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New Products  
4 Flute Long  
Length Ball



Vol. V

# GENERAL PURPOSE

SOLID CARBIDE  
ENDMILLS



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Extra Long	Ball	4	4 Flute Extra Long Length - Ball End	BA304X & LS	<a href="#">17</a>
Extra Long	Ball	2	2 Flute Extra Long Length - Ball End, ALTiN Coated	ZB302X & LS	<a href="#">18</a>
Extra Long	Ball	4	4 Flute Extra Long Length - Ball End, ALTiN Coated	ZB304X & LS	<a href="#">18</a>

# RECOMMENDATIONS

WIDIN offers a wide selection of high-performance tools, see the 2018 Products Catalogue or consult an authorized WIDIN sales representative for additional product offerings

## Aluminum

Catalogue	Series Number	Page	Series Description
2018 Product Catalogue	WAB, WAE & WAR	54 - 63	Alu-wave - 2 & 3 Flute, Bright & DLC Coated
General Purpose	EA302	5	2 Flute Standard Length - Square End, Bright
General Purpose	BA302	8	2 Flute Standard Length - Ball End, Bright

Note: For different lengths, see these series in “S” for Stub, “L” for Long Length, “X” for Extra Long Length and “LS” for Long Shank.

## Stainless Steels

Catalogue	Series Number	Page	Series Description
2018 Product Catalogue	XXB, XXE & XXR	119 - 124	Sus-Mate 4 & 5 Flutes, ALTiN+H
General Purpose	ZR304	7	4 Flute Standard Length - Corner Radius, ALTiN Coated
General Purpose	ZR304	9	4 Flute Standard Length - Ball End, ALTiN Coated

Note: For different lengths, see these series in “S” for Stub, “L” for Long Length, “X” for Extra Long Length and “LS” for Long Shank.

## Tool Steels & Medium Alloys

Catalogue	Series Number	Page	Series Description
2018 Product Catalogue	XXB, XE & XR	125 - 133	X-Star 4 & 5 Flutes, ALTiN
General Purpose	ZA304	6	4 Flute Standard Length - Square End, ALTiN Coated
General Purpose	ZR304	7	4 Flute Standard Length - Corner Radius, ALTiN Coated
General Purpose	ZB304	9	4 Flute Standard Length - Ball End, ALTiN Coated

## Hardened Tool Steels

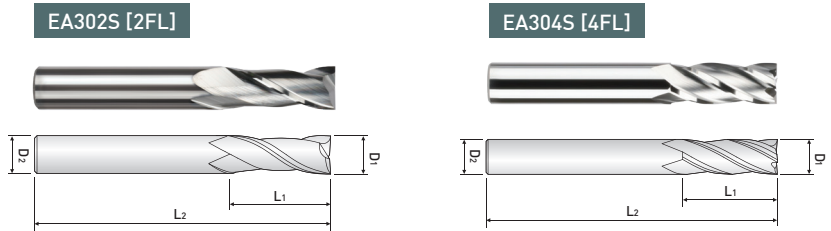
Catalogue	Series Number	Page	Series Description
2018 Product Catalogue	DA, DB, ZE, ZS & ZR	86 - 95	Zamus Star 2, 3, 4 & 5 Flutes, ALTiN+HH
General Purpose	ZR304	7	4 Flute Standard Length - Corner Radius, ALTiN Coated
General Purpose	ZB304	9	4 Flute Standard Length - Ball End, ALTiN Coated

Note: For different lengths, see these series in “S” for Stub, “L” for Long Length, “X” for Extra Long Length and “LS” for Long Shank.

# Stub | Square End

## 2&4 Flute / Stub Length / Uncoated

- Center Cutting - Micro Grain Carbide EndMill
- More Rigidity - Shorter Flute Length
- Slotting & Milling



2 FL. SERIES #	4 FL. SERIES #	D			L2	L1	D2	LIST PRICE
		DECIMAL INCH	FRACTION INCH	METRIC MM	Overall Length INCH	Flute Length INCH	Shank Diameter INCH	
-	EA304002S	0.0313	1/32	0.792	1-1/2	1/32	1/8	\$6.46
-	EA304003S	0.0469	3/64	1.191	1-1/2	3/32	1/8	\$6.46
-	EA304004S	0.0625	1/16	1.588	1 1/2	1/8	1/8	\$5.57
-	EA304006S	0.0938	3/32	2.383	1 1/2	3/16	1/8	\$5.57
EA302008S	EA304008S	0.1250	1/8	3.175	1 1/2	1/4	1/8	\$5.18
-	EA304010S	0.1563	5/32	3.967	2	5/16	3/16	\$8.06
EA302012S	EA304012S	0.1875	3/16	4.763	2	3/8	3/16	\$7.64
-	EA304014S	0.2188	7/32	5.558	2	7/16	1/4	\$9.81
EA302016S	EA304016S	0.2500	1/4	6.350	2 1/2	1/2	1/4	\$9.66
EA302020S	EA304020S	0.3125	5/16	7.938	2 1/2	1/2	5/16	\$9.66
EA302024S	EA304024S	0.3750	3/8	9.525	2 1/2	9/16	3/8	\$15.00
-	EA304028S	0.4375	7/16	11.113	2 1/2	9/16	7/16	\$22.64
EA302032S	EA304032S	0.5000	1/2	12.700	3	5/8	1/2	\$26.87
-	EA304040S	0.6250	5/8	15.875	3	3/4	5/8	\$48.13
-	EA304048S	0.7500	3/4	19.050	3	1	3/4	\$73.41
-	EA304064S	1.0000	1	25.400	3-1/2	1	1	\$119.53

Applicable Working Material

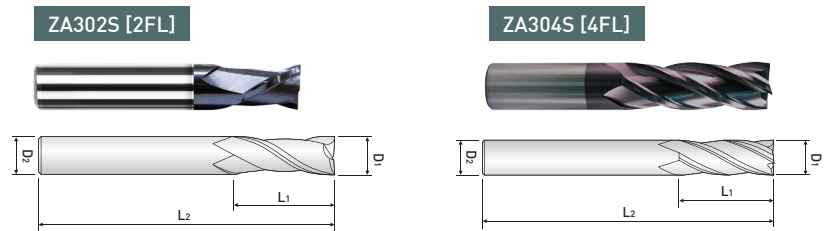
○ : GOOD ◎ : BEST

SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1045,1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6Al4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME	
EA Series	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

# Stub | Square End | ALTiN Coated

## 2&4 Flute / Stub Length / ALTiN Coated

- Center Cutting - Micro Grain Carbide End Mill
- More Rigidity - Shorter Flute Length
- Enhanced Tool Life
- Slotting & Milling



2 FL. SERIES #	4 FL. SERIES #	D			L2	L1	D2	LIST PRICE
		DECIMAL INCH	FRACTION INCH	METRIC MM	Overall Length INCH	Flute Length INCH	Shank Diameter INCH	
-	ZA304002S	0.0313	1/32	0.792	1-1/2	1/32	1/8	\$7.75
-	ZA304003S	0.0469	3/64	1.191	1-1/2	3/32	1/8	\$7.75
-	ZA304004S	0.0625	1/16	1.588	1 1/2	1/8	1/8	\$7.37
-	ZA304006S	0.0938	3/32	2.383	1 1/2	3/16	1/8	\$7.37
ZA302008S	ZA304008S	0.1250	1/8	3.175	1 1/2	1/4	1/8	\$6.98
-	ZA304010S	0.1563	5/32	3.967	2	5/16	3/16	\$9.88
ZA302012S	ZA304012S	0.1875	3/16	4.763	2	3/8	3/16	\$9.43
-	ZA304014S	0.2188	7/32	5.558	2	7/16	1/4	\$12.52
ZA302016S	ZA304016S	0.2500	1/4	6.350	2 1/2	1/2	1/4	\$12.55
ZA302020S	ZA304020S	0.3125	5/16	7.938	2 1/2	1/2	5/16	\$17.24
ZA302024S	ZA304024S	0.3750	3/8	9.525	2 1/2	9/16	3/8	\$20.02
-	ZA304028S	0.4375	7/16	11.113	2 1/2	9/16	7/16	\$28.92
ZA302032S	ZA304032S	0.5000	1/2	12.700	3	5/8	1/2	\$33.17
-	ZA304040S	0.6250	5/8	15.875	3	3/4	5/8	\$60.76
-	ZA304048S	0.7500	3/4	19.050	3	1	3/4	\$89.91
-	ZA304064S	1.0000	1	25.400	3-1/2	1	1	\$143.70

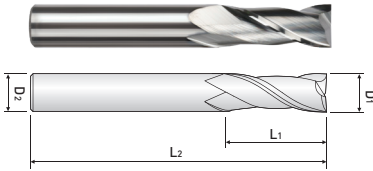
Applicable Working Material

○ : GOOD ◎ : BEST

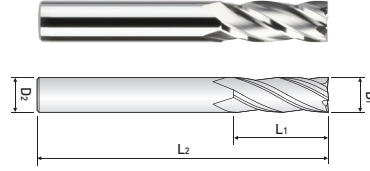
SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1045,1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6Al4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME
ZA Series	◎	◎	◎	◎	◎	○	○	○	○	○	○	○	○	◎	○	○	○	○	○	○	○

# Standard | Square End

EA302[2FL]



EA304 [4FL]



2&4 Flute / Standard Length / Uncoated

- Center Cutting - Micro Grain Carbide EndMill
- Slotting & Milling



2 FL. SERIES #	4 FL. SERIES #	D			L2	L1	D2	LIST PRICE
		DECIMAL INCH	FRACTION INCH	METRIC MM	Overall Length INCH	Flute Length INCH	Shank Diameter INCH	
<a href="#">EA302001</a>	<a href="#">EA304001</a>	0.0156	1/64	0.397	1 1/2	1/32	1/8	\$10.55
<a href="#">EA302002</a>	<a href="#">EA304002</a>	0.0313	1/32	0.792	1 1/2	5/64	1/8	\$6.54
<a href="#">EA302003</a>	<a href="#">EA304003</a>	0.0469	3/64	1.191	1 1/2	7/64	1/8	\$6.54
<a href="#">EA302004</a>	<a href="#">EA304004</a>	0.0625	1/16	1.588	1 1/2	3/16	1/8	\$4.91
<a href="#">EA302005</a>	<a href="#">EA304005</a>	0.0781	5/64	1.984	1 1/2	1/4	1/8	\$4.91
<a href="#">EA302006</a>	<a href="#">EA304006</a>	0.0938	3/32	2.383	1 1/2	5/16	1/8	\$4.91
<a href="#">EA302007</a>	<a href="#">EA304007</a>	0.1094	7/64	2.779	1 1/2	3/8	1/8	\$5.57
<a href="#">EA302008</a>	<a href="#">EA304008</a>	0.1250	1/8	3.175	2	1/2	1/8	\$5.18
<a href="#">EA302009</a>	<a href="#">EA304009</a>	0.1406	9/64	3.571	2	1/2	3/16	\$7.13
<a href="#">EA302010</a>	<a href="#">EA304010</a>	0.1563	5/32	3.967	2	9/16	3/16	\$7.13
<a href="#">EA302011</a>	<a href="#">EA304011</a>	0.1719	11/64	4.366	2	9/16	3/16	\$7.13
<a href="#">EA302012</a>	<a href="#">EA304012</a>	0.1875	3/16	4.763	2	5/8	3/16	\$7.19
<a href="#">EA302013</a>	<a href="#">EA304013</a>	0.2031	13/64	5.159	2 1/2	5/8	1/4	\$10.16
<a href="#">EA302014</a>	<a href="#">EA304014</a>	0.2188	7/32	5.558	2 1/2	5/8	1/4	\$10.82
<a href="#">EA302015</a>	<a href="#">EA304015</a>	0.2344	15/64	5.954	2 1/2	3/4	1/4	\$10.82
<a href="#">EA302016</a>	<a href="#">EA304016</a>	0.2500	1/4	6.350	2 1/2	3/4	1/4	\$9.04
<a href="#">EA302018</a>	<a href="#">EA304018</a>	0.2813	9/32	7.142	2 1/2	3/4	5/16	\$13.95
<a href="#">EA302020</a>	<a href="#">EA304020</a>	0.3125	5/16	7.938	2 1/2	13/16	5/16	\$12.58
<a href="#">EA302022</a>	<a href="#">EA304022</a>	0.3438	11/32	8.733	2 1/2	7/8	3/8	\$16.45
<a href="#">EA302024</a>	<a href="#">EA304024</a>	0.3750	3/8	9.525	3	1	3/8	\$15.35
<a href="#">EA302026</a>	<a href="#">EA304026</a>	0.4063	13/32	10.317	3	1	7/16	\$23.69
<a href="#">EA302028</a>	<a href="#">EA304028</a>	0.4375	7/16	11.113	3	1	7/16	\$21.43
<a href="#">EA302030</a>	<a href="#">EA304030</a>	0.4688	15/32	11.908	3	1	1/2	\$28.45
<a href="#">EA302032</a>	<a href="#">EA304032</a>	0.5000	1/2	12.700	3	1	1/2	\$24.12
<a href="#">EA302036</a>	<a href="#">EA304036</a>	0.5625	9/16	14.288	3 1/2	1 1/8	9/16	\$40.12
<a href="#">EA302040</a>	<a href="#">EA304040</a>	0.6250	5/8	15.875	3 1/2	1 1/4	5/8	\$48.71
<a href="#">EA302044</a>	<a href="#">EA304044</a>	0.6875	11/16	17.463	4	1 3/8	3/4	\$77.89
<a href="#">EA302048</a>	<a href="#">EA304048</a>	0.7500	3/4	19.050	4	1 1/2	3/4	\$74.30
<a href="#">EA302056</a>	<a href="#">EA304056</a>	0.8750	7/8	22.225	4	1 1/2	7/8	\$107.28
<a href="#">EA302064</a>	<a href="#">EA304064</a>	1.0000	1	25.400	4	1 1/2	1	\$120.98

