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Inch & Metric

ALU-WAVE

Aluminum Series

special geometries on flute and clearance reliefs
excellent for aluminum, aluminum alloys, brass,
copper and other non-ferrous metals

WIDIN

WIDIN CO.,LTD.


WIDIN
WIDIN (주)위딘
WIDIN (주)위딘

The future of WIDIN is always bright.

WIDIN will share the same vision with customers by providing top quality products at competitive price, best service and pursue the core management doctrine of “Customer-based management”.

With the WIDIN’s rapid growth, its export is also increasing every year through steady improvement in technology, quality and great efforts for opening up a new market.

As WIDIN’s mission, endless growth and development, WIDIN will make steady progress to the world.

Greeting

Making customer's dreams a reality- The best mechanical solution

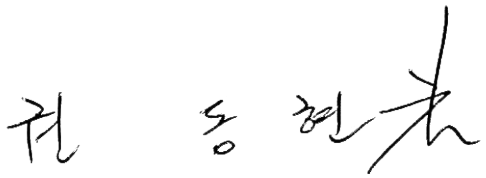
Since its establishment in 1988, WIDIN CO.,LTD. has been contributed to pursue the utmost customer satisfaction for the current and potential customers in the globalized market.

With continuously doing development and creativeness of the new technology through the great initiative, we, WIDIN CO.,LTD. is always ready to response of customer needs in customer mind and eye.

To cope with the enormous, various customer demands and satisfaction from popular products to high value added products in the cutting tools industry, WIDIN CO.,LTD. will put its best effort and will play a role of marketing initiator to lead the new 21st era by production and marketing linkage.

Aim to provide the best for money, fine tuned price, utmost quality, excellent customer services based on professionalism, all WIDIN CO.,LTD. will promise to do its best effort at time and where it is.

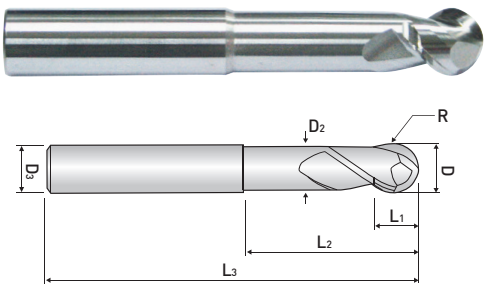
Thank you.



President and CEO Dong Hyun Kwon

ALU-WAVE SERIES

	EDP NO.	APPEARANCE	FEATURE	STOCK	PAGE
Inch	WAB312A ...series		2 FLUTE, BALL ENDMILL, REGULAR LENGTH	•	6
	WAE302A ...series		2 FLUTE, SQUARE ENDMILL, STUB LENGTH	•	7
	WAE312A ...series		2 FLUTE, SQUARE ENDMILL, REGULAR LENGTH	•	8
	WAE322A ...series		2 FLUTE, SQUARE ENDMILL, LONG LENGTH	•	9
	WAR302A ...series		2 FLUTE, CORNER RADIUS ENDMILL, STUB LENGTH	•	10
	WAR312A ...series		2 FLUTE, CORNER RADIUS ENDMILL, REGULAR LENGTH	•	11
	WAR322A ...series		2 FLUTE, CORNER RADIUS ENDMILL, LONG LENGTH	•	12
	WAE303A ...series		3 FLUTE, SQUARE ENDMILL, STUB LENGTH	•	13
	WAE313A ...series		3 FLUTE, SQUARE ENDMILL, REGULAR LENGTH	•	14
	WAE323A ...series		3 FLUTE, SQUARE ENDMILL, LONG LENGTH	•	15
	WAR303A ...series		3 FLUTE, CORNER RADIUS ENDMILL, STUB LENGTH	•	16
	WAR313A ...series		3 FLUTE, CORNER RADIUS ENDMILL, REGULAR LENGTH	•	17
	WAR323A ...series		CORNERRADIUS s/b CORNER RADIUS	•	18
	WAF303A ...series		3 FLUTE, ROUGHER ENDMILL, REGULAR & LONG LENGTHS	•	19
	WAF313A ...series		3 FLUTE, ROUGHER ENDMILL, LONG REACH & STUB CUT	•	20
	APF505 ...series		3 FLUTE, 5XD SOLID CARBIDE DRILL, DLC COATED	•	21
Metric	WAB312 ...series		2 FLUTE, 50° HELIX BALL ENDMILL	•	24
	WAE301 ...series		1 FLUTE, SQUARE ENDMILL, REGULAR LENGTH	•	25
	WAE302 ...series		2 FLUTE, SQUARE ENDMILL, REGULAR LENGTH	•	27
	WAE30(2)3 ...series		3 FLUTE, SQUARE ENDMILL, REGULAR & LONG LENGTH	•	29
	WAR302 ...series		2 FLUTE, CORNER RADIUS ENDMILL, REGULAR LENGTH	•	34
	WAR303 ...series		3 FLUTE, CORNER RADIUS ENDMILL, REGULAR LENGTH	•	36
	WAR502 ...series		2 FLUTE, CORNER RADIUS ENDMILL, DLC COATED, REGULAR LENGTH	•	38
	WAR503 ...series		3 FLUTE, CORNER RADIUS ENDMILL, DLC COATED, REGULAR LENGTH	•	39
	WAF303 ...series		3 FLUTE, ROUGHER ENDMILL, REGULAR & LONG LENGTH	•	40



2 FLUTE, REGULAR LENGTH, STUB NOSE BALL ENDMILL - for Aluminum

- High performance geometry and polished flutes on Aluminum, Non-Ferrous Materials, Graphite & Plastics.
- Available both Uncoated and Diamond Like Coated for more performance options.

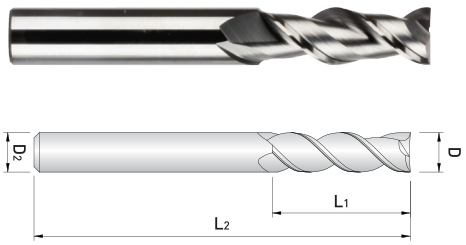
WAB312A ...series

EDP. No.	Dimension(INCH)						
	D	R	L1	L2	L3	D2	SH.Dia
WAB312A008	1/8	R1/16	1/8	3/8	3	.115	1/8
WAB312A012	3/16	R3/32	3/16	9/16	3	.175	3/16
WAB312A016	1/4	R1/8	1/4	2	3	.230	1/4
WAB312A024	3/8	R3/16	3/8	2-1/4	3-1/2	.345	3/8
WAB312A032	1/2	R1/4	1/2	2-1/2	4	.460	1/2

■ Tolerance

Mill Dia.(Inch)	Shank Dia.
± .0008	h6

※ Items can be changed for quality improvement without notice



2 FLUTE, STUB LENGTH SQUARE
- for Aluminum

- High performance geometry and polished flutes
- Optimized design for effective chip evacuation
- Great workpiece finish
- Excellent for Aluminum, Other Non-Ferrous Metals, Graphite & Plastics

WAE302A ...series

FINE GRAIN HELIX SHARP EDGE D.L.C.

EDP NO.		Dimension (INCH)			
NON-COATED	DLC COATED	D	C.L	OAL	SH.Dia
WAE302A008	WAE502A008	1/8	1/4	1-1/2	1/8
WAE302A012	WAE502A012	3/16	5/16	2	3/16
WAE302A016	WAE502A016	1/4	3/8	2-1/2	1/4
WAE302A020	WAE502A020	5/16	7/16	2-1/2	5/16
WAE302A024	WAE502A024	3/8	1/2	2-1/2	3/8
WAE302A028	WAE502A028	7/16	9/16	2-3/4	7/16
WAE302A032	WAE502A032	1/2	3/4	3	1/2
WAE302A040	WAE502A040	5/8	7/8	3-1/2	5/8
WAE302A048	WAE502A048	3/4	1	4	3/4
WAE302A064	WAE502A064	1	1-1/2	4	1

■ Tolerance

Mill Dia.(Inch)	Shank Dia.
0 ~ .0008	h6

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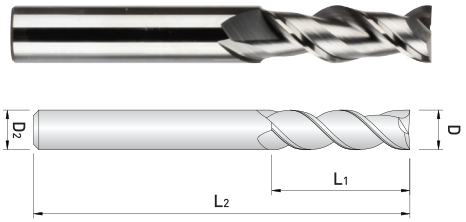

2 FLUTE, REGULAR LENGTH, SQUARE ENDMILL
- for Aluminum

- High performance geometry and polished flutes
- Optimized design for effective chip evacuation
- Great workpiece finish
- Excellent for Aluminum, Other Non-Ferrous Metals, Graphite & Plastics

WAE312A ...series

EDP. No.		Dimension (INCH)			
NON-COATED	DLC COATED	D	C.L	OAL	SH.Dia
WAE312A008	WAE512A008	1/8	3/8	1-1/2	1/8
WAE312A012	WAE512A012	3/16	9/16	2	3/16
WAE312A016	WAE512A016	1/4	3/4	2-1/2	1/4
WAE312A020	WAE512A020	5/16	13/16	2-1/2	5/16
WAE312A024	WAE512A024	3/8	1	2-1/2	3/8
WAE312A028	WAE512A028	7/16	1	2-3/4	7/16
WAE312A032	WAE512A032	1/2	1-1/4	3	1/2
WAE312A040	WAE512A040	5/8	1-5/8	3-1/2	5/8
WAE312A048	WAE512A048	3/4	1-5/8	4	3/4
WAE312A064	WAE512A064	1	2	5	1

■ Tolerance

Mill Dia.(Inch)	Shank Dia.
0 ~ .0008	h6

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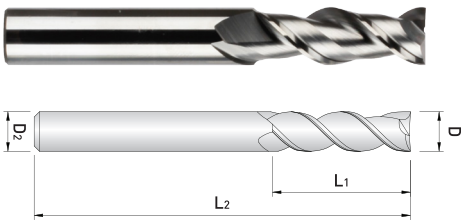
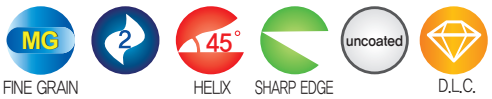


2 FLUTE, LONG LENGTH, SQUARE ENDMILL
- for Aluminum

- High performance geometry and polished flutes
- Optimized design for effective chip evacuation
- Great workpiece finish
- Excellent for Aluminum, Other Non-Ferrous Metals, Graphite & Plastics

WAE322A ...series



EDP. No.		Dimension (INCH)			
NON-COATED	DLC COATED	D	C.L	OAL	SH.Dia
WAE322A016	WAE522A016	1/4	1-1/2	4	1/4
WAE322A020	WAE522A020	5/16	1-1/2	4	5/16
WAE322A024	WAE522A024	3/8	1-1/2	4	3/8
WAE322A032	WAE522A032	1/2	2	4	1/2
WAE322A040	WAE522A040	5/8	2-1/2	5	5/8
WAE322A048	WAE522A048	3/4	2-1/2	5	3/4
WAE322A064	WAE522A064	1	3-1/4	6	1

■ Tolerance

Mill Dia.(Inch)	Shank Dia.
0 ~ .0008	h6

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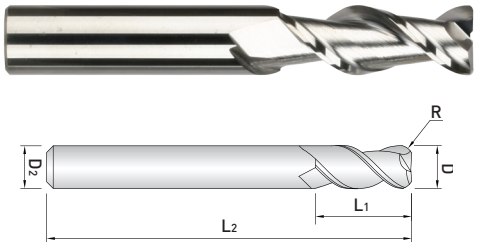

2 FLUTE, STUB LENGTH, CORNER RADIUS - for Aluminum

- High performance geometry and polished flutes
- Optimized design for effective chip evacuation
- Great workpiece finish
- Excellent for Aluminum, Other Non-Ferrous Metals, Graphite & Plastics

WAR302A ...series

FINE GRAIN HELIX D.L.C.

