m7	
Tolerance (shank Dia.)	h6	
Point angle	140°	
Twist angle	30°	
Thinning	X type	
Coolant	Through/External	
International standard	DIN 6537	

P Steel K Cast iron

(mm)

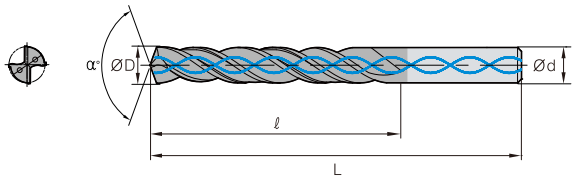
Designation		ØD	Ød	3D		5D		8D	
				ℓ	L	ℓ	L	ℓ	L
HSDP (H)	100 - □D(-A)	10.0	10	47	89	61	103	95	139
	101 - □D(-A)	10.1	12	55	102	71	118	106	155
	102 - □D(-A)	10.2	12	55	102	71	118	106	155
	103 - □D(-A)	10.3	12	55	102	71	118	106	155
	104 - □D(-A)	10.4	12	55	102	71	118	106	155
	105 - □D(-A)	10.5	12	55	102	71	118	106	155
	106 - □D(-A)	10.6	12	55	102	71	118	106	155
	107 - □D(-A)	10.7	12	55	102	71	118	106	155
	108 - □D(-A)	10.8	12	55	102	71	118	106	155
	109 - □D(-A)	10.9	12	55	102	71	118	106	155
	110 - □D(-A)	11.0	12	55	102	71	118	106	155
	111 - □D(-A)	11.1	12	55	102	71	118	114	163
	112 - □D(-A)	11.2	12	55	102	71	118	114	163
	113 - □D(-A)	11.3	12	55	102	71	118	114	163
	114 - □D(-A)	11.4	12	55	102	71	118	114	163
	115 - □D(-A)	11.5	12	55	102	71	118	114	163
	116 - □D(-A)	11.6	12	55	102	71	118	114	163
	117 - □D(-A)	11.7	12	55	102	71	118	114	163
	118 - □D(-A)	11.8	12	55	102	71	118	114	163
	119 - □D(-A)	11.9	12	55	102	71	118	114	163
	120 - □D(-A)	12.0	12	55	102	71	118	114	163
	121 - □D(-A)	12.1	14	60	107	77	124	133	182
	122 - □D(-A)	12.2	14	60	107	77	124	133	182
	123 - □D(-A)	12.3	14	60	107	77	124	133	182
	124 - □D(-A)	12.4	14	60	107	77	124	133	182
	125 - □D(-A)	12.5	14	60	107	77	124	133	182
	126 - □D(-A)	12.6	14	60	107	77	124	133	182
	127 - □D(-A)	12.7	14	60	107	77	124	133	182
	128 - □D(-A)	12.8	14	60	107	77	124	133	182
	129 - □D(-A)	12.9	14	60	107	77	124	133	182
	130 - □D(-A)	13.0	14	60	107	77	124	133	182
	131 - □D(-A)	13.1	14	60	107	77	124	133	182
	132 - □D(-A)	13.2	14	60	107	77	124	133	182
	133 - □D(-A)	13.3	14	60	107	77	124	133	182
	134 - □D(-A)	13.4	14	60	107	77	124	133	182

※(H): In case of oil hole is applied, mark 'H' / (-A): In case of Weldon shank is applied, mark '-A'

※ 5D and 8D depth of cut, only through coolant type is available

HSD Plus

HSDP(H) - □D



Terminology	P	K
Grade	PC325W	
Tolerance (drill Dia.)	m7	
Tolerance (shank Dia.)	h6	
Point angle	140°	
Twist angle	30°	
Thinning	X type	
Coolant	Through/External	
International standard	DIN 6537	

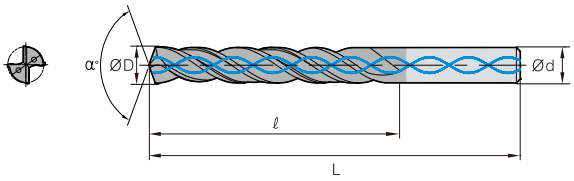
P Steel K Cast iron

(mm)

Designation		ØD	Ød	3D		5D		8D	
				ℓ	L	ℓ	L	ℓ	L
HSDP (H)	135 - □D(-A)	13.5	14	60	107	77	124	133	182
	136 - □D(-A)	13.6	14	60	107	77	124	133	182
	137 - □D(-A)	13.7	14	60	107	77	124	133	182
	138 - □D(-A)	13.8	14	60	107	77	124	133	182
	139 - □D(-A)	13.9	14	60	107	77	124	133	182
	140 - □D(-A)	14.0	14	60	107	77	124	133	182
	141 - □D(-A)	14.1	16	65	115	83	133	152	204
	142 - □D(-A)	14.2	16	65	115	83	133	152	204
	143 - □D(-A)	14.3	16	65	115	83	133	152	204
	144 - □D(-A)	14.4	16	65	115	83	133	152	204
	145 - □D(-A)	14.5	16	65	115	83	133	152	204
	146 - □D(-A)	14.6	16	65	115	83	133	152	204
	147 - □D(-A)	14.7	16	65	115	83	133	152	204
	148 - □D(-A)	14.8	16	65	115	83	133	152	204
	149 - □D(-A)	14.9	16	65	115	83	133	152	204
	150 - □D(-A)	15.0	16	65	115	83	133	152	204
	151 - □D(-A)	15.1	16	65	115	83	133	152	204
	152 - □D(-A)	15.2	16	65	115	83	133	152	204
	153 - □D(-A)	15.3	16	65	115	83	133	152	204
	154 - □D(-A)	15.4	16	65	115	83	133	152	204
	155 - □D(-A)	15.5	16	65	115	83	133	152	204
	156 - □D(-A)	15.6	16	65	115	83	133	152	204
	157 - □D(-A)	15.7	16	65	115	83	133	152	204
	158 - □D(-A)	15.8	16	65	115	83	133	152	204
	159 - □D(-A)	15.9	16	65	115	83	133	152	204
	160 - □D(-A)	16.0	16	65	115	83	133	152	204
	161 - □D(-A)	16.1	18	73	123	93	143	171	223
	162 - □D(-A)	16.2	18	73	123	93	143	171	223
	163 - □D(-A)	16.3	18	73	123	93	143	171	223
	164 - □D(-A)	16.4	18	73	123	93	143	171	223
	165 - □D(-A)	16.5	18	73	123	93	143	171	223
	166 - □D(-A)	16.6	18	73	123	93	143	171	223
	167 - □D(-A)	16.7	18	73	123	93	143	171	223
	168 - □D(-A)	16.8	18	73	123	93	143	171	223
	169 - □D(-A)	16.9	18	73	123	93	143	171	223

※(H): In case of oil hole is applied, mark 'H' / (-A): In case of Weldon shank is applied, mark '-A'
※ 5D and 8D depth of cut, only through coolant type is available

HSDP(H) - □D



Terminology	P	K
Grade	PC325W	
Tolerance (drill Dia.)	m7	
Tolerance (shank Dia.)	h6	
Point angle	140°	
Twist angle	30°	
Thinning	X type	
Coolant	Through/External	
International standard	DIN 6537	

P Steel K Cast iron

(mm)

Designation		ØD	Ød	3D		5D		8D	
				ℓ	L	ℓ	L	ℓ	L
HSDP (H)	170 - □D(-A)	17.0	18	73	123	93	143	171	223
	171 - □D(-A)	17.1	18	73	123	93	143	171	223
	172 - □D(-A)	17.2	18	73	123	93	143	171	223
	173 - □D(-A)	17.3	18	73	123	93	143	171	223
	174 - □D(-A)	17.4	18	73	123	93	143	171	223
	175 - □D(-A)	17.5	18	73	123	93	143	171	223
	176 - □D(-A)	17.6	18	73	123	93	143	171	223
	177 - □D(-A)	17.7	18	73	123	93	143	171	223
	178 - □D(-A)	17.8	18	73	123	93	143	171	223
	179 - □D(-A)	17.9	18	73	123	93	143	171	223
	180 - □D(-A)	18.0	18	73	123	93	143	171	223
	181 - □D(-A)	18.1	20	79	131	101	153	191	244
	182 - □D(-A)	18.2	20	79	131	101	153	191	244
	183 - □D(-A)	18.3	20	79	131	101	153	191	244
	184 - □D(-A)	18.4	20	79	131	101	153	191	244
	185 - □D(-A)	18.5	20	79	131	101	153	191	244
	186 - □D(-A)	18.6	20	79	131	101	153	191	244
	187 - □D(-A)	18.7	20	79	131	101	153	191	244
	188 - □D(-A)	18.8	20	79	131	101	153	191	244
	189 - □D(-A)	18.9	20	79	131	101	153	191	244
	190 - □D(-A)	19.0	20	79	131	101	153	191	244
	191 - □D(-A)	19.1	20	79	131	101	153	191	244
	192 - □D(-A)	19.2	20	79	131	101	153	191	244
	193 - □D(-A)	19.3	20	79	131	101	153	191	244
	194 - □D(-A)	19.4	20	79	131	101	153	191	244
	195 - □D(-A)	19.5	20	79	131	101	153	191	244
	196 - □D(-A)	19.6	20	79	131	101	153	191	244
	197 - □D(-A)	19.7	20	79	131	101	153	191	244
	198 - □D(-A)	19.8	20	79	131	101	153	191	244
	199 - □D(-A)	19.9	20	79	131	101	153	191	244
	200 - □D(-A)	20.0	20	79	131	101	153	191	244

※(H): In case of oil hole is applied, mark 'H' / (-A): In case of Weldon shank is applied, mark '-A'
※ 5D and 8D depth of cut, only through coolant type is available

HSD Plus

Recommended cutting conditions

HSD SERIES

Workpiece				vc (m/min)	fn (mm/rev)				
					Feed rate (mm/rev) per drill dia. (mm)				
ISO		Workpiece	HB		Ø3.0~4.0	Ø4.1~8.0	Ø8.1~12.0	Ø12.1~16.0	Ø16.1~20.0
P	Carbon steel	Low carbon steel	80~120	120 (80~150)	0.10~0.15	0.16~0.24	0.16~0.30	0.20~0.36	0.25~0.40
		High carbon steel	over 250	100 (80~150)	0.10~0.15	0.16~0.24	0.16~0.30	0.20~0.36	0.25~0.40
	Alloy steel	Low alloy steel	140~260	90 (80~150)	0.10~0.15	0.16~0.24	0.16~0.30	0.20~0.36	0.25~0.40
		Hardened low alloy steel	200~400	60 (50~100)	0.10~0.15	0.16~0.24	0.16~0.30	0.20~0.36	0.25~0.40
		High alloy steel	50~260	50 (40~80)	0.10~0.15	0.16~0.24	0.16~0.30	0.20~0.36	0.25~0.40
		Hardened high alloy steel	over 250	50 (40~80)	0.08~0.13	0.08~0.22	0.14~0.26	0.17~0.32	0.22~0.35
K	Cast iron	Gray cast iron	150~230	110 (80~150)	0.10~0.15	0.12~0.24	0.18~0.30	0.22~0.36	0.28~0.40
		Ductile cast iron	160~260	80 (63~100)	0.10~0.15	0.12~0.24	0.18~0.30	0.22~0.36	0.28~0.40

HSDP SERIES

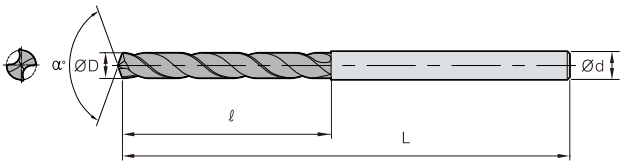
Workpiece				vc (m/min)	fn (mm/rev)				
					Feed rate (mm/rev) per drill dia. (mm)				
ISO		Workpiece	HB		Ø3.0~4.0	Ø4.1~8.0	Ø8.1~12.0	Ø12.1~16.0	Ø16.1~20.0
P	Carbon steel	Low carbon steel	80~120	150 (95~150)	0.10~0.15	0.16~0.24	0.16~0.30	0.20~0.36	0.25~0.40
		High carbon steel	over 250	130 (80~135)	0.10~0.15	0.16~0.24	0.16~0.30	0.20~0.36	0.25~0.40
	Alloy steel	Low alloy steel	140~260	150 (95~150)	0.10~0.15	0.16~0.24	0.16~0.30	0.20~0.36	0.25~0.40
		Hardened low alloy steel	200~400	60 (40~70)	0.10~0.15	0.16~0.24	0.16~0.30	0.20~0.36	0.25~0.40
		High alloy steel	50~260	50 (30~55)	0.10~0.15	0.16~0.24	0.16~0.30	0.20~0.36	0.25~0.40
		Hardened high alloy steel	over 250	40 (25~45)	0.08~0.13	0.08~0.22	0.14~0.26	0.17~0.32	0.22~0.35
K	Cast iron	Gray cast iron	150~230	110 (80~150)	0.10~0.15	0.12~0.24	0.18~0.30	0.22~0.36	0.28~0.40
		Ductile cast iron	160~260	80 (63~100)	0.10~0.15	0.12~0.24	0.18~0.30	0.22~0.36	0.28~0.40

HSD Line up

Designation	Oil hole	Shank type	Aspect ratio		
			3D	5D	8D
HSD	H	A	○	○	-
		F(Weldon type)	○	○	-
	-	A	○	-	-
		F(Weldon type)	○	-	-
HSDP	H	A	○	○	○
		F(Weldon type)	○	○	○
	-	A	○	-	-
		F(Weldon type)	○	-	-

ESD Plus

ESDP - □P



Terminology	P	M	K	N
Grade	PC325U			FG2
Tolerance (drill Dia.)	h7			
Tolerance (shank Dia.)	h6			
Point angle	140°			135°
Twist angle	30°			
Thinning	X type			
Coolant	External			

P Steel M Stainless steel K Cast iron N Non-ferrous metal

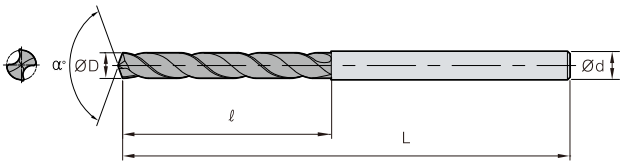
(mm)

Designation		ØD	Ød	3P		5P		7P	
				ℓ	L	ℓ	L	ℓ	L
ESDP	010 - □P	1.0	3	5	45	8	45	12	60
	011 - □P	1.1	3	6	45	9	45	12	60
	012 - □P	1.2	3	6	45	10	45	12	60
	013 - □P	1.3	3	7	45	10	45	15	60
	014 - □P	1.4	3	7	45	11	45	15	60
	015 - □P	1.5	3	7	45	11	45	15	60
	016 - □P	1.6	3	8	45	12	45	20	60
	017 - □P	1.7	3	8	45	12	45	20	60
	018 - □P	1.8	3	9	45	13	45	20	60
	019 - □P	1.9	3	9	45	14	45	20	60
	020 - □P	2.0	3	10	50	18	50	25	66
	021 - □P	2.1	3	10	50	18	50	25	66
	022 - □P	2.2	3	12	50	18	50	25	66
	023 - □P	2.3	3	12	50	18	50	25	66
	024 - □P	2.4	3	12	50	18	50	30	66
	025 - □P	2.5	3	12	50	18	50	30	66
	026 - □P	2.6	3	12	50	18	50	30	66
	027 - □P	2.7	3	15	50	18	50	30	66
	028 - □P	2.8	3	15	50	18	50	30	66
	029 - □P	2.9	3	15	50	18	50	30	66
	030 - □P	3.0	3	16	55	20	55	45	80
	031 - □P	3.1	4	16	55	20	55	45	80
	032 - □P	3.2	4	16	55	20	55	45	80
	033 - □P	3.3	4	16	55	20	55	45	80
	034 - □P	3.4	4	16	55	20	55	45	80
	035 - □P	3.5	4	16	55	20	55	45	80
	036 - □P	3.6	4	18	55	25	55	45	80
	037 - □P	3.7	4	18	55	25	55	45	80
	038 - □P	3.8	4	20	55	25	55	45	80
	039 - □P	3.9	4	20	55	25	55	45	80
	040 - □P	4.0	4	20	55	25	55	45	80
	041 - □P	4.1	5	20	55	25	55	45	80
	042 - □P	4.2	5	20	63	33	63	45	80
	043 - □P	4.3	5	23	63	33	63	45	80
	044 - □P	4.4	5	23	63	33	63	45	80
	045 - □P	4.5	5	23	63	33	63	45	80
	046 - □P	4.6	5	23	63	33	63	45	80
	047 - □P	4.7	5	23	63	33	63	45	80
	048 - □P	4.8	5	25	63	33	63	45	80

※ Order made items available

ESD Plus

ESDP - □P



Terminology	P	M	K	N
Grade	PC325U			FG2
Tolerance (drill Dia.)	h7			
Tolerance (shank Dia.)	h6			
Point angle	140°		135°	
Twist angle	30°			
Thinning	X type			
Coolant	External			

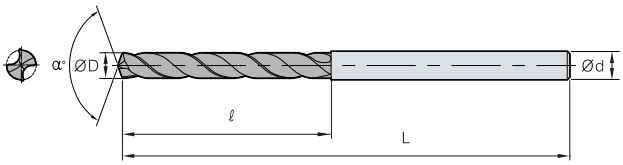
P Steel M Stainless steel K Cast iron N Non-ferrous metal

(mm)

Designation		ØD	Ød	3P		5P		7P	
				ℓ	L	ℓ	L	ℓ	L
ESDP	049 - □P	4.9	5	25	63	33	63	45	80
	050 - □P	5.0	5	25	63	33	63	45	80
	051 - □P	5.1	6	25	63	33	63	45	80
	052 - □P	5.2	6	28	66	36	66	50	83
	053 - □P	5.3	6	28	66	36	66	50	83
	054 - □P	5.4	6	28	66	36	66	50	83
	055 - □P	5.5	6	28	66	36	66	50	83
	056 - □P	5.6	6	28	66	36	66	50	83
	057 - □P	5.7	6	28	66	36	66	50	83
	058 - □P	5.8	6	28	66	36	66	50	83
	059 - □P	5.9	6	28	66	36	66	50	83
	060 - □P	6.0	6	30	66	36	66	50	83
	061 - □P	6.1	7	30	66	36	66	50	83
	062 - □P	6.2	7	32	75	42	75	53	85
	063 - □P	6.3	7	32	75	42	75	53	85
	064 - □P	6.4	7	32	75	42	75	53	85
	065 - □P	6.5	7	32	75	42	75	53	85
	066 - □P	6.6	7	32	75	42	75	53	85
	067 - □P	6.7	7	32	75	42	75	53	85
	068 - □P	6.8	7	32	75	42	75	53	85
	069 - □P	6.9	7	32	75	42	75	53	85
	070 - □P	7.0	7	32	75	42	75	53	85
	071 - □P	7.1	8	32	75	42	75	53	85
	072 - □P	7.2	8	36	80	46	80	58	90
	073 - □P	7.3	8	36	80	46	80	58	90
	074 - □P	7.4	8	36	80	46	80	58	90
	075 - □P	7.5	8	36	80	46	80	58	90
	076 - □P	7.6	8	36	80	46	80	58	90
	077 - □P	7.7	8	36	80	46	80	58	90
	078 - □P	7.8	8	36	80	46	80	58	90
	079 - □P	7.9	8	36	80	46	80	58	90
	080 - □P	8.0	8	36	80	46	80	58	90
	081 - □P	8.1	9	36	80	46	80	58	90
	082 - □P	8.2	9	38	85	50	85	64	98
	083 - □P	8.3	9	38	85	50	85	64	98
	084 - □P	8.4	9	38	85	50	85	64	98
	085 - □P	8.5	9	38	85	50	85	64	98
	086 - □P	8.6	9	40	85	50	85	64	98
	087 - □P	8.7	9	40	85	50	85	64	98

※ Order made items available

ESDP - □P



Terminology	P	M	K	N
Grade	PC325U			FG2
Tolerance (drill Dia.)	h7			
Tolerance (shank Dia.)	h6			
Point angle	140°			135°
Twist angle	30°			
Thinning	X type			
Coolant	External			

P Steel M Stainless steel K Cast iron N Non-ferrous metal

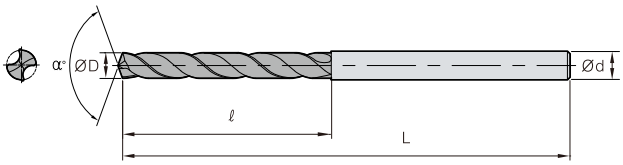
(mm)