Applicable Working Material

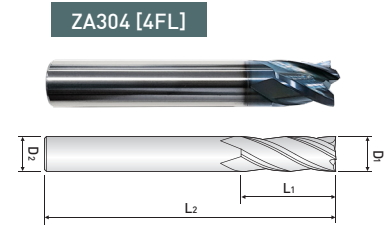
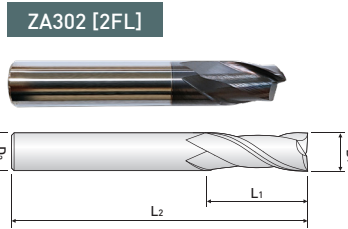
○ : GOOD ● : BEST

SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1045,1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6Al4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME
ZA Series	○	○	○	○	●	○															

# Standard | Square End | ALTiN Coated

## 2&4 Flute / Standard Length / ALTiN Coated

- Center Cutting - Micro Grain Carbide EndMill
- Enhanced Tool Life
- Slotting & Milling



2 FL. SERIES #	4 FL. SERIES #	D			L2 Overall Length INCH	L1 Flute Length INCH	D2 Shank Diameter INCH	LIST PRICE
		DECIMAL INCH	FRACTION INCH	METRIC MM				
<a href="#">ZA302001</a>	<a href="#">ZA304001</a>	0.0156	1/64	0.397	1 1/2	1/32	1/8	\$12.24
<a href="#">ZA302002</a>	<a href="#">ZA304002</a>	0.0313	1/32	0.792	1 1/2	5/64	1/8	\$7.84
<a href="#">ZA302003</a>	<a href="#">ZA304003</a>	0.0469	3/64	1.191	1 1/2	7/64	1/8	\$7.84
<a href="#">ZA302004</a>	<a href="#">ZA304004</a>	0.0625	1/16	1.588	1 1/2	3/16	1/8	\$6.93
<a href="#">ZA302005</a>	<a href="#">ZA304005</a>	0.0781	5/64	1.984	1 1/2	1/4	1/8	\$6.93
<a href="#">ZA302006</a>	<a href="#">ZA304006</a>	0.0938	3/32	2.383	1 1/2	5/16	1/8	\$6.93
<a href="#">ZA302007</a>	<a href="#">ZA304007</a>	0.1094	7/64	2.779	1 1/2	3/8	1/8	\$6.93
<a href="#">ZA302008</a>	<a href="#">ZA304008</a>	0.1250	1/8	3.175	2	1/2	1/8	\$6.17
<a href="#">ZA302009</a>	<a href="#">ZA304009</a>	0.1406	9/64	3.571	2	1/2	3/16	\$9.30
<a href="#">ZA302010</a>	<a href="#">ZA304010</a>	0.1563	5/32	3.967	2	9/16	3/16	\$9.30
<a href="#">ZA302011</a>	<a href="#">ZA304011</a>	0.1719	11/64	4.366	2	9/16	3/16	\$9.30
<a href="#">ZA302012</a>	<a href="#">ZA304012</a>	0.1875	3/16	4.763	2	5/8	3/16	\$8.87
<a href="#">ZA302013</a>	<a href="#">ZA304013</a>	0.2031	13/64	5.159	2 1/2	5/8	1/4	\$13.39
<a href="#">ZA302014</a>	<a href="#">ZA304014</a>	0.2188	7/32	5.558	2 1/2	5/8	1/4	\$13.39
<a href="#">ZA302015</a>	<a href="#">ZA304015</a>	0.2344	15/64	5.954	2 1/2	3/4	1/4	\$13.39
<a href="#">ZA302016</a>	<a href="#">ZA304016</a>	0.2500	1/4	6.350	2 1/2	3/4	1/4	\$11.44
<a href="#">ZA302018</a>	<a href="#">ZA304018</a>	0.2813	9/32	7.142	2 1/2	3/4	5/16	\$19.60
<a href="#">ZA302020</a>	<a href="#">ZA304020</a>	0.3125	5/16	7.938	2 1/2	13/16	5/16	\$18.15
<a href="#">ZA302022</a>	<a href="#">ZA304022</a>	0.3438	11/32	8.733	2 1/2	7/8	3/8	\$22.28
<a href="#">ZA302024</a>	<a href="#">ZA304024</a>	0.3750	3/8	9.525	3	1	3/8	\$21.10
<a href="#">ZA302026</a>	<a href="#">ZA304026</a>	0.4063	13/32	10.317	3	1	7/16	\$31.21
<a href="#">ZA302028</a>	<a href="#">ZA304028</a>	0.4375	7/16	11.113	3	1	7/16	\$28.78
<a href="#">ZA302030</a>	<a href="#">ZA304030</a>	0.4688	15/32	11.908	3	1	1/2	\$36.26
<a href="#">ZA302032</a>	<a href="#">ZA304032</a>	0.5000	1/2	12.700	3	1	1/2	\$28.97
-	<a href="#">ZA304032-1.25</a>	0.5000	1/2	12.700	3	1 1/4	1/2	\$32.53
<a href="#">ZA302036</a>	<a href="#">ZA304036</a>	0.5625	9/16	14.288	3 1/2	1 1/8	9/16	\$52.33
<a href="#">ZA302040</a>	<a href="#">ZA304040</a>	0.6250	5/8	15.875	3 1/2	1 1/4	5/8	\$61.50
<a href="#">ZA302044</a>	<a href="#">ZA304044</a>	0.6875	11/16	17.463	4	1 3/8	3/4	\$94.46
<a href="#">ZA302048</a>	<a href="#">ZA304048</a>	0.7500	3/4	19.050	4	1 1/2	3/4	\$91.00
<a href="#">ZA302056</a>	<a href="#">ZA304056</a>	0.8750	7/8	22.225	4	1 1/2	7/8	\$125.79
<a href="#">ZA302064</a>	<a href="#">ZA304064</a>	1.0000	1	25.400	4	1 1/2	1	\$145.44

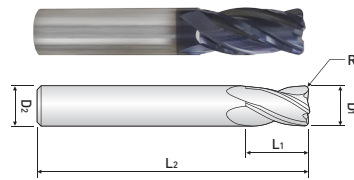
### Applicable Working Material

○ : GOOD ◎ : BEST

SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1045,1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6Al4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME
ZA Series	◎	◎	◎	◎	◎	○								◎	○						

# Standard | Corner Radius | ALTiN Coated

ZR304 [4FL]



4 Flute / Standard Length / ALTiN Coated

- Center Cutting - Micro Grain Carbide EndMill
- Enhanced Tool Life
- Stronger Tool Corners



4 FL. SERIES #	D			L2	L1	R	D2	LIST PRICE
	DECIMAL INCH	FRACTION INCH	METRIC MM					
ZR304A008010	0.1250	1/8	3.175	2	1/2	0.010	1/8	\$7.84
ZR304A008015	0.1250	1/8	3.175	2	1/2	0.015	1/8	\$7.84
ZR304A008020	0.1250	1/8	3.175	2	1/2	0.020	1/8	\$7.84
ZR304A008030	0.1250	1/8	3.175	2	1/2	0.030	1/8	\$7.84
ZR304A012010	0.1875	3/16	4.763	2	5/8	0.010	3/16	\$11.46
ZR304A012015	0.1875	3/16	4.763	2	5/8	0.015	3/16	\$11.46
ZR304A012020	0.1875	3/16	4.763	2	5/8	0.020	3/16	\$11.46
ZR304A012030	0.1875	3/16	4.763	2	5/8	0.030	3/16	\$11.46
ZR304A016010	0.2500	1/4	6.350	2 1/2	3/4	0.010	1/4	\$12.94
ZR304A016015	0.2500	1/4	6.350	2 1/2	3/4	0.015	1/4	\$12.94
ZR304A016020	0.2500	1/4	6.350	2 1/2	3/4	0.020	1/4	\$12.94
ZR304A016030	0.2500	1/4	6.350	2 1/2	3/4	0.030	1/4	\$12.94
ZR304A016045	0.2500	1/4	6.350	2 1/2	3/4	0.045	1/4	\$12.94
ZR304A020015	0.3125	5/16	7.938	2 1/2	13/16	0.015	5/16	\$19.56
ZR304A020020	0.3125	5/16	7.938	2 1/2	13/16	0.020	5/16	\$19.56
ZR304A020030	0.3125	5/16	7.938	2 1/2	13/16	0.030	5/16	\$19.56
ZR304A020045	0.3125	5/16	7.938	2 1/2	13/16	0.045	5/16	\$19.56
ZR304A020060	0.3125	5/16	7.938	2 1/2	13/16	0.060	5/16	\$19.56
ZR304A024010	0.3750	3/8	9.525	3	1	0.010	3/8	\$23.02
ZR304A024015	0.3750	3/8	9.525	3	1	0.015	3/8	\$23.02
ZR304A024020	0.3750	3/8	9.525	3	1	0.020	3/8	\$23.02
ZR304A024030	0.3750	3/8	9.525	3	1	0.030	3/8	\$23.02
ZR304A024045	0.3750	3/8	9.525	3	1	0.045	3/8	\$23.02
ZR304A024060	0.3750	3/8	9.525	3	1	0.060	3/8	\$23.02
ZR304A032010	0.5000	1/2	12.700	3	1	0.010	1/2	\$30.22
ZR304A032015	0.5000	1/2	12.700	3	1	0.015	1/2	\$30.22
ZR304A032020	0.5000	1/2	12.700	3	1	0.020	1/2	\$30.22
ZR304A032030	0.5000	1/2	12.700	3	1	0.030	1/2	\$30.22
ZR304A032060	0.5000	1/2	12.700	3	1	0.060	1/2	\$30.22
ZR304A040030	0.6250	5/8	15.875	3 1/2	1 1/4	0.030	5/8	\$65.95
ZR304A040060	0.6250	5/8	15.875	3 1/2	1 1/4	0.060	5/8	\$65.95
ZR304A040090	0.6250	5/8	15.875	3 1/2	1 1/4	0.090	5/8	\$65.95
ZR304A040125	0.6250	5/8	15.875	3 1/2	1 1/4	0.125	5/8	\$65.95
ZR304A048030	0.7500	3/4	19.050	4	1 1/2	0.030	3/4	\$98.64
ZR304A048060	0.7500	3/4	19.050	4	1 1/2	0.060	3/4	\$98.64
ZR304A048090	0.7500	3/4	19.050	4	1 1/2	0.090	3/4	\$98.64
ZR304A048125	0.7500	3/4	19.050	4	1 1/2	0.125	3/4	\$164.41
ZR304A064030	1.0000	1	25.400	4	1 1/2	0.030	1	\$153.72
ZR304A064060	1.0000	1	25.400	4	1 1/2	0.060	1	\$153.72
ZR304A064090	1.0000	1	25.400	4	1 1/2	0.030	1	\$256.20
ZR304A064125	1.0000	1	25.400	4	1 1/2	0.060	1	\$256.20