EDP. No.		Dimension (INCH)				
NON-COATED	DLC COATED	D	R	C.L	OAL	SH.Dia
WAR302A008010	WAR502A008010	1/8	.010	1/4	1-1/2	1/8
WAR302A012010	WAR502A012010	3/16	.010	5/16	2	3/16
WAR302A016010	WAR502A016010	1/4	.010	3/8	2-1/2	1/4
WAR302A020020	WAR502A020020	5/16	.020	7/16	2-1/2	5/16
WAR302A024020	WAR502A024020	3/8	.020	1/2	2-1/2	3/8
WAR302A028020	WAR502A028020	7/16	.020	9/16	2-3/4	7/16
WAR302A032020	WAR502A032020	1/2	.020	3/4	3	1/2
WAR302A040030	WAR502A040030	5/8	.030	7/8	3-1/2	5/8
WAR302A048030	WAR502A048030	3/4	.030	1	4	3/4
WAR302A064030	WAR502A064030	1	.030	1-1/2	4	1

■ Tolerance

Mill Dia.(Inch)	Shank Dia.
0 ~ .0008	h6

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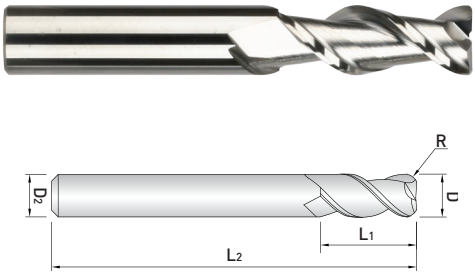

2 FLUTE, REGULAR LENGTH, CORNER RADIUS ENDMILL - for Aluminum

- High performance geometry and polished flutes
- Optimized design for effective chip evacuation
- Great workpiece finish
- Excellent for Aluminum, Other Non-Ferrous Metals, Graphite & Plastics

WAR312A ...series

FINE GRAIN HELIX D.L.C.

EDP. No.		Dimension (INCH)				
NON-COATED	DLC COATED	D	R	C.L	OAL	SH.Dia
WAR312A008010	WAR512A008010	1/8	.010	3/8	1-1/2	1/8
WAR312A012010	WAR512A012010	3/16	.010	9/16	2	3/16
WAR312A016010	WAR512A016010	1/4	.010	3/4	2-1/2	1/4
WAR312A020020	WAR512A020020	5/16	.020	13/16	2-1/2	5/16
WAR312A024020	WAR512A024020	3/8	.020	1	2-1/2	3/8
WAR312A028020	WAR512A028020	7/16	.020	1	2-3/4	7/16
WAR312A032020	WAR512A032020	1/2	.020	1-1/4	3	1/2
WAR312A040030	WAR512A040030	5/8	.030	1-5/8	3-1/2	5/8
WAR312A048030	WAR512A048030	3/4	.030	1-5/8	4	3/4
WAR312A064030	WAR512A064030	1	.030	2	5	1

■ Tolerance

Mill Dia.(Inch)	Shank Dia.
0 ~ .0008	h6

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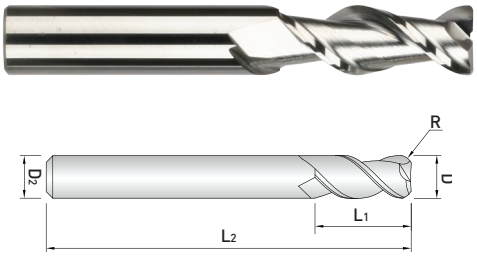

2 FLUTE, LONG LENGTH, CORNER RADIUS - for Aluminum

- High performance geometry and polished flutes
- Optimized design for effective chip evacuation
- Great workpiece finish
- Excellent for Aluminum, Other Non-Ferrous Metals, Graphite & Plastics

WAR322A ...series

MG FINE GRAIN | 2 | R ±.0006 | 45° HELIX | uncoated | D.L.C.

EDP. No.		Dimension (INCH)				
NON-COATED	DLC COATED	D	C.L	C.L	OAL	SH.Dia
WAR322A016010	WAR522A016010	1/4	.010	1-1/2	4	1/4
WAR322A020020	WAR522A020020	5/16	.020	1-1/2	4	5/16
WAR322A024020	WAR522A024020	3/8	.020	1-1/2	4	3/8
WAR322A032020	WAR522A032020	1/2	.020	2	4	1/2
WAR322A040030	WAR522A040030	5/8	.030	2-1/2	5	5/8
WAR322A048030	WAR522A048030	3/4	.030	2-1/2	5	3/4
WAR322A064030	WAR522A064030	1	.030	3-1/4	6	1

■ Tolerance

Mill Dia.(Inch)	Shank Dia.
0 ~ .0008	h6

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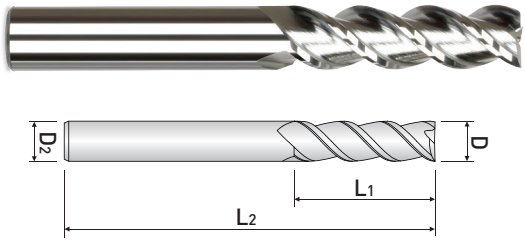

3 FLUTE, STUB LENGTH, SQUARE - for Aluminum

- High performance geometry and polished flutes
- Designed for high speed cutting with excellent workpiece finish
- Optimized design for reducing cutting load and effective chip evacuation
- Excellent for Aluminum, Aluminum Alloys, Copper and Other Non-Ferrous Metals

WAE303A ...series

EDP. No.		Dimension (INCH)			
NON-COATED	DLC COATED	D	C.L	OAL	SH.Dia
WAE303A008	WAE503A008	1/8	1/4	1-1/2	1/8
WAE303A012	WAE503A012	3/16	5/16	2	3/16
WAE303A016	WAE503A016	1/4	3/8	2-1/2	1/4
WAE303A020	WAE503A020	5/16	7/16	2-1/2	5/16
WAE303A024	WAE503A024	3/8	1/2	2-1/2	3/8
WAE303A028	WAE503A028	7/16	9/16	2-3/4	7/16
WAE303A032	WAE503A032	1/2	5/8	3	1/2
WAE303A040	WAE503A040	5/8	3/4	3-1/2	5/8
WAE303A048	WAE503A048	3/4	1	4	3/4
WAE303A064	WAE503A064	1	1-1/4	4	1

■ Tolerance

Mill Dia.(Inch)	Shank Dia.
0 ~ .0008	h6

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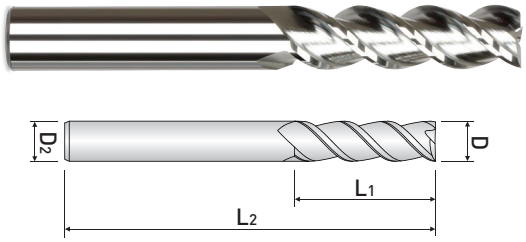

3 FLUTE, REGULAR LENGTH, SQUARE
- for Aluminum

- High performance geometry and polished flutes
- Designed for high speed cutting with excellent workpiece finish
- Optimized design for reducing cutting load and effective chip evacuation
- Excellent for Aluminum, Aluminum Alloys, Copper and Other Non-Ferrous Metals

WAE313A ...series

MG FINE GRAIN | 3 | 45° HELIX | SHARP EDGE | uncoated D.L.C.

EDP. No.		Dimension (INCH)			
NON-COATED	DLC COATED	D	C.L	OAL	SH.Dia
WAE313A008	WAE513A008	1/8	3/8	1-1/2	1/8
WAE313A012	WAE513A012	3/16	9/16	2	3/16
WAE313A016	WAE513A016	1/4	3/4	2-1/2	1/4
WAE313A020	WAE513A020	5/16	13/16	2-1/2	5/16
WAE313A024	WAE513A024	3/8	1	2-1/2	3/8
WAE313A028	WAE513A028	7/16	1-1/4	2-3/4	7/16
WAE313A032	WAE513A032	1/2	1-1/4	3	1/2
WAE313A040	WAE513A040	5/8	1-5/8	3-1/2	5/8
WAE313A048	WAE513A048	3/4	1-5/8	4	3/4
WAE313A064	WAE513A064	1	2	5	1

■ Tolerance

Mill Dia.(Inch)	Shank Dia.
0 ~ .0008	h6

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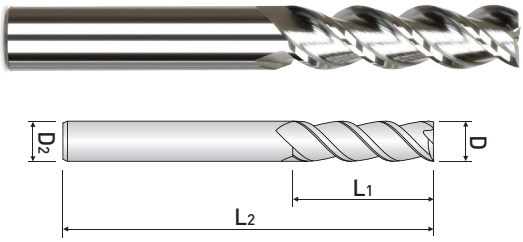

3 FLUTE, LONG LENGTH, SQUARE
- for Aluminum

- High performance geometry and polished flutes
- Designed for high speed cutting with excellent workpiece finish
- Optimized design for reducing cutting load and effective chip evacuation
- Excellent for Aluminum, Aluminum Alloys, Copper and Other Non-Ferrous Metals

WAE323A ...series

FINE GRAIN HELIX SHARP EDGE D.L.C.

EDP. No.		Dimension (INCH)			
NON-COATED	DLC COATED	D	C.L	OAL	SH.Dia
WAE323A016	WAE523A016	1/4	1-1/2	4	1/4
WAE323A020	WAE523A020	5/16	1-1/2	4	5/16
WAE323A024	WAE523A024	3/8	1-1/2	4	3/8
WAE323A032	WAE523A032	1/2	2	4	1/2
WAE323A040	WAE523A040	5/8	2-1/2	5	5/8
WAE323A048	WAE523A048	3/4	2-1/2	5	3/4
WAE323A064	WAE523A064	1	3-1/4	6	1

■ Tolerance

Mill Dia.(Inch)	Shank Dia.
0 ~ .0008	h6

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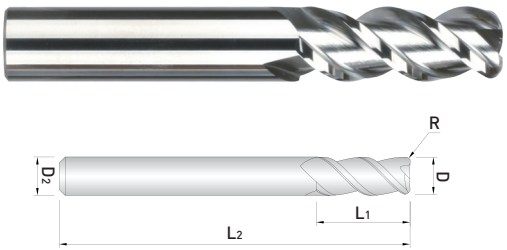


3 FLUTE, STUB LENGTH, CORNER RADIUS - for Aluminum

- High performance geometry and polished flutes
- Designed for high speed cutting with excellent workpiece finish
- Optimized design for reducing cutting load and effective chip evacuation
- Excellent for Aluminum, Aluminum Alloys, Copper and Other Non-Ferrous Metals

WAR303A ...series

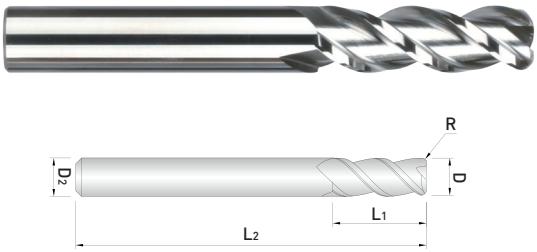
MG FINE GRAIN | 3 | R ±.0006 | 45° HELIX | uncoated | D.L.C.

