

Vol. IV  
**GENERAL  
PURPOSE**

SOLID CARBIDE  
ENDMILLS



# CONTENT

Length	End Cut	No. of Flute	Series Description	Series No.	Page No.
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Extra Long	Ball	4	4 Flute Extra Long Length - Ball End, ALTiN Coated	ZB304X & LS	16



# 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

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.

## 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.

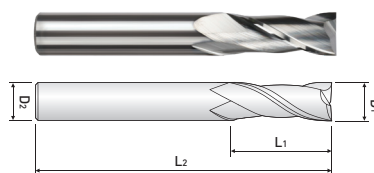
# Stub | Square End

## 2&4 Flute / Stub Length / Uncoated

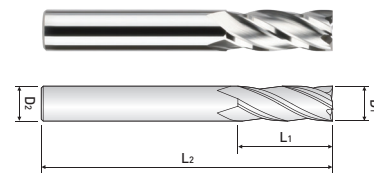
- Center Cutting - Micro Grain Carbide End Mill
- More Rigidity - Shorter Flute Length
- Slotting & Milling



EA302S [2FL]



EA304S [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				
-	EA304002S	0.0313	1/32	0.792	1-1/2	1/32	1/8	\$6.03
-	EA304003S	0.0469	3/64	1.191	1-1/2	3/32	1/8	\$6.03
-	EA304004S	0.0625	1/16	1.588	1 1/2	1/8	1/8	\$4.53
-	EA304006S	0.0938	3/32	2.383	1 1/2	3/16	1/8	\$4.53
EA302008S	EA304008S	0.1250	1/8	3.175	1 1/2	1/4	1/8	\$4.78
-	EA304010S	0.1563	5/32	3.967	2	5/16	3/16	\$6.57
EA302012S	EA304012S	0.1875	3/16	4.763	2	3/8	3/16	\$6.63
-	EA304014S	0.2188	7/32	5.558	2	7/16	1/4	\$9.98
EA302016S	EA304016S	0.2500	1/4	6.350	2 1/2	1/2	1/4	\$8.34
EA302020S	EA304020S	0.3125	5/16	7.938	2 1/2	1/2	5/16	\$11.60
EA302024S	EA304024S	0.3750	3/8	9.525	2 1/2	9/16	3/8	\$14.16
-	EA304028S	0.4375	7/16	11.113	2 1/2	9/16	7/16	\$19.77
EA302032S	EA304032S	0.5000	1/2	12.700	3	5/8	1/2	\$22.25
-	EA304040S	0.6250	5/8	15.875	3	3/4	5/8	\$44.93
-	EA304048S	0.7500	3/4	19.050	3	1	3/4	\$68.53
-	EA304064S	1.0000	1	25.400	3-1/2	1	1	\$111.59

Applicable Working Material

○ : GOOD ◎ : BEST

SERIES	CARBON STEELS LOW (1010, 1018)	CARBON STEELS MED (1025, 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 INCONNEL	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	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

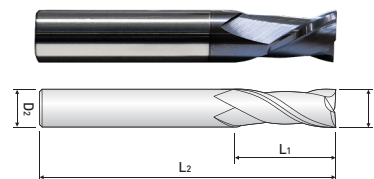
# Stub | Square End | ALTiN Coated

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

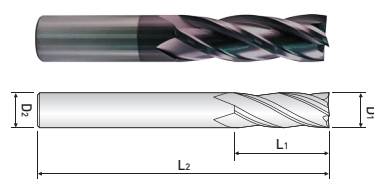
- Center Cutting - Micro Grain Carbide End Mill
- More Rigidity - Shorter Flute Length
- Enhanced Tool Life
- Slotting & Milling



ZA302S [2FL]