Applicable Working Material

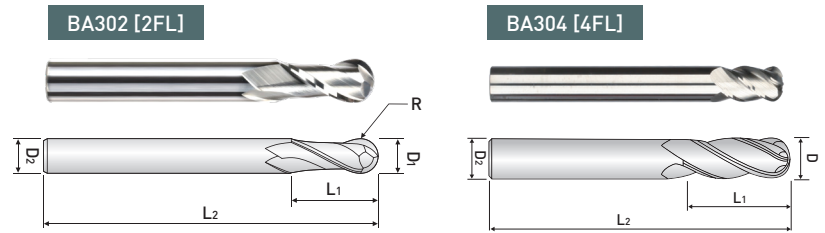
○ : GOOD ◎ : BEST

SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1035,1045)	CARBON STEELS HIGH (1065)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6Al4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME
ZA Series	◎	◎	◎	◎	◎	○								◎	○						

# Standard | Ball End

2 & 4 Flute / Standard Length / Uncoated

- Center Cutting - Micro Grain Carbide EndMill
- Slotting & Milling



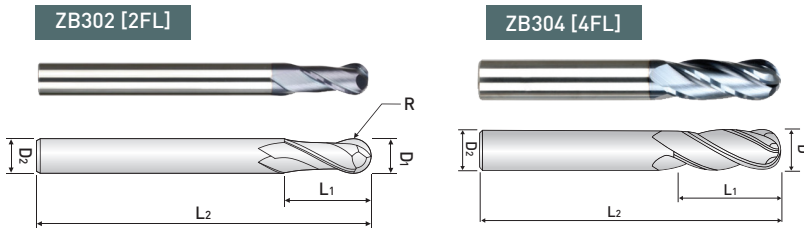
2 FL. SERIES #	4 FL. SERIES #	D			L2	L1	D2	LIST PRICE
		DECIMAL INCH	FRACTION INCH	METRIC MM	Overall Length INCH	Flute Length INCH	Shank Diameter INCH	
<a href="#">BA302001</a>	<a href="#">BA304001</a>	0.0156	1/64	0.397	1 1/2	1/32	1/8	\$14.45
<a href="#">BA302002</a>	<a href="#">BA304002</a>	0.0313	1/32	0.792	1 1/2	5/64	1/8	\$8.39
<a href="#">BA302003</a>	<a href="#">BA304003</a>	0.0469	3/64	1.191	1 1/2	7/64	1/8	\$8.08
<a href="#">BA302004</a>	<a href="#">BA304004</a>	0.0625	1/16	1.588	1 1/2	3/16	1/8	\$6.85
<a href="#">BA302005</a>	<a href="#">BA304005</a>	0.0781	5/64	1.984	1 1/2	1/4	1/8	\$6.85
<a href="#">BA302006</a>	<a href="#">BA304006</a>	0.0938	3/32	2.383	1 1/2	5/16	1/8	\$6.85
<a href="#">BA302007</a>	<a href="#">BA304007</a>	0.1094	7/64	2.779	1 1/2	3/8	1/8	\$6.85
<a href="#">BA302008</a>	<a href="#">BA304008</a>	0.1250	1/8	3.175	2	1/2	1/8	\$6.59
<a href="#">BA302009</a>	<a href="#">BA304009</a>	0.1406	9/64	3.571	2	1/2	3/16	\$9.65
<a href="#">BA302010</a>	<a href="#">BA304010</a>	0.1563	5/32	3.967	2	9/16	3/16	\$9.65
<a href="#">BA302011</a>	<a href="#">BA304011</a>	0.1719	11/64	4.366	2	9/16	3/16	\$9.65
<a href="#">BA302012</a>	<a href="#">BA304012</a>	0.1875	3/16	4.763	2	5/8	3/16	\$8.94
<a href="#">BA302013</a>	<a href="#">BA304013</a>	0.2031	13/64	5.159	2 1/2	5/8	1/4	\$13.48
<a href="#">BA302014</a>	<a href="#">BA304014</a>	0.2188	7/32	5.558	2 1/2	5/8	1/4	\$13.48
<a href="#">BA302015</a>	<a href="#">BA304015</a>	0.2344	15/64	5.954	2 1/2	3/4	1/4	\$13.48
<a href="#">BA302016</a>	<a href="#">BA304016</a>	0.2500	1/4	6.350	2 1/2	3/4	1/4	\$12.66
<a href="#">BA302018</a>	<a href="#">BA304018</a>	0.2813	9/32	7.142	2 1/2	3/4	5/16	\$18.78
<a href="#">BA302020</a>	<a href="#">BA304020</a>	0.3125	5/16	7.938	2 1/2	13/16	5/16	\$17.24
<a href="#">BA302022</a>	<a href="#">BA304022</a>	0.3438	11/32	8.733	2 1/2	7/8	3/8	\$22.80
<a href="#">BA302024</a>	<a href="#">BA304024</a>	0.3750	3/8	9.525	3	1	3/8	\$23.20
<a href="#">BA302026</a>	<a href="#">BA304026</a>	0.4063	13/32	10.317	3	1	7/16	\$30.51
<a href="#">BA302028</a>	<a href="#">BA304028</a>	0.4375	7/16	11.113	3	1	7/16	\$28.95
<a href="#">BA302030</a>	<a href="#">BA304030</a>	0.4688	15/32	11.908	3	1	1/2	\$36.65
<a href="#">BA302032</a>	<a href="#">BA304032</a>	0.5000	1/2	12.700	3	1	1/2	\$34.36
<a href="#">BA302036</a>	<a href="#">BA304036</a>	0.5625	9/16	14.288	3 1/2	1 1/8	9/16	\$52.10
<a href="#">BA302040</a>	<a href="#">BA304040</a>	0.6250	5/8	15.875	3 1/2	1 1/4	5/8	\$61.91
<a href="#">BA302044</a>	<a href="#">BA304044</a>	0.6875	11/16	17.463	4	1 3/8	3/4	\$101.14
<a href="#">BA302048</a>	<a href="#">BA304048</a>	0.7500	3/4	19.050	4	1 1/2	3/4	\$93.62
<a href="#">BA302056</a>	<a href="#">BA304056</a>	0.8750	7/8	22.225	4	1 1/2	7/8	\$139.73
<a href="#">BA302064</a>	<a href="#">BA304064</a>	1.0000	1	25.400	4	1 1/2	1	\$149.32

## Applicable Working Material

○ : GOOD ● : BEST

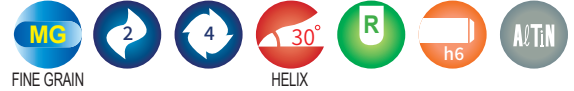
SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1045,1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6Al4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME
BA Series	○	○	○	○	○	○															

# Standard | Ball End | ALTiN Coated



2&4 Flute / Standard Length / ALTiN Coated

- Center Cutting - Micro Grain Carbide EndMills
- More Rigidity - Shorter Flute Length
- Enhanced Tool Life
- Slotting & Milling



2 FL. SERIES #	4 FL. SERIES #	D			L2 Overall Length INCH	L1 Flute Length INCH	D2 Shank Diameter INCH	LIST PRICE
		DECIMAL INCH	FRACTION INCH	METRIC MM				
ZB302001	ZB304001	0.0156	1/64	0.397	1 1/2	1/32	1/8	\$15.85
ZB302002S	-	0.0313	1/32	0.792	1 1/2	1/32	1/8	\$9.95
ZB302002	ZB304002	0.0313	1/32	0.792	1 1/2	5/64	1/8	\$9.95
ZB302003	ZB304003	0.0469	3/64	1.191	1 1/2	7/64	1/8	\$9.65
ZB302004S	-	0.0625	1/16	1.588	1 1/2	1/16	1/8	\$8.45
ZB302004	ZB304004	0.0625	1/16	1.588	1 1/2	3/16	1/8	\$8.45
ZB302005	ZB304005	0.0781	5/64	1.984	1 1/2	1/4	1/8	\$8.45
ZB302006S	ZB304006S	0.0938	3/32	2.383	1 1/2	3/32	1/8	\$8.45
ZB302006	ZB304006	0.0938	3/32	2.383	1 1/2	5/16	1/8	\$8.45
ZB302007	ZB304007	0.1094	7/64	2.779	1 1/2	3/8	1/8	\$8.45
ZB302008S	-	0.1250	1/8	3.175	1 1/2	5/16	1/8	\$8.20
ZB302008	ZB304008	0.1250	1/8	3.175	2	1/2	1/8	\$8.20
ZB302009	ZB304009	0.1406	9/64	3.571	2	1/2	3/16	\$11.19
ZB302010	ZB304010	0.1563	5/32	3.967	2	9/16	3/16	\$11.19
ZB302011	ZB304011	0.1719	11/64	4.366	2	9/16	3/16	\$11.19
ZB302012S	-	0.1875	3/16	4.763	2	3/8	3/16	\$10.50
ZB302012	ZB304012	0.1875	3/16	4.763	2	5/8	3/16	\$10.50
ZB302013	ZB304013	0.2031	13/64	5.159	2 1/2	5/8	1/4	\$15.82
ZB302014	ZB304014	0.2188	7/32	5.558	2 1/2	5/8	1/4	\$15.82
ZB302015	ZB304015	0.2344	15/64	5.954	2 1/2	3/4	1/4	\$15.82
ZB302016S	-	0.2500	1/4	6.350	2 1/2	1/2	1/4	\$15.03
ZB302016	ZB304016	0.2500	1/4	6.350	2 1/2	3/4	1/4	\$15.03
ZB302018	ZB304018	0.2813	9/32	7.142	2 1/2	3/4	5/16	\$18.33
ZB302020S	-	0.3125	5/16	7.938	2 1/2	9/16	5/16	\$21.75
ZB302020	ZB304020	0.3125	5/16	7.938	2 1/2	13/16	5/16	\$21.75
ZB302022	ZB304022	0.3438	11/32	8.733	2 1/2	7/8	3/8	\$27.16
ZB302024S	-	0.3750	3/8	9.525	3	3/4	3/8	\$27.56
ZB302024	ZB304024	0.3750	3/8	9.525	3	1	3/8	\$27.56
ZB302026	ZB304026	0.4063	13/32	10.317	3	1	7/16	\$35.94
ZB302028	ZB304028	0.4375	7/16	11.113	3	1	7/16	\$34.42
ZB302030	ZB304030	0.4688	15/32	11.908	3	1	1/2	\$41.93
ZB302032S	-	0.5000	1/2	12.700	3	7/8	1/2	\$42.01
ZB302032	ZB304032	0.5000	1/2	12.700	3	1	1/2	\$42.01
ZB302036	ZB304036	0.5625	9/16	14.288	3 1/2	1 1/8	9/16	\$54.91
ZB302040S	-	0.6250	5/8	15.875	3 1/2	1	5/8	\$76.30
ZB302040	ZB304040	0.6250	5/8	15.875	3 1/2	1 1/4	5/8	\$76.30
ZB302044	ZB304044	0.6875	11/16	17.463	4	1 3/8	3/4	\$119.87
ZB302048S	-	0.7500	3/4	19.050	4	1	3/4	\$111.90
ZB302048	ZB304048	0.7500	3/4	19.050	4	1 1/2	3/4	\$111.90
ZB302056	ZB304056	0.8750	7/8	22.225	4	1 1/2	7/8	\$163.59
ZB302064S	-	1.0000	1	25.400	4	1	1	\$176.55
ZB302064	ZB304064	1.0000	1	25.400	4	1 1/2	1	\$176.55