Designation		ØD	Ød	3P		5P		7P	
				ℓ	L	ℓ	L	ℓ	L
ESDP	088 - □P	8.8	9	40	85	50	85	64	98
	089 - □P	8.9	9	40	85	50	85	64	98
	090 - □P	9.0	9	40	85	50	85	64	98
	091 - □P	9.1	10	42	85	50	85	64	98
	092 - □P	9.2	10	42	90	55	90	68	105
	093 - □P	9.3	10	42	90	55	90	68	105
	094 - □P	9.4	10	42	90	55	90	68	105
	095 - □P	9.5	10	42	90	55	90	68	105
	096 - □P	9.6	10	45	90	55	90	68	105
	097 - □P	9.7	10	45	90	55	90	68	105
	098 - □P	9.8	10	45	90	55	90	68	105
	099 - □P	9.9	10	45	90	55	90	68	105
	100 - □P	10.0	10	45	90	55	90	68	105
	101 - □P	10.1	11	-	-	55	90	68	105
	102 - □P	10.2	11	-	-	57	95	73	110
	103 - □P	10.3	11	-	-	57	95	73	110
	104 - □P	10.4	11	-	-	57	95	73	110
	105 - □P	10.5	11	-	-	57	95	73	110
	106 - □P	10.6	11	-	-	57	95	73	110
	107 - □P	10.7	11	-	-	57	95	73	110
	108 - □P	10.8	11	-	-	57	95	73	110
	109 - □P	10.9	11	-	-	57	95	73	110
	110 - □P	11.0	11	-	-	57	95	73	110
	111 - □P	11.1	12	-	-	57	95	73	110
	112 - □P	11.2	12	-	-	63	102	80	120
	113 - □P	11.3	12	-	-	63	102	80	120
	114 - □P	11.4	12	-	-	63	102	80	120
	115 - □P	11.5	12	-	-	63	102	80	120
	116 - □P	11.6	12	-	-	63	102	80	120
	117 - □P	11.7	12	-	-	63	102	80	120
	118 - □P	11.8	12	-	-	63	102	80	120
	119 - □P	11.9	12	-	-	63	102	80	120
	120 - □P	12.0	12	-	-	63	102	80	120
	121 - □P	12.1	13	-	-	63	102	80	120
	122 - □P	12.2	13	-	-	63	102	90	137
	123 - □P	12.3	13	-	-	63	102	90	137
	124 - □P	12.4	13	-	-	63	102	90	137
	125 - □P	12.5	13	-	-	63	102	90	137
	126 - □P	12.6	13	-	-	63	102	90	137

※ Order made items available

ESD Plus

ESDP - □P



Terminology	P	M	K	N
Grade	PC325U			FG2
Tolerance (drill Dia.)	h7			
Tolerance (shank Dia.)	h6			
Point angle	140°		135°	
Twist angle	30°			
Thinning	X type			
Coolant	External			

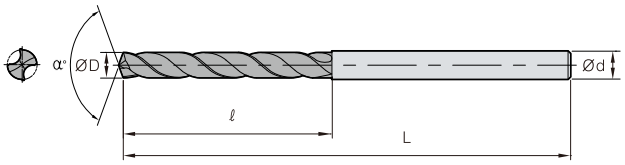
P Steel M Stainless steel K Cast iron N Non-ferrous metal

(mm)

Designation		ØD	Ød	3P		5P		7P	
				ℓ	L	ℓ	L	ℓ	L
ESDP	127 - □P	12.7	13	-	-	63	102	90	137
	128 - □P	12.8	13	-	-	63	102	90	137
	129 - □P	12.9	13	-	-	63	102	90	137
	130 - □P	13.0	13	-	-	63	102	90	137
	131 - □P	13.1	14	-	-	63	102	90	137
	132 - □P	13.2	14	-	-	65	107	96	147
	133 - □P	13.3	14	-	-	65	107	96	147
	134 - □P	13.4	14	-	-	65	107	96	147
	135 - □P	13.5	14	-	-	65	107	96	147
	136 - □P	13.6	14	-	-	65	107	96	147
	137 - □P	13.7	14	-	-	65	107	96	147
	138 - □P	13.8	14	-	-	65	107	96	147
	139 - □P	13.9	14	-	-	65	107	96	147
	140 - □P	14.0	14	-	-	65	107	96	147
	141 - □P	14.1	15	-	-	65	107	96	147
	142 - □P	14.2	15	-	-	68	115	100	153
	143 - □P	14.3	15	-	-	68	115	100	153
	144 - □P	14.4	15	-	-	68	115	100	153
	145 - □P	14.5	15	-	-	68	115	100	153
	146 - □P	14.6	15	-	-	68	115	100	153
	147 - □P	14.7	15	-	-	68	115	100	153
	148 - □P	14.8	15	-	-	68	115	100	153
	149 - □P	14.9	15	-	-	68	115	100	153
	150 - □P	15.0	15	-	-	68	115	100	153
	151 - □P	15.1	16	-	-	68	115	100	153
	152 - □P	15.2	16	-	-	70	120	112	160
	153 - □P	15.3	16	-	-	70	120	112	160
	154 - □P	15.4	16	-	-	70	120	112	160
	155 - □P	15.5	16	-	-	70	120	112	160
	156 - □P	15.6	16	-	-	70	120	112	160
	157 - □P	15.7	16	-	-	70	120	112	160
	158 - □P	15.8	16	-	-	70	120	112	160
	159 - □P	15.9	16	-	-	70	120	112	160
	160 - □P	16.0	16	-	-	70	120	112	160
	161 - □P	16.1	17	-	-	70	120	112	160
	162 - □P	16.2	17	-	-	70	120	112	160
	163 - □P	16.3	17	-	-	70	120	112	160
	164 - □P	16.4	17	-	-	70	120	112	160
	165 - □P	16.5	17	-	-	72	125	112	160

※ Order made items available

ESDP - □P



Terminology	P	M	K	N
Grade	PC325U			FG2
Tolerance (drill Dia.)	h7			
Tolerance (shank Dia.)	h6			
Point angle	140°			135°
Twist angle	30°			
Thinning	X type			
Coolant	External system			

P Steel M Stainless steel K Cast iron N Non-ferrous metal

(mm)

Designation		ØD	Ød	3P		5P		7P	
				ℓ	L	ℓ	L	ℓ	L
ESDP	166 - □P	16.6	17	-	-	72	125	112	160
	167 - □P	16.7	17	-	-	72	125	112	160
	168 - □P	16.8	17	-	-	72	125	112	160
	169 - □P	16.9	17	-	-	72	125	112	160
	170 - □P	17.0	17	-	-	72	125	112	160
	171 - □P	17.1	18	-	-	72	125	112	160
	172 - □P	17.2	18	-	-	72	125	112	160
	173 - □P	17.3	18	-	-	72	125	112	160
	174 - □P	17.4	18	-	-	72	125	112	160
	175 - □P	17.5	18	-	-	75	130	112	160
	176 - □P	17.6	18	-	-	75	130	112	160
	177 - □P	17.7	18	-	-	75	130	112	160
	178 - □P	17.8	18	-	-	75	130	112	160
	179 - □P	17.9	18	-	-	75	130	112	160
	180 - □P	18.0	18	-	-	75	130	112	160
	181 - □P	18.1	19	-	-	75	130	112	160
	182 - □P	18.2	19	-	-	75	130	112	160
	183 - □P	18.3	19	-	-	75	130	112	160
	184 - □P	18.4	19	-	-	75	130	112	160
	185 - □P	18.5	19	-	-	78	130	112	160
	186 - □P	18.6	19	-	-	78	130	112	160
	187 - □P	18.7	19	-	-	78	130	112	160
	188 - □P	18.8	19	-	-	78	130	112	160
	189 - □P	18.9	19	-	-	78	130	112	160
	190 - □P	19.0	19	-	-	78	130	112	160
	191 - □P	19.1	20	-	-	78	130	112	160
	192 - □P	19.2	20	-	-	78	130	112	160
	193 - □P	19.3	20	-	-	78	130	112	160
	194 - □P	19.4	20	-	-	78	130	112	160
	195 - □P	19.5	20	-	-	82	135	112	160
	196 - □P	19.6	20	-	-	82	135	112	160
	197 - □P	19.7	20	-	-	82	135	112	160
	198 - □P	19.8	20	-	-	82	135	112	160
	199 - □P	19.9	20	-	-	82	135	112	160
	200 - □P	20.0	20	-	-	82	135	112	160

※ Order made items available

ESD Plus

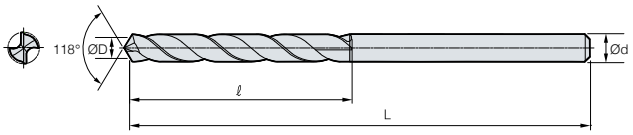
Recommended cutting conditions

Workpiece				Grade	vc (m/min)	fn (mm/rev)				
						Feed rate (mm/rev) per drill dia. (mm)				
ISO		Workpiece	HB	Recommended		Ø2.5~4.0	Ø4.1~8.0	Ø8.1~12.0	Ø12.1~16.0	Ø16.1~20.0
P	Carbon steel	Low carbon steel	80~120	PC325U	72 (64~120)	0.08~0.12	0.13~0.19	0.16~0.24	0.20~0.29	0.24~0.32
		High carbon steel	over 250	PC325U	40 (32~64)	0.06~0.16	0.06~0.16	0.08~0.20	0.12~0.20	0.12~0.24
	Alloy steel	Low alloy steel	140~260	PC325U	72 (64~120)	0.08~0.12	0.13~0.19	0.16~0.24	0.20~0.29	0.24~0.32
		Hardened low alloy steel	200~400	PC325U	48 (40~80)	0.08~0.12	0.13~0.19	0.16~0.24	0.20~0.29	0.24~0.32
		High alloy steel	50~260	PC325U	40 (32~64)	0.06~0.16	0.06~0.16	0.08~0.20	0.12~0.20	0.12~0.24
		Hardened high alloy steel	over 250	PC325U	40 (32~64)	0.06~0.16	0.06~0.16	0.08~0.20	0.12~0.20	0.12~0.24
M	Stainless steel	Austenite series	135~275	PC325U	36 (20~64)	0.04~0.16	0.04~0.16	0.08~0.20	0.08~0.20	0.12~0.24
		Ferrite series Martensite series	135~275	PC325U	40 (24~64)	0.04~0.16	0.04~0.16	0.08~0.20	0.08~0.20	0.12~0.24
K	Cast iron	Gray cast iron	150~230	PC325U	80 (64~120)	0.08~0.12	0.13~0.19	0.16~0.24	0.20~0.29	0.24~0.32
		Ductile cast iron	160~260	PC325U	72 (56~112)	0.08~0.12	0.13~0.19	0.16~0.24	0.20~0.29	0.24~0.32
N	Aluminum	Aluminum alloy	30~150	FG2	120 (100~176)	0.19~0.30	0.30~0.42	0.42~0.60	0.49~0.68	0.54~0.78
	Copper lloy	Copper alloy	150~160	FG2	120 (100~176)	0.08~0.12	0.13~0.19	0.16~0.24	0.20~0.29	0.24~0.32

• Cutting conditions above are for the case of less than 5D depth of cut and External coolant system applied

SSD-N

SSD-N



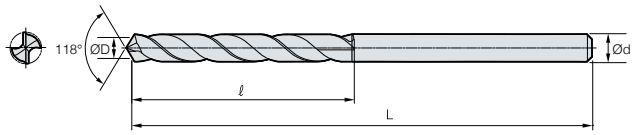
Coating	×
Tolerance (drill Dia.)	h8
Tolerance (shank Dia.)	h7
Point angle	118°
Twist angle	30°
Thinning	X type
Coolant	External

(mm)

Designation		ØD	Ød	ℓ	L
SSD	010-N	1.0	1.0	10	38
	011-N	1.1	1.1	10	38
	012-N	1.2	1.2	10	38
	013-N	1.3	1.3	13	38
	014-N	1.4	1.4	13	38
	015-N	1.5	1.5	13	38
	016-N	1.6	1.6	13	38
	017-N	1.7	1.7	13	38
	018-N	1.8	1.8	13	38
	019-N	1.9	1.9	13	38
	020-N	2.0	2.0	16	45
	021-N	2.1	2.1	16	45
	022-N	2.2	2.2	16	45
	023-N	2.3	2.3	16	45
	024-N	2.4	2.4	18	50
	025-N	2.5	2.5	20	50
	026-N	2.6	2.6	20	50
	027-N	2.7	2.7	22	50
	028-N	2.8	2.8	22	50
	029-N	2.9	2.9	22	50
	030-N	3.0	3.0	22	50
	031-N	3.1	3.1	25	50
	032-N	3.2	3.2	25	50
	033-N	3.3	3.3	25	50
	034-N	3.4	3.4	25	50
	035-N	3.5	3.5	25	50
	036-N	3.6	3.6	28	55
	037-N	3.7	3.7	28	55
	038-N	3.8	3.8	28	55
	039-N	3.9	3.9	28	55
	040-N	4.0	4.0	28	55
	041-N	4.1	4.1	30	60
	042-N	4.2	4.2	30	60
	043-N	4.3	4.3	30	60
	044-N	4.4	4.4	30	60
	045-N	4.5	4.5	30	60
	046-N	4.6	4.6	33	65
	047-N	4.7	4.7	33	65
	048-N	4.8	4.8	35	65

Designation		ØD	Ød	ℓ	L
SSD	049-N	4.9	4.9	35	65
	050-N	5.0	5.0	35	65
	051-N	5.1	5.1	35	65
	052-N	5.2	5.2	35	65
	053-N	5.3	5.3	35	65
	054-N	5.4	5.4	35	65
	055-N	5.5	5.5	35	65
	056-N	5.6	5.6	38	75
	057-N	5.7	5.7	38	75
	058-N	5.8	5.8	38	75
	059-N	5.9	5.9	38	75
	060-N	6.0	6.0	38	75
	061-N	6.1	6.1	38	75
	062-N	6.2	6.2	38	75
	063-N	6.3	6.3	38	75
	064-N	6.4	6.4	38	75
	065-N	6.5	6.5	38	75
	066-N	6.6	6.6	45	80
	067-N	6.7	6.7	45	80
	068-N	6.8	6.8	45	80
	069-N	6.9	6.9	45	80
	070-N	7.0	7.0	45	80
	071-N	7.1	7.1	45	80
	072-N	7.2	7.2	45	80
	073-N	7.3	7.3	45	80
	074-N	7.4	7.4	45	80
	075-N	7.5	7.5	45	80
	076-N	7.6	7.6	50	85
	077-N	7.7	7.7	50	85
	078-N	7.8	7.8	50	85
	079-N	7.9	7.9	50	85
	080-N	8.0	8.0	50	85
	081-N	8.1	8.1	50	85
	082-N	8.2	8.2	50	85
	083-N	8.3	8.3	50	85
	084-N	8.4	8.4	50	85
	085-N	8.5	8.5	50	85
	086-N	8.6	8.6	50	95
	087-N	8.7	8.7	50	95

SSD-N



Coating	×
Tolerance (drill Dia.)	h8
Tolerance (shank Dia.)	h7
Point angle	118°
Twist angle	30°
Thinning	X type
Coolant	External

(mm)

Designation		ØD	Ød	ℓ	L
SSD	088-N	8.8	8.8	50	95
	089-N	8.9	8.9	50	95
	090-N	9.0	9.0	50	95
	091-N	9.1	9.1	50	95
	092-N	9.2	9.2	50	95
	093-N	9.3	9.3	50	95
	094-N	9.4	9.4	50	95
	095-N	9.5	9.5	50	95
	096-N	9.6	9.6	50	95
	097-N	9.7	9.7	50	95
	098-N	9.8	9.8	50	95
	099-N	9.9	9.9	55	100
	100-N	10.0	10.0	55	100
	101-N	10.1	10.1	55	115
	102-N	10.2	10.2	55	115
	103-N	10.3	10.3	55	115
	104-N	10.4	10.4	55	115

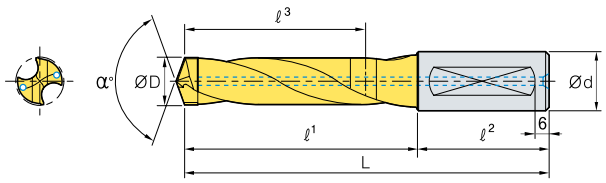
Designation		ØD	Ød	ℓ	L
SSD	105-N	10.5	10.5	55	115
	106-N	10.6	10.6	60	115
	107-N	10.7	10.7	60	115
	108-N	10.8	10.8	60	115
	109-N	10.9	10.9	60	115
	110-N	11.0	11.0	60	115
	111-N	11.1	11.1	65	120
	112-N	11.2	11.2	65	120
	113-N	11.3	11.3	65	120
	115-N	11.5	11.5	65	120
	118-N	11.8	11.8	65	120
	119-N	11.9	11.9	65	120
	120-N	12.0	12.0	65	120
	124-N	12.4	12.4	70	125
	125-N	12.5	12.5	70	125
	130-N	13.0	13.0	75	130

Recommended cutting conditions

Workpiece				Grade	vc (m/min)	Feed rate (mm/rev) per drill dia. (mm)			
ISO		Workpiece	HB			Ø2.5~Ø4.0	Ø4.1~Ø8.0	Ø8.1~Ø12.0	Ø12.1~Ø15.0
P	Carbon steel	Low carbon steel	80~120	Carbide	35 (20~65)	0.02~0.06	0.04~0.08	0.06~0.12	0.10~0.16
N	Aluminum	Aluminum alloy	30-150		100 (94~120)	0.03~0.06	0.05~0.08	0.08~0.12	0.12~0.18
	Copper lloy	Copper alloy	150-160		80 (65~95)	0.03~0.06	0.05~0.08	0.08~0.12	0.12~0.18

Vulcan Drill

VZD-MA, MBA



Type	MA	MBA
Grade	PC230F	
Tolerance (drill Dia.)	h7	
Tolerance (shank Dia.)	h7	
Point angle	140°	150°
Twist angle	25°	20°
Thinning	X type	
Coolant	Through	

(mm)

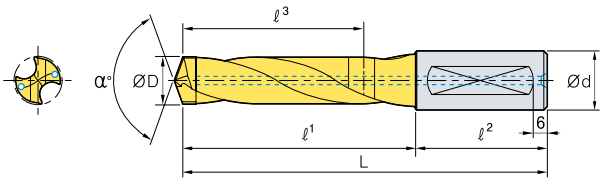
	Designation	ØD	Ød	L	ℓ1	ℓ2	ℓ3
VZD	126~135MA, MBA	12.6~13.5	16	110	62	48	44
	136~145MA, MBA	13.6~14.5	16	115	67	48	48
	146~155MA, MBA	14.6~15.5	20	125	75	50	55
	156~165MA, MBA	15.6~16.5	20	130	80	50	59
	166~175MA, MBA	16.6~17.5	20	135	85	50	63
	176~185MA, MBA	17.6~18.5	20	140	90	50	66
	186~195MA, MBA	18.6~19.5	25	155	99	56	74
	196~205MA, MBA	19.6~20.5	25	155	99	56	73
	206~215MA, MBA	20.6~21.5	25	155	99	56	72
	216~225MA, MBA	21.6~22.5	25	160	104	56	76
	226~235MA, MBA	22.6~23.5	25	160	104	56	74
	236~245MA, MBA	23.6~24.5	32	170	110	60	79
	246~255MA, MBA	24.6~25.5	32	170	110	60	78
	256~265MA, MBA	25.6~26.5	32	175	115	60	82
	266~275MA, MBA	26.6~27.5	32	175	115	60	80
	276~285MA, MBA	27.6~28.5	32	180	120	60	84
	286~295MA, MBA	28.6~29.5	32	185	125	60	88
	296~305MA, MBA	29.6~30.5	32	185	125	60	87
	306~315MA, MBA	30.6~31.5	40	205	135	70	95
	316~325MA, MBA	31.6~32.5	40	210	140	70	98
	326~335MA, MBA	32.6~33.5	40	215	145	70	101
	336~345MA, MBA	33.6~34.5	40	220	150	70	104
	346~355MA, MBA	34.6~35.5	40	225	155	70	107
	356~365MA, MBA	35.6~36.5	40	225	155	70	110
	366~375MA, MBA	36.6~37.5	40	230	160	70	113
	376~385MA, MBA	37.6~38.5	40	235	165	70	116
	386~395MA, MBA	38.6~39.5	40	240	170	70	119
	396~405MA, MBA	39.6~40.5	40	245	175	70	122

※ VZD□□□MA: For General steel, Ductile cast iron
MBA: For Mild steel, Low carbon steel

※ Order made items: VZD□□□M□ × Flute length - Total length L
Ex.1) MA Type, Machined diameter: Ø18.6 mm, Flute length: 110 mm, Total length: 200 mm → VZD186MA × 110-200L
Ex.2) MA Type, Machined diameter: Ø18.63, Flute length: 110 mm, Total length: 200 mm → VZD1863MA × 110-200L
Ex.3) MA Type, Machined diameter: Ø18.6, Standard → VZD186MA

Vulcan Drill

VZD-LA, LBA



Type	LA	LBA
Grade	PC230F	
Tolerance (drill Dia.)	h7	
Tolerance (shank Dia.)	h7	
Point angle	140°	150°
Twist angle	25°	20°
Thinning	X type	
Coolant	Through	

(mm)