ZA304S [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				
-	ZA304002S	0.0313	1/32	0.792	1-1/2	1/32	1/8	\$7.23
-	ZA304003S	0.0469	3/64	1.191	1-1/2	3/32	1/8	\$7.23
-	ZA304004S	0.0625	1/16	1.588	1 1/2	1/8	1/8	\$6.39
-	ZA304006S	0.0938	3/32	2.383	1 1/2	3/16	1/8	\$6.39
ZA302008S	ZA304008S	0.1250	1/8	3.175	1 1/2	1/4	1/8	\$5.69
-	ZA304010S	0.1563	5/32	3.967	2	5/16	3/16	\$8.58
ZA302012S	ZA304012S	0.1875	3/16	4.763	2	3/8	3/16	\$8.18
-	ZA304014S	0.2188	7/32	5.558	2	7/16	1/4	\$12.35
ZA302016S	ZA304016S	0.2500	1/4	6.350	2 1/2	1/2	1/4	\$10.55
ZA302020S	ZA304020S	0.3125	5/16	7.938	2 1/2	1/2	5/16	\$16.74
ZA302024S	ZA304024S	0.3750	3/8	9.525	2 1/2	9/16	3/8	\$19.47
-	ZA304028S	0.4375	7/16	11.113	2 1/2	9/16	7/16	\$26.54
ZA302032S	ZA304032S	0.5000	1/2	12.700	3	5/8	1/2	\$26.72
-	ZA304040S	0.6250	5/8	15.875	3	3/4	5/8	\$56.72
-	ZA304048S	0.7500	3/4	19.050	3	1	3/4	\$83.93
-	ZA304064S	1.0000	1	25.400	3-1/2	1	1	\$134.14

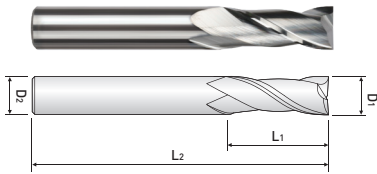
Applicable Working Material

○ : GOOD ◎ : BEST

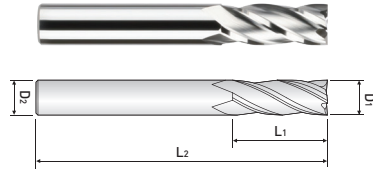
SERIES	CARBON STEELS LOW (1010, 1018)	CARBON STEELS MED (1025, 1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140, 4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONNEL	TITANIUM (6A14V)	HARDENED STEELS 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	◎	◎	◎	◎	◎	○	○	○	○	○	○	○	○	◎	○	○	○	○	○	○	○	○

# Standard | Square End

EA302[2FL]



EA304 [4FL]



2&4 Flute / Standard Length / Uncoated

- Center Cutting - Micro Grain Carbide End Mill
- 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				
EA302001	EA304001	0.0156	1/64	0.397	1 1/2	1/32	1/8	\$9.96