Applicable Working Material

○ : GOOD ◎ : BEST

SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1035,1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6AL4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME
BA Series	◎	◎	◎	◎	◎	○								◎	○						

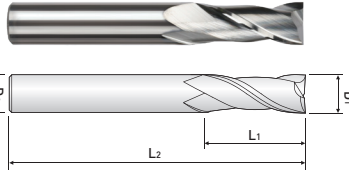
# Long | Square End

## 2&4 Flute / Long Length / Uncoated

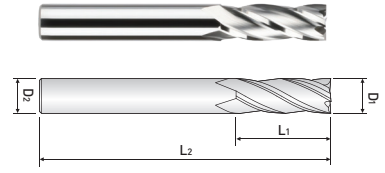
- Center Cutting - Micro Grain Carbide EndMill
- Longer Reach vs. Standard Length
- Slotting & Milling



EA302L [2FL]



EA304L [4FL]



2 FL. SERIES #	4 FL. SERIES #	D			L2	L1	D2	LIST PRICE
		DECIMAL INCH	FRACTION INCH	METRIC MM	Overall Length INCH	Flute Length INCH	Shank Diameter INCH	
<a href="#">EA302008L</a>	<a href="#">EA304008L</a>	0.1250	1/8	3.175	2 1/4	3/4	1/8	\$8.62
<a href="#">EA302012L</a>	<a href="#">EA304012L</a>	0.1875	3/16	4.763	2 1/4	3/4	3/16	\$10.09
<a href="#">EA302016L</a>	<a href="#">EA304016L</a>	0.2500	1/4	6.350	3	1 1/8	1/4	\$14.18
<a href="#">EA302020L</a>	<a href="#">EA304020L</a>	0.3125	5/16	7.938	3	1 1/8	5/16	\$18.91
<a href="#">EA302024L</a>	<a href="#">EA304024L</a>	0.3750	3/8	9.525	3 1/2	1 1/8	3/8	\$22.08
<a href="#">EA302028L</a>	<a href="#">EA304028L</a>	0.4375	7/16	11.113	4	1 1/2	7/16	\$38.12
<a href="#">EA302032L</a>	<a href="#">EA304032L</a>	0.5000	1/2	12.700	4	1 1/2	1/2	\$44.00
<a href="#">EA302040L</a>	<a href="#">EA304040L</a>	0.6250	5/8	15.875	5	2 1/4	5/8	\$91.51
<a href="#">EA302048L</a>	<a href="#">EA304048L</a>	0.7500	3/4	19.050	5	2 1/4	3/4	\$118.78
<a href="#">EA302064L</a>	<a href="#">EA304064L</a>	1.0000	1	25.400	5	2 1/4	1	\$194.14

Applicable Working Material

○ : GOOD ◎ : BEST

SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1035,1045)	CARBON STEELS HIGH (1065)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6A14V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME	
EA Series	○	○	○	○	○	○																

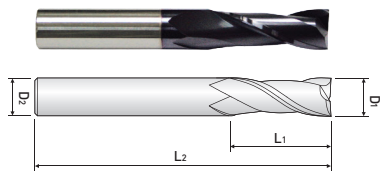
# Long | Square End | ALTiN Coated

## 2&4 Flute / Long Length / ALTiN Coated

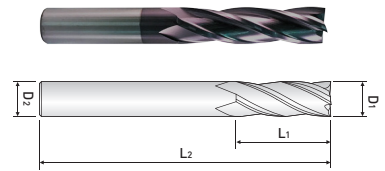
- Center Cutting - Micro Grain Carbide EndMill
- Longer Reach vs. Standard Length
- Enhanced Tool Life
- Slotting & Milling



ZA302L [2FL]



ZA304L [4FL]



2 FL. SERIES #	4 FL. SERIES #	D			L2	L1	D2	LIST PRICE
		DECIMAL INCH	FRACTION INCH	METRIC MM	Overall Length INCH	Flute Length INCH	Shank Diameter INCH	
<a href="#">ZA302008L</a>	<a href="#">ZA304008L</a>	0.1250	1/8	3.175	2 1/4	3/4	1/8	\$10.10
<a href="#">ZA302012L</a>	<a href="#">ZA304012L</a>	0.1875	3/16	4.763	2 1/4	3/4	3/16	\$12.58
<a href="#">ZA302016L</a>	<a href="#">ZA304016L</a>	0.2500	1/4	6.350	3	1 1/8	1/4	\$17.95
<a href="#">ZA302020L</a>	<a href="#">ZA304020L</a>	0.3125	5/16	7.938	3	1 1/8	5/16	\$24.06
<a href="#">ZA302024L</a>	<a href="#">ZA304024L</a>	0.3750	3/8	9.525	3 1/2	1 1/8	3/8	\$27.83
<a href="#">ZA302028L</a>	<a href="#">ZA304028L</a>	0.4375	7/16	11.113	4	1 1/2	7/16	\$41.88
<a href="#">ZA302032L</a>	<a href="#">ZA304032L</a>	0.5000	1/2	12.700	4	1 1/2	1/2	\$56.16
-	<a href="#">ZA304032L1</a>	0.5000	1/2	12.700	4	1-1/4	1/2	\$55.15
-	<a href="#">ZA304032L2</a>	0.5000	1/2	12.700	4	2	1/2	\$58.52
<a href="#">ZA302040L</a>	<a href="#">ZA304040L</a>	0.6250	5/8	15.875	5	2 1/4	5/8	\$108.37
<a href="#">ZA302048L</a>	<a href="#">ZA304048L</a>	0.7500	3/4	19.050	5	2 1/4	3/4	\$136.77
<a href="#">ZA302064L</a>	<a href="#">ZA304064L</a>	1.0000	1	25.400	5	2 1/4	1	\$209.90

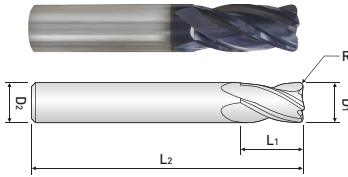
Applicable Working Material

○ : GOOD ◎ : BEST

SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1035,1045)	CARBON STEELS HIGH (1065)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6A14V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME	
ZA Series	◎	◎	◎	◎	◎	○								◎	○							

# Long | Corner Radius | ALTiN Coated

ZR304L [4FL]



4 Flute / Long Length / ALTiN Coated

- Center Cutting - Micro Grain Carbide EndMill
- Longer Reach vs. Standard Length
- Enhanced Tool Life
- Stronger Tool Corners



4 FL. SERIES #	D			L2 Overall Length INCH	L1 Flute Length INCH	R Corner Radius INCH	D2 Shank Diameter INCH	LIST PRICE
	DECIMAL INCH	FRACTION INCH	METRIC MM					
ZR304A008010L	0.1250	1/8	3.175	3	3/4	0.010	1/8	\$9.67
ZR304A008020L	0.1250	1/8	3.175	3	3/4	0.020	1/8	\$9.67
ZR304A008030L	0.1250	1/8	3.175	3	3/4	0.030	1/8	\$9.67
ZR304A012010L	0.1875	3/16	4.763	3	1 1/8	0.010	3/16	\$14.47
ZR304A012020L	0.1875	3/16	4.763	3	1 1/8	0.020	3/16	\$14.47
ZR304A012030L	0.1875	3/16	4.763	3	1 1/8	0.030	3/16	\$14.47
ZR304A016010L	0.2500	1/4	6.350	3	1 1/8	0.010	1/4	\$20.65
ZR304A016020L	0.2500	1/4	6.350	3	1 1/8	0.020	1/4	\$20.65
ZR304A016030L	0.2500	1/4	6.350	3	1 1/8	0.030	1/4	\$20.65
ZR304A016045L	0.2500	1/4	6.350	3	1 1/8	0.045	1/4	\$20.65
ZR304A032060-4	0.2500	1/4	6.350	4	1	0.060	1/4	\$21.87
ZR304A016060L-6	0.2500	1/4	6.350	6	1 1/2	0.060	1/4	\$29.26
ZR304A020020L	0.3125	5/16	7.938	3	1 1/8	0.020	5/16	\$27.67
ZR304A020030L	0.3125	5/16	7.938	3	1 1/8	0.030	5/16	\$27.67
ZR304A020045L	0.3125	5/16	7.938	3	1 1/8	0.045	5/16	\$27.67
ZR304A024010L	0.3750	3/8	9.525	3 1/2	1 1/8	0.010	3/8	\$32.01
ZR304A024020L	0.3750	3/8	9.525	3 1/2	1-1/2	0.020	3/8	\$32.01
ZR304A024030L	0.3750	3/8	9.525	3 1/2	1-1/2	0.030	3/8	\$32.01
ZR304A024045L	0.3750	3/8	9.525	3 1/2	1-1/2	0.045	3/8	\$32.01
ZR304A024060-4	0.3750	3/8	9.525	4	1	0.060	3/8	\$32.32
ZR304A024060L-6	0.3750	3/8	9.525	6	1 1/2	0.060	3/8	\$44.73
ZR304A032015L	0.5000	1/2	12.700	4	1 1/2	0.015	1/2	\$56.16
ZR304A032020L	0.5000	1/2	12.700	4	1 1/2	0.020	1/2	\$56.16
ZR304A032030L	0.5000	1/2	12.700	4	1 1/2	0.030	1/2	\$56.16
ZR304A032060L	0.5000	1/2	12.700	4	1 1/2	0.060	1/2	\$56.16
ZR304A032090L	0.5000	1/2	12.700	4	1 1/2	0.090	1/2	\$56.16
ZR304A032125L	0.5000	1/2	12.700	4	1 1/2	0.125	1/2	\$56.16
ZR304A032060-4	0.5000	1/2	12.700	4	1	0.060	1/2	\$44.73
ZR304A032060X-6	0.5000	1/2	12.700	6	1 1/2	0.060	1/2	\$76.60
ZR304A040030L	0.6250	5/8	15.875	5	2 1/4	0.030	5/8	\$109.95
ZR304A040060L	0.6250	5/8	15.875	5	2 1/4	0.060	5/8	\$109.95
ZR304A040090L	0.6250	5/8	15.875	5	2 1/4	0.090	5/8	\$109.95
ZR304A048030L	0.7500	3/4	19.050	5	2 1/4	0.030	3/4	\$138.78
ZR304A048060L	0.7500	3/4	19.050	5	2 1/4	0.060	3/4	\$138.78
ZR304A048090L	0.7500	3/4	19.050	5	2 1/4	0.090	3/4	\$138.78
ZR304A048125L	0.7500	3/4	19.050	5	2 1/4	0.125	3/4	\$231.31
ZR304A064030L	1.0000	1	25.400	5	2 1/4	0.030	1	\$212.98
ZR304A064060L	1.0000	1	25.400	5	2 1/4	0.060	1	\$212.98
ZR304A064090L	1.0000	1	25.400	5	2 1/4	0.090	1	\$354.98
ZR304A064125L	1.0000	1	25.400	5	2 1/4	0.125	1	\$354.98