EDP. No.		Dimension (INCH)				
NON-COATED	DLC COATED	D	R	C.L	OAL	SH.Dia
WAR303A008010	WAR503A008010	1/8	.010	1/4	1-1/2	1/8
WAR303A012010	WAR503A012010	3/16	.010	5/16	2	3/16
WAR303A012020	WAR503A012020	3/16	.020	5/16	2	3/16
WAR303A016010	WAR503A016010	1/4	.010	3/8	2-1/2	1/4
WAR303A016020	WAR503A016020	1/4	.020	3/8	2-1/2	1/4
WAR303A016030	WAR503A016030	1/4	.030	3/8	2-1/2	1/4
WAR303A016060	WAR503A016060	1/4	.060	3/8	2-1/2	1/4
WAR303A020020	WAR503A020020	5/16	.020	7/16	2-1/2	5/16
WAR303A020030	WAR503A020030	5/16	.030	7/16	2-1/2	5/16
WAR303A024020	WAR503A024020	3/8	.020	1/2	2-1/2	3/8
WAR303A024030	WAR503A024030	3/8	.030	1/2	2-1/2	3/8
WAR303A024060	WAR503A024060	3/8	.060	1/2	2-1/2	3/8
WAR303A028020	WAR503A028020	7/16	.020	9/16	2-3/4	7/16
WAR303A032020	WAR503A032020	1/2	.020	5/8	3	1/2
WAR303A032030	WAR503A032030	1/2	.030	5/8	3	1/2
WAR303A032060	WAR503A032060	1/2	.060	5/8	3	1/2
WAR303A040030	WAR503A040030	5/8	.030	3/4	3-1/2	5/8
WAR303A040060	WAR503A040060	5/8	.060	3/4	3-1/2	5/8
WAR303A040090	WAR503A040090	5/8	.090	3/4	3-1/2	5/8
WAR303A048060	WAR503A048060	3/4	.060	1	4	3/4
WAR303A048090	WAR503A048090	3/4	.090	1	4	3/4
WAR303A048120	WAR503A048120	3/4	.120	1	4	3/4
WAR303A064060	WAR503A064060	1	.060	1-1/4	4	1
WAR303A064090	WAR503A064090	1	.090	1-1/4	4	1
WAR303A064120	WAR503A064120	1	.120	1-1/4	4	1

■ Tolerance

Mill Dia.(Inch)	Shank Dia.
0 ~ .0008	h6

※ Items can be changed for quality improvement without notice



3 FLUTE, REGULAR LENGTH, CORNER RADIUS - for Aluminum

- High performance geometry and polished flutes
- Designed for high speed cutting with excellent workpiece finish
- Optimized design for reducing cutting load and effective chip evacuation
- Excellent for Aluminum, Aluminum Alloys, Copper and Other Non-Ferrous Metals

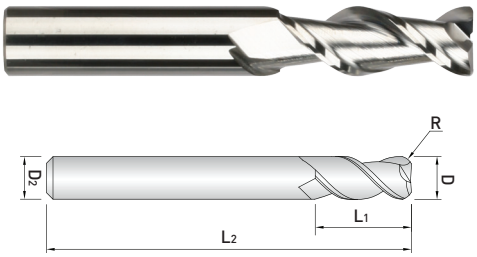
WAR313A ...series

EDP. No.		Dimension (INCH)				
NON-COATED	DLC COATED	D	R	C.L	OAL	SH.Dia
WAR313A008010	WAR513A008010	1/8	.010	3/8	1-1/2	1/8
WAR313A012010	WAR513A012010	3/16	.010	9/16	2	3/16
WAR313A012020	WAR513A012020	3/16	3/16	9/16	2	3/16
WAR313A016010	WAR513A016010	1/4	.010	5/8	2-1/2	1/4
WAR313A016020	WAR513A016020	1/4	.020	5/8	2-1/2	1/4
WAR313A016030	WAR513A016030	1/4	.030	5/8	2-1/2	1/4
WAR313A016060	WAR513A016060	1/4	.060	5/8	2-1/2	1/4
WAR313A020020	WAR513A020020	5/16	.020	13/16	2-1/2	5/16
WAR313A020030	WAR513A020030	5/16	.030	13/16	2-1/2	5/16
WAR313A024020	WAR513A024020	3/8	.020	1	2-1/2	3/8
WAR313A024030	WAR513A024030	3/8	.030	1	2-1/2	3/8
WAR313A024060	WAR513A024060	3/8	.060	1	2-1/2	3/8
WAR313A028020	WAR513A028020	7/16	.020	1-1/4	2-3/4	7/16
WAR313A032020	WAR513A032020	1/2	.020	1-1/4	3	1/2
WAR313A032030	WAR513A032030	1/2	.030	1-1/4	3	1/2
WAR313A032060	WAR513A032060	1/2	.060	1-1/4	3	1/2
WAR313A040030	WAR513A040030	5/8	.030	1-5/8	3-1/2	5/8
WAR313A040060	WAR513A040060	5/8	.060	1-5/8	3-1/2	5/8
WAR313A040090	WAR513A040090	5/8	.090	1-5/8	3-1/2	5/8
WAR313A048060	WAR513A048060	3/4	.060	1-5/8	4	3/4
WAR313A048090	WAR513A048090	3/4	.090	1-5/8	4	3/4
WAR313A048120	WAR513A048120	3/4	.120	1-5/8	4	3/4
WAR313A064060	WAR513A064060	1	.060	2	5	1
WAR313A064090	WAR513A064090	1	.090	2	5	1
WAR313A064120	WAR513A064120	1	.120	2	5	1

■ Tolerance

Mill Dia.(Inch)	Shank Dia.
0 ~ .0008	h6

※ Items can be changed for quality improvement without notice



3 FLUTE, LONG LENGTH, CORNER RADIUS ENDMILL - for Aluminum

- High performance geometry and polished flutes
- Designed for high speed cutting with excellent workpiece finish
- Optimized design for reducing cutting load and effective chip evacuation
- Excellent for Aluminum, Aluminum Alloys, Copper and Other Non-Ferrous Metals

MG FINE GRAIN | 3 | R ±.0006 | 45° HELIX | uncoated

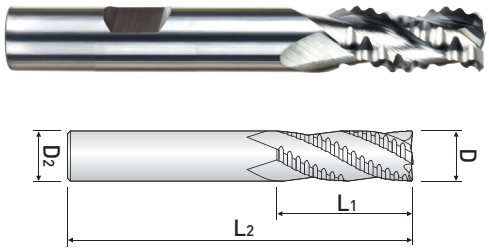
WAR323A ...series

EDP. No.		Dimension (INCH)				
NON-COATED	DLC COATED	D	R	C.L	OAL	SH.Dia
WAR323A016010	WAR523A016010	1/4	.010	1-1/2	4	1/4
WAR323A016020	WAR523A016020	1/4	1/4	1-1/2	4	1/4
WAR323A016030	WAR523A016030	1/4	1/4	1-1/2	4	1/4
WAR323A016060	WAR523A016060	1/4	1/4	1-1/2	4	1/4
WAR323A020020	WAR523A020020	5/16	5/16	1-1/2	4	5/16
WAR323A020030	WAR523A020030	5/16	5/16	1-1/2	4	5/16
WAR323A024020	WAR523A024020	3/8	3/8	1-1/2	4	3/8
WAR323A024030	WAR523A024030	3/8	3/8	1-1/2	4	3/8
WAR323A024060	WAR523A024060	3/8	3/8	1-1/2	4	3/8
WAR323A032020	WAR523A032020	1/2	1/2	2	4	1/2
WAR323A032030	WAR523A032030	1/2	1/2	2	4	1/2
WAR323A032060	WAR523A032060	1/2	1/2	2	4	1/2
WAR323A040030	WAR523A040030	5/8	5/8	2-1/2	5	5/8
WAR323A040060	WAR523A040060	5/8	5/8	2-1/2	5	5/8
WAR323A040090	WAR523A040090	5/8	5/8	2-1/2	5	5/8
WAR323A048060	WAR523A048060	3/4	3/4	2-1/2	5	3/4
WAR323A048090	WAR523A048090	3/4	3/4	2-1/2	5	3/4
WAR323A048120	WAR523A048120	3/4	3/4	2-1/2	5	3/4
WAR323A064060	WAR523A064060	1	1	3-1/4	6	1
WAR323A064090	WAR523A064090	1	1	3-1/4	6	1
WAR323A064120	WAR523A064120	1	1	3-1/4	6	1

■ Tolerance

Mill Dia.(Inch)	Shank Dia.
0 ~ .0008	h6

※ Items can be changed for quality improvement without notice



3 FLUTE, ROUGHER ENDMILL, REGULAR & LONG LENGTH - for Aluminum

- High performance geometry and coarse pitch combined for excellent tool life
- Regular and Long lengths
- Uncoated only
- Excellent for Aluminum, Aluminum Alloys, Non-Ferrous Metals, Graphite and Plastics

WAF303A ...series

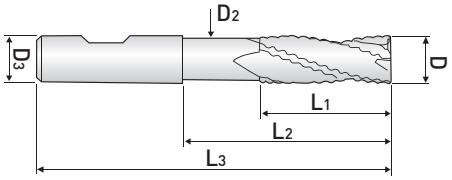
EDP. No.	Dimension (INCH)			
	D	C.L	OAL	SH.Dia
WAF303A024	3/8	1	3	3/8
WAF303A024L	3/8	1-1/2	3-1/2	3/8
WAF303A032	1/2	1-1/4	3-1/4	1/2
WAF303A032L	1/2	2	4	1/2
WAF303A040	5/8	1-1/4	3-1/2	5/8
WAF303A040L	5/8	2-1/2	5	5/8
WAF303A048	3/4	1-1/2	4	3/4
WAF303A048L	3/4	2-1/2	5	3/4
WAF303A064	1	1-1/2	4	1

※ Weldon Flat available upon request

■ Tolerance

Mill Dia.(Inch)	1/4 ~ 3/8	1/2 ~ 5/8	3/4 ~ 1
Tolerance	0 ~ -.0022	0 ~ -.0027	0 ~ -.0033

※ Items can be changed for quality improvement without notice



3 FLUTE, ROUGHER ENDMILL, LONG REACH & STUB CUT - for Aluminum

- High performance geometry and coarse pitch combined for excellent tool life
- Extra-long OAL with long necked reach and stub flute length
- Uncoated only
- Excellent for Aluminum, Aluminum Alloys, Non-Ferrous Metals, Graphite and Plastics