EA302002	EA304002	0.0313	1/32	0.792	1 1/2	5/64	1/8	\$6.35
EA302003	EA304003	0.0469	3/64	1.191	1 1/2	7/64	1/8	\$6.35
EA302004	EA304004	0.0625	1/16	1.588	1 1/2	3/16	1/8	\$4.77
EA302005	EA304005	0.0781	5/64	1.984	1 1/2	1/4	1/8	\$4.77
EA302006	EA304006	0.0938	3/32	2.383	1 1/2	5/16	1/8	\$4.77
EA302007	EA304007	0.1094	7/64	2.779	1 1/2	3/8	1/8	\$5.41
EA302008	EA304008	0.1250	1/8	3.175	2	1/2	1/8	\$5.03
EA302009	EA304009	0.1406	9/64	3.571	2	1/2	3/16	\$6.92
EA302010	EA304010	0.1563	5/32	3.967	2	9/16	3/16	\$6.92
EA302011	EA304011	0.1719	11/64	4.366	2	9/16	3/16	\$6.92
EA302012	EA304012	0.1875	3/16	4.763	2	5/8	3/16	\$6.98
EA302013	EA304013	0.2031	13/64	5.159	2 1/2	5/8	1/4	\$9.86
EA302014	EA304014	0.2188	7/32	5.558	2 1/2	5/8	1/4	\$10.50
EA302015	EA304015	0.2344	15/64	5.954	2 1/2	3/4	1/4	\$10.50
EA302016	EA304016	0.2500	1/4	6.350	2 1/2	3/4	1/4	\$8.78
EA302018	EA304018	0.2813	9/32	7.142	2 1/2	3/4	5/16	\$13.54
EA302020	EA304020	0.3125	5/16	7.938	2 1/2	13/16	5/16	\$12.21
EA302022	EA304022	0.3438	11/32	8.733	2 1/2	7/8	3/8	\$15.97
EA302024	EA304024	0.3750	3/8	9.525	3	1	3/8	\$14.90
EA302026	EA304026	0.4063	13/32	10.317	3	1	7/16	\$23.00
EA302028	EA304028	0.4375	7/16	11.113	3	1	7/16	\$20.81
EA302030	EA304030	0.4688	15/32	11.908	3	1	1/2	\$27.62
EA302032	EA304032	0.5000	1/2	12.700	3	1	1/2	\$25.44
EA302036	EA304036	0.5625	9/16	14.288	3 1/2	1 1/8	9/16	\$38.95
EA302040	EA304040	0.6250	5/8	15.875	3 1/2	1 1/4	5/8	\$47.29
EA302044	EA304044	0.6875	11/16	17.463	4	1 3/8	3/4	\$75.62
EA302048	EA304048	0.7500	3/4	19.050	4	1 1/2	3/4	\$72.24
EA302056	EA304056	0.8750	7/8	22.225	4	1 1/2	7/8	\$104.16
EA302064	EA304064	1.0000	1	25.400	4	1 1/2	1	\$117.46