	Designation	ØD	Ød	L	ℓ1	ℓ2	ℓ3
VZD	126~135LA, LBA	12.6~13.5	16	140	92	48	74
	136~145LA, LBA	13.6~14.5	16	145	97	48	78
	146~155LA, LBA	14.6~15.5	20	155	105	50	85
	156~165LA, LBA	15.6~16.5	20	165	115	50	94
	166~175LA, LBA	16.6~17.5	20	170	120	50	98
	176~185LA, LBA	17.6~18.5	20	175	125	50	101
	186~195LA, LBA	18.6~19.5	25	190	134	56	109
	196~205LA, LBA	19.6~20.5	25	195	139	56	113
	206~215LA, LBA	20.6~21.5	25	195	139	56	112
	216~225LA, LBA	21.6~22.5	25	200	144	56	116
	226~235LA, LBA	22.6~23.5	25	210	154	56	124
	236~245LA, LBA	23.6~24.5	32	220	160	60	129
	246~255LA, LBA	24.6~25.5	32	225	165	60	133
	256~265LA, LBA	25.6~26.5	32	230	170	60	137
	266~275LA, LBA	26.6~27.5	32	235	175	60	141
	276~285LA, LBA	27.6~28.5	32	240	180	60	144
	286~295LA, LBA	28.6~29.5	32	245	185	60	148
	296~305LA, LBA	29.6~30.5	32	255	195	60	157
	306~315LA, LBA	30.6~31.5	40	275	205	70	166
	316~325LA, LBA	31.6~32.5	40	280	210	70	172
	326~335LA, LBA	32.6~33.5	40	280	215	70	173
	336~345LA, LBA	33.6~34.5	40	290	220	70	177
	346~355LA, LBA	34.6~35.5	40	295	225	70	181
	356~365LA, LBA	35.6~36.5	40	300	230	70	183
	366~375LA, LBA	36.6~37.5	40	305	235	70	188
	376~385LA, LBA	37.6~38.5	40	315	245	70	193
	386~395LA, LBA	38.6~39.5	40	320	250	70	198
	396~405LA, LBA	39.6~40.5	40	325	255	70	203

※ VZD□□□LA: For General steel, Ductile cast iron
LBA: For Mild steel, Low carbon steel

※ Order made items: VZD□□□M□ × Flute length - Total length L
Ex.1) LA Type, Machined diameter: Ø18.6 mm, Flute length: 110 mm, Total length: 200 mm → VZD186LA × 110-200L
Ex.2) LA Type, Machined diameter: Ø18.63, Flute length: 110 mm, Total length: 200 mm → VZD1863LA × 110-200L
Ex.3) LA Type, Machined diameter: Ø18.6, Standard → VZD186LA

Vulcan Drill

Recommended cutting conditions

Form	Workpiece	Hardness	~ Ø15		~ Ø20		~ Ø40	
			vc (m/min)	fn (mm/rev)	vc (m/min)	fn (mm/rev)	vc (m/min)	fn (mm/rev)
MA LA	Mild steel, General steel, Alloy steel	Under HB250	40~90 (65)	0.15~0.30 (0.20)	40~90 (65)	0.20~0.40 (0.30)	40~90 (70)	0.20~0.45 (0.35)
	General steel, Alloy steel	Under HB320	40~90 (60)	0.10~0.25 (0.20)	40~90 (60)	0.15~0.35 (0.25)	40~90 (65)	0.20~0.40 (0.30)
	Mold steel	HB250	40~70 (50)	0.10~0.25 (0.20)	40~70 (50)	0.15~0.30 (0.25)	40~70 (50)	0.20~0.35 (0.30)
	Stainless steel	HB250	30~50 (45)	0.10~0.20 (0.15)	30~50 (45)	0.15~0.25 (0.20)	30~50 (45)	0.20~0.30 (0.25)
	Ductile cast iron	-	50~100 (70)	0.20~0.35 (0.30)	50~100 (70)	0.20~0.40 (0.35)	50~100 (70)	0.25~0.50 (0.40)
MBA LBA	Mild steel, General steel, Alloy steel	Under HB250	40~90 (75)	0.20~0.40 (0.30)	40~90 (75)	0.20~0.40 (0.30)	40~90 (80)	0.20~0.45 (0.35)
	General steel, Alloy steel	Under HB320	35~80 (55)	0.15~0.30 (0.25)	35~80 (55)	0.15~0.30 (0.25)	40~80 (60)	0.15~0.40 (0.30)

Burnishing Drill

BDS

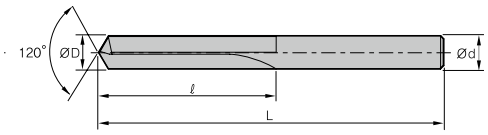


Fig 1

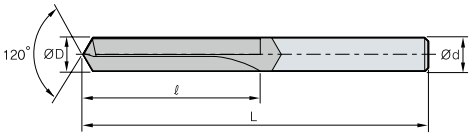


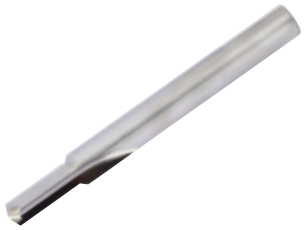
Fig 2

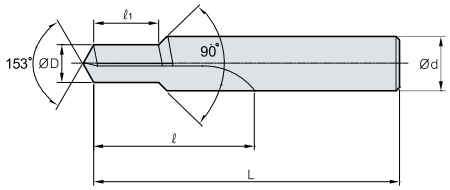
(mm)

	Designation	ØD	Ød	ℓ	L	Fig.
BDS	040S	4.0	4	35	80	1
	050S	5.0	5	40	85	1
	060S	6.0	6	50	95	1
	070S	7.0	7	55	100	1
	080S	8.0	8	65	110	1
	090S	9.0	9	70	120	1
	100S	10.0	10	80	130	1
	110S	11.0	11	90	140	1
	120B	12.0	12	95	150	2
	130B	13.0	16	105	160	2
	140B	14.0	16	110	170	2
	150B	15.0	16	120	185	2
	160B	16.0	16	125	190	2

BDT (Step)

For tapping a foundation hole





(mm)

	Designation	ØD	Ød	ℓ	ℓ1	L	Tap
BDT	M05080 - ℓ1	4.2	6	35	9~15	90	M5XP0.8
	M06100 - ℓ1	5.0	7	40	11~18	95	M6XP1.0
	M08125 - ℓ1	6.8	10	50	15~24	105	M8XP1.25
	M10125 - ℓ1	8.8	12	55	17~30	110	M10XP1.25
	M10150 - ℓ1	8.5	12	55	17~30	110	M10XP1.5
	M12125 - ℓ1	10.8	14	60	19~36	120	M12XP1.25
	M12150 - ℓ1	10.5	14	60	19~36	120	M12XP1.5
	M12175 - ℓ1	10.3	14	60	19~36	120	M12XP1.75

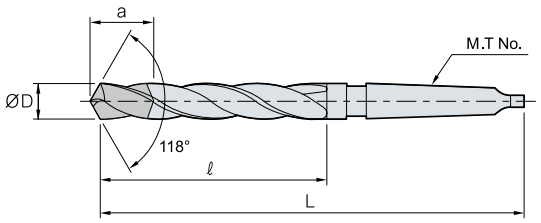
Burnishing Drill

Recommended cutting conditions

Workpiece	Cutting speed vc (m/min)	Feed rate (mm/rev) per drill dia. (mm)				
		Ø2.0~3.0	Ø3.5~5.0	Ø5.5~8.0	Ø8.5~12.0	Ø12.5~18.0
Aluminum alloy, Copper alloy	30~60	0.02~0.05	0.03~0.10	0.04~0.15	0.05~0.20	0.05~0.30
Aluminum alloy for die castings	50~80	0.02~0.05	0.03~0.10	0.04~0.15	0.05~0.20	0.05~0.30
Cast iron (GC) Ductile cast	25~60	0.01~0.04	0.02~0.08	0.05~0.12	0.05~0.20	0.05~0.30
Iron (GCD)	20~50	0.01~0.03	0.02~0.05	0.03~0.08	0.04~0.12	0.05~0.15

Top Solid Drill

TSDM



(mm)

	Designation	ØD	L	ℓ	a	M.T No
TSDM	080~085	8.0~8.5	168	85	25	1
	086~090	8.6~9.0	172	88	25	1
	091~095	9.1~9.5	175	92	26	1
	096~100	9.6~10.0	178	95	26	1
	101~105	10.1~10.5	182	98	26	1
	106~110	10.6~11.0	185	102	26	1
	111~115	11.1~11.5	188	105	26	1
	116~120	11.6~12.0	192	108	26	1
	121~125	12.1~12.5	195	112	26	1
	126~130	12.6~13.0	198	115	26	2
	131~135	13.1~13.5	202	118	27	2
	136~140	13.6~14.0	205	122	27	2
	141~145	14.1~14.5	222	122	27	2
	146~150	14.6~15.0	225	125	27	2
	151~155	15.1~15.5	228	125	27	2
	156~160	15.6~16.0	230	130	27	2
	161~165	16.1~16.5	232	132	27	2
	166~170	16.6~17.0	234	135	27	2
	171~180	17.1~18.0	240	140	27	2
	181~190	18.1~19.0	245	145	27	2
	191~200	19.1~20.0	250	150	30	2
	201~210	20.1~21.0	255	155	30	2
	211~220	21.1~22.0	260	160	30	2
	221~230	22.1~23.0	265	165	30	2
	231~250	23.1~25.0	285	165	34	3

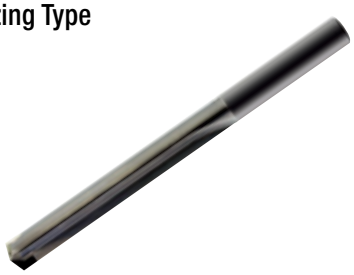
Recommended cutting conditions

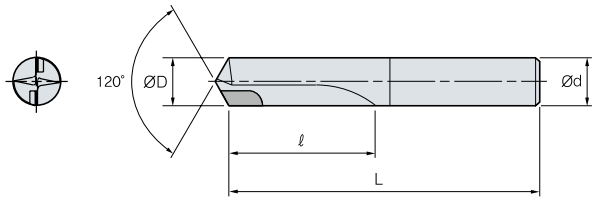
Diameter	Cutting condition	Ductile cast iron	Gray cast iron	Soft steel
Ø8.0~Ø10.0	vc (m/min)	30 (20~35)	40 (20~60)	100 (50~150)
	fn (mm/rev)	0.30 (0.20~0.40)	0.30 (0.20~0.40)	0.15 (0.10~0.20)
Ø10.1~Ø15.0	vc (m/min)	50 (30~70)	60 (30~80)	130 (70~200)
	fn (mm/rev)	0.35 (0.30~0.40)	0.35 (0.30~0.40)	0.15 (0.10~0.20)
Ø15.1~Ø25.0	vc (m/min)	60 (50~60)	75 (50~100)	150 (100~250)
	fn (mm/rev)	0.35 (0.30~0.45)	0.40 (0.30~0.50)	0.15 (0.10~0.20)

PCD Drill

PDD

Brazing Type





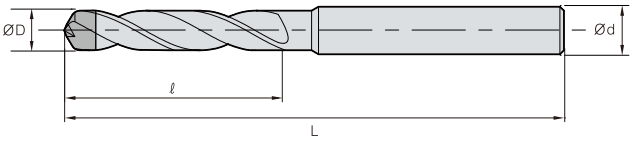
(mm)

	Designation	ØD	Ød	ℓ	L
PDD	0500	5.0	5.0	30	80
	0550	5.5	5.5	30	80
	0600	6.0	6.0	30	80
	0650	6.5	6.5	40	95
	0700	7.0	7.0	40	95
	0750	7.5	7.5	45	100
	0800	8.0	8.0	45	100
	0850	8.5	8.5	50	110
	0900	9.0	9.0	50	110
	0950	9.5	9.5	55	115
	1000	10.0	10.0	55	115
	1050	10.5	10.5	60	120
	1100	11.0	11.0	60	120
	1150	11.5	11.5	65	125
	1200	12.0	12.0	65	125

PCD Drill

CPD (Standard)

Cone Type

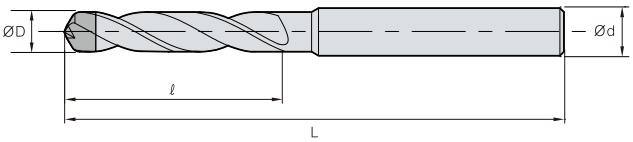


(mm)

	Designation	ØD	Ød	ℓ	L
CPD	020~030	2.0~3.0	4	10	43
	031~035	3.1~3.5	4	15	43
	036~040	3.6~4.0	4	15	43
	041~050	4.1~5.0	6	20	53
	051~060	5.1~6.0	6	25	63
	061~070	6.1~7.0	8	30	79
	071~080	7.1~8.0	8	35	79

CPDL (Long)

Cone Type



(mm)

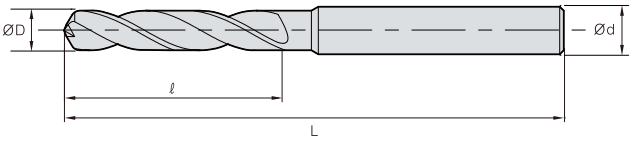
	Designation	ØD	Ød	ℓ	L
CPD	020~030	2.0~3.0	4	90	160
	031~035	3.1~3.5	4	90	160
	036~040	3.6~4.0	4	90	160
	041~050	4.1~5.0	6	90	160
	051~060	5.1~6.0	6	90	160
	061~070	6.1~7.0	8	90	160
	071~080	7.1~8.0	8	90	160

Notice

- High functional drill for machining in various cutting range : Cone type drill(CPD)
- Realizing excellent accuracy and surface finish
- High precision premium PCD drill

SPD

Sandwich Type



(mm)

Designation		ØD	Ød	ℓ	L
SPD	040	4.0	4	20	43
	045	4.5	6	20	53
	050	5.0	6	25	63
	055	5.5	6	25	63
	060	6.0	6	25	63
	065	6.5	8	30	79
	070	7.0	8	35	79
	075	7.5	8	35	79
	080	8.0	8	35	79
	085	8.5	10	60	110
	090	9.0	10	60	110
	095	9.5	10	60	110
	100	10.0	10	60	110
	105	10.5	10	60	110
	110	11.0	12	70	110
	115	11.5	12	70	110
	120	12.0	12	80	150
	125	12.5	12	80	150
	130	13.0	14	80	150
	135	13.5	14	80	150
	140	14.0	14	80	150
	145	14.5	14	80	150
	150	15.0	16	80	150
	160	16.0	16	80	150

Notice

- High functional drill for machining in various cutting range : Sandwich type drill(SPD)
- Realizing excellent accuracy and surface finish
- High precision premium PCD drill

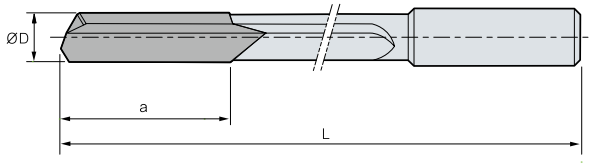
Recommended cutting conditions

Workpiece	vc (m/min)	fn (mm/rev)
CFRP	50~250	0.075 (0.05~0.25)
Aluminum alloy		0.050 (0.03~0.20)
Counter sink section		0.040 (0.02~0.15)

Gun Drill

KGDS

Single lip type



Designation description	
O.OO	Diameter
□□□□	Length
D□□	Driver code no.

(mm)

	Designation	ØD	a
KGDS	O.OO-□□□□ / D□□	2.00~2.49	18
	O.OO-□□□□ / D□□	2.50~2.99	18
	O.OO-□□□□ / D□□	3.00~3.49	19
	O.OO-□□□□ / D□□	3.50~3.99	19
	O.OO-□□□□ / D□□	4.00~4.49	23
	O.OO-□□□□ / D□□	4.50~4.99	23
	O.OO-□□□□ / D□□	5.00~5.49	24
	O.OO-□□□□ / D□□	5.50~5.99	26
	O.OO-□□□□ / D□□	6.00~6.49	27
	O.OO-□□□□ / D□□	6.50~6.99	28
	O.OO-□□□□ / D□□	7.00~7.49	29
	O.OO-□□□□ / D□□	7.50~7.99	30
	O.OO-□□□□ / D□□	8.00~8.49	31
	O.OO-□□□□ / D□□	8.50~8.99	31
	O.OO-□□□□ / D□□	9.00~8.49	31
	O.OO-□□□□ / D□□	9.50~9.99	31
	O.OO-□□□□ / D□□	10.00~10.49	31
	O.OO-□□□□ / D□□	10.50~10.99	32
	O.OO-□□□□ / D□□	11.00~11.49	35
	O.OO-□□□□ / D□□	11.50~11.99	35
	O.OO-□□□□ / D□□	12.00~12.49	38

	Designation	ØD	a
KGDS	O.OO-□□□□ / D□□	12.50~12.99	38
	O.OO-□□□□ / D□□	13.00~13.99	38
	O.OO-□□□□ / D□□	14.00~14.99	38
	O.OO-□□□□ / D□□	15.00~15.99	39
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	O.OO-□□□□ / D□□	18.00~18.99	41
	O.OO-□□□□ / D□□	19.00~19.99	41
	O.OO-□□□□ / D□□	20.00~20.99	44
	O.OO-□□□□ / D□□	21.00~21.99	46
	O.OO-□□□□ / D□□	22.00~22.99	49
	O.OO-□□□□ / D□□	23.00~23.99	51
	O.OO-□□□□ / D□□	24.00~24.99	52
	O.OO-□□□□ / D□□	25.00~25.99	54
	O.OO-□□□□ / D□□	26.00~26.99	54
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	O.OO-□□□□ / D□□	30.00~30.99	59
	O.OO-□□□□ / D□□	31.00~31.99	61
	O.OO-□□□□ / D□□	32.00~32.99	61

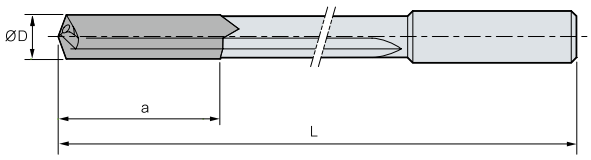
※ When ordering, please mark the overall length(L) and driver number (or drawing)

Code system

KGD	S	12.05	-	1500	/	D30
KORLOY Gun Drill	Lib type S = Single T = Twin	Drill dia. Ø12.05		Length of drill 1500mm		Drive no. D30

KGDT

Twin lip type



Designation description	
O.OO	Diameter
□□□□	Length
D□□	Driver code no.

(mm)

	Designation	ØD	a
KGDT	O.OO-□□□□ / D□□	8.00~8.49	38
	O.OO-□□□□ / D□□	8.50~8.99	38
	O.OO-□□□□ / D□□	9.00~8.49	40
	O.OO-□□□□ / D□□	9.50~9.99	40
	O.OO-□□□□ / D□□	10.00~10.49	40
	O.OO-□□□□ / D□□	10.50~10.99	40
	O.OO-□□□□ / D□□	11.00~11.49	45
	O.OO-□□□□ / D□□	11.50~11.99	45
	O.OO-□□□□ / D□□	12.00~12.49	45
	O.OO-□□□□ / D□□	12.50~12.99	48
	O.OO-□□□□ / D□□	13.00~13.99	48
	O.OO-□□□□ / D□□	14.00~14.99	48
	O.OO-□□□□ / D□□	15.00~15.99	48
	O.OO-□□□□ / D□□	16.00~16.99	50
	O.OO-□□□□ / D□□	17.00~17.99	50
	O.OO-□□□□ / D□□	18.00~18.99	50
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	O.OO-□□□□ / D□□	21.00~21.99	55
	O.OO-□□□□ / D□□	22.00~22.99	55
	O.OO-□□□□ / D□□	23.00~23.99	60

※ When ordering, please mark the overall length(L) and driver number (or drawing)

Available overall length

Designation	Drill Dia.	Overall length				
		250mm	500mm	1000mm	1500mm	2000mm
KGDS	2.00~2.99	○	○			
	3.00~3.49	○	○	○		
	3.50~32.99	○	○	○	○	○
KGDT	6.00~24.00	○	○	○		

Gun Drill

Recommended cutting conditions

Workpiece	Hardness (HB)	Cutting speed vc (m/min)	Feed rate (mm/rev) per drill dia. (mm)					
			~Ø4	~Ø6	~Ø10	~Ø14	~Ø24	Ø25~
Carbon steel Alloy steel	~150	100~150	0.005~0.015	0.010~0.025	0.015~0.035	0.020~0.050	0.030~0.070	0.040~0.080
	150~250	80~120	0.005~0.010	0.010~0.020	0.015~0.030	0.020~0.040	0.030~0.060	0.030~0.060
	250~350	50~100	0.005~0.010	0.005~0.010	0.010~0.020	0.015~0.030	0.020~0.040	0.020~0.040
	350~	~30	-	0.005~0.010	0.005~0.010	0.010~0.020	0.020~0.035	0.020~0.035
Stainless steel	~250	50~80	0.005~0.015	0.010~0.020	0.010~0.020	0.010~0.030	0.020~0.035	0.020~0.040
	250~350	40~50	-	0.005~0.015	0.010~0.015	0.010~0.020	0.010~0.020	0.010~0.020
Cast iron	~220	80~100	0.010~0.0120	0.020~0.040	0.030~0.050	0.040~0.080	0.080~0.120	0.100~0.150
	220~	40~80	0.005~0.010	0.005~0.015	0.010~0.020	0.015~0.030	0.020~0.050	0.025~0.070
Aluminum alloy	-	180~250	0.010~0.020	0.020~0.040	0.030~0.060	0.040~0.080	0.100~0.180	0.150~0.200
Light alloy	-	120~200	0.005~0.010	0.010~0.020	0.020~0.025	0.020~0.030	0.030~0.040	0.040~0.060