WAF313A ...series

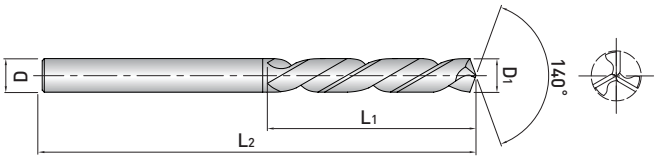
EDP. No.	Dimension (INCH)					
	D	C.L	Neck Length	OAL	Neck Dia.	SH.Dia
WAF313A024	3/8	7/16	2-1/4	3-1/2	0.345	3/8
WAF313A032	1/2	9/16	2-1/2	4	0.460	1/2
WAF313A040	5/8	3/4	3	5	0.575	5/8
WAF313A048	3/4	13/16	4	6	0.710	3/4
WAF313A064	1	15/16	4	6	0.960	1

※ Weldon Flat available upon request

■ Tolerance

Mill Dia.(Inch)	1/4 ~ 3/8	1/2 ~ 5/8	3/4 ~ 1
Tolerance	0 ~ -.0022	0 ~ -.0027	0 ~ -.0033

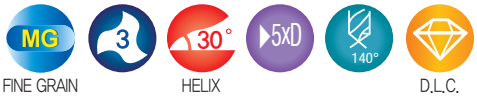
※ Items can be changed for quality improvement without notice



3 FLUTE, 5XD SOLID CARBIDE DRILL
- for Aluminum

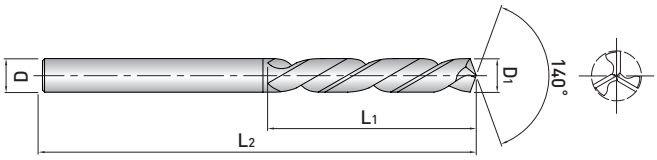
- DLC coated for longer tool life and maintain edge sharpness
- High performance geometry to optimize performance and finish
- High performance, micro grain solid carbide drill
- High performance drill point
- No spot drilling required

APF505 ...series



EDP NO.	Diameter			Flute Length	OAL	shank
	inch	fraction	mm			
APF505030	.1181		3	20	60	3
APF50503175	.1250	1/8"	3.175	27/32	2-3/8	4
APF50503263	.1285	#30	3.263	27/32	2-3/8	4
APF505035	.1378		3.5	22	63	4
APF50503572	.1406	9/64"	3.571	15/16	2-1/2	4
APF50503967	.1562	5/32"	3.967	15/16	2-1/2	4
APF505040	.1575	-	4	24	65	4
APF505045	.1772	-	4.5	24	65	5
APF50504762	.1875	3/16 "	4.762	1-1/4	2-3/4	5
APF50504800	.1890	#12	4.800	1-1/4	2-3/4	5
APF50504851	.1910	#11	4.851	1-1/4	2-3/4	5
APF50504914	.1935	#10	4.914	1-1/4	2-3/4	5
APF505050	.1969	-	5	32	75	5
APF50505054	.1990	#8	5.054	1-5/16	3"	6
APF50505105	.2010	#7	5.105	1-5/16	3"	6
APF50505158	.2031	13/64"	5.158	1-5/16	3"	6
APF50505181	.2040	#6	5.181	1-3/8	3"	6
APF50505219	.2055	#5	5.219	1-3/8	3"	6
APF50505308	.2090	#4	5.308	1-3/8	3"	6
APF50505410	.2130	#3	5.410	1-3/8	3"	6
APF505055	.2165	-	5.5	35	75	6
APF50505556	.2188	7/32 "	5.556	1-3/8	3"	6
APF50505613	.2210	#2	5.613	1-3/8	3"	6
APF50505791	.2280	#1	5.791	1-3/8	3"	6
APF50505953	.2344	15/64 "	5.953	1-1/2	3-1/4	6
APF505060	.2362	-	6	38	82	6
APF50506045	.2380	B	6.045	1-5/8	3-1/4	7
APF50506146	.2420	C	6.146	1-5/8	3-1/4	7
APF50506248	.2460	D	6.248	1-5/8	3-1/4	7
APF50506350	.2500	1/4 / E"	6.350	1-5/8	3-1/4	7
APF505065	.2559	-	6.5	41	82	7
APF50506527	.2570	F	6.527	1-11/16	3-1/4	7
APF50506629	.2610	G	6.629	1-11/16	3-1/2	7

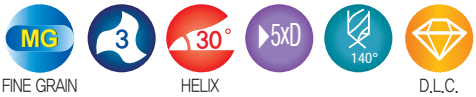
▶NEXT



3 FLUTE, 5XD SOLID CARBIDE DRILL
- for Aluminum

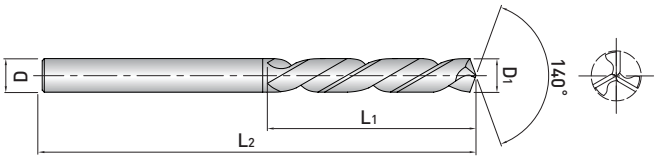
- DLC coated for longer tool life and maintain edge sharpness
- High performance geometry to optimize performance and finish
- High performance, micro grain solid carbide drill
- High performance drill point
- No spot drilling required

APF505 ...series



EDP NO.	Diameter			Flute Length	OAL	shank
	inch	fraction	mm			
APF50506746	.2656	17/64 "	6.746	1-11/16	3-1/2	7
APF50506756	.2660	H	6.756	1-11/16	3-1/2	7
APF50506908	.2720	I	6.908	1-11/16	3-1/2	7
APF505070	.2756	-	7	43	88	7
APF50507035	.2770	J	7.035	1-11/16	3-1/2	8
APF50507142	.2812	9/32 "	7.142	1-3/4	3-1/2	8
APF50507366	.2900	L	7.366	1-3/4	3-1/2	8
APF505075	.2953	-	7.5	44	95	8
APF50507541	.2969	19/64 "	7.541	1-7/8	3-3/4	8
APF50507670	.3020	N	7.670	1-7/8	3-3/4	8
APF50507937	.3125	5/16 "	7.937	1-7/8	3-3/4	8
APF505080	.3150	-	8	48	95	8
APF50508026	.3160	O	8.026	1-7/8	3-3/4	9
APF50508204	.3230	P	8.204	2-3/32	3-3/4	9
APF50508333	.3281	21/64 "	8.333	2-3/32	4"	9
APF50508432	.3320	Q	8.432	2-3/32	4"	9
APF505085	.3346	-	8.5	53	100	9
APF50508610	.3390	R	8.610	2-3/32	4"	9
APF50508732	.3438	11/32 "	8.732	2-3/16	4"	9
APF50508839	.3480	S	8.839	2-3/16	4"	9
APF505090	.3543	-	9	55	100	9
APF50509093	.3580	T	9.093	2-9/32	4-1/4	10
APF50509128	.3594	23/64 "	9.128	2-9/32	4-1/4	10
APF50509347	.3680	U	9.347	2-9/32	4-1/4	10
APF505095	.3740	-	9.5	58	108	10
APF50509525	.3750	3/8 "	9.525	2-3/8	4-1/4	10
APF50509575	.3770	V	9.575	2-3/8	4-1/4	10
APF50509804	.3860	W	9.804	2-3/8	4-1/2	10
APF50509921	.3906	25/64 "	9.921	2-3/8	4-1/2	10
APF505100	.3937	-	10	60	114	10
APF50510083	.3970	X	10.083	2-1/2	4-1/2	11
APF50510261	.4040	Y	10.261	2-9/16	4-1/2	11
APF50510317	.4062	13/32 "	10.317	2-9/16	4-1/2	11

▶NEXT



3 FLUTE, 5XD SOLID CARBIDE DRILL
- for Aluminum

- DLC coated for longer tool life and maintain edge sharpness
- High performance geometry to optimize performance and finish
- High performance, micro grain solid carbide drill
- High performance drill point
- No spot drilling required

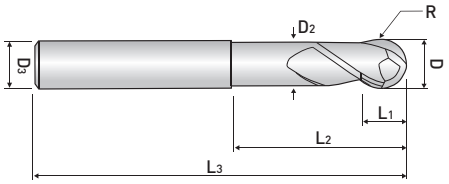
APF505 ...series

EDP NO.	Diameter			Flute Length	OAL	shank
	inch	fraction	mm			
APF505105	.4134		10.5	67	114	11
APF50510716	.4219	27/64 "	10.716	2-11/16	4-1/2	11
APF505110	.4331	-	11	68	114	11
APF50511112	.4375	7/16 "	11.112	2-13/16	4-3/4	12
APF505115	.4528		11.5	70	120	12
APF50511508	.4531	29/64 "	11.508	2-7/8	4-3/4	12
APF50511907	.4688	15/32 "	11.907	2-7/8	4-3/4	12
APF505120	.4724	-	12	73	120	12
APF50512303	.4844	31/64 "	12.303	3"	5-5/16	13
APF505125	.4921	-	12.5	75	135	13
APF505127	.5000	1/2 "	12.7	3-1/16	5-3/8	13
APF505130	.5118	-	13	78	136	13
APF50513096	.5156	33/64 "	13.096	3-1/8	5-3/8	14
APF50513492	.5312	17/32 "	13.492	3-5/16	5-11/16	14
APF50513891	.5469	35/64 "	13.891	3-3/8	5-13/16	14
APF505140	.5512	-	14	86	148	14
APF50514287	.5625	9/16 "	14.287	3-1/2	5-15/16	15
APF50514683	.5781	37/64 "	14.683	3-1/2	6"	15
APF505150	.5906	-	15	90	152	15
APF50515082	.5938	19/32 "	15.082	3-9/16	6"	16
APF50515478	.6094	39/64 "	15.478	3-11/16	6-3/16	16
APF50515875	.6250	5/8 "	15.875	3-3/4	6-5/16	16
APF505160	.6299	-	16	95	160	16

■ Tolerance

Mill Dia.(mm)	Shank Dia.
0 ~ -0.012	h6

※ Items can be changed for quality improvement without notice



2FLUTE, BALL ENDMILL, REGULAR LENGTH - for Aluminum

- Excellent cutting quality on aluminum & copper
- high polished flute face improving chip evacuation and Lubricity

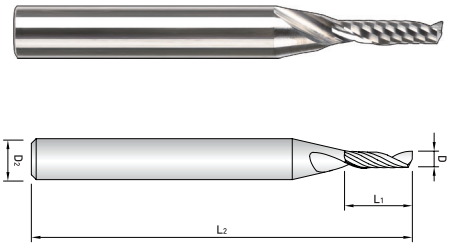
WAB312 ...series

EDP NO.	Dimension (mm)						
	D	R	L_1	L_2	L_3	D_2	D_3
WAB312 060	6	3	5.5	25	55	5.4	6
WAB312 061	6	3	5.5	40	90	5.4	6
WAB312 080	8	4	7	30	65	7.2	8
WAB312 081	8	4	7	50	100	7.2	8
WAB312 100	10	5	8.5	35	75	9	10
WAB312 101	10	5	10	50	100	9	10
WAB312 102	10	5	10	60	150	9	10
WAB312 120	12	6	10.5	40	75	11	12
WAB312 121	12	6	12	50	110	11	12
WAB312 122	12	6	12	60	150	11	12
WAB312 160	16	8	14	50	90	14.5	16
WAB312 161	16	8	16	70	150	14.5	16
WAB312 162	16	8	16	90	200	14.5	16
WAB312 200	20	10	17	50	100	18	20