Applicable Working Material

○ : GOOD ◎ : BEST

SERIES	CARBON STEELS LOW (1010, 1018)	CARBON STEELS MED (1025, 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 INCONNEL	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	○	○	○	○	○	○																

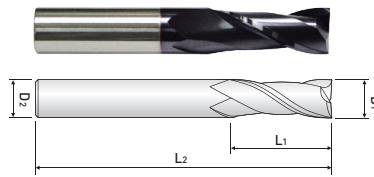
# Standard | Square End | ALTiN Coated

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

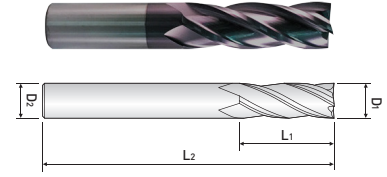
- Center Cutting - Micro Grain Carbide End Mill
- Enhanced Tool Life
- Slotting & Milling



ZA302 [2FL]



ZA304 [4FL]



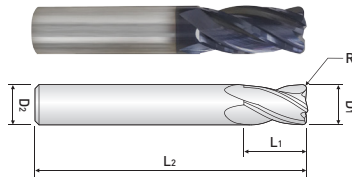
2 FL. SERIES #	4 FL. SERIES #	D			L2 Overall Length INCH	L1 Flute Length INCH	D2 Shank Diameter INCH	LIST PRICE
		DECIMAL INCH	FRACTION INCH	METRIC MM				
ZA302001	ZA304001	0.0156	1/64	0.397	1 1/2	1/32	1/8	\$11.88
ZA302002	ZA304002	0.0313	1/32	0.792	1 1/2	5/64	1/8	\$7.61
ZA302003	ZA304003	0.0469	3/64	1.191	1 1/2	7/64	1/8	\$7.61
ZA302004	ZA304004	0.0625	1/16	1.588	1 1/2	3/16	1/8	\$6.73
ZA302005	ZA304005	0.0781	5/64	1.984	1 1/2	1/4	1/8	\$6.73
ZA302006	ZA304006	0.0938	3/32	2.383	1 1/2	5/16	1/8	\$6.73
ZA302007	ZA304007	0.1094	7/64	2.779	1 1/2	3/8	1/8	\$6.73
ZA302008	ZA304008	0.1250	1/8	3.175	2	1/2	1/8	\$5.99
ZA302009	ZA304009	0.1406	9/64	3.571	2	1/2	3/16	\$9.03
ZA302010	ZA304010	0.1563	5/32	3.967	2	9/16	3/16	\$9.03
ZA302011	ZA304011	0.1719	11/64	4.366	2	9/16	3/16	\$9.03
ZA302012	ZA304012	0.1875	3/16	4.763	2	5/8	3/16	\$8.61
ZA302013	ZA304013	0.2031	13/64	5.159	2 1/2	5/8	1/4	\$13.00
ZA302014	ZA304014	0.2188	7/32	5.558	2 1/2	5/8	1/4	\$13.00
ZA302015	ZA304015	0.2344	15/64	5.954	2 1/2	3/4	1/4	\$13.00
ZA302016	ZA304016	0.2500	1/4	6.350	2 1/2	3/4	1/4	\$11.11
ZA302018	ZA304018	0.2813	9/32	7.142	2 1/2	3/4	5/16	\$19.03
ZA302020	ZA304020	0.3125	5/16	7.938	2 1/2	13/16	5/16	\$17.62
ZA302022	ZA304022	0.3438	11/32	8.733	2 1/2	7/8	3/8	\$21.63
ZA302024	ZA304024	0.3750	3/8	9.525	3	1	3/8	\$20.49
ZA302026	ZA304026	0.4063	13/32	10.317	3	1	7/16	\$30.30
ZA302028	ZA304028	0.4375	7/16	11.113	3	1	7/16	\$27.94
ZA302030	ZA304030	0.4688	15/32	11.908	3	1	1/2	\$35.20
ZA302032	ZA304032	0.5000	1/2	12.700	3	1	1/2	\$28.13
-	ZA304032-1.25	0.5000	1/2	12.700	3	1 1/4	1/2	\$31.58
ZA302036	ZA304036	0.5625	9/16	14.288	3 1/2	1 1/8	9/16	\$50.81
ZA302040	ZA304040	0.6250	5/8	15.875	3 1/2	1 1/4	5/8	\$59.71
ZA302044	ZA304044	0.6875	11/16	17.463	4	1 3/8	3/4	\$91.71
ZA302048	ZA304048	0.7500	3/4	19.050	4	1 1/2	3/4	\$88.35
ZA302056	ZA304056	0.8750	7/8	22.225	4	1 1/2	7/8	\$122.13
ZA302064	ZA304064	1.0000	1	25.400	4	1 1/2	1	\$141.20

SERIES	CARBON STEELS LOW (1010, 1018)	CARBON STEELS MED (1025, 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 End Mill
- Enhanced Tool Life
- Stronger Tool Corners