Chucking / Machine Reamer

SCRS

Chucking reamer

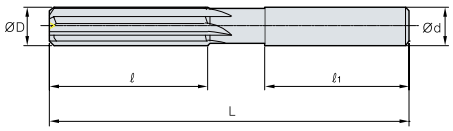


Fig. 1

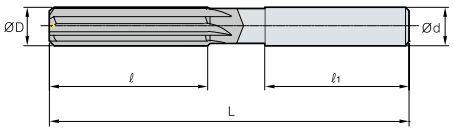


Fig. 2

(mm)

	Designation	No. of flute	ØD	Ød	ℓ	ℓ1	L	Fig.
SCRS	050S	4	5.0	6	20	40	100	1
	060S	4	6.0	6	20	40	115	1
	070S	4	7.0	8	20	40	125	1
	080S	4	8.0	8	20	40	135	1
	090S	4	9.0	10	20	45	140	1
	100B	4	10.0	10	25	50	145	2
	110B	4	11.0	12	25	50	150	2
	120B	4	12.0	12	25	50	160	2
	130B	4	13.0	16	25	50	165	2
	140B	6	14.0	16	25	50	170	2
	150B	6	15.0	16	30	50	180	2
	160B	6	16.0	16	30	50	190	2
	180B	6	18.0	20	30	55	210	2
	200B	6	20.0	20	40	60	230	2

SCRH

Chucking reamer

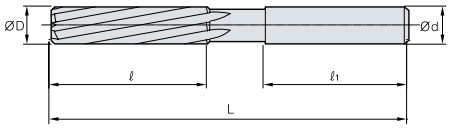


Fig. 1

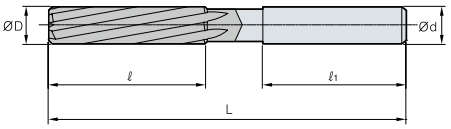


Fig. 2

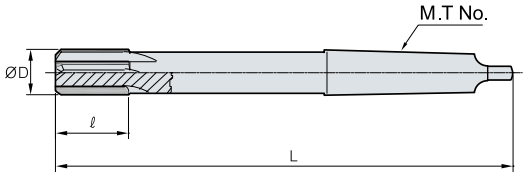
(mm)

	Designation	No. of flute	ØD	Ød	ℓ	ℓ1	L	Fig.
SCRH	050S	4	5.0	6	20	40	100	1
	060S	4	6.0	6	20	40	115	1
	070S	4	7.0	8	20	40	125	1
	080S	4	8.0	8	20	40	135	1
	090S	4	9.0	10	20	45	140	1
	100B	4	10.0	10	25	50	145	2
	110B	4	11.0	12	25	50	150	2
	120B	4	12.0	12	25	50	160	2
	130B	4	13.0	16	25	50	165	2
	140B	6	14.0	16	25	50	170	2
	150B	6	15.0	16	30	50	180	2
	160B	6	16.0	16	30	50	190	2
	180B	6	18.0	20	30	55	210	2
	200B	6	20.0	20	40	60	230	2

Chucking / Machine Reamer

TCRS

Chucking reamer

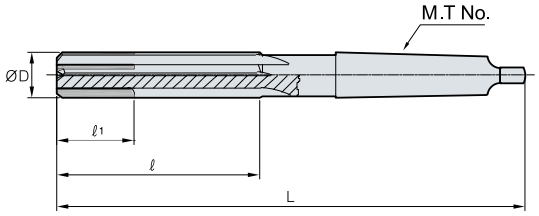


(mm)

	Designation	No. of flute	ØD	ℓ	L	M.T No.
TCRS	070	4	7.0	20	150	1
	080	4	8.0	20	150	1
	090	4	9.0	20	160	1
	100	4	10.0	25	160	1
	110	4	11.0	25	170	1
	120	4	12.0	25	170	1
	130	4	13.0	25	180	1
	140	6	14.0	25	190	1
	150	6	15.0	30	200	2
	160	6	16.0	30	200	2
	180	6	18.0	30	220	2
	200	6	20.0	40	230	2
	250	6	25.0	40	260	3
	280	8	28.0	40	270	3
	300	8	30.0	50	290	3

TMRS

Machine reamer

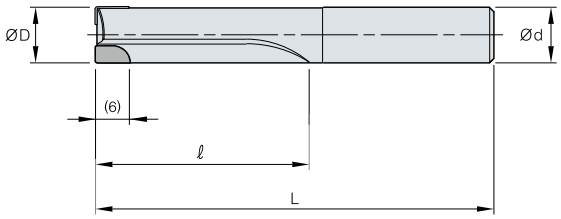


(mm)

	Designation	No. of flute	ØD	ℓ	ℓ1	L	M.T No.
TMRS	070	4	7.0	60	60	150	1
	080	4	8.0	70	70	150	1
	090	4	9.0	70	70	160	1
	100	4	10.0	75	75	170	1
	110	4	11.0	75	75	170	1
	120	4	12.0	80	40	180	1
	130	4	13.0	85	40	190	1
	140	6	14.0	90	45	210	1
	150	6	15.0	90	45	215	2
	160	6	16.0	100	50	220	2
	180	6	18.0	105	50	225	2
	200	6	20.0	120	50	240	2
	250	6	25.0	130	50	270	3
	280	8	28.0	140	50	280	3
	300	8	30.0	150	50	290	3

PCD Reamer

PDR



(mm)

	Designation	No. of flute	ØD	Ød	ℓ	L
PDR	2050	2	5.0	6	30	65
	2060	2	6.0	6	40	75
	2070	2	7.0	8	40	75
	2080	2	8.0	8	40	75
	2090	2	9.0	10	40	85
	2100	2	10.0	10	40	85
	2120	2	12.0	12	50	95
	2140	2	14.0	16	50	95
	2150	2	15.0	16	50	100
	4160	4	16.0	16	50	100
	4180	4	18.0	20	60	110
	4200	4	20.0	20	60	110

Recommended cutting conditions

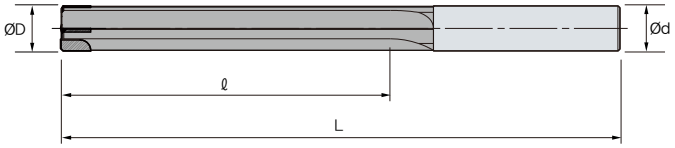
For high speed and high precision machining

Workpiece	vc (m/min)	fn (mm/rev)
Aluminum alloy	50 ~ 250	0.05~0.20

Cermet Reamer

KCR

Standard type

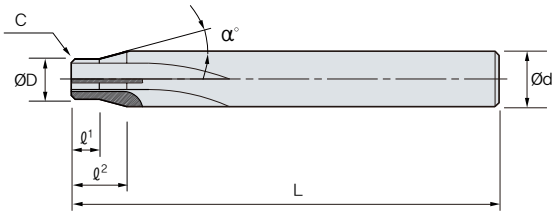


(mm)

	Designation	No. of flute	ØD	Ød	ℓ	L
KCR	060~079-25-70L	2	6.0~7.9	8	25	70
	080~099-035-90L	2	8.0~9.9	10	35	90
	100~119-050-100L	4	10.0~11.9	12	50	100
	120~159-060-110L	4	12.0~15.9	12	60	110
	160~199-060-110L	4	16.0~19.9	16	60	110
	200~259-060-110L	4	20.0~25.9	20	60	110
	260~300-070-130L	4	26.0~30.0	25	70	130

• The length of flute and overhang length of reamer are available for quotation • The maximum overhang length is 150mm

Special type



(mm)

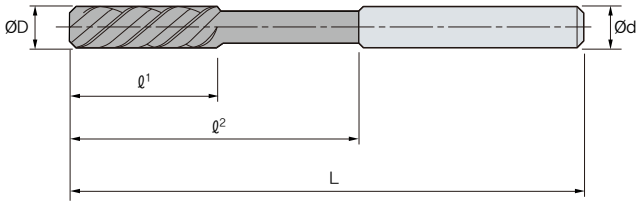
	Designation	No. of flute	ØD	Ød	ℓ1	ℓ2	L	α°
KCR	□□□~□□□-□□□L	2~4	8.0~25.9	12~30	7~18	2~15	70	10°~ 60°

Recommended cutting conditions

Workpiece	Hardness	fz (mm/t)	vc (m/min)
Carbon steel	Under HRC30	0.1~0.4	50~80
High carbon steel, Alloy steel	HRC30 ~ 40	0.1~0.4	80~120
	HRC40 ~ 50	0.1~0.4	50~80
Alloy steel	More than HRC50	0.05~0.2	30~60

Broach Reamer

HBRE

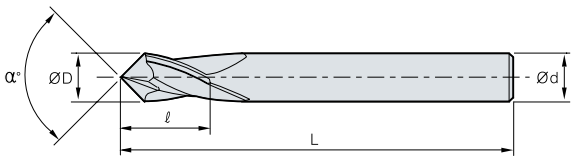


(mm)

Designation		No. of flute	ØD	Ød	ℓ1	ℓ2	L	Type
HBRE	030	3	3.0	3	20	40	70	Solid
	040	3	4.0	4	25	40	70	Solid
	060	4	6.0	6	30	50	80	Solid
	080	4	8.0	8	30	60	100	Solid
	100	4	10.0	10	30	60	100	Solid
	120	4	12.0	12	40	70	120	Top Solid
	160	6	16.0	16	40	80	130	Top Solid
	200	6	20.0	20	50	90	150	Top Solid
	250	6	25.0	25	50	90	150	Top Solid

Chamfer Tool

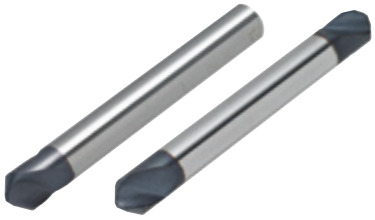
CET



(mm)

Designation		ØD	Ød	ℓ	L	α°
CET060 -	030	3.0	3	5.5	50	60°
	040	4.0	4	7	50	
	060	6.0	6	10	60	
	080	8.0	8	13	70	
	100	10.0	10	16	70	
	120	12.0	12	18	80	
	160	16.0	16	24	100	
CET090 -	030	3.0	3	5.5	50	90°
	040	4.0	4	7	50	
	060	6.0	6	10	60	
	080	8.0	8	13	70	
	100	10.0	10	16	70	
	120	12.0	12	18	80	
	160	16.0	16	24	100	
CET120 -	030	3.0	3	5.5	50	120°
	040	4.0	4	7	50	
	060	6.0	6	10	60	
	080	8.0	8	13	70	
	100	10.0	10	16	70	
	120	12.0	12	18	80	
	160	16.0	16	24	100	

CCT



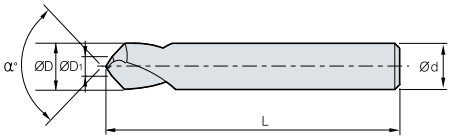


Fig 1

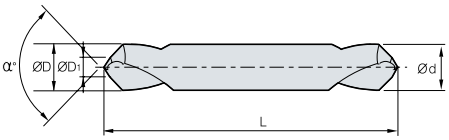


Fig 2

(mm)

Designation		ØD = Ød	ØD1	L	α°	Fig.
CCT060 -	**030**	3.0	1.0	40	60°	1
	040	4.0	1.5	40		
	060	6.0	2.0	50		
	080	8.0	2.5	60		
	100	10.0	3.0	70		
	120	12.0	4.0	80		
	160	16.0	5.0	100		
CCT060T -	**030**	3.0	1.0	40		2
	040	4.0	1.5	40		
	060	6.0	2.0	50		
	080	8.0	2.5	60		
	100	10.0	3.0	70		
	120	12.0	4.0	80		
	160	16.0	5.0	100		
CCT060T -	**030L**	3.0	1.0	100		
	040L	4.0	1.5	100		
	060L	6.0	2.0	100		
	080L	8.0	2.5	120		
	100L	10.0	3.0	120		
	120L	12.0	4.0	150		
CCT090 -	**030**	3.0	1.0	40	90°	1
	040	4.0	1.5	40		
	060	6.0	2.0	50		
	080	8.0	2.5	60		
	100	10.0	3.0	70		
	120	12.0	4.0	80		
	160	16.0	5.0	100		
CCT090T -	**030**	3.0	1.0	40		2
	040	4.0	1.5	40		
	060	6.0	2.0	50		
	080	8.0	2.5	60		
	100	10.0	3.0	70		
	120	12.0	4.0	80		
	160	16.0	5.0	100		
CCT090T -	**030L**	3.0	1.0	100		
	040L	4.0	1.5	100		
	060L	6.0	2.0	100		
	080L	8.0	2.5	120		
	100L	10.0	3.0	120		
	120L	12.0	4.0	150		
CCT120 -	**030**	3.0	1.0	40	120°	1
	040	4.0	1.5	40		
	060	6.0	2.0	50		
	080	8.0	2.5	60		

Chamfer Tool

CCT

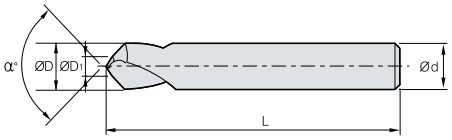


Fig 1

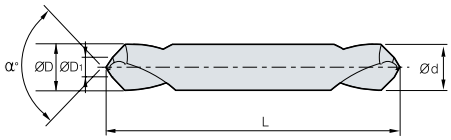
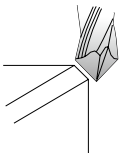
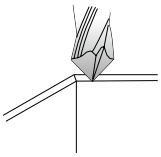
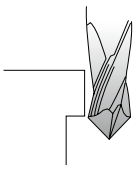
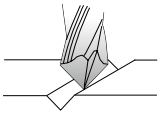
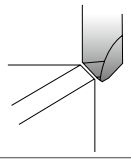
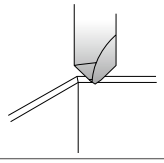
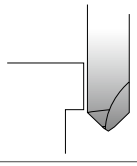
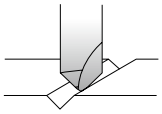


Fig 2

(mm)

Designation		ØD = Ød	ØD1	L	α°	Fig.
CCT120 -	100	10.0	3.0	70	120°	1
	120	12.0	4.0	80		
	160	16.0	5.0	100		
CCT120T -	030	3.0	1.0	40	120°	2
	040	4.0	1.5	40		
	060	6.0	2.0	50		
	080	8.0	2.5	60		
	100	10.0	3.0	70		
	120	12.0	4.0	80		
	160	16.0	5.0	100		
CCT120T -	030L	3.0	1.0	100		
	040L	4.0	1.5	100		
	060L	6.0	2.0	100		
	080L	8.0	2.5	120		
	100L	10.0	3.0	120		
	120L	12.0	4.0	150		

CET/CCT Application example

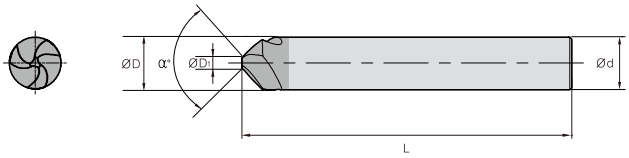
	Centering	Hole Chamfering	Chamfering (External)	Chamfering (Internal)	Side milling	Slot milling
Application (CET)						
60°	×	●	●	● ~ ▲	●	×
90°	▲	●	●	●	●	● ~ ▲
120°	●	●	●	●	●	●
Application (CCT)						
60°	●	●	● ~ ▲	▲ ~ ×	×	×
90°	●	●	● ~ ▲	▲ ~ ×	×	×
120°	●	●	●	●	×	●

Counter Sink

CSPC 3000

3 | Unequal Division /Lead | h6 shank | Substrate PC40T

ØD	Tolerance
All	±0.5



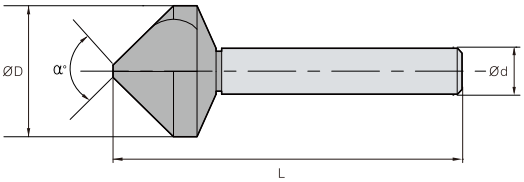
(mm)

	Designation	ØD	Ød	ØD1	L	α°
CSPC	3060-050	6.0	6	1.5	50	90°
	3080-060	8.0	8	2	60	90°
	3100-070	10.0	10	2.5	70	90°
	3120-075	12.0	12	2.8	75	90°
	3160-080	16.0	16	3.2	80	90°
	3200-090	20.0	20	3.5	90	90°

CSNC 3000

3 | Straight Type | h9 shank | Substrate PC20T

ØD	Tolerance
All	±1.0



(mm)

	Designation	ØD	Ød	Range of Dia	L	α°
CSNC	3100-047	10.0	6	2.0~9.0	47	90°
	3150-053	15.0	8	3.0~14.0	53	90°
	3200-057	20.0	10	4.0~19.0	57	90°
	3250-067	25.0	12	5.0~24.0	67	90°
	3300-075	30.0	12	6.0~29.0	75	90°

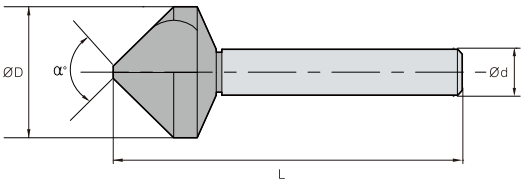
※ Order made available

Counter Sink

CSNC 1000

1 | Straight Type | h9 shank | Substrate PC20T

ØD	Tolerance
All	±1.0



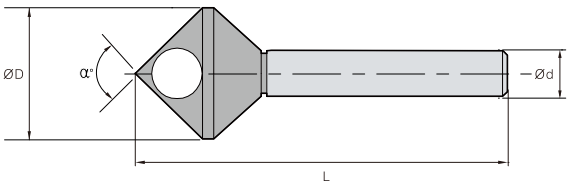
(mm)

	Designation	ØD	Ød	Range of Dia	L	α°
CSNC	1100-048	10.0	6	2.0~9.0	48	90°
	1150-054	15.0	8	2.0~14.0	54	90°
	1200-059	20.0	10	2.0~19.0	59	90°
	1250-069	25.0	12	3.0~24.0	69	90°
	1300-077	30.0	12	4.0~29.0	77	90°

CSHC 1000

1 | Hole Type | h9 shank | Substrate PC20T

ØD	Tolerance
All	±1.0



(mm)

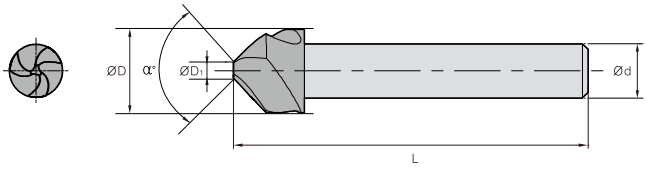
	Designation	ØD	Ød	Range of Dia	L	α°
CSHC	1100-045	10.0	6	4.0~8.0	45	90°
	1150-055	15.0	8	5.0~12.0	55	90°
	1200-070	20.0	10	8.0~15.0	70	90°
	1250-075	25.0	12	10.0~20.0	75	90°
	1300-085	30.0	12	12.0~25.0	85	90°

※ Order made available

CSPH3000

3 | Unequal Division /Lead | h8 shank | Substrate HC40T

ØD	Tolerance
All	±0.5



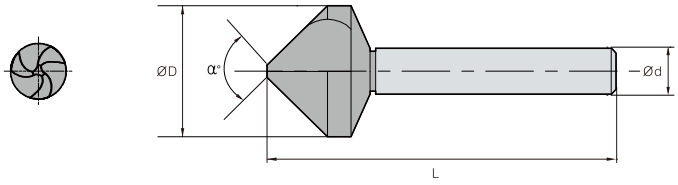
(mm)

	Designation	ØD	Ød	ØD1	L	α°
CSPH	3060-045	6.3	5	1.5	45	90°
	3080-050	8.3	6	2.0	50	90°
	3100-050	10.4	6	2.5	50	90°
	3120-056	12.4	8	2.8	56	90°
	3160-060	16.5	10	3.2	60	90°
	3200-063	20.5	10	3.5	63	90°
	3250-068	25.0	10	3.8	68	90°

CSNH 3000

3 | Straight Type | h9 shank | Substrate HC10T HC20T

ØD	Tolerance
All	±1.0 ±1°



(mm)

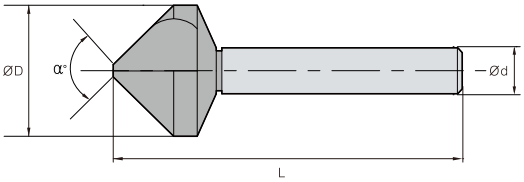
	Designation	ØD	Ød	Range of Dia	L	α°
CSNH	3100-050	10.0	6	3~9	50	90°
	3150-055	15.0	8	3~14	55	90°
	3200-060	20.0	10	4~19	60	90°
	3250-068	25.0	12	5~24	68	90°
	3300-079	30.0	12	6~29	79	90°
	3350-085	35.0	12	7~34	85	90°
	3400-090	40.0	12	8~39	90	90°
	3450-095	45.0	16	9~44	95	90°
	3500-100	50.0	16	12~49	100	90°