Applicable Working Material

○ : GOOD ◎ : BEST

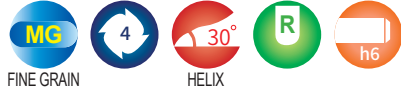
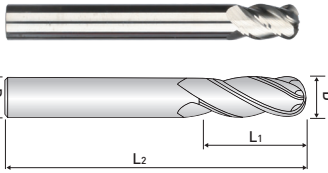
SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1045,1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061,7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6Al4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME
ZA Series	◎	◎	◎	◎	◎	○								◎	○						

# Long | Ball End

**4 Flute / Long Length / Uncoated**

- Center Cutting - Micro Grain Carbide -EndMill
- Slotting & Milling

**BA304 [4FL]**



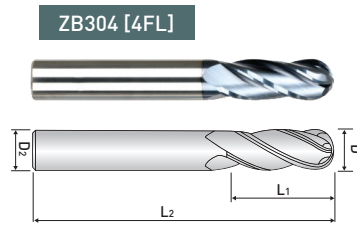
4 FL. SERIES #	D			L2	L1	D2	LIST PRICE
	DECIMAL INCH	FRACTION INCH	METRIC MM	Overall Length INCH	Flute Length INCH	Shank Diameter INCH	
<a href="#">BA304008L</a>	0.1250	1/8	3.175	2 1/2	3/4	1/8	\$7.58
<a href="#">BA304012L</a>	0.1875	3/16	4.763	2 1/2	3/4	3/16	\$10.28
<a href="#">BA304016L</a>	0.2500	1/4	6.350	3	1	1/4	\$14.56
<a href="#">BA304020L</a>	0.3125	5/16	7.938	3 1/2	1 1/8	5/16	\$19.83
<a href="#">BA304024L</a>	0.3750	3/8	9.525	3 1/2	1 1/8	3/8	\$26.68
<a href="#">BA304028L</a>	0.4375	7/16	11.113	4	1 1/2	7/16	\$33.29
<a href="#">BA304032L</a>	0.5000	1/2	12.700	4	1 1/2	1/2	\$39.51
<a href="#">BA304032L1</a>	0.5000	1/2	12.700	4	2	1/2	\$52.90
<a href="#">BA304040L</a>	0.6250	5/8	15.875	5	2	5/8	\$71.20
<a href="#">BA304048L</a>	0.7500	3/4	19.050	5	2	3/4	\$107.66
<a href="#">BA304064L</a>	1.0000	1	25.400	5	2	1	\$171.72

## Applicable Working Material

○ : GOOD ◎ : BEST

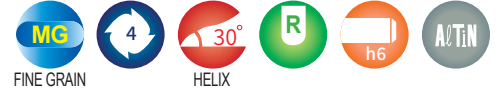
SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1035,1045)	CARBON STEELS HIGH (1065)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061,7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6Al4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME
BA Series	○	○	○	○	○	○															

# Long | Ball End | ALTiN Coated



4 Flute / Long Length/ ALTiN coated

- Center Cutting - Micro Grain Carbide -EndMill
- Enhanced Tool Life
- Slotting & Milling



4 FL. SERIES #	D			L2	L1	D2	LIST PRICE
	DECIMAL INCH	FRACTION INCH	METRIC MM	Overall Length INCH	Flute Length INCH	Shank Diameter INCH	
<a href="#">ZB304008L</a>	0.1250	1/8	3.175	2 1/2	3/4	1/8	\$9.43
<a href="#">ZB304012L</a>	0.1875	3/16	4.763	2 1/2	3/4	3/16	\$12.08
<a href="#">ZB304016L</a>	0.2500	1/4	6.350	3	1	1/4	\$17.28
<a href="#">ZB304020L</a>	0.3125	5/16	7.938	3 1/2	1 1/8	5/16	\$25.01
<a href="#">ZB304024L</a>	0.3750	3/8	9.525	3 1/2	1 1/8	3/8	\$31.69
<a href="#">ZB304028L</a>	0.4375	7/16	11.113	4	1 1/2	7/16	\$39.58
<a href="#">ZB304032L</a>	0.5000	1/2	12.700	4	1 1/2	1/2	\$48.31
<a href="#">ZB304032L1</a>	0.5000	1/2	12.700	4	2	1/2	\$63.25
<a href="#">ZB304040L</a>	0.6250	5/8	15.875	5	2	5/8	\$87.75
<a href="#">ZB304048L</a>	0.7500	3/4	19.050	5	2	3/4	\$128.69
<a href="#">ZB304064L</a>	1.0000	1	25.400	5	2	1	\$203.03

## Applicable Working Material

○ : GOOD ◎ : BEST

SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1035,1045)	CARBON STEELS HIGH (1065)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6Al4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME
BA Series	◎	◎	◎	◎	◎	○								◎	○						

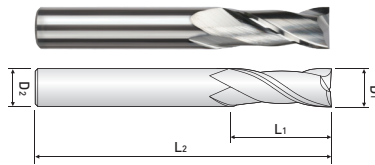
# Extra Long | Square End

2&4 Flute / Extra Long Length / Uncoated

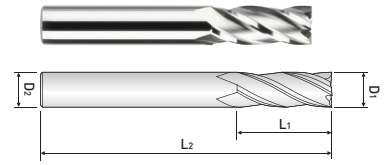
- Center Cutting - Micro Grain Carbide EndMill
- Extra Long Overall Length
- Slotting & Milling



EA302X & LS [2FL]



EA304X & LS [4FL]



2 FL. SERIES #	4 FL. SERIES #	D			L2 Overall Length INCH	L1 Flute Length INCH	D2 Shank Diameter INCH	LIST PRICE
		DECIMAL INCH	FRACTION INCH	METRIC MM				
<a href="#">EA302008X</a>	<a href="#">EA304008X</a>	0.1250	1/8	3.175	3	1	1/8	\$10.07
<a href="#">EA302012X</a>	<a href="#">EA304012X</a>	0.1875	3/16	4.763	3	1 1/8	3/16	\$12.94
<a href="#">EA302012LS</a>	<a href="#">EA304012LS</a>	0.1875	3/16	4.763	4	1 1/2	3/16	\$17.65
<a href="#">EA302016X</a>	<a href="#">EA304016X</a>	0.2500	1/4	6.350	4	1 1/2	1/4	\$20.55
<a href="#">EA302016LS</a>	<a href="#">EA304016LS</a>	0.2500	1/4	6.350	6	1 1/2	1/4	\$33.51
<a href="#">EA302020X</a>	<a href="#">EA304020X</a>	0.3125	5/16	7.938	4	1 5/8	5/16	\$24.79
<a href="#">EA302024X</a>	<a href="#">EA304024X</a>	0.3750	3/8	9.525	4	1 3/4	3/8	\$31.69
<a href="#">EA302024LS</a>	<a href="#">EA304024LS</a>	0.3750	3/8	9.525	6	2	3/8	\$47.13
<a href="#">EA302028X</a>	<a href="#">EA304028X</a>	0.4375	7/16	11.113	6	2	7/16	\$58.11
<a href="#">EA302032X</a>	<a href="#">EA304032X</a>	0.5000	1/2	12.700	6	2	1/2	\$68.94
<a href="#">EA302032LS</a>	<a href="#">EA304032LS</a>	0.5000	1/2	12.700	6	3	1/2	\$72.01
<a href="#">EA302040X</a>	<a href="#">EA304040X</a>	0.6250	5/8	15.875	6	3	5/8	\$118.80
<a href="#">EA302048X</a>	<a href="#">EA304048X</a>	0.7500	3/4	19.050	6	3	3/4	\$147.85
<a href="#">EA302064X</a>	<a href="#">EA304064X</a>	1.0000	1	25.400	6	3	1	\$243.00

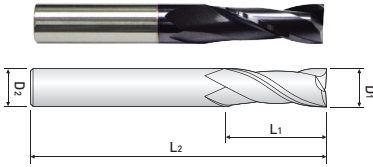
## Applicable Working Material

○ : GOOD ◎ : BEST

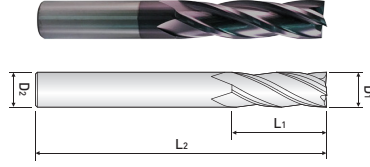
SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1035,1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6Al4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME
EA Series	○	○	○	○	○	○															

# Extra Long | Square End | ALTiN Coated

ZA302X & LS [2FL]



ZA304X & LS [4FL]



2&4 Flute / Extra Long Length / ALTiN Coated

- Center Cutting - Micro Grain Carbide EndMill
- Extra Long Overall Length
- Enhanced Tool Life
- Slotting & Milling



2 FL. SERIES #	4 FL. SERIES #	D			L2 Overall Length INCH	L1 Flute Length INCH	D2 Shank Diameter INCH	LIST PRICE
		DECIMAL INCH	FRACTION INCH	METRIC MM				
<a href="#">ZA302008X</a>	<a href="#">ZA304008X</a>	0.1250	1/8	3.175	3	1	1/8	\$12.14
<a href="#">ZA302012X</a>	<a href="#">ZA304012X</a>	0.1875	3/16	4.763	3	1 1/8	3/16	\$15.59
<a href="#">ZA302012LS</a>	<a href="#">ZA304012LS</a>	0.1875	3/16	4.763	4	1 1/2	3/16	\$21.49
<a href="#">ZA302016X</a>	<a href="#">ZA304016X</a>	0.2500	1/4	6.350	4	1 1/2	1/4	\$27.31
<a href="#">ZA302016LS</a>	<a href="#">ZA304016LS</a>	0.2500	1/4	6.350	6	1 1/2	1/4	\$43.64
<a href="#">ZA302020X</a>	<a href="#">ZA304020X</a>	0.3125	5/16	7.938	4	1 5/8	5/16	\$33.20
<a href="#">ZA302024X</a>	<a href="#">ZA304024X</a>	0.3750	3/8	9.525	4	1 3/4	3/8	\$38.99
<a href="#">ZA302024LS</a>	<a href="#">ZA304024LS</a>	0.3750	3/8	9.525	6	2	3/8	\$59.77
<a href="#">ZA302028X</a>	<a href="#">ZA304028X</a>	0.4375	7/16	11.113	6	2	7/16	\$72.25
<a href="#">ZA302032X</a>	<a href="#">ZA304032X</a>	0.5000	1/2	12.700	6	2	1/2	\$78.46
<a href="#">ZA302032LS</a>	<a href="#">ZA304032LS</a>	0.5000	1/2	12.700	6	3	1/2	\$81.37
<a href="#">ZA302040X</a>	<a href="#">ZA304040X</a>	0.6250	5/8	15.875	6	3	5/8	\$136.92
<a href="#">ZA302048X</a>	<a href="#">ZA304048X</a>	0.7500	3/4	19.050	6	3	3/4	\$169.17
<a href="#">ZA302064X</a>	<a href="#">ZA304064X</a>	1.0000	1	25.400	6	3	1	\$267.60
-	<a href="#">ZA304064LS</a>	1.0000	1	25.400	7	4	1	\$310.82

## Applicable Working Material

○ : GOOD ◎ : BEST

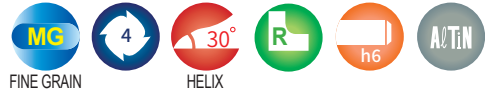
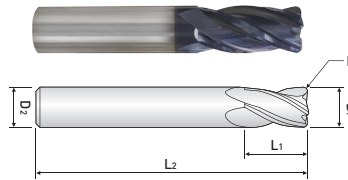
SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1035,1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061,7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6Al4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME
ZA Series	◎	◎	◎	◎	◎	○								◎	○						

# Extra Long | Corner Radius | ALTiN Coated

4 Flute / Extra Long Length / Corner Radius / ALTiN Coated

- Center Cutting - Micro Grain Carbide EndMill
- Extra Long Overall Length
- Enhanced Tool Life
- Stronger Tool Corners

ZR304X & LS [4FL]