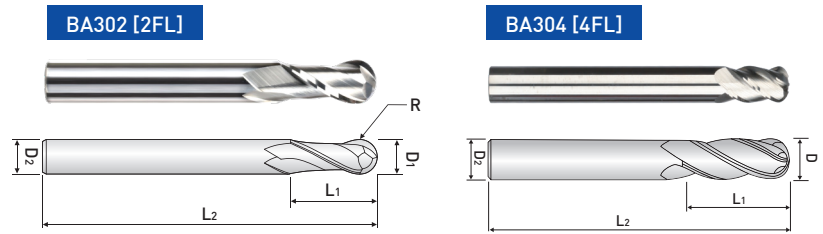
4 FL. SERIES #	D			L2 Overall Length INCH	L1 Flute Length INCH	R Corner Radius INCH	D2 Shank Diameter INCH	LIST PRICE
	DECIMAL INCH	FRACTION INCH	METRIC MM					
ZR304A008010	0.1250	1/8	3.175	2	1/2	0.010	1/8	\$7.61
ZR304A008015	0.1250	1/8	3.175	2	1/2	0.015	1/8	\$7.61
ZR304A008020	0.1250	1/8	3.175	2	1/2	0.020	1/8	\$7.61
ZR304A008030	0.1250	1/8	3.175	2	1/2	0.030	1/8	\$7.61
ZR304A012010	0.1875	3/16	4.763	2	5/8	0.010	3/16	\$11.13
ZR304A012015	0.1875	3/16	4.763	2	5/8	0.015	3/16	\$11.13
ZR304A012020	0.1875	3/16	4.763	2	5/8	0.020	3/16	\$11.13
ZR304A012030	0.1875	3/16	4.763	2	5/8	0.030	3/16	\$11.13
ZR304A016010	0.2500	1/4	6.350	2 1/2	3/4	0.010	1/4	\$12.56
ZR304A016015	0.2500	1/4	6.350	2 1/2	3/4	0.015	1/4	\$12.56
ZR304A016020	0.2500	1/4	6.350	2 1/2	3/4	0.020	1/4	\$12.56
ZR304A016030	0.2500	1/4	6.350	2 1/2	3/4	0.030	1/4	\$12.56
ZR304A016045	0.2500	1/4	6.350	2 1/2	3/4	0.045	1/4	\$12.56
ZR304A020015	0.3125	5/16	7.938	2 1/2	13/16	0.015	5/16	\$18.99
ZR304A020020	0.3125	5/16	7.938	2 1/2	13/16	0.020	5/16	\$18.99
ZR304A020030	0.3125	5/16	7.938	2 1/2	13/16	0.030	5/16	\$18.99
ZR304A020045	0.3125	5/16	7.938	2 1/2	13/16	0.045	5/16	\$18.99
ZR304A020060	0.3125	5/16	7.938	2 1/2	13/16	0.060	5/16	\$18.99
ZR304A024010	0.3750	3/8	9.525	3	1	0.010	3/8	\$22.35
ZR304A024015	0.3750	3/8	9.525	3	1	0.015	3/8	\$22.35
ZR304A024020	0.3750	3/8	9.525	3	1	0.020	3/8	\$22.35
ZR304A024030	0.3750	3/8	9.525	3	1	0.030	3/8	\$22.35
ZR304A024045	0.3750	3/8	9.525	3	1	0.045	3/8	\$22.35
ZR304A024060	0.3750	3/8	9.525	3	1	0.060	3/8	\$22.35
ZR304A032010	0.5000	1/2	12.700	3	1	0.010	1/2	\$29.34
ZR304A032015	0.5000	1/2	12.700	3	1	0.015	1/2	\$29.34
ZR304A032020	0.5000	1/2	12.700	3	1	0.020	1/2	\$29.34
ZR304A032030	0.5000	1/2	12.700	3	1	0.030	1/2	\$29.34
ZR304A032060	0.5000	1/2	12.700	3	1	0.060	1/2	\$29.34
ZR304A040030	0.6250	5/8	15.875	3 1/2	1 1/4	0.030	5/8	\$64.03
ZR304A040060	0.6250	5/8	15.875	3 1/2	1 1/4	0.060	5/8	\$64.03
ZR304A040090	0.6250	5/8	15.875	3 1/2	1 1/4	0.090	5/8	\$64.03
ZR304A040125	0.6250	5/8	15.875	3 1/2	1 1/4	0.125	5/8	\$64.03
ZR304A048030	0.7500	3/4	19.050	4	1 1/2	0.030	3/4	\$95.77
ZR304A048060	0.7500	3/4	19.050	4	1 1/2	0.060	3/4	\$95.77
ZR304A048090	0.7500	3/4	19.050	4	1 1/2	0.090	3/4	\$95.77
ZR304A048125	0.7500	3/4	19.050	4	1 1/2	0.125	3/4	\$95.77
ZR304A064030	1.0000	1	25.400	4	1 1/2	0.030	1	\$149.24
ZR304A064060	1.0000	1	25.400	4	1 1/2	0.060	1	\$149.24
ZR304A064090	1.0000	1	25.400	4	1 1/2	0.030	1	\$149.24
ZR304A064125	1.0000	1	25.400	4	1 1/2	0.060	1	\$149.24

SERIES	CARBON STEELS LOW (1010, 1018)	CARBON STEELS MED (1005, 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
ZR304A	⊙	⊙	⊙	⊙	⊙	○								⊙	○						