Counter Sink

CSNH 1000

1 | Straight Type | h9 shank | Substrate HC10T HC20T

ØD	Tolerance
All	±1.0



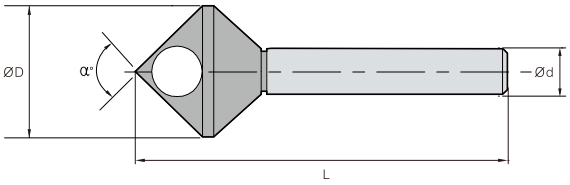
(mm)

	Designation	ØD	Ød	Range of Dia	L	α°
CSNH	1100-070	10.0	6	2~9	50	90°
	1150-075	15.0	8	2~14	55	90°
	1200-090	20.0	10	2~19	60	90°
	1250-080	25.0	12	2~24	70	90°
	1300-090	30.0	12	6~29	75	90°
	1350-080	35.0	12	7~34	80	90°
	1400-085	40.0	12	8~39	85	90°
	1450-087	45.0	12	9~44	87	90°
	1500-090	50.0	12	12~49	90	90°

CSHH 1000

1 | Hole Type | h9 shank | Substrate HC10T HC20T

ØD	Tolerance
All	±1.0



(mm)

	Designation	ØD	Ød	Range of Dia	L	α°
CSHH	1100-070	10.0	6	3~9	50	90°
	1150-075	15.0	8	5~12	60	90°
	1200-090	20.0	10	8~15	65	90°
	1250-080	25.0	12	10~20	74	90°
	1300-090	30.0	12	12~25	85	90°
	1350-095	35.0	16	14~30	95	90°
	1400-105	40.0	16	16~35	105	90°
	1450-120	45.0	16	18~40	120	90°
	1500-130	50.0	16	20~45	130	90°

Counter Sink

Recommended cutting conditions

CSPC

Diameter (Ø)	Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Stainless Steels HRC30~50		Hardened steels HRC45~55		Aluminum alloy	
	R.P.M n (min⁻¹)	Feed (mm/min)	R.P.M n (min⁻¹)	Feed (mm/min)	R.P.M n (min⁻¹)	Feed (mm/min)	R.P.M n (min⁻¹)	Feed (mm/min)	R.P.M n (min⁻¹)	Feed (mm/min)
6.0	3,030	1,550	1,820	600	1,520	500	1,350	240	7,580	3,870
8.0	2,300	1,520	1,370	580	1,150	480	1,015	270	5,750	3,800
10.0	1,840	1,490	1,100	590	920	500	810	270	4,590	3,720
12.0	1,540	1,480	930	610	780	510	690	270	3,850	3,700
16.0	1,150	1,310	690	520	570	460	505	260	2,890	3,470

CSNC/CSHC

1F(Hole) Type

Diameter (Ø)	Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Stainless Steels		Aluminum alloy	
	vc (m/min)	Feed (mm/min)	vc (m/min)	Feed (mm/min)	vc (m/min)	Feed (mm/min)	vc (m/min)	Feed (mm/min)
~ 10.0	42~72	121	28~48	120	15~17	50	50~110	350
10.0 ~ 20.0		110		70		25		230
20.0 ~ 30.0		75		50		20		200

CSNC

3F Type

Diameter (Ø)	Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Stainless Steels		Aluminum alloy	
	vc (m/min)	Feed (mm/min)	vc (m/min)	Feed (mm/min)	vc (m/min)	Feed (mm/min)	vc (m/min)	Feed (mm/min)
~ 10.0	30~60	170	20~40	100	10~12	30	40~100	350
10.0 ~ 20.0		85		60		16		230
20.0 ~ 30.0		60		40		10		200

CSPH

Diameter (Ø)	Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Stainless Steels HRC30~50		Hardened steels HRC45~55		Aluminum alloy	
	R.P.M n (min⁻¹)	Feed (mm/min)	R.P.M n (min⁻¹)	Feed (mm/min)	R.P.M n (min⁻¹)	Feed (mm/min)	R.P.M n (min⁻¹)	Feed (mm/min)	R.P.M n (min⁻¹)	Feed (mm/min)
6.3	1,328	230	1,970	350	905	160	807	140	5,760	1,040
8.3	995	230	1,490	360	690	160	610	140	4,370	1,050
10.4	792	230	1,190	360	550	160	487	130	3,485	940
12.4	665	230	1,000	360	460	150	407	130	2,920	960
16.5	500	230	750	360	345	160	307	140	2,200	990
20.5	402	230	600	360	276	160	247	140	1,770	1,010

Counter Sink

Recommended cutting conditions

CSNH/CSHH

1F(Hole) Type

Diameter (Ø)	Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Stainless Steels		Aluminum alloy	
	vc (m/min)	Feed (mm/min)	vc (m/min)	Feed (mm/min)	vc (m/min)	Feed (mm/min)	vc (m/min)	Feed (mm/min)
~ 10.0	20-30	110	16-20	55	50-60	255	50-100	450
10.0 ~ 20.0		55		35		180		350
20.0 ~ 30.0		35		55		150		300

CSNH

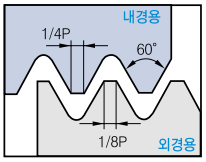
3F Type

Diameter (Ø)	Alloy steels & carbon steels under HRC30		Pre-hardened steels HRC30~45		Stainless Steels		Aluminum alloy		Plastic	
	vc (m/min)	Feed (mm/min)	vc (m/min)	Feed (mm/min)	vc (m/min)	Feed (mm/min)	vc (m/min)	Feed (mm/min)	vc (m/min)	Feed (mm/min)
~ 10.0	10~15	60	8~12	35	4~6	30	50~60	255	35~70	400
10.0 ~ 20.0		30		25		16		180		300
20.0 ~ 30.0		20		15		10		150		250

Thread Mill

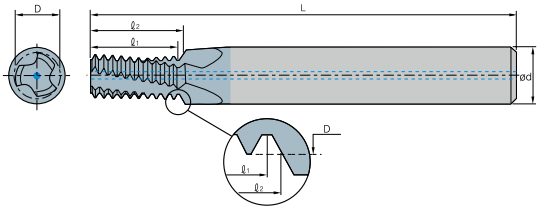
ISO Metric

Helical flutes with thru-hole coolant



Internal

Defined by : R262 (DIN 13)
Tolerance class : 6H



(ℓ2≤ 1.5×Thread Diameter)

Thread		Pitch (mm)	Designation		Dimensions (mm)					No,of flute	Tooth	*Bore dia,
M Coarse	M Fine			Internal	Ød	D	L	ℓ1	ℓ2	z	zt	mm
M3×0.5	M3.5~M16×0.50	0.5	STMHC	04024L04-I0.50ISO	4	2.40	45	4.5	4.7	3	9	2.5
M4×0.7	-	0.7		04031L06-I0.70ISO	4	3.15	45	6.3	6.6	3	9	3.3
M5×0.8	-	0.8		04039L07-I0.80ISO	4	3.90	45	7.2	7.6	3	9	4.2
M6×1.0	M8~M40×1.00	1.0		06048L09-I1.00ISO	6	4.80	57	9.0	9.5	3	9	5.0
M8×1.25	-	1.25		08065L13-I1.25ISO	8	6.50	61	12.5	13.1	3	10	6.8
M10×1.5	M12~M48×1.50	1.5		10082L15-I1.50ISO	10	8.20	73	15.0	15.7	3	10	8.5
M12×1.75	-	1.75		10099L18-I1.75ISO	10	9.90	73	17.5	18.4	4	10	10.2
M14×2.0	M17~M80×2.00	2.0		12116L21-I2.00ISO	12	11.60	73	20.0	21.0	4	10	12.0
M16×2.0	M17~M80×2.00	2.0		14136L25-I2.00ISO	14	13.60	92	24.0	25.0	4	12	14.0

(ℓ2≤ 2×Thread Diameter)

Thread		Pitch (mm)	Designation		Dimensions (mm)					No,of flute	Tooth	*Bore dia,
M Coarse	M Fine			Internal	Ød	D	L	ℓ1	ℓ2	z	zt	mm
M3×0.5	M3.5~M16×0.50	0.5	STMHC	04024L06-I0.50ISO	4	2.40	45	6.0	6.2	3	12	2.5
	M4×0.50	0.5		04032L08-I0.50ISO	4	3.20	45	8.0	8.2	3	16	3.5
	M5×0.50	0.5		06042L10-I0.50ISO	6	4.20	57	10.0	10.2	3	20	4.5
M4×0.7	-	0.7		04031L08-I0.70ISO	4	3.15	45	8.4	8.7	3	12	3.3
	M6×0.75	0.75		06050L12-I0.75ISO	6	5.00	57	12.0	12.4	3	16	5.3
M5×0.8	-	0.8		04039L10-I0.80ISO	4	3.90	45	10.4	10.8	3	13	4.2
M6×1.0	M8~M40×1.00	1.0		06048L12-I1.00ISO	6	4.80	57	12.0	12.5	3	12	5.0
	M8×1.00	1.0		08067L16-I1.00ISO	8	6.70	61	16.0	16.5	3	16	7.0
	M10×1.00	1.0		10087L20-I1.00ISO	10	8.70	73	20.0	20.5	3	20	9.0
	M12×1.00	1.0		12107L24-I1.00ISO	12	10.70	73	24.0	24.5	4	24	11.0
M8×1.25	-	1.25		08065L16-I1.25ISO	8	6.50	61	16.2	16.9	3	13	6.8
	M10×1.25	1.25		10085L20-I1.25ISO	10	8.50	73	20.0	20.6	3	16	8.8
M10×1.5	M12~M48×1.50	1.5		10082L20-I1.50ISO	10	8.20	73	19.5	20.2	3	13	8.5
	M12×1.50	1.5		10099L24-I1.50ISO	10	9.90	73	24.0	24.7	4	16	10.5
	M14×1.50	1.5		12119L29-I1.50ISO	12	11.90	80	28.5	29.2	4	19	12.5
	M16×1.50	1.5		14139L32-I1.50ISO	14	13.90	92	31.5	32.2	4	21	14.5
M12×1.75	-	1.75		10099L25-I1.75ISO	10	9.90	73	24.5	25.4	4	14	10.2
M14×2.0	M17~M80×2.00	2.0		12116L29-I2.00ISO	12	11.60	80	28.0	29.0	4	14	12.0
M16×2.0	M17~M80×2.00	2.0		14136L33-I2.00ISO	14	13.60	92	32.0	33.0	4	16	14.0
M18×2.5	-	2.5		16148L36-I2.50ISO	16	14.80	92	35.0	36.2	4	14	15.5
M 20×2.5	-	2.5		18171L41-I2.50ISO	18	17.10	102	40.0	41.2	4	16	17.5
M 24×3.0	-	3.0		20199L49-I3.00ISO	20	19.90	102	48.0	49.5	4	16	21.0

* Bore Diameter applies to smallest thread Dia

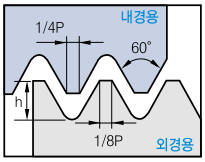
Maximum thread length = $\ell_2 - \frac{\text{Pitch}}{4}$

● : Stock item

Thread Mill

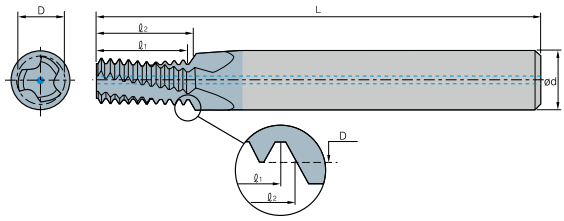
American UN (UNC,UNF,UNEF)

Helical flutes with thru-hole coolant



Internal

Defined by : ANSI B1.1.74
Tolerance class : 2B



(ℓ2≤ 1.5×Thread Diameter)

Thread			Pitch (tpi)	Designation		Dimensions (mm)					No,of flute	Tooth	*Bore dia,
UNC	UNF	UNEF			Internal	Ød	D	L	ℓ1	ℓ2	z	zt	mm
No.10~24	5/16″,3/8″×24	9/16″~11/16″×24	24	STMHC	04035L07-I24UNC	4	3.58	45	7.4	7.9	3	7	3.8
No.10~24	5/16″,3/8″×24	9/16″~11/16″×24	24		06041L08-I24UNC	6	4.15	57	8.5	9.0	3	8	4.5
1/4″×20	7/16″,1/2″×20	3/4″~1″×20	20		06048L09-I20UNC	6	4.88	57	8.9	9.5	3	7	5.2
5/16″×18	9/16″,5/8″×18	11/16″~1 11/16″×18	18		08061L11-I18UNC	8	6.15	61	11.3	12.0	3	8	6.5
3/8″×16	3/4″×16	-	16		08076L15-I16UNC	8	7.65	61	14.3	15.1	3	9	8.0
7/16″×14	7/8″×14	-	14		10090L17-I14UNC	10	9.00	73	16.3	17.2	3	9	9.3
1/2″×13	-	-	13		12104L20-I13UNC	12	10.35	73	19.5	20.5	4	10	10.8
9/16″×12	1″~1 1/2″×12	-	12		12118L22-I12UNC	12	11.80	73	21.2	22.2	4	10	12.3

(ℓ2≤ 2×Thread Diameter)

Thread			Pitch (tpi)	Designation		Dimensions (mm)					No,of flute	Tooth	*Bore dia,
UNC	UNF	UNEF			Internal	Ød	D	L	ℓ1	ℓ2	z	zt	mm
	No.10~32	No. 12~3/8″×32	32	STMHC	04038L09-I32UNF	4	3.80	45	9.5	9.9	3	12	4.0
	-	No. 12~3/8″×32	32		06044L11-I32UNEF	6	4.40	57	11.1	11.5	3	14	4.7
	No.12, 1/4″×28	7/16″; 1/2″×28	28		06043L11-I28UNF	6	4.30	57	10.9	11.3	3	12	4.6
	1/4″×28	7/16″; 1/2″×28	28		06052L13-I28UNF	6	5.15	57	12.7	13.1	3	14	5.5
	-	7/16″; 1/2″×28	28		10099L22-I28UNEF	10	9.90	73	21.8	22.2	3	24	10.2
No.10~24	5/16″, 3/8″×24	9/16″~11/16″×24	24		04035L10-I24UNC	4	3.58	45	9.5	10.0	3	9	3.8
No.12~24	5/16″, 3/8″×24	9/16″~11/16″×24	24		06041L11-I24UNC	6	4.15	57	10.6	11.1	3	10	4.5
	5/16″, 3/8″×24	9/16″~11/16″×24	24		08066L16-I24UNF	8	6.68	61	15.9	16.4	3	15	6.8
	3/8″×24	9/16″~11/16″×24	24		10082L19-I24UNF	10	8.20	73	19.0	19.6	3	18	8.5
	-	9/16″~11/16″×24	24		14129L29-I24UNEF	14	12.90	92	28.6	29.1	4	27	13.2
1/4″×20	7/16″, 1/2″×20	3/4″~1″×20	20		06048L13-I20UNC	6	4.88	57	12.7	13.3	3	10	5.2
	7/16″, 1/2″×20	3/4″~1″×20	20		10096L22-I20UNF	10	9.60	73	21.6	22.2	3	17	9.8
	1/2″×20	3/4″~1″×20	20		12111L26-I20UNF	12	11.10	80	25.4	26.0	3	20	11.5
	-	3/4″~1″×20	20		18174L38-I20UNEF	18	17.40	102	38.1	38.7	4	30	17.8
5/16″×18	9/16″, 5/8″×18	11/16″~1 11/16″×18	18		08061L16-I18UNC	8	6.15	61	15.5	16.2	3	11	6.5
	9/16″, 5/8″×18	11/16″~1 11/16″×18	18		14125L28-I18UNF	14	12.50	92	28.2	28.9	4	20	12.8
	5/8″×18	11/16″~1 11/16″×18	18		16141L31-I18UNF	16	14.10	92	31.0	31.7	4	22	14.5
3/8″×16	3/4″×16	-	16		08076L19-I16UNC	8	7.65	61	19.0	19.8	3	12	8.0
	3/4″×16	-	16		18170L38-I16UNF	18	17.00	102	38.1	38.8	4	24	17.5
7/16″×14	7/8″×14	-	14		10090L22-I14UNC	10	9.00	73	21.8	22.7	3	12	9.3
	7/8″×14	-	14		20199L44-I14UNF	20	19.90	102	43.5	44.4	4	24	20.5
1/2″×13	-	-	13		12104L26-I13UNC	12	10.35	80	25.4	26.4	4	13	10.8
9/16″×12	1″~1 1/2″×12	-	12		12118L28-I12UNC	12	11.80	80	27.5	28.6	4	13	12.3
	1″~1 1/2″×12	-	12		20199L51-I12UNF	20	19.90	102	50.8	51.9	4	24	23.5
5/8″×11	-	-	11		14131L33-I11UNC	14	13.10	92	32.3	33.5	4	14	13.5
3/4″×10	-	-	10		16159L39-I10UNC	16	15.90	92	38.1	39.4	4	15	16.5
7/8″×9	-	-	9		20190L46-I9UNC	20	19.00	102	45.2	46.6	4	16	19.5
1″×8	-	-	8		20199L52-I8UNC	20	19.90	102	50.8	52.4	4	16	22.0

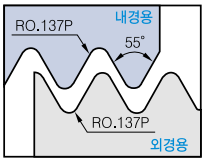
* Bore Diameter applies to smallest thread Dia

Maximum thread length = $\ell_2 - \frac{\text{Pitch}}{4}$

● : Stock item

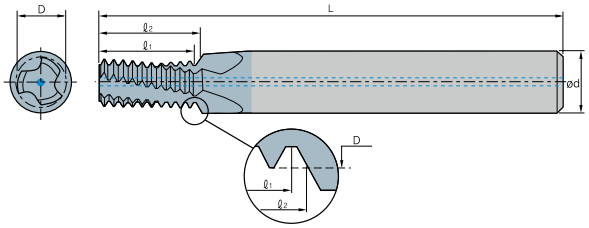
Whitworth (BSW,BSF)

Helical flutes with thru-hole coolant



External / Internal

Defined by : B.S.84 : 1956,
DIN 259, ISO228/1 : 1982
Tolerance class : Medium class A

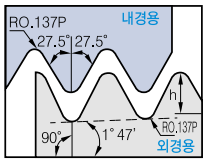


(ℓ2≤2×Thread Diameter)

Thread		Pitch (tpi)	Designation		Dimensions (mm)					No.of flute	Tooth	*Bore dia.
BSW	BSF		External/Internal		Ød	D	L	ℓ1	ℓ2	z	zt	mm
	1/4″×26	26	STMHC	06050L13-EI26BSF	6	5.00	57	12.7	13.2	3	13	5.3
	5/16″×22	22		08063L16-EI22BSF	8	6.35	61	16.2	16.7	3	14	6.7
1/4″×20	3/8″×20	20		06044L13-EI20BSW	6	4.45	57	12.7	13.3	3	10	5.0
	3/8″×20	20		08076L19-EI20BSF	8	7.65	61	19.0	197	3	15	8.2
5/16″×18	7/16″×18	18		06058L16-EI18BSW	6	5.85	57	15.5	16.2	3	11	6.5
	7/16″×18	18		10092L23-EI18BSF	10	9.20	73	22.6	23.3	3	16	9.7
3/8″×16	1/2″, 9/16″×16	16		08072L19-EI16BSW	8	7.20	61	19.0	19.8	3	12	7.9
	1/2″, 9/16″×16	16		12105L26-EI16BSF	12	10.50	80	25.4	26.2	4	16	11.1
	9/16″×16	16		14122L29-EI16BSF	14	12.15	92	28.6	29.4	4	18	12.6
7/16″×14	5/8″, 11/16″×14	14		10085L22-EI14BSW	10	8.50	73	21.8	22.7	3	12	9.2
	5/8″, 11/16″×14	14		14134L31-EI14BSF	14	13.40	92	30.8	31.7	4	17	14.0
	11/16″×14	14		16150L35-EI14BSF	16	15.00	92	34.5	35.4	4	19	15.6
1/2″×12	3/4″×12	12		10096L26-EI12BSW	10	9.65	73	25.4	26.5	3	12	10.5
9/16″×12	3/4″×12	12		12113L28-EI12BSW	12	11.25	80	27.5	28.6	4	13	12.1
	3/4″×12	12		18162L39-EI12BSF	18	16.20	102	38.1	39.2	4	18	16.8
5/8″×11	7/8″×11	11		14126L33-EI11BSW	14	12.60	92	32.3	33.5	4	14	13.4
11/16″×11		11		16142L35-EI11BSW	16	14.20	92	34.6	35.8	4	15	15.0

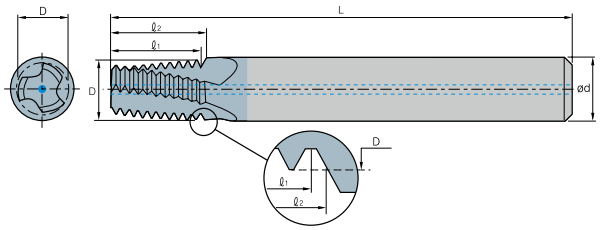
BSPT

Helical flutes with thru-hole coolant



External / Internal

Defined by : B.S.21 : 1985
Tolerance class : Standard BSPT



Thread	Pitch (tpi)	Designation		Dimensions (mm)					No.of flute	Tooth	*Bore dia.
Standard		Internal		Ød	D	L	ℓ1	ℓ2	z	zt	mm
1/16″×28	28	STMHC	06059L10-EI28BSPT	6	5.90	57	10.0	10.2	3	11	6.7
1/8″×28	28		08076L10-EI28BSPT	8	7.65	61	10.0	10.2	3	11	8.7
1/4″×19	19		10099L15-EI19BSPT	10	9.90	73	14.7	15.4	3	11	11.8
3/8″×19	19		12111L15-EI19BSPT	12	11.15	73	14.7	15.4	4	11	15.2
1/2″, 3/4″×14	14		16142L22-EI14BSPT	16	14.25	92	21.8	22.7	4	12	19.0
1″, 1 1/2″, 2″, 2 1/2″×11	11		20196L28-EI11BSPT	20	19.60	102	27.7	28.9	4	12	30.7