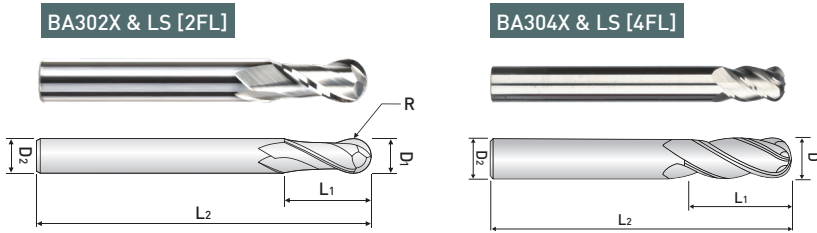
4 FL. SERIES #	D			L2 Overall Length INCH	L1 Flute Length INCH	R Corner Radius INCH	D2 Shank Diame- ter INCH	LIST PRICE
	DECIMAL INCH	FRACTION INCH	METRIC MM					
<a href="#">ZR304A016010X</a>	0.2500	1/4	6.350	4	1 1/2	0.010	1/4	\$28.16
<a href="#">ZR304A016020X</a>	0.2500	1/4	6.350	4	1 1/2	0.020	1/4	\$28.16
<a href="#">ZR304A016030X</a>	0.2500	1/4	6.350	4	1 1/2	0.030	1/4	\$28.16
<a href="#">ZR304A016045X</a>	0.2500	1/4	6.350	4	1 1/2	0.045	1/4	\$28.16
<a href="#">ZR304A016010LS</a>	0.2500	1/4	6.350	6	1 1/2	0.010	1/4	\$48.00
<a href="#">ZR304A016020LS</a>	0.2500	1/4	6.350	6	1 1/2	0.020	1/4	\$48.00
<a href="#">ZR304A016030LS</a>	0.2500	1/4	6.350	6	1 1/2	0.030	1/4	\$48.00
<a href="#">ZR304A016045LS</a>	0.2500	1/4	6.350	6	1 1/2	0.045	1/4	\$48.00
<a href="#">ZR304A020020X</a>	0.3125	5/16	7.938	4	1 5/8	0.020	5/16	\$34.24
<a href="#">ZR304A020030X</a>	0.3125	5/16	7.938	4	1 5/8	0.030	5/16	\$34.24
<a href="#">ZR304A020045X</a>	0.3125	5/16	7.938	4	1 5/8	0.045	5/16	\$34.24
<a href="#">ZR304A024010X</a>	0.3750	3/8	9.525	4	1 3/4	0.010	3/8	\$40.19
<a href="#">ZR304A024020X</a>	0.3750	3/8	9.525	4	1 3/4	0.020	3/8	\$40.19
<a href="#">ZR304A024030X</a>	0.3750	3/8	9.525	4	1 3/4	0.030	3/8	\$40.19
<a href="#">ZR304A024045X</a>	0.3750	3/8	9.525	4	1 3/4	0.045	3/8	\$40.19
<a href="#">ZR304A024010LS</a>	0.3750	3/8	9.525	6	2	0.010	3/8	\$65.76
<a href="#">ZR304A024020LS</a>	0.3750	3/8	9.525	6	2	0.020	3/8	\$65.76
<a href="#">ZR304A024030LS</a>	0.3750	3/8	9.525	6	2	0.030	3/8	\$65.76
<a href="#">ZR304A024045LS</a>	0.3750	3/8	9.525	6	2	0.045	3/8	\$65.76
<a href="#">ZR304A032010X</a>	0.5000	1/2	12.700	6	2	0.010	1/2	\$76.15
<a href="#">ZR304A032015X</a>	0.5000	1/2	12.700	6	2	0.015	1/2	\$76.15
<a href="#">ZR304A032020X</a>	0.5000	1/2	12.700	6	2	0.020	1/2	\$76.15
<a href="#">ZR304A032030X</a>	0.5000	1/2	12.700	6	2	0.030	1/2	\$76.15
<a href="#">ZR304A032060X</a>	0.5000	1/2	12.700	6	2	0.060	1/2	\$76.15
<a href="#">ZR304A032010LS</a>	0.5000	1/2	12.700	6	3	0.010	1/2	\$80.77
<a href="#">ZR304A032015LS</a>	0.5000	1/2	12.700	6	3	0.015	1/2	\$80.77
<a href="#">ZR304A032020LS</a>	0.5000	1/2	12.700	6	3	0.020	1/2	\$80.77
<a href="#">ZR304A032030LS</a>	0.5000	1/2	12.700	6	3	0.030	1/2	\$80.77
<a href="#">ZR304A032060LS</a>	0.5000	1/2	12.700	6	3	0.060	0.5	\$80.77
<a href="#">ZR304A040030X</a>	0.6250	5/8	15.875	6	3	0.030	0.625	\$132.89
<a href="#">ZR304A040060X</a>	0.6250	5/8	15.875	6	3	0.060	5/8	\$132.89
<a href="#">ZR304A040090X</a>	0.6250	5/8	15.875	6	3	0.090	5/8	\$132.89
<a href="#">ZR304A048030X</a>	0.7500	3/4	19.050	6	3	0.030	3/4	\$164.18
<a href="#">ZR304A048060X</a>	0.7500	3/4	19.050	6	3	0.060	3/4	\$164.18
<a href="#">ZR304A048090X</a>	0.7500	3/4	19.050	6	3	0.090	3/4	\$164.18
<a href="#">ZR304A064030X</a>	1.0000	1	25.400	6	3	0.030	1	\$259.72
<a href="#">ZR304A064060X</a>	1.0000	1	25.400	6	3	0.060	1	\$259.72

## Applicable Working Material

○ : GOOD ◎ : BEST

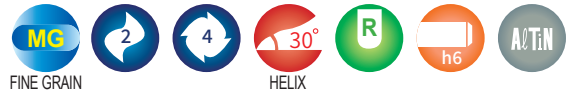
SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1035,1045)	CARBON STEELS HIGH (1065)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061,7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6Al4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME
ZB Series	◎	◎	◎	◎	◎	○								◎	○						

# Extra Long | Ball End



2&4 Flute / Extra Long Length / ALTiN Coating

- Center Cutting - Micro Grain Carbide EndMill
- Extra Long Overall Length
- Slotting & Milling



2 FL. SERIES #	4 FL. SERIES #	D			L2 Overall Length INCH	L1 Flute Length INCH	D2 Shank Diameter INCH	LIST PRICE
		DECIMAL INCH	FRACTION INCH	METRIC MM				
<a href="#">BA302008X</a>	<a href="#">BA304008X</a>	0.1250	1/8	3.175	3	1	1/8	\$12.24
<a href="#">BA302012X</a>	<a href="#">BA304012X</a>	0.1875	3/16	4.763	3	1 1/8	3/16	\$15.97
<a href="#">BA302012LS</a>	<a href="#">BA304012LS</a>	0.1875	3/16	4.763	4	1 1/2	3/16	\$21.54
<a href="#">BA302016X</a>	<a href="#">BA304016X</a>	0.2500	1/4	6.350	4	1 1/2	1/4	\$23.55
<a href="#">BA302016LS</a>	<a href="#">BA304016LS</a>	0.2500	1/4	6.350	6	1 1/2	1/4	\$30.57
<a href="#">BA302020X</a>	<a href="#">BA304020X</a>	0.3125	5/16	7.938	4	1 5/8	5/16	\$27.82
<a href="#">BA302024X</a>	<a href="#">BA304024X</a>	0.3750	3/8	9.525	4	1 3/4	3/8	\$33.86
<a href="#">BA302024LS</a>	<a href="#">BA304024LS</a>	0.3750	3/8	9.525	6	2	3/8	\$60.08
<a href="#">BA302028X</a>	<a href="#">BA304028X</a>	0.4375	7/16	11.113	6	2	7/16	\$61.86
<a href="#">BA302032X</a>	<a href="#">BA304032X</a>	0.5000	1/2	12.700	6	2	1/2	\$72.23
<a href="#">BA302032LS</a>	<a href="#">BA304032LS</a>	0.5000	1/2	12.700	6	3	1/2	\$113.26
<a href="#">BA302040X</a>	<a href="#">BA304040X</a>	0.6250	5/8	15.875	6	3	5/8	\$127.72
<a href="#">BA302048X</a>	<a href="#">BA304048X</a>	0.7500	3/4	19.050	6	3	3/4	\$158.98
<a href="#">BA302064X</a>	<a href="#">BA304064X</a>	1.0000	1	25.400	6	3	1	\$255.26

## Applicable Working Material

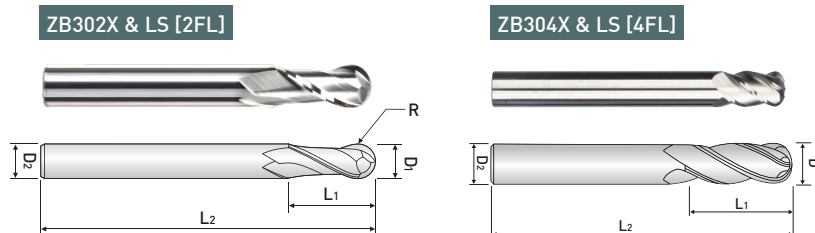
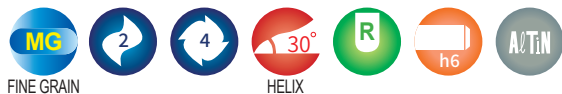
○ : GOOD ◎ : BEST

SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1045,1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061,7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6Al4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME
BA Series	○	○	○	○	○	○															

# Extra Long | Ball End | ALTiN Coated

## 2&4 Flute / Extra Long Length / ALTiN Coated

- Center Cutting - Micro Grain Carbide EndMill
- Extra Long Overall Length
- Enhanced Tool Life
- Slotting & Milling



2 FL. SERIES #	4 FL. SERIES #	D			L2 Overall Length INCH	L1 Flute Length INCH	D2 Shank Diameter INCH	LIST PRICE
		DECIMAL INCH	FRACTION INCH	METRIC MM				
<a href="#">ZB302008X</a>	<a href="#">ZB304008X</a>	0.1250	1/8	3.175	3	1	1/8	\$15.06
<a href="#">ZB302012X</a>	<a href="#">ZB304012X</a>	0.1875	3/16	4.763	3	1 1/8	3/16	\$19.79
<a href="#">ZB302012LS</a>	<a href="#">ZB304012LS</a>	0.1875	3/16	4.763	4	1 1/2	3/16	\$25.49
<a href="#">ZB302016X</a>	<a href="#">ZB304016X</a>	0.2500	1/4	6.350	4	1 1/2	1/4	\$30.77
<a href="#">ZB302016LS</a>	<a href="#">ZB304016LS</a>	0.2500	1/4	6.350	6	1 1/2	1/4	\$36.88
<a href="#">ZB302020X</a>	<a href="#">ZB304020X</a>	0.3125	5/16	7.938	4	1 5/8	5/16	\$37.71
<a href="#">ZB302024X</a>	<a href="#">ZB304024X</a>	0.3750	3/8	9.525	4	1 3/4	3/8	\$47.56
<a href="#">ZB302024LS</a>	<a href="#">ZB304024LS</a>	0.3750	3/8	9.525	6	2	3/8	\$67.56
<a href="#">ZB302028X</a>	<a href="#">ZB304028X</a>	0.4375	7/16	11.113	6	2	7/16	\$90.79
<a href="#">ZB302032X</a>	<a href="#">ZB304032X</a>	0.5000	1/2	12.700	6	2	1/2	\$96.62
<a href="#">ZB302032LS</a>	<a href="#">ZB304032LS</a>	0.5000	1/2	12.700	6	3	1/2	\$121.06
<a href="#">ZB302040X</a>	<a href="#">ZB304040X</a>	0.6250	5/8	15.875	6	3	5/8	\$151.03
<a href="#">ZB302048X</a>	<a href="#">ZB304048X</a>	0.7500	3/4	19.050	6	3	3/4	\$174.73
<a href="#">ZB302064X</a>	<a href="#">ZB304064X</a>	1.0000	1	25.400	6	3	1	\$307.23