# Standard | Ball End

## 2 & 4 Flute / Standard Length / Uncoated

- Center Cutting - Micro Grain Carbide End Mill
- 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				
BA302001	BA304001	0.0156	1/64	0.397	1 1/2	1/32	1/8	\$14.03
BA302002	BA304002	0.0313	1/32	0.792	1 1/2	5/64	1/8	\$8.15
BA302003	BA304003	0.0469	3/64	1.191	1 1/2	7/64	1/8	\$7.84
BA302004	BA304004	0.0625	1/16	1.588	1 1/2	3/16	1/8	\$6.65
BA302005	BA304005	0.0781	5/64	1.984	1 1/2	1/4	1/8	\$6.65
BA302006	BA304006	0.0938	3/32	2.383	1 1/2	5/16	1/8	\$6.65
BA302007	BA304007	0.1094	7/64	2.779	1 1/2	3/8	1/8	\$6.65
BA302008	BA304008	0.1250	1/8	3.175	2	1/2	1/8	\$6.40
BA302009	BA304009	0.1406	9/64	3.571	2	1/2	3/16	\$9.37
BA302010	BA304010	0.1563	5/32	3.967	2	9/16	3/16	\$9.37
BA302011	BA304011	0.1719	11/64	4.366	2	9/16	3/16	\$9.37
BA302012	BA304012	0.1875	3/16	4.763	2	5/8	3/16	\$8.68
BA302013	BA304013	0.2031	13/64	5.159	2 1/2	5/8	1/4	\$13.09
BA302014	BA304014	0.2188	7/32	5.558	2 1/2	5/8	1/4	\$13.09
BA302015	BA304015	0.2344	15/64	5.954	2 1/2	3/4	1/4	\$13.09
BA302016	BA304016	0.2500	1/4	6.350	2 1/2	3/4	1/4	\$12.29
BA302018	BA304018	0.2813	9/32	7.142	2 1/2	3/4	5/16	\$18.23
BA302020	BA304020	0.3125	5/16	7.938	2 1/2	13/16	5/16	\$16.74
BA302022	BA304022	0.3438	11/32	8.733	2 1/2	7/8	3/8	\$22.14
BA302024	BA304024	0.3750	3/8	9.525	3	1	3/8	\$22.52
BA302026	BA304026	0.4063	13/32	10.317	3	1	7/16	\$29.62
BA302028	BA304028	0.4375	7/16	11.113	3	1	7/16	\$28.11
BA302030	BA304030	0.4688	15/32	11.908	3	1	1/2	\$35.58
BA302032	BA304032	0.5000	1/2	12.700	3	1	1/2	\$33.36
BA302036	BA304036	0.5625	9/16	14.288	3 1/2	1 1/8	9/16	\$50.58
BA302040	BA304040	0.6250	5/8	15.875	3 1/2	1 1/4	5/8	\$60.11
BA302044	BA304044	0.6875	11/16	17.463	4	1 3/8	3/4	\$98.19
BA302048	BA304048	0.7500	3/4	19.050	4	1 1/2	3/4	\$90.89
BA302056	BA304056	0.8750	7/8	22.225	4	1 1/2	7/8	\$135.66
BA302064	BA304064	1.0000	1	25.400	4	1 1/2	1	\$144.97

Applicable Working Material

○ : GOOD ◎ : BEST

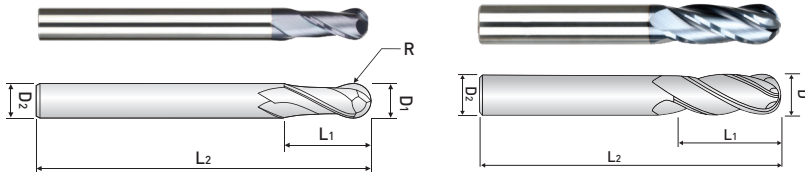
SERIES	CARBON STEELS LOW (1010,1018)	CARBON STEELS MED (1035,1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140,4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061,7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONNEL	TITANIUM (6A14V)	HARDENED STEELS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



# Standard | Ball End | ALTiN Coated

ZB302 [2FL]

ZB304 [4FL]