* Bore Diameter applies to smallest thread Dia

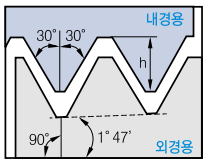
Maximum thread length = $\ell_2 - \frac{\text{Pitch}}{4}$

● : Stock item

Thread Mill

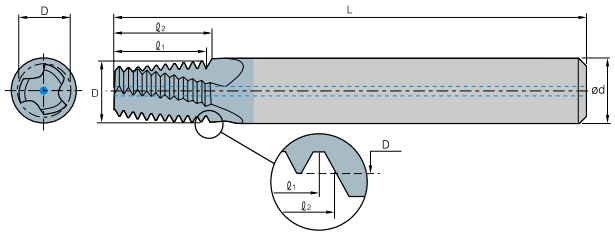
NPT

Helical flutes with thru-hole coolant



External / Internal

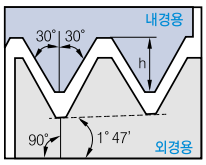
Defined by : USAS B2.1 : 1968
Tolerance class : Standard NPT



Thread Standard	Pitch (tpi)	Designation	Internal	Dimensions (mm) Ød	D	L	ℓ1	ℓ2	No.of flute z	Tooth zt	*Bore dia. mm
1/16″×27	27	STMHC	06059L09-EI27NPT	6	5.90	57	9.4	9.9	3	10	6.3
1/8″×27	27		08076L09-EI27NPT	8	7.65	61	9.4	9.9	3	10	8.5
1/4″×18	18		10099L14-EI18NPT	10	9.90	73	14.1	14.8	3	10	11.1
3/8″×18	18		12111L14-EI18NPT	12	11.15	73	14.1	14.8	4	10	14.5
1/2″, 3/4″×14	14		16142L19-EI14NPT	16	14.25	92	18.1	19.0	4	10	17.7, 23.0
1″, 1 1/14, 1 1/2″, 2″×11.5	11.5		20196L23-EI11.5NPT	20	19.60	102	22.1	23.2	4	10	29.0, 37.7, 44.0, 56.0
2 1/2″×8 ; 3″×8	8		20196L33-EI8NPT	20	19.60	102	31.7	33.3	4	10	66.5, 82.1

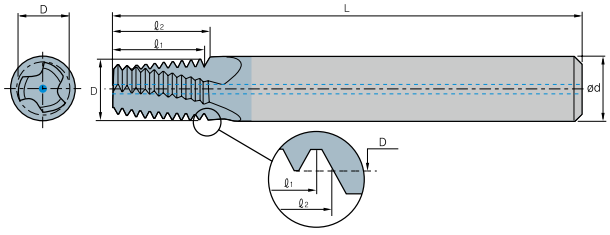
NPTF

Helical flutes with thru-hole coolant



External / Internal

Defined by : ANSI 1.20.3-1976
Tolerance class : Standard NPTF



Thread Standard	Pitch (tpi)	Designation	Internal	Dimensions (mm) Ød	D	L	ℓ1	ℓ2	No.of flute z	Tooth zt	*Bore dia. mm
1/16″×27	27	STMHC	06059L09-EI27NPTF	6	5.90	57	9.4	9.9	3	10	6.3
1/8″×27	27		08076L09-EI27NPTF	8	7.65	61	9.4	9.9	3	10	8.5
1/4″×18	18		10099L14-EI18NPTF	10	9.90	73	14.1	14.8	3	10	11.1
3/8″×18	18		12111L14-EI18NPTF	12	11.15	73	14.1	14.8	4	10	14.5
1/2″, 3/4″×14	14		16142L19-EI14NPTF	16	14.25	92	18.1	19.0	4	10	17.7, 23.4
1″, 1 1/14, 1 1/2″, 2″×11.5	11.5		20196L23-EI11.5NPTF	20	19.60	102	22.1	23.2	4	10	29.0, 37.7, 43.7, 55.6
2 1/2″×8 ; 3″×8	8		20196L33-EI8NPTF	20	19.60	102	31.7	33.3	4	10	66.3, 82.1

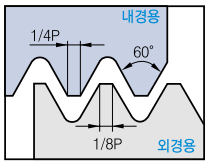
* Bore Diameter applies to smallest thread Dia

Maximum thread length = $\ell_2 - \frac{\text{Pitch}}{4}$

● : Stock item

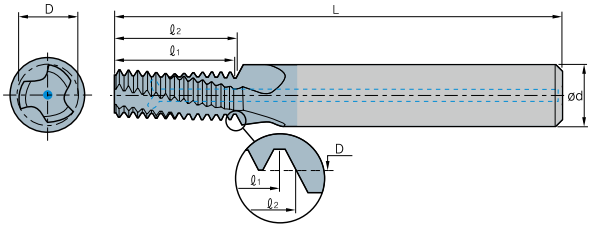
ISO Metric

Helical flutes with radial cooling



Internal

Defined by : R262 (DIN 13)
Tolerance class : 6H

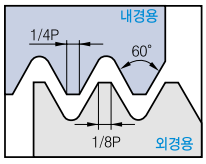


(ℓ2≤2×Thread Diameter)

Thread		Pitch (tpi)	Designation		Dimensions (mm)					No.of flute	Tooth	*Bore dia.
M Coarse	M Fine			Internal	Ød	D	L	ℓ1	ℓ2	z	zt	mm
M6×1.00	M8~M40×1.0	1.0	STMHCR	06048L12-I1.00ISO	6	4.8	57	12.0	12.5	3	12	5.0
	M10×1.0	1.0		10087L20-I1.00ISO	10	8.7	73	20.0	20.5	3	20	9.0
	M12×1.0	1.0		12107L24-I1.00ISO	12	10.7	73	24.0	24.5	4	24	11.0
M8×1.25		1.25		08065L16-I1.25ISO	8	6.5	64	16.3	16.9	3	13	6.8
M10×1.50	M12~M48×1.5	1.5		10082L20-I1.50ISO	10	8.2	73	19.5	20.3	3	13	8.5
	M12×1.5	1.5		10099L24-I1.50ISO	10	9.9	73	24.0	24.8	4	16	10.5
	M14×1.5	1.5		12119L29-I1.50ISO	12	11.9	84	28.5	29.3	4	19	12.5
	M16×1.5	1.5		14139L32-I1.50ISO	14	13.9	84	31.5	32.3	4	21	14.5
M12×1.75		1.75		10099L25-I1.75ISO	10	9.9	73	24.5	25.4	4	14	10.2

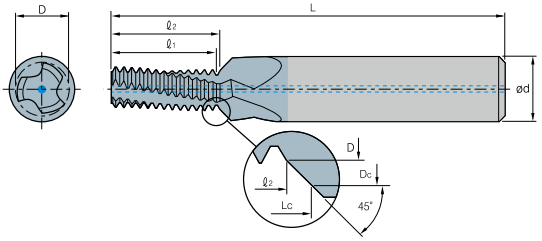
ISO Metric

Helical flutes with thru-hole coolant -thru & Chamfer



Internal

Defined by : R262 (DIN 13)
Tolerance class : 6H



(ℓ2≤2×Thread Diameter)

Thread		Pitch (tpi)	Designation		Dimensions (mm)							No.of flute	Tooth	*Bore dia.
M Coarse	M Fine			Internal	Ød	D	L	ℓ1	ℓ2	z	zt	mm	zt	mm
M6×1.00	M8~M40×1.0	1.0	STMHCC	08048L12-I1.00ISO	8	4.8	6.3	61	12.0	12.5	13.3	3	12	5.0
	M10×1.0	1.0		12087L20-I1.00ISO	12	8.7	10.3	73	20.0	20.5	21.3	3	20	9.0
	M12×1.0	1.0		14107L24-I1.00ISO	14	10.7	12.3	80	24.0	24.5	25.3	4	24	11.0
M8×1.25		1.25		10065L16-I1.25ISO	10	6.5	8.3	73	16.3	16.9	17.8	3	13	6.8
M10×1.5	M12~M48×1.5	1.5		12082L20-I1.50ISO	12	8.2	10.3	80	19.5	20.3	21.3	3	13	8.5
	M12×1.5	1.5		14099L24-I1.50ISO	14	9.9	12.3	80	24.0	24.8	26.0	4	16	10.5
	M14×1.5	1.5		16119L29-I1.50ISO	16	11.9	14.3	92	28.5	29.3	30.5	4	19	12.5
	M16×1.5	1.5		18139L32-I1.50ISO	18	13.9	16.3	92	31.5	32.3	33.5	4	21	14.5
M12×1.75		1.75		14099L25-I1.75ISO	14	9.9	12.3	80	24.5	25.4	26.6	4	14	10.2

* Bore Diameter applies to smallest thread Dia

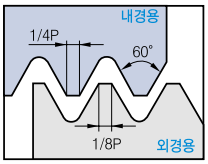
Maximum thread length = $\ell_2 - \frac{\text{Pitch}}{4}$

● : Stock item

Thread Mill

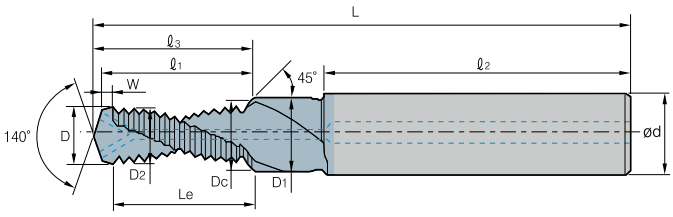
ISO Metric

Drill, Chamfer & Thread with thru-hole coolant



Internal

Defined by : R262 (DIN 13)
Tolerance class : 6H



Thread	Pitch	Designation		Dimensions (mm)											No.of flute	Tooth
ISO 2D M Coarse	(mm)		Internal	L	ℓ3	ℓ1	ℓ2	W	Le	D	Ød	D1	Dc	D2	z	zt
M6×1.00	1.0	STMHCD-	IM6×1.00ISO-2D	62.0	14.5	13.7	36	1.0	12.7	5.0	8	6.6	6.3	4.85	2	11
M8×1.25	1.25		IM8×1.25ISO-2D	74.0	18.2	17.1	40	1.3	15.8	6.8	10	9.0	8.3	6.45	2	11
M10×1.50	1.5		IM10×1.50ISO-2D	79.0	23.4	22.1	45	1.5	20.6	8.5	12	11.0	10.3	8.08	2	12
M12×1.75	1.75		IM12×1.75ISO-2D	89.0	27.1	25.5	45	1.5	24.0	10.3	14	13.5	12.3	9.74	2	12

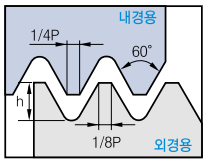
Thread	Pitch	Designation		Dimensions (mm)											No.of flute	Tooth
ISO 2.5D M Coarse	(mm)		Internal	L	ℓ3	ℓ1	ℓ2	W	Le	D	Ød	D1	Dc	D2	z	zt
M6×1.00	1.0	STMHCD-	IM6×1.00ISO-2.5D	62.0	16.5	15.7	36	1.0	14.7	5.0	8	6.6	6.3	4.85	2	13
M8×1.25	1.25		IM8×1.25ISO-2.5D	74.0	23.2	22.1	40	1.3	20.8	6.8	10	9.0	8.3	6.45	2	15
M10×1.50	1.5		IM10×1.50ISO-2.5D	79.0	27.9	26.6	45	1.5	25.1	8.5	12	11.0	10.3	8.08	2	15

Maximum thread length = $\ell_2 - \frac{\text{Pitch}}{4}$

● : Stock item

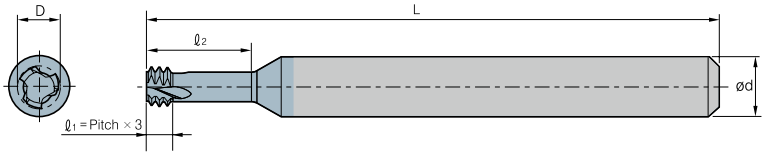
ISO Metric

Deep threading



Internal

Defined by : R262 (DIN 13)
Tolerance class : 6H



(ℓ2≤ 2×Thread Diameter)

Thread		Pitch (mm)	Designation		Dimensions (mm)				No.of flute	Tooth	*Bore dia.
M Coarse	M Fine			Internal	Ød	D	L	ℓ2	z	zt	mm
M1.6×0.35		0.35	STMD3T	03012L034-I0.35ISO	3	1.20	30	3.4	3	3	1.25
M2×0.40		0.4		06015L042-I0.40ISO	6	1.55	57	4.2	3	3	1.6
M2.2×0.45		0.45		06016L046-I0.45ISO	6	1.65	57	4.6	3	3	1.75
M2.5×0.45		0.45		06019L052-I0.45ISO	6	1.95	57	5.2	3	3	2.05
M3×0.50	M3.5~M16×0.5	0.5		06024L062-I0.50ISO	6	2.40	57	6.2	3	3	2.5
M3.5×0.60		0.6		06027L073-I0.60ISO	6	2.75	57	7.3	3	3	2.9
M4×0.70		0.7		06031L083-I0.70ISO	6	3.15	57	8.3	3	3	3.3
M5×0.80		0.8		06040L104-I0.80ISO	6	4.05	57	10.4	3	3	4.2
M6×1.00	M8~M40×1.0	1.0		06048L125-I1.00ISO	6	4.80	57	12.5	3	3	5.0
M8×1.25		1.25		08065L166-I1.25ISO	8	6.50	63	16.6	3	3	6.8
M10×1.50	M12~M48×1.50	1.5		10082L208-I1.50ISO	10	8.20	73	20.8	3	3	8.5
M12×1.75		1.75		10099L250-I1.75ISO	10	9.90	73	25.0	3	3	10.3

3d (ℓ2≤ 3×Thread Diameter)

Thread		Pitch (mm)	Designation		Dimensions (mm)				No.of flute	Tooth	*Bore dia.
M Coarse	M Fine			Internal	Ød	D	L	ℓ2	z	zt	mm
M1.6×0.35		0.35	STMD3T	03012L050-I0.35ISO	3	1.20	30	5.0	3	3	1.25
M2×0.40		0.4		06015L062-I0.40ISO	6	1.55	57	6.2	3	3	1.6
M2.5×0.45		0.45		06019L077-I0.45ISO	6	1.95	57	7.0	3	3	2.05
M3×0.50	M3.5~M16×0.5	0.5		06024L092-I0.50ISO	6	2.40	57	9.2	3	3	2.5
M4×0.70		0.7		06031L123-I0.70ISO	6	3.15	57	12.3	3	3	3.3
M5×0.80		0.8		06040L154-I0.80ISO	6	4.05	57	15.4	3	3	4.2
M6×1.00	M8~M40×1.0	1.0		06048L185-I1.00ISO	6	4.80	57	18.5	3	3	5.0
M8×1.25		1.25		08065L246-I1.25ISO	8	6.50	63	24.6	3	3	6.8

* Bore Diameter applies to smallest thread Dia

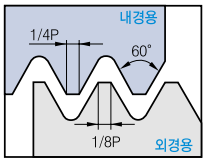
Maximum thread length = $\ell_2 - \frac{\text{Pitch}}{4}$

● : Stock item

Thread Mill

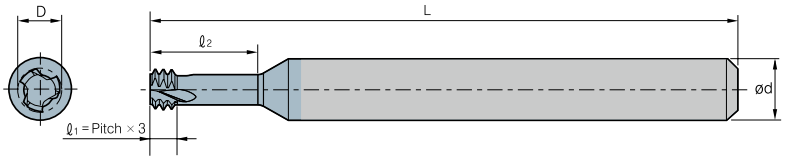
American UN

Deep threading



Internal

Defined by : ANSI B1.1.74
Tolerance class : 2B



(ℓ2≤ 2×Thread Diameter)

Thread		Pitch (tpi)	Designation		Dimensions (mm)				No.of flute	Tooth	*Bore dia.
UNC	UNF			Internal	Ød	D	L	ℓ²	z	zt	mm
	No.1~72	72	STMD3T	06014L039-I72UN	6	1.45	57	3.9	3	3	1.6
No.1~64	No.2~64	64		06014L042-I64UN	6	1.40	57	4.2	3	3	1.5
No.2~56	No.3~56	56		06016L050-I56UN	6	1.65	57	5.0	3	3	1.8
No.3~48	No.4~48	48		06019L060-I48UN	6	1.90	57	6.0	3	3	2.1
No.4, No.5~40	No.6~40	40		06021L060-I40UN	6	2.10	57	6.0	3	3	2.3
No.5~40	No.6~40	40		06024L072-I40UN	6	2.45	57	7.2	3	3	2.6
	No.8~36	36		06033L087-I36UN	6	3.30	57	8.7	3	3	3.5
No.6, No.8~32	No.10~32	32		06025L074-I32UN	6	2.55	57	7.4	3	3	2.8
No.8~32	No.10~32	32		06032L100-I32UN	6	3.20	57	10.0	3	3	3.5
	1/4″×28	28		06052L132-I28UN	6	5.25	57	13.2	3	3	5.5
No.10~24	5/16″×24	24		06035L102-I24UN	6	3.58	57	10.2	3	3	3.9
	5/16″×24	24		08066L165-I24UN	8	6.68	63	16.5	3	3	6.9
1/4″×20	7/16″×20	20		06048L134-I20UN	6	4.88	57	13.4	3	3	5.2
	7/16″×20	20		10095L230-I20UN	10	9.55	73	23.0	3	3	9.9
3/8″×16		16		08067L191-I16UN	8	6.70	63	19.1	3	3	8.0
7/16″×14		14		10090L233-I14UN	10	9.00	73	23.3	3	3	9.4

(ℓ2≤ 3×Thread Diameter)

Thread		Pitch (tpi)	Designation		Dimensions (mm)				No.of flute	Tooth	*Bore dia.
UNC	UNF			Internal	Ød	D	L	ℓ²	z	zt	mm
	No.1~72	72	STMD3T	06014L057-I72UN	6	1.45	57	5.75	3	3	1.6
No.4, No.5~40	No.6~40	40		06021L090-I40UN	6	2.10	57	9.0	3	3	2.3
No.5~40	No.6~40	40		06024L100-I40UN	6	2.45	57	10.0	3	3	2.6
No.6, No.8~32	No.10~32	32		06025L110-I32UN	6	2.55	57	11.0	3	3	2.8
No.8~32	No.10~32	32		06032L130-I32UN	6	3.20	57	13.0	3	3	3.4
	1/4″ 28	28		06052L196-I28UN	6	5.25	57	19.6	3	3	5.5
	5/16″×24	24		08066L245-I24UN	8	6.68	63	24.5	3	3	6.9
1/4″×20	7/16″×20	20		06048L198-I20UN	6	4.88	57	19.8	3	3	5.1

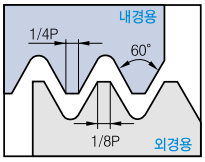
* Bore Diameter applies to smallest thread Dia

Maximum thread length = $\ell_2 - \frac{\text{Pitch}}{4}$

● : Stock item

ISO Metric

Deep threading for hard materials(~HRC62)



Internal

Defined by : R262 (DIN 13)
Tolerance class : 6H

(ℓ2≤2×Thread Diameter)

Thread		Pitch (mm)	Designation		Dimensions (mm)				No.of flute	Tooth	*Bore dia.
M Coarse	M Fine			Internal	Ød	D	L	ℓ2	z	zt	mm
M2×0.4		0.4	STMD2L	06015L042-I0.4ISO	6	1.55	76	4.60	4	2	1.6
M2.2×0.45		0.45		06016L046-I0.45ISO	6	1.65	76	5.05	4	2	1.8
M2.5×0.45		0.45		06019L052-I0.45ISO	6	1.95	76	5.65	4	2	2.05
M3×0.5	M3.5~M16×0.50	0.5		06024L062-I0.5ISO	6	2.40	76	6.75	4	2	2.55
M3.5×0.6		0.6		06027L073-I0.6ISO	6	2.75	76	7.90	4	2	2.95
M4×0.7		0.7		06031L083-I0.7ISO	6	3.15	76	9.05	4	2	3.35
M5×0.8		0.8		06040L104-I0.8ISO	6	4.05	76	11.20	4	2	4.3
M6×1.0	M8~M40×1.00	1.0		06048L125-I1.0ISO	6	4.80	76	13.50	4	2	5.1
M8×1.25		1.25		08065L166-I1.25ISO	8	6.50	80	17.85	4	2	6.8
M10×1.5	M12~M48×1.50	1.5		08079L208-I1.50ISO	8	7.90	80	22.30	4	2	8.6
M12×1.75		1.75		10099L250-I1.75ISO	10	9.90	101	26.75	4	2	10.4