### Applicable Working Material

○ : GOOD ◎ : BEST

SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1035,1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6Al4V)	HARDENED STEELS 35 HRC	HARDENED STEELS 35-45 HRC	HARDENED STEELS 45-50 HRC	HARDENED STEELS 50-70 HRC	MAGNESIUM	BRASS BRONZE	GRAPHITE	COBALT CHROME
ZB Series	◎	◎	◎	◎	◎	○								◎	○						

## ZB302 Series | General Speed Cutting

Material	Non-Alloyed Steels Alloy Steels · Cast Iron		Alloy Steels Heat Resistant Steels		Hardened Steels	
Hardness	~ HRC30		HRC30 ~ HRC40		HRC45 ~ HRC65	
Strength	~ 1000N/mm <sup>2</sup>		1000 ~ 1250N/mm <sup>2</sup>		1500N/mm <sup>2</sup>	
Diameter (INCH)	RPM	FEED	RPM	FEED	RPM	FEED
R1/64 X 1/32	15760	9.80	12720	7.80	5800	3.80
R1/32 X 1/16	15760	13.80	12140	1.60	5320	4.70
R3/64 X 3/32	14400	29.50	10700	19.30	4680	5.90
R1/16 X 1/8	13100	26.70	10000	18.10	4520	5.90
R3/32 X 3/16	9140	32.30	7300	22.80	3680	7.10
R1/8 X 1/4	7780	33.00	6300	24.80	3160	7.50
R5/32 X 5/16	5260	37.50	4420	26.00	2100	7.50
R3/16 X 3/8	4620	40.10	3780	28.00	1780	7.50
R1/4 X 1/2	3780	35.40	2940	26.00	1360	7.50
R5/16 X 5/8	2740	36.20	2320	26.00	1160	7.50
R3/8 X 3/4	2100	33.00	1900	25.00	840	7.50

RPM = rev. / min.  
FEED = inch / min.

Ae: D1/32~D1/4=.008 inch  
D5/16~D3/4=.012 inch  
Ap: 0.2 X D

Ae: D1/32~D1/4=.008 inch  
D5/16~D3/4=.012 inch  
Ap: 0.1 X D

## ZB302 Series | High Speed Cutting

Material	Non-Alloyed Steels Alloy Steels · Cast Iron		Hardened Steels	
Hardness	~ HRC45		~ HRC65	
Strength	~ 1500N/mm <sup>2</sup>		1500N/mm <sup>2</sup>	
Diameter (INCH)	RPM	FEED	RPM	FEED
R1/64 X 1/32	25000	25.60	25000	15.70
R1/32 X 1/16	23000	27.50	23000	16.90
R3/64 X 3/32	21000	34.60	19000	19.30
R1/16 X 1/8	21000	39.40	17000	20.50
R3/32 X 3/16	21000	70.90	12000	23.60
R1/8 X 1/4	21000	90.90	10500	24.80
R5/32 X 5/16	15760	111.80	7880	29.10
R3/16 X 3/8	13660	120.00	6300	33.00
R1/4 X 1/2	10500	103.50	5260	33.00
R5/16 X 5/8	8200	103.50	3780	28.00
R3/8 X 3/4	6300	99.00	2940	20.80

RPM = rev. / min.  
FEED = inch / min.

Ae: D1/32~D1/4=.008 inch  
D5/16~D3/4=.012 inch  
Ap: 0.05 X D

## ZB304 Series | General Speed Cutting

Material	Carbon Steels · Alloy Steels · Cast Iron		Alloy Steels · Tool Steels		Hardened Steels	
Hardness	~ HRC30		HRC30 ~ HRC40		HRC55 ~ HRC65	
Strength	~ 1000N/mm <sup>2</sup>		1000 ~ 1250N/mm <sup>2</sup>		1500N/mm <sup>2</sup>	
Diameter (INCH)	RPM	FEED	RPM	FEED	RPM	FEED
R1/16 X 1/8	13100	40.10	10000	27.00	4520	8.85
R3/32 X 3/16	9140	48.50	7300	34.00	3680	10.50
R1/8 X 1/4	7780	49.50	6300	37.00	3160	11.25
R5/32 X 5/16	5260	56.00	4420	39.00	2100	11.25
R3/16 X 3/8	4620	60.00	3780	42.00	1780	11.25
R1/4 X 1/2	3780	53.00	2940	39.00	1360	11.25
R5/16 X 5/8	2740	54.50	2320	38.50	1160	11.25

RPM = rev. / min.  
FEED = inch / min.

Ae: D1/8~D1/4=.008 inch  
D5/16~D5/8=.012 inch  
Ap: 0.02 X D

Ae: D1/8~D1/4=.008 inch  
D5/16~D5/8=.012 inch  
Ap: 0.1 X D

## ZB304 Series | High Speed Cutting

Material	Carbon Steels · Alloy Steels · Cast Iron		Alloy Steels · Tool Steels	
Hardness	~ HRC45		HRC45 ~ HRC65	
Strength	~ 1500N/mm <sup>2</sup>		~ 1500N/mm <sup>2</sup>	
Diameter (INCH)	RPM	FEED	RPM	FEED
R1/16 X 1/8	21000	59.00	17000	30.50
R3/32 X 3/16	21000	106.25	12000	35.50
R1/8 X 1/4	21000	136.50	10500	37.00
R5/32 X 5/16	15760	167.50	7800	43.50
R3/16 X 3/8	13660	180.00	6300	49.50
R1/4 X 1/2	10500	155.50	5260	49.50
R5/16 X 5/8	8200	155.50	3780	42.00

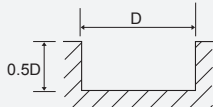
RPM = rev. / min.  
FEED = inch / min.

Ae: D1/8~D1/4=.008 inch  
D5/16~D5/8=.012 inch  
Ap: 0.05 X D

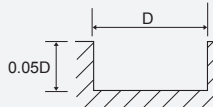
## ZA302 Series

Material	Carbon Steels Alloy Steels · Cast Iron		Alloy Steels Tool Steels		StainlessSteels		Hardened Steels		Hardened Steels	
Hardness	~ HRC30		HRC30 ~ HRC45				HRC45 ~ HRC55		HRC55 ~ HRC65	
Strength	~ 1000N/mm <sup>2</sup>		1000 ~ 1500N/mm <sup>2</sup>				1500 ~ 2000N/mm <sup>2</sup>		2000N/mm <sup>2</sup>	
Diameter (INCH)	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED
1/16	11560	7.50	7560	4.70	6300	3.55	5040	1.40	-	-
1/8	8920	8.25	5560	5.50	4620	4.70	3360	1.55	1900	1.55
3/16	6300	12.60	3780	7.50	3160	6.30	2320	1.95	1260	1.55
1/4	5560	13.80	3360	8.65	2840	7.10	2000	2.15	1100	1.55
5/16	4200	14.95	2520	7.85	2100	7.10	1680	2.95	840	1.55
3/8	3260	13.00	2000	6.30	1680	6.30	1360	2.35	680	1.40
1/2	2740	11.00	1680	5.10	1360	5.10	1160	2.15	560	1.40
5/8	2200	8.65	1360	4.30	1060	4.30	900	1.55	440	0.80
3/4	1680	6.70	1060	3.15	840	3.15	680	1.20	320	0.80
1	1360	5.10	840	2.75	680	2.35	540	0.80	260	0.60

RPM = rev. / min.  
FEED = inch / min.



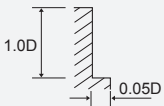
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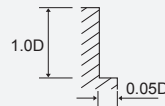


## ZA304 Series

Material	Carbon Steels Alloy Steels · Cast Iron		Alloy Steels Tool Steels		StainlessSteels		Hardened Steels		Hardened Steels	
Hardness	~ HRC30		HRC30 ~ HRC45				HRC45 ~ HRC55		HRC55 ~ HRC65	
Strength	~ 1000N/mm <sup>2</sup>		1000 ~ 1500N/mm <sup>2</sup>				1500 ~ 2000N/mm <sup>2</sup>		2000N/mm <sup>2</sup>	
Diameter (INCH)	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED
1/16	11560	11.00	7560	6.70	6300	5.50	5040	1.95	-	-
1/8	8920	12.60	5560	7.85	4620	6.70	3360	2.35	1900	2.35
3/16	6300	23.60	3780	14.15	3160	11.80	2320	2.75	1260	2.35
1/4	5560	26.00	3360	16.15	2840	13.00	2000	3.15	1100	2.35
5/16	4200	27.95	2520	14.95	2100	13.80	1680	4.30	840	2.35
3/8	3260	24.00	2000	11.80	1680	11.80	1360	3.55	680	1.95
1/2	2740	20.50	1680	9.85	1360	9.45	1160	3.15	560	1.95
5/8	2200	16.15	1360	7.85	1060	7.85	900	2.35	440	1.20
3/4	1680	12.60	1060	6.30	840	5.90	680	1.55	320	1.20
1	1360	9.85	840	5.10	680	4.70	540	1.20	260	0.80

RPM = rev. / min.  
FEED = inch / min.

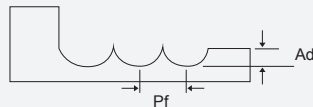




## BA302, BA304 Series

Material	Cast Iron		Mild Steels Carbon Steels		Alloys Steels, Tool Steels, Ti Steels (Annealed)		Hardened Steels, Prehardened Steels, Ti, Alloys (Solution Treated & Aged)		Hardened Steels, Prehardened Steels, Stainless Steels, Inconel, Ni Bases Alloys		Aluminium Alloys	
Hardness					Up to 30 HRc		30 to 38 HRc		38 to 45 HRc			
Strength			Up to 750N/mm									
Diameter (INCH)	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED
1/32	19,600	4.8	19,600	4.5	14,680	2.5	12,200	1.2	9,780	0.9	50,000	6.8
3/64	14,140	5.2	14,140	4.8	10,305	3.0	8,620	1.5	6,885	1.0	35,535	8.0
1/16	11,115	5.8	11,115	5.1	8,045	3.4	6,720	1.7	5,360	1.2	29,585	9.8
5/64	8,090	6.3	8,090	5.4	5,780	3.7	4,810	1.8	3,840	1.4	23,630	11.7
3/32	6,970	6.5	6,970	5.7	4,965	3.9	4,140	1.9	3,290	1.4	20,420	11.8
7/64	5,920	6.7	5,920	6.0	4,205	4.1	3,520	1.9	2,795	1.4	17,325	11.8
1/8	5,090	7.2	5,090	6.1	3,610	4.3	3,030	1.9	2,400	1.4	14,945	11.8
9/64	4,545	7.9	4,545	6.2	3,225	4.3	2,690	1.9	2,140	1.4	13,470	11.8
5/32	4,000	8.6	4,000	6.3	2,850	4.3	2,360	1.9	1,875	1.4	11,990	11.8
11/64	3,670	9.2	3,670	6.6	2,620	4.3	2,160	1.9	1,725	1.4	11,020	12.7
3/16	3,360	9.6	3,360	6.9	2,405	4.4	1,970	1.9	1,580	1.4	10,090	13.6
13/64	3,090	10.1	3,090	7.1	2,205	4.4	1,810	1.9	1,455	1.4	9,275	14.2
7/32	2,870	10.4	2,870	7.1	2,045	4.3	1,690	1.9	1,360	1.4	8,630	14.2
1/4	2,520	11.3	2,520	6.9	1,775	4.2	1,490	1.9	1,205	1.4	7,570	14.6
9/32	2,260	12.5	2,260	6.4	1,580	4.1	1,350	1.9	1,080	1.4	6,785	15.5
5/16	1,995	13.6	1,995	5.9	1,390	4.0	1,200	1.9	960	1.4	6,000	16.4
11/32	1,820	13.7	1,820	5.8	1,290	4.0	1,100	1.9	880	1.4	5,495	16.5
3/8	1,655	13.7	1,655	5.7	1,200	4.0	1,005	1.9	800	1.4	5,020	16.5
13/32	1,515	13.7	1,515	5.6	1,110	3.9	920	1.9	735	1.4	4,610	16.9
7/16	1,420	13.7	1,420	5.4	1,030	3.7	855	1.9	690	1.4	4,300	17.8
1/2	1,250	13.7	1,250	5.2	900	3.5	750	1.9	600	1.4	3,750	18.9
9/16	1,120	13.9	1,120	5.2	795	3.5	660	1.9	530	1.4	3,290	18.5
5/8	1,005	13.9	1,005	5.2	720	3.5	590	1.9	470	1.4	2,960	16.7
11/16	915	13.9	915	5.2	650	3.5	540	1.9	430	1.4	2,715	16.5
3/4	820	12.9	820	5.2	580	3.5	485	1.9	380	1.4	2,415	16.5
7/8	710	11.2	710	5.2	510	3.5	425	1.8	335	1.4	2,100	16.5
1	630	9.8	630	5.1	440	3.5	370	1.6	300	1.4	1,830	16.3

RPM = rev. / min.  
FEED = inch / min.