■ Tolerance

Mill Dia.(mm)	Shank dia.
±0.02	h6

※ Items can be changed for quality improvement without notice



1 FLUTE, SQUARE ENDMILL, REGULAR LENGTH

- Suitable for Acryl, ABS, Mock-up, Nonferrous
- 1F helix type for excellent chip disposal suitable for cutting, slotting for non-ferrous work pieces
- Good wear-resistance using micro grain Alloy material

WAE301 ...series

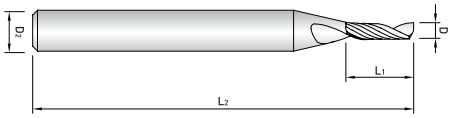
MG FINE GRAIN · 1 · 30° HELIX · uncoated

EDP NO.	Dimension (mm)			
	D	L_1	L_2	D_2
WAE301 002	0.2	0.3	40	4
WAE301 003	0.3	0.9	40	4
WAE301 004	0.4	1.2	40	4
WAE301 005	0.5	1.5	40	4
WAE301 006	0.6	1.8	40	4
WAE301 007	0.7	2.1	40	4
WAE301 008	0.8	2.4	40	4
WAE301 009	0.9	2.7	40	4
WAE301 010	1	3	45	6
WAE301 010-4.5	1	4.5	45	6
WAE301 010-6	1	6	50	6
WAE301 012	1.2	3	45	6
WAE301 012-5	1.2	5	45	6
WAE301 012-6	1.2	6	50	6
WAE301 015	1.5	4	45	6
WAE301 015-6	1.5	6	50	6
WAE301 015-8	1.5	8	50	6
WAE301 020	2	6	50	6
WAE301 020-8	2	8	50	6
WAE301 020-10	2	10	50	6
WAE301 025	2.5	7	50	6

■ Tolerance

Mill Dia.(mm)		Shank dia.
Diameter	Tolerance	
D≤5	0 ~ -0.02	h6
D>5	0 ~ -0.03	

※ Items can be changed for quality improvement without notice



1 FLUTE, SQUARE ENDMILL, REGULAR LENGTH

- Suitable for Acryl, ABS, Mock-up, Nonferrous
- 1F helix type for excellent chip disposal suitable for cutting, slotting for non-ferrous work pieces
- Good wear-resistance using micro grain Alloy material

WAE301 ...series

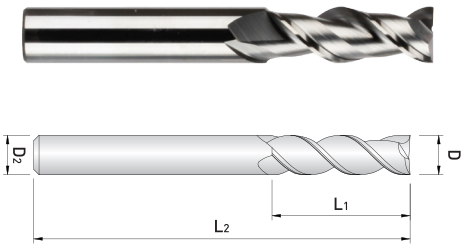
MG FINE GRAIN | 1 | 50° HELIX | uncoated

EDP NO.	Dimension (mm)			
	D	L_1	L_2	D_2
WAE301 025-8	2.5	8	50	6
WAE301 025-10	2.5	10	50	6
WAE301 025-12	2.5	12	50	6
WAE301 030	3	8	50	6
WAE301 030-12	3	12	50	6
WAE301 030-15	3	15	50	6
WAE301 040	4	10	50	6
WAE301 040-15	4	15	50	6
WAE301 040-20	4	20	60	6
WAE301 050	5	13	60	6
WAE301 050-20	5	20	60	6
WAE301 050-25	5	25	60	6
WAE301 060	6	15	60	6
WAE301 060-20	6	20	60	6
WAE301 060-25	6	25	60	6
WAE301 080	8	20	70	8
WAE301 080-25	8	25	75	8
WAE301 100	10	22	75	10
WAE301 100-30	10	30	80	10
WAE301 120	12	26	75	12
WAE301 120-35	12	35	90	12

■ Tolerance

Mill Dia.(mm)		Shank Dia.
Diameter	Tolerance	
D≤5	0 ~ -0.02	h6
D>5	0 ~ -0.03	

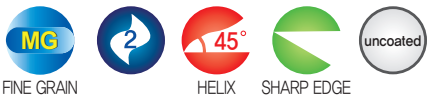
※ Items can be changed for quality improvement without notice



2 FLUTE, SQUARE ENDMILL, REGULAR LENGTH - for Aluminum

- Suitable for Aluminum, Aluminum Alloy, Copper & Non-ferrous material
- high polished flute face improving chip evacuation and Lubricity

WAE302 ...series

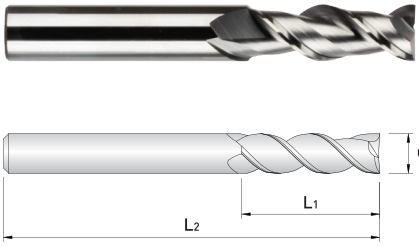


EDP NO.	Dimension (mm)			
	D	L1	L2	D2
WAE302 010	1	3	50	4
WAE302 010-6	1	6	60	6
WAE302 012	1.2	4	50	6
WAE302 015	1.5	6	50	6
WAE302 015-8	1.5	8	60	6
WAE302 020 S4	2	6	50	4
WAE302 020	2	6	50	6
WAE302 020-10	2	10	60	6
WAE302 025	2.5	12	55	6
WAE302 030	3	12	55	6
WAE302 030-15	3	15	65	6
WAE302 035	3.5	14	57	6
WAE302 040	4	14	55	6
WAE302 040-16	4	16	65	6
WAE302 050	5	17	55	6
WAE302 050-22	5	22	60	6
WAE302 060	6	17	60	6
WAE302 060-22	6	22	60	6
WAE302 070	7	20	63	8
WAE302 080	8	23	70	8
WAE302 080-31	8	31	80	8
WAE302 090	9	25	72	10
WAE302 100	10	28	75	10
WAE302 100-36	10	36	90	10
WAE302 110	11	30	80	12
WAE302 120	12	33	80	12
WAE302 120-41	12	41	95	12

■ Tolerance

Mill Dia.(mm)	Shank Dia.
0 ~ -0.02	h6

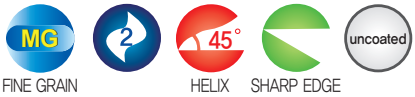
※ Items can be changed for quality improvement without notice



2 FLUTE, SQUARE ENDMILL, REGULAR LENGTH - for Aluminum

- Suitable for Aluminum, Aluminum Alloy, Copper & Non-ferrous material
- high polished flute face improving chip evacuation and Lubricity

WAE302 ...series

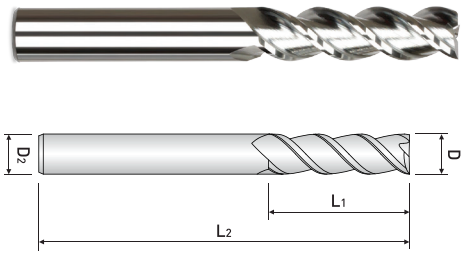


EDP NO.	Dimension (mm)			
	D	L_1	L_2	D_2
WAE302 122	12	45	100	12
WAE302 130	13	35	85	14
WAE302 140	14	38	90	14
WAE302 150	15	40	90	16
WAE302 160	16	45	100	16
WAE302 160-53	16	53	110	16
WAE302 180	18	49	100	18
WAE302 200	20	50	100	20
WAE302 200-55	20	55	110	20
WAE302 250	25	50	120	25

■ Tolerance

Mill Dia.(mm)	Shank Dia.
0 ~ -0.02	h6

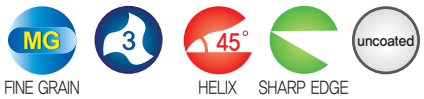
※ Items can be changed for quality improvement without notice



3 FLUTE, SQUARE ENDMILL, REGULAR & LONG LENGTH - for Aluminum

- Suitable for Aluminum, Aluminum Alloy, Copper & Non-ferrous material
- Suitable for high speed cutting
- Optimized design for reducing cutting load and maxi mizing chip evacuation

WAE30(2)3 ...series

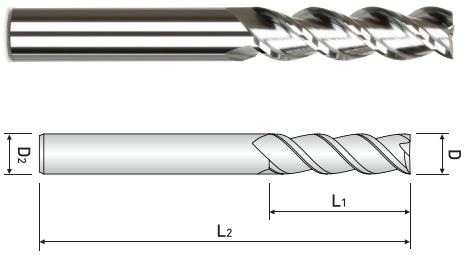


EDP NO.	Dimension (mm)			
	D	L1	L2	D2
WAE303 010-02	1	2	40	6
WAE303 010-025	1	2.5	40	6
WAE303 010	1	3	50	6
WAE303 010-04	1	4	60	6
WAE303 010-06	1	6	60	6
WAE303 012	1.2	4	50	6
WAE303 015-03	1.5	3	40	6
WAE303 015	1.5	5	50	6
WAE303 015-06	1.5	6	60	6
WAE303 015-08	1.5	8	60	6
WAE303 015-10	1.5	10	60	6
WAE303 020-03	2	3	40	6
WAE303 020	2	6	50	6
WAE303 020-08	2	8	60	6
WAE303 020-10	2	10	60	6
WAE303 020-12	2	12	60	6
WAE303 025	2.5	8	40	6
WAE303 025-10	2.5	10	55	6
WAE303 025-12	2.5	12	60	6
WAE303 030-04	3	4	45	6
WAE303 030-08	3	8	45	6
WAE303 030	3	12	55	6
WAE303 031	3	15	65	6
WAE323 030	3	20	70	6
WAE323 031	3	25	75	6

■ Tolerance

Mill Dia.(mm)	Shank Dia.
0 ~ -0.02	h6

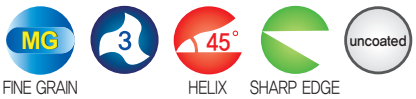
※ Items can be changed for quality improvement without notice



3 FLUTE, SQUARE ENDMILL, REGULAR & LONG LENGTH - for Aluminum

- Suitable for Aluminum, Aluminum Alloy, Copper & Non-ferrous material
- Suitable for high speed cutting
- Optimized design for reducing cutting load and maxi mizing chip evacuation

WAE30(2)3 ...series

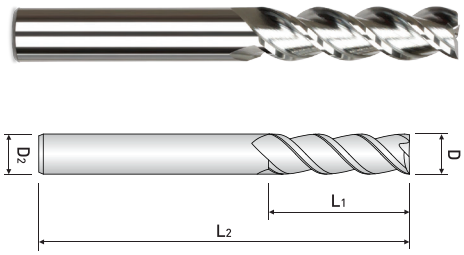


EDP NO.	Dimension (mm)			
	D	L1	L2	D2
WAE323 032	3	30	80	6
WAE303 035	3.5	12	55	6
WAE303 040-05	4	5	45	6
WAE303 040-08	4	8	45	6
WAE303 040-11	4	11	45	6
WAE303 040	4	14	55	6
WAE303 040-16	4	16	65	6
WAE303 041	4	20	70	6
WAE323 040	4	26	75	6
WAE323 041	4	30	80	6
WAE303 045	4.5	15	55	6
WAE303 050-06	5	6	45	6
WAE303 050	5	17	55	6
WAE303 051	5	22	60	6
WAE303 052	5	26	70	6
WAE323 050	5	31	75	6
WAE323 051	5	36	80	6
WAE323 052	5	41	85	6
WAE323 053	5	46	90	6
WAE303 055	5.5	17	55	6
WAE303 060-07	6	7	50	6
WAE303 060-13	6	13	50	6
WAE303 060	6	17	60	6
WAE303 061	6	22	60	6
WAE303 062	6	26	70	6