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

- Center Cutting - Micro Grain Carbide End Mills
- 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	\$15.39
ZB302002S		0.0313	1/32	0.792	1 1/2	1/32	1/8	\$9.66
ZB302002	ZB304002	0.0313	1/32	0.792	1 1/2	5/64	1/8	\$9.66
ZB302003	ZB304003	0.0469	3/64	1.191	1 1/2	7/64	1/8	\$9.37
ZB302004S		0.0625	1/16	1.588	1 1/2	1/16	1/8	\$8.20
ZB302004	ZB304004	0.0625	1/16	1.588	1 1/2	3/16	1/8	\$8.20
ZB302005	ZB304005	0.0781	5/64	1.984	1 1/2	1/4	1/8	\$8.20
ZB302006S	ZB304006S	0.0938	3/32	2.383	1 1/2	3/32	1/8	\$8.20
ZB302006	ZB304006	0.0938	3/32	2.383	1 1/2	5/16	1/8	\$8.20
ZB302007	ZB304007	0.1094	7/64	2.779	1 1/2	3/8	1/8	\$8.20
ZB302008S		0.1250	1/8	3.175	1 1/2	5/16	1/8	\$7.96
ZB302008	ZB304008	0.1250	1/8	3.175	2	1/2	1/8	\$7.96
ZB302009	ZB304009	0.1406	9/64	3.571	2	1/2	3/16	\$10.86
ZB302010	ZB304010	0.1563	5/32	3.967	2	9/16	3/16	\$10.86
ZB302011	ZB304011	0.1719	11/64	4.366	2	9/16	3/16	\$10.86
ZB302012S		0.1875	3/16	4.763	2	3/8	3/16	\$10.19
ZB302012	ZB304012	0.1875	3/16	4.763	2	5/8	3/16	\$10.19
ZB302013	ZB304013	0.2031	13/64	5.159	2 1/2	5/8	1/4	\$15.36
ZB302014	ZB304014	0.2188	7/32	5.558	2 1/2	5/8	1/4	\$15.36
ZB302015	ZB304015	0.2344	15/64	5.954	2 1/2	3/4	1/4	\$15.36
ZB302016S		0.2500	1/4	6.350	2 1/2	1/2	1/4	\$14.59
ZB302016	ZB304016	0.2500	1/4	6.350	2 1/2	3/4	1/4	\$14.59
ZB302018	ZB304018	0.2813	9/32	7.142	2 1/2	3/4	5/16	\$17.80
ZB302020S		0.3125	5/16	7.938	2 1/2	9/16	5/16	\$21.12
ZB302020	ZB304020	0.3125	5/16	7.938	2 1/2	13/16	5/16	\$21.12
ZB302022	ZB304022	0.3438	11/32	8.733	2 1/2	7/8	3/8	\$26.37
ZB302024S		0.3750	3/8	9.525	3	3/4	3/8	\$26.76
ZB302024	ZB304024	0.3750	3/8	9.525	3	1	3/8	\$26.76
ZB302026	ZB304026	0.4063	13/32	10.317	3	1	7/16	\$34.89
ZB302028	ZB304028	0.4375	7/16	11.113	3	1	7/16	\$33.42
ZB302030	ZB304030	0.4688	15/32	11.908	3	1	1/2	\$40.71
ZB302032S		0.5000	1/2	12.700	3	7/8	1/2	\$40.79
ZB302032	ZB304032	0.5000	1/2	12.700	3	1	1/2	\$40.79
ZB302036	ZB304036	0.5625	9/16	14.288	3 1/2	1 1/8	9/16	\$53.31
ZB302040S		0.6250	5/8	15.875	3 1/2	1	5/8	\$74.08
ZB302040	ZB304040	0.6250	5/8	15.875	3 1/2	1 1/4	5/8	\$74.08
ZB302044	ZB304044	0.6875	11/16	17.463	4	1 3/8	3/4	\$116.38
ZB302048S		0.7500	3/4	19.050	4	1	3/4	\$108.64
ZB302048	ZB304048	0.7500	3/4	19.050	4	1 1/2	3/4	\$108.64
ZB302056	ZB304056	0.8750	7/8	22.225	4	1 1/2	7/8	\$158.83
ZB302064S		1.0000	1	25.400	4	1	1	\$171.41
ZB302064	ZB304064	1.0000	1	25.400	4	1 1/2	1	\$171.41

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 INCONNEL	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	
ZB Series	◎	◎	◎	◎	◎	○								◎	○							

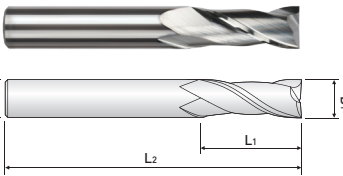
# Long | Square End

## 2&4 Flute / Long Length / Uncoated

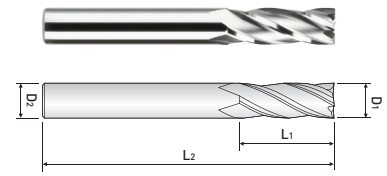
- Center Cutting - Micro Grain Carbide End Mill
- Longer Reach vs. Standard Length
- Slotting & Milling