R	Ad	pf
D < 1/8	0.1D	0.2D
1/8 ≤ D	0.3D	0.7D

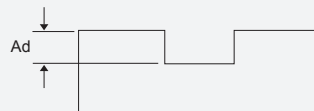
### Note

- for 2Flute
  - Reduce Speeds & Feeds 25% for 2FL. Ball nose Long length
  - Reduce Speeds & Feeds 50% for 2FL. Ball nose Extra Long length
- for 4Flute
  - Increase Speeds & Feeds 40% for 4FL, Ball nose Standard & Stub length
  - Reduce Speeds 25% & Increase Feeds 10% for 4FL. Ball nose Long length
  - Reduce Speeds 50% & Increase Feeds 10% for 4FL. Ball nose Extra Long length

## EA302 Series

Material	Cast Iron		Mild Steels Carbon Steels		Alloys Steels, Tool Steels, Ti Steels (Annealed)		Hardened Steels, Prehardened Steels, Ti, Alloys (Solution Treated & Aged)		Hardened Steels, Prehardened Steels, Stainless Steels, Inconel, Ni Bases Alloys		Aluminium Alloys	
Hardness					Up to 30 HRc		30 to 38 HRc		38 to 45 HRc			
Strength			Up to 750N/mm									
Diameter (INCH)	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED
1/32	20,790	6.6	18,950	4.5	15,900	1.9	13,450	1.4	10,640	1.2	47,700	9.4
3/64	15,225	6.6	13,590	4.5	11,430	1.9	9,660	1.4	7,595	1.2	34,140	9.4
1/16	11,970	6.6	10,660	4.6	9,000	2.0	7,540	1.4	5,925	1.2	26,520	9.4
5/64	8,705	6.6	7,730	4.7	6,570	2.1	5,415	1.4	4,260	1.2	18,900	9.4
3/32	7,480	6.8	6,635	4.7	5,650	2.4	4,650	1.4	3,645	1.2	16,305	9.4
7/64	6,335	6.9	5,610	4.7	4,790	2.6	3,935	1.4	3,075	1.2	13,925	9.4
1/8	5,445	7.1	4,815	4.7	4,125	3.0	3,375	1.4	2,640	1.2	12,060	10.3
9/64	4,870	7.3	4,310	4.7	3,700	3.4	3,020	1.4	2,380	1.2	10,845	12.1
5/32	4,300	7.5	3,815	4.7	3,270	3.7	2,660	1.4	2,115	1.2	9,630	14.0
11/64	3,945	7.6	3,490	4.7	2,990	3.8	2,440	1.4	1,940	1.2	8,835	14.2
3/16	3,615	7.7	3,180	4.7	2,735	3.8	2,225	1.4	1,775	1.2	8,075	14.2
13/64	3,320	8.0	2,920	4.7	2,505	3.8	2,040	1.4	1,630	1.2	7,415	14.2
7/32	3,080	8.6	2,730	4.7	2,345	3.8	1,895	1.4	1,510	1.2	6,915	14.2
1/4	2,690	9.5	2,400	4.7	2,060	3.8	1,660	1.4	1,320	1.2	6,070	14.2
9/32	2,405	10.2	2,140	4.7	1,845	3.8	1,490	1.4	1,185	1.2	5,430	14.2
5/16	2,115	10.8	1,875	4.7	1,630	3.8	1,330	1.4	1,055	1.2	4,785	14.2
11/32	1,940	10.9	1,725	4.7	1,485	3.8	1,220	1.4	970	1.2	4,385	14.2
3/8	1,775	10.9	1,580	4.7	1,340	3.8	1,120	1.4	885	1.2	4,005	14.2
13/32	1,630	10.9	1,455	4.7	1,230	3.8	1,035	1.4	815	1.2	3,680	14.2
7/16	1,510	10.9	1,360	4.7	1,155	3.8	965	1.4	755	1.2	3,440	14.2
1/2	1,310	10.9	1,190	4.7	1,020	3.8	840	1.4	660	1.2	3,010	14.2
9/16	1,175	10.9	1,060	4.7	905	3.8	740	1.4	585	1.2	2,645	14.2
5/8	1,080	11.1	960	4.7	815	3.8	670	1.6	520	1.2	2,355	14.2
11/16	980	11.1	870	4.7	740	3.8	610	1.7	470	1.2	2,160	14.2
3/4	880	11.1	780	4.7	665	3.8	545	1.7	425	1.2	1,920	14.2
7/8	765	11.1	675	4.7	580	3.8	480	1.7	370	1.2	1,660	14.2
1	670	10.9	590	4.7	500	3.8	420	1.7	330	1.2	1,475	14.2

RPM = rev. / min.  
FEED = inch / min.



	Ad
D < 1/8	0.3D
1/8 ≤ D	0.5D

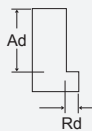
### Note

- for 2Flute
  - Reduce Speeds & Feeds 25% for 2FL. Long length
  - Reduce Speeds & Feeds 50% for 2FL. Extra Long length
- for Side Milling
  - Increase Feeds 25% or More.

## EA304 Series

Material	Cast Iron		Mild Steels Carbon Steels		Alloys Steels, Tool Steels, Ti Steels (Annealed)		Hardened Steels, Prehardened Steels, Ti, Alloys (Solution Treated & Aged)		Hardened Steels, Prehardened Steels, Stainless Steels, Inconel, Ni Bases Alloys		Aluminium Alloys	
Hardness					Up to 30 HRc		30 to 38 HRc		38 to 45 HRc			
Strength			Up to 750N/mm									
Diameter (INCH)	RPM	In/min	RPM	In/min	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED
1/32	21,150	23.9	23,240	11.8	15,900	10.9	14,600	4.5	12,200	3.5	50,000	39.4
3/64	14,140	23.9	15,680	11.8	11,390	10.9	10,305	4.5	8,145	3.5	40,275	39.4
1/16	11,115	23.9	12,105	11.8	8,895	10.9	8,045	4.5	6,390	3.5	31,710	39.4
5/64	8,090	23.9	8,535	11.8	6,395	10.9	5,780	4.5	4,625	3.5	23,135	39.4
3/32	6,970	23.9	7,320	12.6	5,495	10.9	4,965	4.4	3,960	3.4	19,820	40.6
7/64	5,920	23.9	6,200	13.5	4,660	10.9	4,205	4.3	3,340	3.4	16,725	41.8
1/8	5,090	24.6	5,330	14.4	4,005	10.9	3,610	4.3	2,870	3.3	14,370	42.9
9/64	4,545	26.3	4,785	15.4	3,580	10.9	3,225	4.3	2,585	3.3	12,935	43.8
5/32	4,000	28.0	4,240	16.4	3,150	10.9	2,850	4.3	2,295	3.3	11,505	44.8
11/64	3,670	28.1	3,885	16.9	2,895	11.2	2,620	4.3	2,100	3.3	10,565	45.2
3/16	3,360	28.1	3,555	17.2	2,655	11.6	2,405	4.3	1,910	3.3	9,660	45.6
13/64	3,090	28.1	3,260	17.6	2,445	11.8	2,205	4.3	1,750	3.3	8,880	46.0
7/32	2,870	28.1	3,020	17.9	2,285	11.8	2,045	4.3	1,630	3.3	8,280	46.3
1/4	2,520	28.1	2,640	18.2	2,000	11.8	1,775	4.3	1,430	3.3	7,280	46.8
9/32	2,260	28.1	2,380	18.3	1,785	11.8	1,580	4.3	1,295	3.3	6,520	47.0
5/16	1,995	28.1	2,115	18.4	1,570	11.8	1,390	4.3	1,150	3.3	5,760	47.2
11/32	1,820	28.3	1,940	19.4	1,445	11.8	1,290	4.3	1,055	3.3	5,280	47.2
3/8	1,655	28.6	1,775	20.4	1,325	11.8	1,200	4.3	965	3.3	4,830	47.2
13/32	1,515	28.9	1,630	21.0	1,220	11.8	1,110	4.3	885	3.3	4,430	48.0
7/16	1,420	29.1	1,510	21.1	1,140	11.8	1,035	4.3	825	3.3	4,120	49.8
1/2	1,250	30.9	1,310	22.5	995	12.2	900	4.3	720	3.3	3,585	52.0
9/16	1,120	34.3	1,175	24.9	880	13.1	795	4.3	635	3.3	3,170	52.0
5/8	1,005	35.5	1,055	25.7	790	13.8	720	4.3	570	3.3	2,840	52.0
11/16	915	38.4	960	25.9	720	13.9	650	4.3	515	3.3	2,595	52.0
3/4	820	39.4	860	26.3	640	13.9	580	4.1	465	3.3	2,340	52.0
7/8	710	35.5	750	23.6	560	12.6	510	3.7	405	3.0	2,015	49.1
1	630	31.2	660	20.7	490	10.9	440	3.3	360	2.6	1,775	43.5

RPM = rev. / min.  
FEED = inch / min.



Ad = 1.5D  
Rd = 0.1D

### Note

- for 4Flute
  - Reduce Speeds & Feeds 25% for 4FL. Long length
  - Reduce Speeds & Feeds 50% for 4FL. Extra Long length
- for Slot Milling
  - Reduce Feeds 20% to 50%

## ZR304A Corner Radius Series

Material	Carbon Steels Alloy Steels · Cast Iron		Alloy Steels Tool Steels		StainlessSteels		Hardened Steels		Hardened Steels	
Hardness	~ HRC30		HRC30 ~ HRC45				HRC45 ~ HRC55		HRC55 ~ HRC65	
Strength	~ 1000N/mm <sup>2</sup>		1000 ~ 1500N/mm <sup>2</sup>				1500 ~ 2000N/mm <sup>2</sup>		2000N/mm <sup>2</sup>	
Diameter (INCH)	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED	RPM	FEED
1/16	11560	11.00	7560	6.70	6300	5.50	5040	1.95	-	-
1/8	8920	12.60	5560	7.85	4620	6.70	3360	2.35	1900	2.35
3/16	6300	23.60	3780	14.15	3160	11.80	2320	2.75	1260	2.35
1/4	5560	26.00	3360	16.15	2840	13.00	2000	3.15	1100	2.35
5/16	4200	27.95	2520	14.95	2100	13.80	1680	4.30	840	2.35
3/8	3260	24.00	2000	11.80	1680	11.80	1360	3.55	680	1.95
1/2	2740	20.50	1680	9.85	1360	9.45	1160	3.15	560	1.95
5/8	2200	16.15	1360	7.85	1060	7.85	900	2.35	440	1.20
3/4	1680	12.60	1060	6.30	840	5.90	680	1.55	320	1.20
1	1360	9.85	840	5.10	680	4.70	540	1.20	260	0.80

RPM = rev. / min.  
FEED = inch / min.





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