■ Tolerance

Mill Dia.(mm)	Shank Dia.
0 ~ -0.02	h6

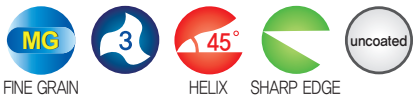
※ Items can be changed for quality improvement without notice



3 FLUTE, SQUARE ENDMILL, REGULAR & LONG LENGTH - for Aluminum

- Suitable for Aluminum, Aluminum Alloy, Copper & Non-ferrous material
- Suitable for high speed cutting
- Optimized design for reducing cutting load and maxi mizing chip evacuation

WAE30(2)3 ...series

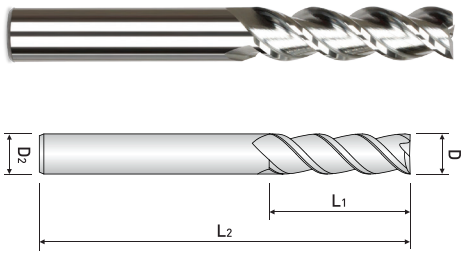


EDP NO.	Dimension (mm)			
	D	L1	L2	D2
WAE303 063	6	31	75	6
WAE323 060	6	36	80	6
WAE323 061	6	43	90	6
WAE323 062	6	51	100	6
WAE303 070	7	23	65	8
WAE303 080-10	8	10	60	8
WAE303 080-20	8	20	60	8
WAE303 080	8	23	70	8
WAE303 080-29	8	29	80	8
WAE303 081	8	31	80	8
WAE303 082	8	36	85	8
WAE323 080	8	41	90	8
WAE323 081	8	46	95	8
WAE323 082	8	51	100	8
WAE323 083	8	56	105	8
WAE323 084	8	66	110	8
WAE303 090	9	28	70	10
WAE303 100-12	10	12	65	10
WAE303 100-23	10	23	65	10
WAE303 100	10	28	75	10
WAE303 100-33	10	33	90	10
WAE303 101	10	36	90	10
WAE303 100-41	10	41	90	10
WAE303 102	10	46	100	10
WAE303 103	10	51	100	10

■ Tolerance

Mill Dia.(mm)	Shank Dia.
0 ~ -0.02	h6

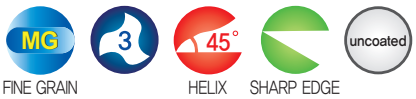
※ Items can be changed for quality improvement without notice



3 FLUTE, SQUARE ENDMILL, REGULAR & LONG LENGTH - for Aluminum

- Suitable for Aluminum, Aluminum Alloy, Copper & Non-ferrous material
- Suitable for high speed cutting
- Optimized design for reducing cutting load and maximizing chip evacuation

WAE30(2)3 ...series

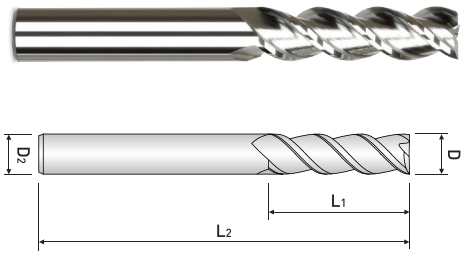


EDP NO.	Dimension (mm)			
	D	L_1	L_2	D_2
WAE323 100	10	56	110	10
WAE323 100-61	10	61	110	10
WAE323 101	10	66	120	10
WAE303 110	11	30	80	12
WAE303 120-14	12	14	70	12
WAE303 120-27	12	27	70	12
WAE303 120	12	33	80	12
WAE303 121	12	41	95	12
WAE303 122	12	46	100	12
WAE303 122-51	12	51	100	12
WAE303 123	12	56	110	12
WAE303 124-61	12	61	110	12
WAE323 120	12	66	120	12
WAE323 120-71	12	71	120	12
WAE323 121	12	76	135	12
WAE303 130	13	35	85	14
WAE303 140	14	38	90	14
WAE303 150	15	40	90	16
WAE303 160-19	16	19	90	16
WAE303 160-33	16	33	90	16
WAE303 160	16	45	100	16
WAE303 160-53	16	53	105	16
WAE303 161	16	56	110	16

■ Tolerance

Mill Dia.(mm)	Shank Dia.
0 ~ -0.02	h6

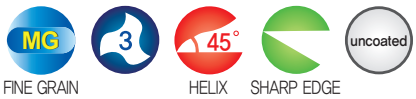
※ Items can be changed for quality improvement without notice



3 FLUTE, SQUARE ENDMILL, REGULAR & LONG LENGTH - for Aluminum

- Suitable for Aluminum, Aluminum Alloy, Copper & Non-ferrous material
- Suitable for high speed cutting
- Optimized design for reducing cutting load and maximizing chip evacuation

WAE30(2)3 ...series

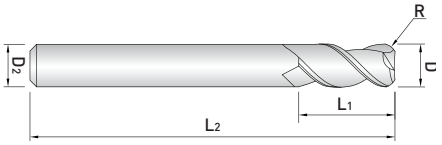


EDP NO.	Dimension (mm)			
	D	L1	L2	D2
WAE303 162	16	66	130	16
WAE303 163	16	76	150	16
WAE323 160	16	86	160	16
WAE323 161	16	96	180	16
WAE323 162	16	106	190	16
WAE323 163	16	116	200	16
WAE303 180	18	49	100	18
WAE303 200-23	20	23	90	20
WAE303 200-39	20	39	90	20
WAE303 200	20	50	100	20
WAE303 201	20	60	110	20
WAE303 202	20	70	130	20
WAE303 203	20	76	150	20
WAE323 200	20	86	160	20
WAE323 201	20	96	180	20
WAE323 202	20	106	190	20
WAE323 203	20	116	200	20
WAE323 204	20	126	220	20
WAE303 250	25	50	120	25

■ Tolerance

Mill Dia.(mm)	Shank Dia.
0 ~ -0.02	h6

※ Items can be changed for quality improvement without notice



2 FLUTE, CORNER RADIUS ENDMILL, REGULAR LENGTH - for Aluminum

- Suitable for Aluminum, Aluminum Alloy, Copper & Non-Ferrous Material

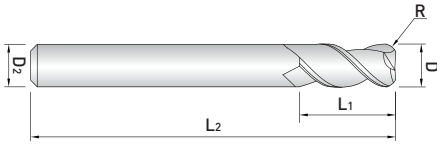
WAR302 ...series

EDP NO.	Dimension (mm)				
	D	R	L_1	L_2	D_2
WAR302 06 05	6	0.5	15	50	6
WAR302 06 10	6	1	15	50	6
WAR302 06 15	6	1.5	15	50	6
WAR302 06 20	6	2	15	50	6
WAR302 08 05	8	0.5	20	60	8
WAR302 08 10	8	1	20	60	8
WAR302 08 15	8	1.5	20	60	8
WAR302 08 20	8	2	20	60	8
WAR302 08 30	8	3	20	60	8
WAR302 10 05	10	0.5	25	70	10
WAR302 10 10	10	1	25	70	10
WAR302 10 15	10	1.5	25	70	10
WAR302 10 20	10	2	25	70	10
WAR302 10 30	10	3	25	70	10
WAR302 10 40	10	4	25	70	10
WAR302 12 10	12	1	30	75	12
WAR302 12 20	12	2	30	75	12
WAR302 12 30	12	3	30	75	12
WAR302 12 40	12	4	30	75	12
WAR302 14 10	14	1	35	80	14
WAR302 14 20	14	2	35	80	14
WAR302 14 30	14	3	35	80	14
WAR302 14 40	14	4	35	80	14
WAR302 14 50	14	5	35	80	14

■ Tolerance

Mill Dia. (mm)	Shank Dia.
0 ~ -0.02	h6

※ Items can be changed for quality improvement without notice



2 FLUTE, CORNER RADIUS ENDMILL, REGULAR LENGTH - for Aluminum

- Suitable for Aluminum, Aluminum Alloy, Copper & Non-Ferrous Material

WAR302 ...series

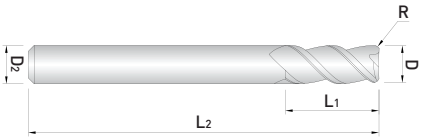
FINE GRAIN HELIX

EDP NO.	Dimension (mm)				
	D	R	L_1	L_2	D_2
WAR302 16 10	16	1	40	90	16
WAR302 16 20	16	2	40	90	16
WAR302 16 30	16	3	40	90	16
WAR302 16 40	16	4	40	90	16
WAR302 16 50	16	5	40	90	16
WAR302 20 10	20	1	45	100	20
WAR302 20 20	20	2	45	100	20
WAR302 20 30	20	3	45	100	20
WAR302 20 40	20	4	45	100	20
WAR302 20 50	20	5	45	100	20

■ Tolerance

Mill Dia.(mm)	Shank Dia.
0 ~ -0.02	h6

※ Items can be changed for quality improvement without notice



3 FLUTE, REGULAR LENGTH, CORNER RADIUS - for Aluminum

- Suitable for Aluminum, Aluminum Alloy, Copper & Non-Ferrous Material
- Suitable for High Speed Cutting
- Optimized design for reducing cutting load and effective chip evacuation

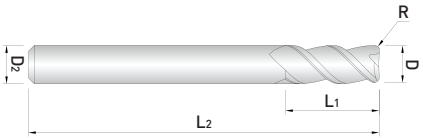
WAR303 ...series

EDP NO.	Dimension (mm)				
	D	R	L_1	L_2	D_2
WAR303 06 05	6	0.5	15	50	6
WAR303 06 10	6	1	15	50	6
WAR303 06 15	6	1.5	15	50	6
WAR303 06 20	6	2	15	50	6
WAR303 08 05	8	0.5	20	60	8
WAR303 08 10	8	1	20	60	8
WAR303 08 15	8	1.5	20	60	8
WAR303 08 20	8	2	20	60	8
WAR303 10 05	10	0.5	25	70	10
WAR303 10 10	10	1	25	70	10
WAR303 10 15	10	1.5	25	70	10
WAR303 10 20	10	2	25	70	10
WAR303 10 30	10	3	25	70	10
WAR303 10 40	10	4	25	70	10
WAR303 12 10	12	1	30	75	12
WAR303 12 20	12	2	30	75	12
WAR303 12 30	12	3	30	75	12

■ Tolerance

Mill Dia. (mm)	Shank Dia.
0 ~ -0.02	h6

※ Items can be changed for quality improvement without notice



3 FLUTE, REGULAR LENGTH, CORNER RADIUS - for Aluminum

- Suitable for Aluminum, Aluminum Alloy, Copper & Non-Ferrous Material
- Suitable for High Speed Cutting
- Optimized design for reducing cutting load and effective chip evacuation