(ℓ2≤3×Thread Diameter)

Thread		Pitch (mm)	Designation		Dimensions (mm)				No.of flute	Tooth	*Bore dia.
M Coarse	M Fine			Internal	Ød	D	L	ℓ2	z	zt	mm
M2×0.4		0.4	STMD2L	06015L062-I0.4ISO	6	1.55	76	6.60	4	2	1.6
M2.2×0.45		0.45		06019L077-I0.45ISO	6	1.95	76	8.15	4	2	2.05
M3×0.5	M3.5~M16×0.50	0.5		06024L092-I0.5ISO	6	2.40	76	9.75	4	2	2.55
M4×0.7		0.7		06031L123-I0.7ISO	6	3.15	76	13.05	4	2	3.35
M5×0.8		0.8		06040L154-I0.8ISO	6	4.05	76	16.20	4	2	4.3
M6×1.0	M8~M40×1.00	1.0		06048L185-I1.0ISO	6	4.80	76	19.50	4	2	5.1
M8×1.25		1.25		08065L246-I1.25ISO	8	6.50	80	25.85	4	2	6.8

* Bore Diameter applies to smallest thread Dia

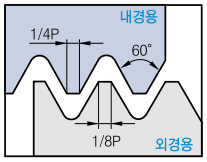
Maximum thread length = $\ell_2 - \frac{\text{Pitch}}{4}$

● : Stock item

Thread Mill

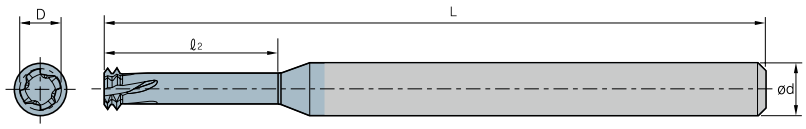
American UN

Deep threading for hard materials(~HRC62)



Internal

Defined by : ANSI B1.1.74
Tolerance class : 2B



(ℓ2≤2×Thread Diameter)

Thread		Pitch (tpi)	Designation		Dimensions (mm)				No.of flute	Tooth	*Bore dia.
UNC	UNF			Internal	Ød	D	L	ℓ2	z	zt	mm
No.2~56	No.3~56	56	STMD2L	06016L050-I56UN	6	1.65	76	5.45	4	2	1.80
No.3~48	No.4~48	48		06019L060-I48UN	6	1.90	76	6.53	4	2	2.10
No.4~40 ; No.5-40	No.6~40	40		06021L060-I40UN	6	2.10	76	6.64	4	2	2.35
No.5~40	No.6~40	40		06024L072-I40UN	6	2.45	76	7.84	4	2	2.65
	No.8~36	36		06033L087-I36UN	6	3.30	76	9.41	4	2	3.55
No.6~32 ; No.8~32	No.10~32	32		06025L074-I32UN	6	2.55	76	8.20	4	2	2.85
No.8~32	No.10~32	32		06032L100-I32UN	6	3.20	76	10.79	4	2	3.50
	1/4″×28	28		06052L132-I28UN	6	5.25	76	14.11	4	2	5.55
No.10~24	5/16″×24	24		06035L102-I24UN	6	3.58	76	11.26	4	2	3.90
	5/16″×24	24		08066L165-I24UN	8	6.68	76	17.56	4	2	7.00
1/4″×20	7/16″×20	20		06048L134-I20UN	6	4.88	76	14.67	4	2	5.20
	7/16″×20	20		10095L230-I20UN	10	9.55	101	24.27	4	2	9.90
3/8″×16		16		08076L197-I16UN	8	7.65	80	21.29	4	2	8.00
7/16″×14		14		10090L233-I14UN	10	9.00	101	25.11	4	2	9.50
1/2″×13		13		10099L256-I13UN	10	9.90	101	27.55	4	2	10.90

(ℓ2≤3×Thread Diameter)

Thread		Pitch (tpi)	Designation		Dimensions (mm)				No.of flute	Tooth	*Bore dia.
UNC	UNF			Internal	Ød	D	L	ℓ2	z	zt	mm
No.4~40, No.5~40	No.6~40	40	STMD2L	06021L090-I40UN	6	2.10	76	9.64	4	2	2.35
No.5~40	No.6~40	40		06024L100-I40UN	6	2.45	76	10.64	4	2	2.65
No.6~32, No.8~32	No.10~32	32		06025L110-I32UN	6	2.55	76	11.79	4	2	2.85
No.8~32	No.10~32	32		06032L130-I32UN	6	3.20	76	13.79	4	2	3.50
	1/4″×28	28		06052L196-I28UN	6	5.25	76	20.51	4	2	5.55
	5/16″×24	24		08066L245-I24UN	8	6.68	80	25.56	4	2	7.00
1/4″~20	7/16″×20	20		06048L198-I20UN	6	4.88	76	21.07	4	2	5.20
7/16″×14		14		10090L335-I14UN	10	9.00	101	35.31	4	2	9.50

* Bore Diameter applies to smallest thread Dia

Maximum thread length = $\ell_2 - \frac{\text{Pitch}}{4}$

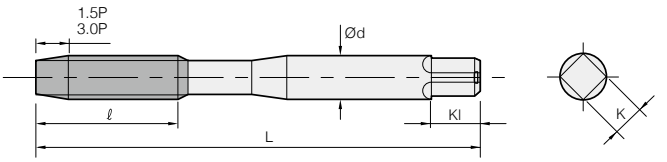
● : Stock item

TAP

ST

Straight tap

3 | 4 | H·A 0° | Carbide | Uncoated FN30T | TiCN PC10T | TiN PC20T



(mm)

Flutes	Designation 1.5P	Designation 3P	Thread size	L	ℓ	d	K	Kl	Limits
3	M3X0.5-ST15	M3X0.5-ST30	M3X0.50	46	11	4.0	3.2	6	KH3
	M4X0.7-ST15	M4X0.7-ST30	M4X0.70	52	13	5.0	4.0	7	KH3
	M5X0.8-ST15	M5X0.8-ST30	M5X0.80	60	16	5.5	4.5	7	KH3
	M6X1.0-ST15	M6X1.0-ST30	M6X1.00	62	19	6.0	4.5	7	KH3
4	M8X1.0-ST15	M8X1.0-ST30	M8X1.00	70	22	6.2	5.0	8	KH3
	M8X1.25-ST15	M8X1.25-ST30	M8X1.25	70	22	6.2	5.0	8	KH4
	M10X1.0-ST15	M10X1.0-ST30	M10X1.00	75	24	7.0	5.5	8	KH3
	M10X1.25-ST15	M10X1.25-ST30	M10X1.25	75	24	7.0	5.5	8	KH4
	M10X1.5-ST15	M10X1.5-ST30	M10X1.50	75	24	7.0	5.5	8	KH4
	M12X1.0-ST15	M12X1.0-ST30	M12X1.00	82	29	8.5	6.5	9	KH3
	M12X1.25-ST15	M12X1.25-ST30	M12X1.25	82	29	8.5	6.5	9	KH4
	M12X1.5-ST15	M12X1.5-ST30	M12X1.50	82	29	8.5	6.5	9	KH4
	M12X1.75-ST15	M12X1.75-ST30	M12X1.75	82	29	8.5	6.5	9	KH5

※ Ideal for mass tapping operations of general cast iron, ductile cast iron, brass-cast, thermosetting plastics, etc

※ Wear resistance highly improved by the use of TiCN, TiN coating for high efficiency tapping operations

Applicable workpiece range

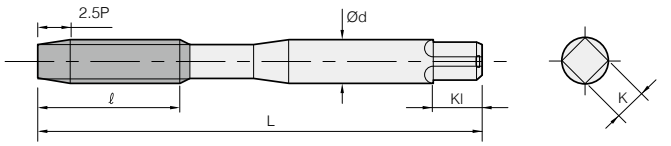
Division	Carbon steel			Alloy steel	Quenched and tempered steel			Stain-less steel	Tool steel	Cast steel	Cast iron	Ductile cast iron	Copper	Brass	Brass-cast	Bronze	Rolled aluminum	Aluminum-cast, alloyed	Magnesium-cast, alloyed	Zinc-cast, alloyed	Titanium alloy		Thermo-setting plastics	Thermo-plastics
	C ~0.25%	C0.25% ~0.45%	C 0.45%~	SCM	25~45 HRC	45~55 HRC	50~60 HRC	SUS	SKD	SC	GC	GCD	Cu	Bs	BsC	PB	Al	AC ADC	MC	ZDC	Ti	Ni	-	-
FN30T											◎	○		○	○	◎		○	○	○			◎	
PC10T											◎	○		○	○	◎		○	○	○			◎	
PC20T											◎	○		○	○	◎		○	○	○			◎	

TAP

SP

Spiral tap

3 | H·A 15° | Carbide | Uncoated FN30T | TiCN PC10T



(mm)

Flutes	Designation 2.5P	Thread size	L	ℓ	d	K	Kl	Limits
3	**M3X0.5-SP25**	M3X0.50	46	11	4.0	3.2	6	KH3
	M4X0.7-SP25	M4X0.70	52	13	5.0	4.0	7	KH3
	M5X0.8-SP25	M5X0.80	60	16	5.5	4.5	7	KH3
	M6X1.0-SP25	M6X1.00	62	19	6.0	4.5	7	KH3
	M8X1.0-SP25	M8X1.00	70	22	6.2	5.0	8	KH3
	M8X1.25-SP25	M8X1.25	70	22	6.2	5.0	8	KH4
	M10X1.0-SP25	M10X1.00	75	24	7.0	5.5	8	KH3
	M10X1.25-SP25	M10X1.25	75	24	7.0	5.5	8	KH4
	M10X1.5-SP25	M10X1.50	75	24	7.0	5.5	8	KH4
	M12X1.0-SP25	M12X1.00	82	29	8.5	6.5	9	KH3
	M12X1.25-SP25	M12X1.25	82	29	8.5	6.5	9	KH4
	M12X1.5-SP25	M12X1.50	82	29	8.5	6.5	9	KH4
	M12X1.75-SP25	M12X1.75	82	29	8.5	6.5	9	KH5

※ Ideal for making blind holes in quantity on general cast iron, ductile cast iron, brass-cast, thermosetting plastics, etc

※ Wear resistance highly improved by the use of TiCN coating for high efficiency tapping operations

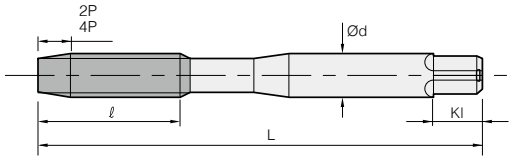
Applicable workpiece range

Division	Carbon steel			Alloy steel	Quenched and tempered steel			Stain-less steel	Tool steel	Cast steel	Cast iron	Ductile cast iron	Copper	Brass	Brass-cast	Bronze	Rolled aluminum	Aluminum-cast, alloyed	Magnesium-cast, alloyed	Zinc-cast, alloyed	Titanium alloy		Thermo-setting plastics	Thermo-plastics
	C ~0.25%	C0.25% ~0.45%	C 0.45%~	SCM	25~45 HRC	45~55 HRC	50~60 HRC	SUS	SKD	SC	GC	GCD	Cu	Bs	BsC	PB	Al	AC ADC	MC	ZDC	Ti	Ni	-	-
FN30T											○	◎	◎	◎	◎	○	○	○	○	○				◎
PC10T											○	◎	◎	◎	◎	○	○	◎	◎	◎			○	◎

RT

Roll tap

Carbide | Uncoated FN30T | TiCN PC10T



(mm)

Flutes	Designation		Thread size	L	ℓ	d	K	Kl	Limits
	2P	4P							
1	**M3X0.5-RT20(S)**	-	M3X0.50	46	11	4.0	3.2	6	GH5
4	**M3X0.5-RT20(M)**	**M3X0.5-RT40(M)**	M3X0.50	46	11	4.0	3.2	6	GH5
1	**M4X0.7-RT20(S)**	-	M4X0.70	52	13	5.0	4.0	7	GH6
4	**M4X0.7-RT20(M)**	**M4X0.7-RT40(M)**	M4X0.70	52	13	5.0	4.0	7	GH6
1	**M5X0.8-RT20(S)**	-	M5X0.80	60	16	5.5	4.5	7	GH6
4	**M5X0.8-RT20(M)**	**M5X0.8-RT40(M)**	M5X0.80	60	16	5.5	4.5	7	GH6
1	**M6X1.0-RT20(S)**	-	M6X1.00	62	19	6.0	4.5	7	GH7
4	**M6X1.0-RT20(M)**	**M6X1.0-RT40(M)**	M6X1.00	62	19	6.0	4.5	7	GH7
1	**M8X1.25-RT20(S)**	-	M8X1.25	70	22	6.2	5.0	8	GH7
4	**M8X1.25-RT20(M)**	**M8X1.25-RT40(M)**	M8X1.25	70	22	6.2	5.0	8	GH7
1	**M10X1.25-RT20(S)**	-	M10X1.25	75	24	7.0	5.5	8	GH7
4	**M10X1.25-RT20(M)**	**M10X1.25-RT40(M)**	M10X1.25	75	24	7.0	5.5	8	GH7
1	**M12X1.0-RT20(S)**	-	M12X1.00	82	29	8.5	6.5	9	GH7
4	**M12X1.0-RT20(M)**	**M12X1.0-RT40(M)**	M12X1.00	82	29	8.5	6.5	9	GH7
1	**M12X1.25-RT20(S)**	-	M12X1.25	82	29	8.5	6.5	9	GH7
4	**M12X1.25-RT20(M)**	**M12X1.25-RT40(M)**	M12X1.25	82	29	8.5	6.5	9	GH7
1	**M12X1.5-RT20(S)**	-	M12X1.50	82	29	8.5	6.5	9	GH7
4	**M12X1.5-RT20(M)**	**M12X1.5-RT40(M)**	M12X1.50	82	29	8.5	6.5	9	GH7
1	**M12X1.75-RT20(S)**	-	M12X1.75	82	29	8.5	6.5	9	GH8
4	**M12X1.75-RT20(M)**	**M12X1.75-RT40(M)**	M12X1.75	82	29	8.5	6.5	9	GH8

※ For general use on both steels and non-ferrous metal

※ Wear resistance highly improved by the use of TiCN coating for high efficiency tapping operations

※ Ideal for making both through holes and blind holes on non-ferrous metals

Applicable workpiece range

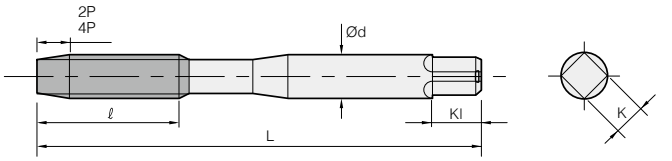
Division	Carbon steel			Alloy steel	Quenched and tempered steel			Stain-less steel	Tool steel	Cast steel	Cast iron	Ductile cast iron	Copper	Brass	Brass-cast	Bronze	Rolled aluminum	Aluminum-cast, alloyed	Magnesium-cast, alloyed	Zinc-cast, alloyed	Titanium alloy		Thermo-setting plastics	Thermo-plastics
	C ~0.25%	C0.25% ~0.45%	C 0.45%~	SCM	25~45 HRC	45~55 HRC	50~60 HRC	SUS	SKD	SC	GC	GCD	Cu	Bs	BsC	PB	Al	AC ADC	MC	ZDC	Ti	Ni	-	-
FN30T													◎	◎	◎		◎	◎		◎				
PC10T	◎	◎	○	○				◎					◎	◎	◎		◎	◎		◎				

TAP

SR

Spiral roll tap

Carbide | Uncoated FN30T | TiCN PC10T



(mm)

Designation		Thread size	L	ℓ	d	K	Kl	Limits
2P	4P							
M3X0.5-SR20	**M3X0.5-SR40**	M3X0.50	46	18	4.0	3.2	6	GH6
M3.5X0.6-SR20	**M3.5X0.6-SR40**	M3.5X0.60	46	18	4.0	3.2	6	GH6
M4X0.7-SR20	**M4X0.7-SR40**	M4X0.70	52	20	5.0	4.0	7	GH7
M5X0.8-SR20	**M5X0.8-SR40**	M5X0.80	60	22	5.5	4.5	7	GH7
M6X1.0-SR20	**M6X1.0-SR40**	M6X1.00	62	24	6.0	4.5	7	GH7

※ For general use for tapping aluminum, magnesium and zinc as well as non-ferrous metal
※ Ideal for tapping steel, non-ferrous materials and stainless steel
※ Wear resistance highly improved by the use of TiCN coating for high efficiency tapping operations

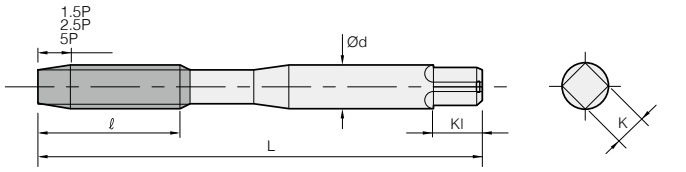
Applicable workpiece range

Division	Carbon steel			Alloy steel	Quenched and tempered steel			Stain-less steel	Tool steel	Cast steel	Cast iron	Ductile cast iron	Copper	Brass	Brass-cast	Bronze	Rolled aluminum	Aluminum-cast, alloyed	Magnesium-cast, alloyed	Zinc-cast, alloyed	Titanium alloy		Thermo-setting plastics	Thermo-plastics
	C ~0.25%	C0.25% ~0.45%	C 0.45%~	SCM	25~45 HRC	45~55 HRC	50~60 HRC	SUS	SKD	SC	GC	GCD	Cu	Bs	BsC	PB	Al	AC ADC	MC	ZDC	Ti	Ni	-	-
FN30T													◎	◎	◎		◎	◎		◎				
PC10T	◎	◎	○	○				◎					◎	◎	◎		◎	◎		◎				

ST

Straight tap

3 | 4 | H·A 0° | HSSE | Uncoated HN30T | TiN HC20T | TiCN HC10T | Steam Oxide HH30T



(mm)

Flutes	Designation 1.5P	2.5P	5P	Thread size	L	ℓ	d	K	Kl	Limits
3	M3X0.5-ST15	M3X0.5-ST25	M3X0.5-ST50	M3X0.50	46	11	4.0	3.2	6	KH2
	M4X0.7-ST15	M4X0.7-ST25	M4X0.7-ST50	M4X0.70	52	13	5.0	4.0	7	KH2
	M5X0.8-ST15	M5X0.8-ST25	M5X0.8-ST50	M5X0.80	60	16	5.5	4.5	7	KH2
	M6X1.0-ST15	M6X1.0-ST25	M6X1.0-ST50	M6X1.00	62	19	6.0	4.5	7	KH2
4	M8X1.25-ST15	M8X1.25-ST25	M8X1.25-ST50	M8X1.25	70	22	6.2	5.0	8	KH2
	M10X1.25-ST15	M10X1.25-ST25	M10X1.25-ST50	M10X1.25	75	24	7.0	5.5	8	KH2
	M10X1.5-ST15	M10X1.5-ST25	M10X1.5-ST50	M10X1.50	75	24	7.0	5.5	8	KH3
	M12X1.0-ST15	M12X1.0-ST25	M12X1.0-ST50	M12X1.00	82	29	8.5	6.5	9	KH2
	M12X1.25-ST15	M12X1.25-ST25	M12X1.25-ST50	M12X1.25	82	29	8.5	6.5	9	KH2
	M12X1.5-ST15	M12X1.5-ST25	M12X1.5-ST50	M12X1.50	82	29	8.5	6.5	9	KH3
	M12X1.75-ST15	M12X1.75-ST25	M12X1.75-ST50	M12X1.75	82	29	8.5	6.5	9	KH3
	M14X1.5-ST15	M14X1.5-ST25	M14X1.5-ST50	M14X1.50	88	30	10.5	8.0	11	KH3
	M14X2.0-ST15	M14X2.0-ST25	M14X2.0-ST50	M14X2.00	88	30	10.5	8.0	11	KH3
	M16X1.5-ST15	M16X1.5-ST25	M16X1.5-ST50	M16X1.50	95	32	12.5	10.0	13	KH3
	M16X2.0-ST15	M16X2.0-ST25	M16X2.0-ST50	M16X2.00	95	32	12.5	10.0	13	KH3
	M18X1.5-ST15	M18X1.5-ST25	M18X1.5-ST50	M18X1.50	100	37	14.0	11.0	14	KH3
	M18X2.5-ST15	M18X2.5-ST25	M18X2.5-ST50	M18X2.50	100	37	14.0	11.0	14	KH3
	M20X1.5-ST15	M20X1.5-ST25	M20X1.5-ST50	M20X1.50	105	37	15.0	12.0	15	KH3
	M20X2.5-ST15	M20X2.5-ST25	M20X2.5-ST50	M20X2.50	105	37	15.0	12.0	15	KH3

※ Ideal for making both through holes and blind holes on carbon steel, alloy steel and non-ferrous metal
※ Wear resistance highly improved by the use of TiN, TiCN, Steam oxide coating for high efficiency tapping operations
※ Built-up edges are prevented thanks to a reduced coefficient of friction gained by using porous cutting fluid of Fe3O4
※ Ideal for tapping stainless steel, cast steel, carbon steel for machine structures, etc