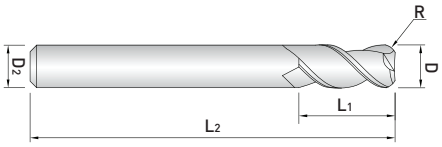
WAR303 ...series

EDP NO.	Dimension (mm)				
	D	R	L_1	L_2	D_2
WAR303 12 40	12	4	30	75	12
WAR303 14 10	14	1	35	80	14
WAR303 14 20	14	2	35	80	14
WAR303 14 30	14	3	35	80	14
WAR303 14 40	14	4	35	80	14
WAR303 14 50	14	5	35	80	14
WAR303 16 10	16	1	40	90	16
WAR303 16 20	16	2	40	90	16
WAR303 16 30	16	3	40	90	16
WAR303 16 40	16	4	40	90	16
WAR303 16 50	16	5	40	90	16
WAR303 20 10	20	1	45	100	20
WAR303 20 20	20	2	45	100	20
WAR303 20 30	20	3	45	100	20
WAR303 20 40	20	4	45	100	20
WAR303 20 50	20	5	45	100	20

■ Tolerance

Mill Dia.(mm)	Shank Dia.
0 ~ -0.02	h6

※ Items can be changed for quality improvement without notice



2 FLUTE, CORNER RADIUS ENDMILL with DLC COATING, REGULAR LENGTH
- for Aluminum

- Suitable for Aluminum, Aluminum Alloy, Copper & Non-Ferrous Material
- Adjust Corner Radius to prevent chipping (Not applicable for R Shape machining)
- Diamond Film Coating maximizes the tool life
- DLC Coated to improve chip evacuation and prolong tool life

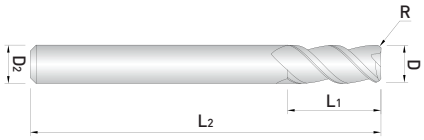
WAR502 ...series

EDP NO.	Dimension (mm)				
	D	R	L_1	L_2	D_2
WAR502 010	1	0.05	3	40	6
WAR502 015	1.5	0.05	5	40	6
WAR502 020	2	0.1	6	40	6
WAR502 021	2	0.1	12	50	6
WAR502 030	3	0.1	10	50	6
WAR502 031	3	0.1	20	60	6
WAR502 040	4	0.1	12	50	6
WAR502 041	4	0.1	20	60	6
WAR502 050	5	0.1	15	57	6
WAR502 060	6	0.1	15	57	6
WAR502 061	6	0.1	22	65	6
WAR502 070	7	0.1	20	63	8
WAR502 080	8	0.1	20	63	8
WAR502 081	8	0.1	28	70	8
WAR502 090	9	0.1	25	72	10
WAR502 100	10	0.2	28	72	10
WAR502 101	10	0.2	32	80	10
WAR502 110	11	0.2	30	80	12
WAR502 120	12	0.2	32	80	12
WAR502 121	12	0.2	40	100	12

■ Tolerance

Mill Dia. (mm)	Shank dia.
0 ~ -0.02	h6

※ Items can be changed for quality improvement without notice



3 FLUTE, CORNER RADIUS ENDMILL with DLC COATING, REGULAR LENGTH
- for Aluminum

- Suitable for Aluminum, Aluminum Alloy, Copper & Non-Ferrous Material
- Diamond Film Coating maximizes the tool life
- DLC Coated to improve chip evacuation and prolong tool life

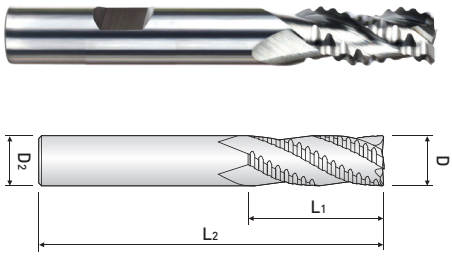
WAR503 ...series

EDP NO.	Dimension (mm)				
	D	R	L_1	L_2	D_2
WAR503 040	4	0.5	14	57	6
WAR503 041	4	1	25	62	6
WAR503 060	6	0.5	16	57	6
WAR503 061	6	1	25	62	6
WAR503 080	8	0.5	22	63	8
WAR503 081	8	1	35	80	8
WAR503 100	10	0.5	28	72	10
WAR503 101	10	1	45	100	10
WAR503 120	12	0.5	32	80	12
WAR503 121	12	1	45	100	12
WAR503 160	16	0.5	45	90	16
WAR503 161	16	1	65	125	16
WAR503 200	20	0.5	50	100	20
WAR503 201	20	1	70	130	20

■ Tolerance

Mill Dia. (mm)	Shank dia.
0 ~ -0.02	h6

※ Items can be changed for quality improvement without notice



3 FLUTE, ROUGHER ENDMILL, REGULAR & LONG LENGTH - for Aluminum

- Suitable for Aluminum, Aluminum Alloy, Copper & Non-Ferrous Material
- High performance geometry and coarse pitch combined for excellent tool life
- Regular and Long lengths
- Uncoated only
- Excellent for Aluminum, Aluminum Alloys, Non-Ferrous Metals, Graphite and Plastics

WAF303 ...series

EDP NO.	Dimension (mm)			
	D	L1	L2	D2
WAF303 040	4	10	55	6
WAF303 050	5	15	55	6
WAF303 060	6	16	60	6
WAF303 061	6	25	80	6
WAF303 070	7	16	63	8
WAF303 080	8	20	65	8
WAF303 081	8	30	90	8
WAF303 090	9	19	72	10
WAF303 100	10	25	75	10
WAF303 101	10	40	100	10
WAF303 120	12	30	80	12
WAF303 121	12	50	110	12
WAF303 140	14	35	90	14
WAF303 160	16	42	100	16
WAF303 161	16	52	150	16
WAF303 162	16	65	125	16
WAF303 180	18	32	92	18
WAF303 200	20	38	104	20
WAF303 201	20	55	160	20

※ Flat Shank is available upon request
ex) WAF303100F

■ Tolerance

㎛=1/1000㎜

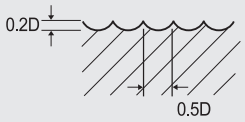
Tolerance \ Dia.	from 1 to 3	over 3 to 6	over 6 to 10	over 10 to 18	over 18 to 30
Cutting Edge(h10)	0 -40	0 -48	0 -58	0 -70	0 -84
Shank(h6)	0 -6	0 -8	0 -9	0 -11	0 -13

※ Items can be changed for quality improvement without notice.

WAB312 series ▶ General Cutting

MATERIAL	ALUMINIUM ALLOY		COPPER ALLOY	
DIAMETER(mm)	RPM	FEED	RPM	FEED
6	18,000	1,750	5,500	440
8	14,000	2,000	4,200	500
10	14,000	2,350	4,200	580
12	14,000	3,000	4,200	750
16	11,000	2,700	3,300	670
20	8,000	2,200	2,200	600

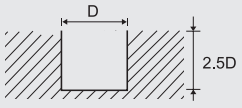
RPM = rev. / min.
FEED = mm / min.



WAE301 series ▶Slotting General Cutting

MATERIAL	ACRYLIC		ALLOY STEELS	
DIAMETER(mm)	RPM	FEED	RPM	FEED
1.0	32,000	2,000	23,000	1,300
2.0	32,000	2,200	23,000	1,500
3.0	25,000	2,400	18,000	1,700
4.0	20,000	2,400	15,000	1,800
5.0	15,000	2,200	12,000	1,800
6.0	13,500	2,300	10,000	1,800
8.0	10,000	2,400	7,800	1,900
10.0	8,000	2,400	6,000	2,000
12.0	7,000	2,200	5,000	1,900

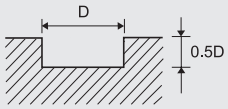
RPM=rev. / min.
FEED=mm / min.



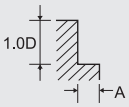
WAE302 series ▶Slotting, Side Cutting General Cutting

MATERIAL	ALLOY STEELS, CAST IRON		ALUMINUM	
HARDNESS	~HB 230			
DIAMETER(mm)	RPM	FEED	RPM	FEED
1.0	16,870	505	16,870	845
1.5	13,150	525	13,150	790
2.0	11,300	565	11,300	790
2.5	10,565	635	10,565	845
3.0	10,000	700	10,000	900
4.0	10,000	900	10,000	1,100
5.0	10,000	1,000	10,000	1,300
6.0	10,000	1,200	10,000	1,500
7.0	8,850	1,240	8,850	1,505
8.0	8,000	1,400	8,000	1,800
9.0	8,000	1,550	8,000	1,680
10.0	8,000	1,700	8,000	2,100
12.0	8,000	2,100	8,000	2,600
14.0	6,000	1,800	6,000	2,200
16.0	6,000	1,900	6,000	2,400
18.0	4,000	1,400	4,000	1,800
20.0	4,000	1,600	4,000	1,900

RPM=rev. / min.
FEED=mm / min.



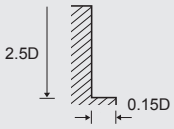
A : Φ3 ~ Φ10 = 0.25 x D
Φ12 ~ Φ20 = 0.5 x D



WAE30(2)3 series ▶Side Cutting General Cutting

MATERIAL	ALUMINUM, NONFERROUS METALS	
DIAMETER(mm)	RPM	FEED
3	7,000	455
4	7,000	546
5	7,000	651
6	7,000	756
8	5,600	861
10	5,600	1,050
12	5,600	882
14	4,200	1,106
16	4,200	1,211
18	2,800	910
20	2,800	956

RPM=rev. / min.
FEED=mm / min.

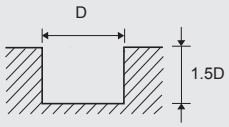


▫ Please reduce cutting speed around 20~30% from the above table for AE323 series

WAE30(2)3 series ▶Slotting General Cutting

MATERIAL	ALUMINUM, NONFERROUS METALS	
DIAMETER(mm)	RPM	FEED
3	7,000	350
4	7,000	441
5	7,000	504
6	7,000	606
8	5,600	700
10	5,600	854
12	5,600	1,050
14	4,200	903
16	4,200	945
18	2,800	700
20	2,800	805

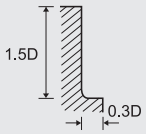
RPM=rev. / min.
FEED=mm / min.



WAR302 series ▶ Side Cutting High Speed Cutting

MATERIAL	ALUMINUM ALLOY (<Si 4%)		ALUMINUM ALLOY (<Si 8%)		ALUMINUM ALLOY (DIE CASTING)		ALUMINUM ALLOY (Cu)	
DIAMETER(mm)	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED
4	24,000	4,800	19,900	3,980	16,000	3,200	12,000	2,400
6	16,000	3,840	13,200	3,160	10,600	2,544	8,000	1,920
8	12,000	3,600	9,900	2,970	8,000	2,400	6,000	1,800
10	9,500	3,420	8,000	2,880	6,300	2,260	4,800	1,720
12	8,000	3,200	6,600	2,640	5,300	2,120	4,000	1,600
14	6,800	2,990	5,600	2,460	4,500	1,980	3,400	1,490
16	6,000	3,000	5,000	2,500	4,000	2,000	3,000	1,500
18	5,300	2,600	4,400	2,200	3,500	1,750	2,600	1,300
20	4,800	2,400	4,000	2,000	3,200	1,600	2,400	1,200

RPM=rev. / min.
FEED=mm / min.

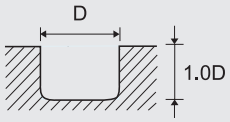


WAR302 series ▶ Slotting

General Cutting

MATERIAL	ALUMINUM ALLOY (<Si 4%)		ALUMINUM ALLOY (<Si 8%)		ALUMINUM ALLOY (DIE CASTING)		ALUMINUM ALLOY (Cu)	
DIAMETER(mm)	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED
4	24,000	3,840	19,900	2,980	16,000	2,240	12,000	1,440
6	16,000	3,072	13,200	2,370	10,600	1,780	8,000	1,150
8	12,000	2,880	9,900	2,230	8,000	1,680	6,000	1,080
10	9,500	2,730	8,000	2,160	6,300	1,580	4,800	1,030
12	8,000	2,560	6,600	1,980	5,300	1,480	4,000	960
14	6,800	2,390	5,600	1,845	4,500	1,380	3,400	890
16	6,000	2,400	5,000	1,870	4,000	1,400	3,000	900
18	5,300	2,080	4,400	1,650	3,500	1,220	2,600	780
20	4,800	1,920	4,000	1,500	3,200	1,260	2,400	720

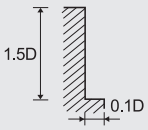
RPM=rev. / min.
FEED=mm / min.

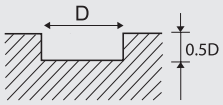


WAR502 series ▶ Side Cutting, Slotting General Cutting

MATERIAL	ALUMUNUM ALLOY (A7075)		ALUMINUM ALLOY CASTING (Si13%)		MAGNESIUM ALLOY, COPPER ALLOY	
DIAMETER(mm)	RPM	FEED	RPM	FEED	RPM	FEED
1	32,000	220	32,000	220	23,000	220
1.2	32,000	230	32,000	230	19,000	220
1.4	32,000	260	32,000	260	16,500	220
1.5	32,000	280	32,000	280	15,500	220
1.6	32,000	320	32,000	320	14,500	220
1.8	32,000	360	32,000	360	13,000	220
2	32,000	420	32,000	420	11,500	220
2.5	25,000	600	25,000	600	9,500	250
3	21,000	700	21,000	700	7,950	250
4	15,500	725	15,500	725	5,950	280
5	12,500	760	12,500	760	4,750	295
6	10,500	830	10,500	830	3,950	310
8	7,950	890	7,950	890	2,950	300
10	6,350	995	6,350	995	2,350	365
12	5,300	1,050	5,300	1,050	1,950	390

RPM=rev. / min.
FEED=mm / min.

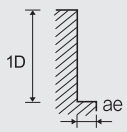




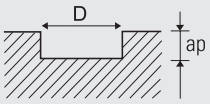
WAR502 series ▶ Side Cutting, Slotting High Speed Cutting

MATERIAL	ALUMUNUM ALLOY (A7075)		ALUMINUM ALLOY CASTING (Si13%)		MAGNESIUM ALLOY, COPPER ALLOY	
DIAMETER(mm)	RPM	FEED	RPM	FEED	RPM	FEED
1	50,000	1,000	50,000	950	42,000	700
1.2	50,000	1,200	50,000	1,150	36,000	700
1.4	50,000	1,400	50,000	1,250	31,000	700
1.5	50,000	1,600	48,000	1,250	29,500	700
1.6	50,000	1,700	45,000	1,250	28,000	700
1.8	50,000	1,850	41,000	1,250	26,500	750
2	50,000	2,000	38,000	1,250	24,000	750
2.5	48,000	2,100	31,000	1,250	20,000	750
3	40,000	2,100	26,000	1,250	17,000	750
4	33,000	2,250	20,000	1,350	14,000	800
5	31,000	2,800	19,200	1,650	12,500	950
6	26,000	2,800	15,900	1,700	10,500	1,000
8	19,500	2,900	12,000	1,800	7,900	1,000
10	15,500	3,200	9,600	1,900	6,350	1,100
12	13,000	3,200	8,000	1,900	5,300	1,100

RPM=rev. / min.
FEED=mm / min.



	ae
Alumunm Alloy, Alumunm Alloy Casting	0.1D
Magnsium Alloy, Copper Alloy	0.05D

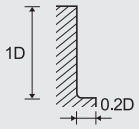


	ae
Alumunm Alloy, Alumunm Alloy Casting	0.15D
Magnsium Alloy, Copper Alloy	0.1D

WAR503 series ▶ Side Cutting General Cutting

MATERIAL	ALUMUNUM ALLOY (A7075)		ALUMINUM ALLOY CASTING (Si13%)		MAGNESIUM ALLOY, COPPER ALLOY	
DIAMETER(mm)	RPM	FEED	RPM	FEED	RPM	FEED
3	21,000	1,100	21,000	1,100	7,950	325
4	15,500	1,250	15,500	1,250	5,950	365
5	12,500	1,300	12,500	1,275	4,750	385
6	10,500	1,400	10,500	1,400	3,950	400
8	7,950	1,500	7,950	1,500	2,950	460
10	6,350	1,700	6,350	1,700	2,350	475
12	5,300	1,750	5,300	1,750	1,950	510
16	3,950	1,750	3,950	1,750	1,450	510
20	3,150	1,750	3,150	1,750	1,150	510

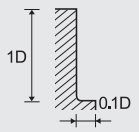
RPM=rev. / min.
FEED=mm / min.



WAR503 series ▶ Side Cutting High Speed Cutting

MATERIAL	ALUMUNUM ALLOY (A7075)		ALUMINUM ALLOY CASTING (Si13%)		MAGNESIUM ALLOY, COPPER ALLOY	
DIAMETER(mm)	RPM	FEED	RPM	FEED	RPM	FEED
3	40,000	2,100	24,000	1,250	17,000	625
4	32,000	2,250	19,200	1,550	14,300	800
5	32,000	3,250	19,200	1,950	12,700	925
6	26,500	3,500	15,900	2,150	10,600	960
8	20,000	3,750	12,000	2,250	8,000	1,130
10	16,000	4,300	9,600	2,580	6,350	1,150
12	13,300	4,400	8,000	2,650	5,300	1,250
16	10,000	4,400	6,000	2,650	4,000	1,250
20	8,000	4,400	4,800	2,650	3,200	1,250

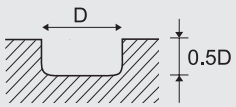
RPM=rev. / min.
FEED=mm / min.



WAR503 series ▶ Slotting General Cutting

MATERIAL	ALUMUNUM ALLOY (A7075)		ALUMINUM ALLOY CASTING (Si13%)		MAGNESIUM ALLOY, COPPER ALLOY (AZ91·AZ80A·C1100)	
DIAMETER(mm)	RPM	FEED	RPM	FEED	RPM	FEED
3	21,000	770	2,100	770	7,950	325
4	15,500	810	15,500	810	5,950	375
5	12,500	860	12,500	860	4,750	385
6	10,500	950	10,500	950	3,950	400
8	8,000	1,000	8,000	1,000	2,950	460
10	6,350	1,150	6,350	1,150	2,350	475
12	5,300	1,200	5,300	1,200	1,950	510
16	3,950	1,200	3,950	1,200	1,450	510
20	3,150	1,200	3,150	1,200	1,150	510

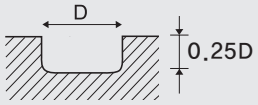
RPM=rev. / min.
FEED=mm / min.



WAR503 series ▶ Slotting High Speed Cutting

MATERIAL	ALUMUNUM ALLOY (A7075)		ALUMINUM ALLOY CASTING (Si13%)	
DIAMETER(mm)	RPM	FEED	RPM	FEED
3	40,000	1,450	24,000	880
4	32,000	1,700	19,200	1,000
5	32,000	2,200	19,200	1,350
6	26,500	2,400	15,900	1,450
8	20,000	2,500	12,000	1,500
10	16,000	2,800	9,600	1,700
12	13,300	2,950	8,000	1,800
16	10,000	3,000	6,000	1,800
20	8,000	3,000	4,800	1,800

RPM=rev. / min.
FEED=mm / min.

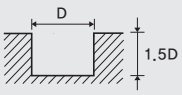


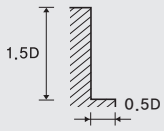
WAF303 series

▶Slotting, Side Cutting General Cutting

MATERIAL	ALUMINUM, NONFERROUS METALS			
DIAMETER(mm)	RPM	FEED	RPM	FEED
6	10,500	800	13,500	1,050
8	8,000	700	10,500	900
10	6,500	750	8,500	950
12	5,250	800	6,800	1,050
16	4,000	800	5,200	1,050
20	3,200	800	4,200	1,050

RPM=rev. / min.
FEED=mm / min.





APF505 series

▶Fractional

Work Material	Aluminum Alloy	Cast Aluminum	Magnesium	Copper & Brass	Titanium
Type	6061	380			6Al-4V
SFM	450 ~ 650	300 ~ 500	250 ~ 500	250 ~ 400	100 ~ 300
Cutting Diameter	CHIPLOAD PER FLUTE(Fz)				
3/16"	.0020" ~ .0040"	.0015" ~ .0030"	.0015" ~ .0030"	.0010" ~ .0025"	.0010" ~ .0020"
1/4"	.0025" ~ .0050"	.0020" ~ .0040"	.0020" ~ .0040"	.0020" ~ .0030"	.0020" ~ .0030"
5/16"	.0035" ~ .0060"	.0030" ~ .0050"	.0030" ~ .0050"	.0020" ~ .0030"	.0020" ~ .0030"
3/8"	.0045" ~ .0070"	.0030" ~ .0060"	.0030" ~ .0060"	.0020" ~ .0040"	.0020" ~ .0040"
1/2"	.0055" ~ .0080"	.0035" ~ .0070"	.0035" ~ .0070"	.0030" ~ .0050"	.0030" ~ .0050"
5/8"	.0065" ~ .0100"	.0040" ~ .0080"	.0040" ~ .0080"	.0030" ~ .0060"	.0030" ~ .0060"

▶Metric

Work Material	Aluminum Alloy	Cast Aluminum	Magnesium	Copper & Brass	Titanium
Type	6061	380			6Al-4V
V(m/min)	140 ~ 200	90 ~ 150	75 ~ 150	75 ~ 120	30 ~ 90
Cutting Diameter	CHIPLOAD PER FLUTE(Fz)				
4	.050 ~ .100	.038 ~ .075	.038 ~ .075	.025 ~ .060	.025 ~ .050
6	.065 ~ .125	.050 ~ .100	.050 ~ .100	.050 ~ .075	.050 ~ .075
8	.090 ~ .150	.075 ~ .125	.075 ~ .125	.050 ~ .075	.050 ~ .075
10	.115 ~ .175	.075 ~ .150	.075 ~ .150	.050 ~ .100	.050 ~ .100
12	.150 ~ .200	.090 ~ .175	.090 ~ .175	.075 ~ .125	.075 ~ .125
16	.165 ~ .250	.100 ~ .200	.100 ~ .200	.075 ~ .150	.075 ~ .150

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Head office & Changwon Factory
172, Sahwa-ro, Uichang-gu, Changwon-si, Gyeongsangnam-do, Korea [51389]

Chicago Office(WIDIN. INC.)
1801 Hicks Rd, Unit B Rolling Meadow il 60008

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