Applicable workpiece range

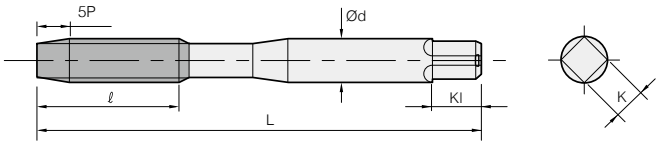
Division	Carbon steel			Alloy steel	Quenched and tempered steel			Stain-less steel	Tool steel	Cast steel	Cast iron	Ductile cast iron	Copper	Brass	Brass-cast	Bronze	Rolled aluminum	Aluminum-cast, alloyed	Magnesium-cast, alloyed	Zinc-cast, alloyed	Titanium alloy		Thermo-setting plastics	Thermo-plastics
	C ~0.25%	C0.25% ~0.45%	C 0.45%~	SCM	25~45 HRC	45~55 HRC	50~60 HRC	SUS	SKD	SC	GC	GCD	Cu	Bs	BsC	PB	Al	AC ADC	MC	ZDC	Ti	Ni	-	-
HN30T		○										○		○	○	○	○	○	○	○				
HC20T	○	○	○	○	○									○	○	○	○	○	○	○				
HC10T	○	○	○	○	○									○	○	○	○	○	○	○				
HH30T	◎	◎	◎	◎	◎	◎	◎	○	○	○	○	○												

TAP

PT

Point tap

3 | H·A 0° | HSSE | Uncoated HN30T | TiN HC20T | TiCN HC10T | Steam Oxide HH30T



(mm)

Flutes	Designation 5P	Thread size	L	ℓ	d	K	Kl	Limits
3	M3X0.5-PT50	M3X0.50	46	11	4.0	3.2	6	KH2
	M4X0.7-PT50	M4X0.70	52	13	5.0	4.0	7	KH2
	M5X0.8-PT50	M5X0.80	60	16	5.5	4.5	7	KH2
	M6X1.0-PT50	M6X1.00	62	19	6.0	4.5	7	KH2
	M8X1.25-PT50	M8X1.25	70	22	6.2	5.0	8	KH3
	M10X1.25-PT50	M10X1.25	75	24	7.0	5.5	8	KH3
	M10X1.5-PT50	M10X1.50	75	24	7.0	5.5	8	KH3
	M12X1.0-PT50	M12X1.00	82	29	8.5	6.5	9	KH3
	M12X1.25-PT50	M12X1.25	82	29	8.5	6.5	9	KH3
	M12X1.5-PT50	M12X1.50	82	29	8.5	6.5	9	KH3
	M12X1.75-PT50	M12X1.75	82	29	8.5	6.5	9	KH4
	M14X1.5-PT50	M14X1.50	88	30	10.5	8.0	11	KH3
	M14X2.0-PT50	M14X2.00	88	30	10.5	8.0	11	KH4
	M16X1.5-PT50	M16X1.50	95	32	12.5	10.0	13	KH3
	M16X2.0-PT50	M16X2.00	95	32	12.5	10.0	13	KH4
	M18X1.5-PT50	M18X1.50	100	37	14.0	11.0	14	KH4
	M18X2.5-PT50	M18X2.50	100	37	14.0	11.0	14	KH4
	M20X1.5-PT50	M20X1.50	105	37	15.0	12.0	15	KH4
	M20X2.5-PT50	M20X2.50	105	37	15.0	12.0	15	KH4

※ Ideal for making through holes on carbon steel, alloy steel and non-ferrous metal
※ Wear resistance highly improved by the use of TiN, TiCN, Steam oxide coating for high efficiency tapping operations
※ Built-up edges are prevented thanks to a reduced coefficient of friction gained by using porous cutting fluid of Fe3O4
※ Ideal for tapping stainless steel, cast steel, carbon steel for machine structures, etc

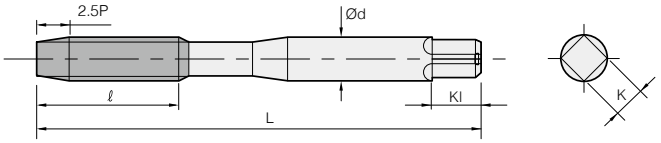
Applicable workpiece range

Division	Carbon steel			Alloy steel	Quenched and tempered steel			Stain-less steel	Tool steel	Cast steel	Cast iron	Ductile cast iron	Copper	Brass	Brass-cast	Bronze	Rolled aluminum	Aluminum-cast, alloyed	Magnesium-cast, alloyed	Zinc-cast, alloyed	Titanium alloy		Thermo-setting plastics	Thermo-plastics
	C ~0.25%	C0.25% ~0.45%	C 0.45%~	SCM	25~45 HRC	45~55 HRC	50~60 HRC	SUS	SKD	SC	GC	GCD	Cu	Bs	BsC	PB	Al	AC ADC	MC	ZDC	Ti	Ni	-	-
HN30T		○	○	◎							○	○	○	○	○	○	◎	○	○	○				○
HC20T	○	○	○	○				◎	○	○	○	○	○	○	○	○	○	○	○	○	○	○		○
HC10T	◎	◎	◎	○				○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		○
HH30T	◎	◎	◎	◎	◎	◎	◎	○	○	○	○	○												

SP

Spiral tap

3 | 4 | H·A 35° | HSSE | Uncoated HN30T | TiN HC20T | TiCN HC10T | Steam Oxide HH30T



(mm)

Flutes	Designation 2.5P	Thread size	L	ℓ	d	K	Kl	Limits
3	M3X0.5-SP25	M3X0.50	46	11	4.0	3.2	6	KH2
	M4X0.7-SP25	M4X0.70	52	13	5.0	4.0	7	KH2
	M5X0.8-SP25	M5X0.80	60	16	5.5	4.5	7	KH2
	M6X1.0-SP25	M6X1.00	62	19	6.0	4.5	7	KH2
	M8X1.25-SP25	M8X1.25	70	22	6.2	5.0	8	KH2
	M10X1.25-SP25	M10X1.25	75	24	7.0	5.5	8	KH2
	M10X1.5-SP25	M10X1.50	75	24	7.0	5.5	8	KH2
	M12X1.0-SP25	M12X1.00	82	29	8.5	6.5	9	KH2
	M12X1.25-SP25	M12X1.25	82	29	8.5	6.5	9	KH2
	M12X1.5-SP25	M12X1.50	82	29	8.5	6.5	9	KH2
	M12X1.75-SP25	M12X1.75	82	29	8.5	6.5	9	KH2
	M14X1.5-SP25	M14X1.50	88	30	10.5	8.0	11	KH2
	M14X2.0-SP25	M14X2.00	88	30	10.5	8.0	11	KH2
	M16X1.5-SP25	M16X1.50	95	32	12.5	10.0	13	KH2
	M16X2.0-SP25	M16X2.00	95	32	12.5	10.0	13	KH2
4	M18X1.5-SP25	M18X1.50	100	37	14.0	11.0	14	KH2
	M18X2.5-SP25	M18X2.50	100	37	14.0	11.0	14	KH3
	M20X1.5-SP25	M20X1.50	105	37	15.0	12.0	15	KH3
	M20X2.5-SP25	M20X2.50	105	37	15.0	12.0	15	KH3

※ Ideal for making blind holes. Its flutes provide excellent chip evacuation in tapping carbon steel, alloy steel and non-ferrous materials
※ Wear resistance highly improved by the use of TiN, TiCN, Steam oxide coating for high efficiency tapping operations
※ Built-up edges are prevented thanks to a reduced coefficient of friction gained by using porous cutting fluid of Fe3O4
※ Ideal for tapping stainless steel, cast steel, carbon steel for machine structures, etc

Applicable workpiece range

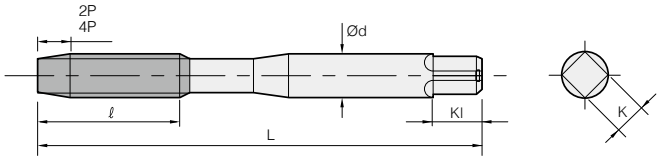
Division	Carbon steel			Alloy steel	Quenched and tempered steel			Stain-less steel	Tool steel	Cast steel	Cast iron	Ductile cast iron	Copper	Brass	Brass-cast	Bronze	Rolled aluminum	Aluminum-cast, alloyed	Magnesium-cast, alloyed	Zinc-cast, alloyed	Titanium alloy		Thermo-setting plastics	Thermo-plastics
	C ~0.25%	C0.25% ~0.45%	C 0.45%~	SCM	25~45 HRC	45~55 HRC	50~60 HRC	SUS	SKD	SC	GC	GCD	Cu	Bs	BsC	PB	Al	AC ADC	MC	ZDC	Ti	Ni	-	-
HN30T		○		◎								○	○	○	○	○	○	○	○	○				○
HC20T	○	○	○	○				○	○	○		○	○	○	○	○	○	○	○	○	○			○
HC10T	○	◎	◎	○				○	○	○		○	○	○	○	○	○	◎	○	○	○	○		○
HH30T	◎	◎	◎	◎	◎	◎	◎	○	○	○	○	○												

TAP

RT

Roll tap

HSSE | Uncoated HN30T | TiN HC20T | TiCN HC10T



(mm)

Flutes	Designation		Thread size	L	ℓ	d	K	Kl	Limits
	2P	4P							
1	M3X0.5-RT20(S)	-	M3X0.50	46	11	4.0	3.2	6	GH5
4	M3X0.5-RT20(M)	M3X0.5-RT40(M)	M3X0.50	46	11	4.0	3.2	6	GH5
1	M4X0.7-RT20(S)	-	M4X0.70	52	13	5.0	4.0	7	GH6
4	M4X0.7-RT20(M)	M4X0.7-RT40(M)	M4X0.70	52	13	5.0	4.0	7	GH6
1	M5X0.8-RT20(S)	-	M5X0.80	60	16	5.5	4.5	7	GH6
4	M5X0.8-RT20(M)	M5X0.8-RT40(M)	M5X0.80	60	16	5.5	4.5	7	GH6
1	M6X1.0-RT20(S)	-	M6X1.00	62	19	6.0	4.5	7	GH7
4	M6X1.0-RT20(M)	M6X1.0-RT40(M)	M6X1.00	62	19	6.0	4.5	7	GH7
1	M8X1.25-RT20(S)	-	M8X1.25	70	22	6.2	5.0	8	GH7
4	M8X1.25-RT20(M)	M8X1.25-RT40(M)	M8X1.25	70	22	6.2	5.0	8	GH7
1	M10X1.25-RT20(S)	-	M10X1.25	75	24	7.0	5.5	8	GH7
4	M10X1.25-RT20(M)	M10X1.25-RT40(M)	M10X1.25	75	24	7.0	5.5	8	GH7
1	M10X1.5-RT20(S)	-	M10X1.50	75	24	7.0	5.5	8	GH7
4	M10X1.5-RT20(M)	M10X1.5-RT40(M)	M10X1.50	75	24	7.0	5.5	8	GH7
1	M12X1.0-RT20(S)	-	M12X1.00	82	29	8.5	6.5	9	GH7
4	M12X1.0-RT20(M)	M12X1.0-RT40(M)	M12X1.00	82	29	8.5	6.5	9	GH7
1	M12X1.25-RT20(S)	-	M12X1.25	82	29	8.5	6.5	9	GH7
4	M12X1.25-RT20(M)	M12X1.25-RT40(M)	M12X1.25	82	29	8.5	6.5	9	GH7
1	M12X1.5-RT20(S)	-	M12X1.50	82	29	8.5	6.5	9	GH7
4	M12X1.5-RT20(M)	M12X1.5-RT40(M)	M12X1.50	82	29	8.5	6.5	9	GH7
1	M12X1.75-RT20(S)	-	M12X1.75	82	29	8.5	6.5	9	GH8
4	M12X1.75-RT20(M)	M12X1.75-RT40(M)	M12X1.75	82	29	8.5	6.5	9	GH8

※ For general use for both steels and non-ferrous metal

※ Wear resistance highly improved by the use of TiN, TiCN coating for high efficiency tapping operations

※ Ideal for tapping non-ferrous alloys such as aluminum, zinc, copper, etc

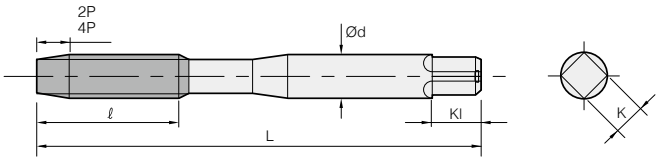
Applicable workpiece range

Division	Carbon steel			Alloy steel	Quenched and tempered steel			Stain-less steel	Tool steel	Cast steel	Cast iron	Ductile cast iron	Copper	Brass	Brass-cast	Bronze	Rolled aluminum	Aluminum-cast, alloyed	Magnesium-cast, alloyed	Zinc-cast, alloyed	Titanium alloy		Thermo-setting plastics	Thermo-plastics
	C ~0.25%	C0.25% ~0.45%	C 0.45%~	SCM	25~45 HRC	45~55 HRC	50~60 HRC	SUS	SKD	SC	GC	GCD	Cu	Bs	BsC	PB	Al	AC ADC	MC	ZDC	Ti	Ni	-	-
HN30T													○	○	○	○	○	○		◎				
HC20T	○	○	○	○				◎	○	○		○	○	○	○									
HC10T	◎	◎	○	○				◎					◎	◎	◎		◎	◎		◎				

SR

Spiral roll tap

HSSE | Uncoated HN30T | TiN HC20T | TiCN HC10T



(mm)

Designation		Thread size	L	ℓ	d	K	Kl	Limits
2P	4P							
M3X0.5-SR20	**M3X0.5-SR40**	M3X0.5	46	18	4.0	3.2	6	GH6
M3.5X0.6-SR20	**M3.5X0.6-SR40**	M3.5X0.6	48	18	4.0	3.2	6	GH6
M4X0.7-SR20	**M4X0.7-SR40**	M4X0.7	52	20	5.0	4.0	7	GH7
M5X0.8-SR20	**M5X0.8-SR40**	M5X0.8	60	22	5.5	4.5	7	GH7
M6X1.0-SR20	**M6X1.0-SR40**	M6X1.0	62	24	6.0	4.5	7	GH7

※ For general use for tapping aluminum, magnesium and zinc as well as non-ferrous metal
※ Wear resistance highly improved by the use of TiN, TiCN coating for high efficiency tapping operations
※ Ideal for tapping steel, non-ferrous materials and stainless steel

Applicable workpiece range

Division	Carbon steel			Alloy steel	Quenched and tempered steel			Stain-less steel	Tool steel	Cast steel	Cast iron	Ductile cast iron	Copper	Brass	Brass-cast	Bronze	Rolled aluminum	Aluminum-cast, alloyed	Magnesium-cast, alloyed	Zinc-cast, alloyed	Titanium alloy		Thermo-setting plastics	Thermo-plastics
	C ~0.25%	C0.25% ~0.45%	C 0.45%~	SCM	25~45 HRC	45~55 HRC	50~60 HRC	SUS	SKD	SC	GC	GCD	Cu	Bs	BsC	PB	Al	AC ADC	MC	ZDC	Ti	Ni	-	-
HN30T													○	○	○	○	○	○		◎				
HC20T	○	○	○	○				◎	○	○		○	○	○	○									
HC10T	◎	◎	○	○				◎					◎	◎	◎		◎	◎		◎				

TAP

Line-up

Carbide tap

	Tap type	Picture	Features	Grade	Size
ST	Straight tap		• For through holes and mass production • For cast iron, medium carbon steel and non-ferrous metal	FN30T	M3~M12
				PC10T	M3~M12
				PC20T	M3~M12
SP	Spiral tap		• For blind holes • Better chip evacuation through flutes	FN30T	M3~M12
				PC10T	M3~M12
RT	Roll tap		• For non-ferrous metal • For through holes and blind holes	FN30T	M3~M12
				PC10T	M3~M12
SR	Spiral roll tap		• For non-ferrous metal, Al and magnesium	FN30T	M3~M6
				PC10T	M3~M6

HSS tap

	Tap type	Picture	Features	Grade	Size
ST	Straight tap		• For through holes and mass production • For cast iron, medium carbon steel and non-ferrous metal	HN30T	M3~M20
				HC20T	M3~M20
				HC10T	M3~M20
				HH30T	M3~M20
PT	Point tap		• For through holes and mass production • Similar shape to the straight type but specialized with easier chip evacuation	HN30T	M3~M20
				HC20T	M3~M20
				HC10T	M3~M20
				HH30T	M3~M20
SP	Spiral tap		• For blind holes • Chip evacuation through flutes	HN30T	M3~M20
				HC20T	M3~M20
				HC10T	M3~M20
				HH30T	M3~M24
RT	Roll tap		• For non-ferrous metal • For through holes and blind holes	HN30T	M3~M12
				HC20T	M3~M12
				HC10T	M3~M12
SR	Spiral roll tap		• For non-ferrous metal, Al and magnesium	HN30T	M3~M6
				HC20T	M3~M6
				HC10T	M3~M6

Recommended drill diameter [On 2nd class thread basis]

Straight tap & Spiral tap

Thread size	Drill diameter		
	Min	Recommended	Max
M3X0.50	2.459	2.5	2.599
M4X0.70	3.242	3.3	3.422
M5X0.80	4.134	4.2	4.334
M6X1.00	4.917	5.0	5.153
M8X1.25	6.647	6.8	6.912
M10X1.25	8.647	8.8	8.912
M10X1.50	8.376	8.5	8.676
M12X1.00	10.917	11.0	11.153
M12X1.25	10.647	10.8	10.912
M12X1.50	10.376	10.5	10.676

Thread size	Drill diameter		
	Min	Recommended	Max
M12X1.75	10.106	10.3	10.441
M14X1.50	12.376	12.5	12.676
M14X2.00	11.835	12.0	12.21
M16X1.50	14.376	14.5	14.676
M16X2.00	13.835	14.0	14.21
M18X1.50	16.376	16.5	16.676
M18X2.50	15.294	15.5	15.744
M20X1.50	18.376	18.5	18.676
M20X2.50	17.294	17.5	17.744
-	-	-	-

Roll tap

Thread size	Drill diameter		
	Min	Recommended	Max
M3X0.50	2.76	2.8	2.81
M4X0.70	3.65	3.7	3.7
M5X0.80	4.59	4.6	4.66
M6X1.00	5.48	5.5	5.57
M8X1.25	7.34	7.4	7.41
M10X1.25	9.34	9.4	9.41

Thread size	Drill diameter		
	Min	Recommended	Max
M10X1.50	9.18	9.2	9.28
M12X1.00	11.48	11.5	11.57
M12X1.25	11.34	11.4	11.41
M12X1.50	11.18	11.2	11.28
M12X1.75	11.05	11.1	11.15
-	-	-	-

Recommended cutting speeds and cutting fluid

- For machining cold/hot forging steel and sintered ferrous alloy in high feed, high depth of cut and highly interrupted conditions
- Excellent resistance to chipping, fracture and thermal cracks
- Improved surface finish due to optimized cutting edges

ISO	Division		Cutting speed, vc (m/min)					Cutting fluid			
			Straight tap	Spiral tap	Point tap	Carbide tap	Roll tap	Insoluble	Water soluble emulsion	Semi dry	Dry
P	Low carbon steel	≥ 0.25%C	8~13	8~13	15~25	-	8~13	◎	○	△	△
	Medium carbon steel	≥ 0.25~0.45%C	7~12	7~12	10~15	-	7~10	◎	○	△	△
	High carbon steel	≥ 0.45%C	6~9	6~9	8~13	-	5~8	◎	○	△	△
	Alloy steel	SCM	7~12	7~12	10~15	-	5~8	◎	△	△	△
	Quenched and tempered steel	HRC25 ~ 45	3~5	3~5	4~6	-	-	◎	△	-	-
	Tool steel	SKD	6~9	6~9	7~10	-	-	◎	-	-	-
	Cast steel	SCM	6~11	6~11	10~15	-	-	◎	○	-	-
M	Stainless steel	SUS	4~7	5~8	8~13	-	5~10	◎	○	-	-
	Precipitation hardened stainless steel	SUS630 SUS631	3~5	3~5	4~6	-	-	◎	-	-	-
K	Cast iron	GC	10~15	-	-	10~20	-	◎	○	○	○
	Ductile cast iron	GCD	7~12	7~12	10~20	10~20	-	◎	○	○	-
N	Copper	Cu	6~9	6~11	7~12	10~20	7~12	○	○	-	-
	Brass, brass-cast	Bs Bsc	10~15	10~20	15~25	15~25	7~12	○	○	○	○
	Bronze, bronze-cast	PB PBC	6~11	6~11	10~20	10~20	7~12	○	○	-	-
	Rolled aluminum	Al	10~20	10~20	15~25	-	10~20	◎	○	△	-
	Aluminum-cast, alloyed	AC ACD	10~15	10~15	15~20	10~20	10~25	◎	○	△	-
	Magnesium-cast, alloyed	MC	7~12	7~12	10~15	10~20	-	◎	○	○	-
	Zinc-cast, alloyed	ZDC	1~12	7~12	10~15	10~20	7~12	◎	○	△	-
	Thermosetting plastics	Bakelite phenol epoxy	10~20	-	-	15~25	-	-	○	○	○
	Thermoplastics	Nylon vinyl chloride	10~20	10~15	10~20	10~20	-	-	○	○	○

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