EA302L [2FL]



EA304L [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				
EA302008L	EA304008L	0.1250	1/8	3.175	2 1/4	3/4	1/8	\$8.37
EA302012L	EA304012L	0.1875	3/16	4.763	2 1/4	3/4	3/16	\$9.80
EA302016L	EA304016L	0.2500	1/4	6.350	3	1 1/8	1/4	\$21.44
EA302020L	EA304020L	0.3125	5/16	7.938	3	1 1/8	5/16	\$18.36
EA302024L	EA304024L	0.3750	3/8	9.525	3 1/2	1 1/8	3/8	\$20.62
EA302028L	EA304028L	0.4375	7/16	11.113	4	1 1/2	7/16	\$37.01
EA302032L	EA304032L	0.5000	1/2	12.700	4	1 1/2	1/2	\$42.72
EA302040L	EA304040L	0.6250	5/8	15.875	5	2 1/4	5/8	\$88.84
EA302048L	EA304048L	0.7500	3/4	19.050	5	2 1/4	3/4	\$115.32
EA302064L	EA304064L	1.0000	1	25.400	5	2 1/4	1	\$188.49

Applicable Working Material

○ : GOOD ◎ : BEST

SERIES	CARBON STEELS LOW (1010, 1018)	CARBON STEELS MED (1025, 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 INCONNEL	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	○	○	○	○	○	○																

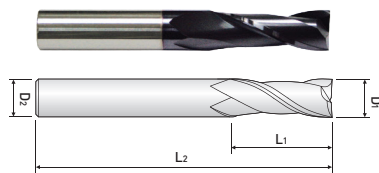
# Long | Square End | ALTiN Coated

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

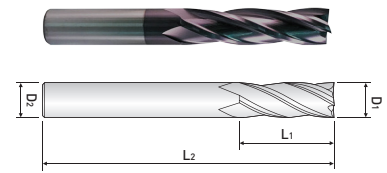
- Center Cutting - Micro Grain Carbide End Mill
- Longer Reach vs. Standard Length
- Enhanced Tool Life
- Slotting & Milling



ZA302L [2FL]



ZA304L [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				
ZA302008L	ZA304008L	0.1250	1/8	3.175	2 1/4	3/4	1/8	\$9.81
ZA302012L	ZA304012L	0.1875	3/16	4.763	2 1/4	3/4	3/16	\$12.21
ZA302016L	ZA304016L	0.2500	1/4	6.350	3	1 1/8	1/4	\$17.43
ZA302020L	ZA304020L	0.3125	5/16	7.938	3	1 1/8	5/16	\$23.36
ZA302024L	ZA304024L	0.3750	3/8	9.525	3 1/2	1 1/8	3/8	\$27.02
ZA302028L	ZA304028L	0.4375	7/16	11.113	4	1 1/2	7/16	\$40.66
ZA302032L	ZA304032L	0.5000	1/2	12.700	4	1 1/2	1/2	\$54.52
-	ZA304032L1	0.5000	1/2	12.700	4	1-1/4	1/2	\$53.54
-	ZA304032L2	0.5000	1/2	12.700	4	2	1/2	\$56.82
ZA302040L	ZA304040L	0.6250	5/8	15.875	5	2 1/4	5/8	\$101.16
ZA302048L	ZA304048L	0.7500	3/4	19.050	5	2 1/4	3/4	\$105.21
ZA302064L	ZA304064L	1.0000	1	25.400	5	2 1/4	1	\$203.79

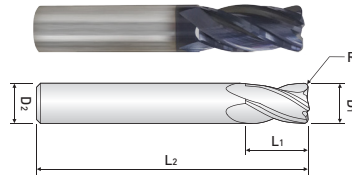
Applicable Working Material

○ : GOOD ◎ : BEST

SERIES	CARBON STEELS LOW (1010, 1018)	CARBON STEELS MED (1025, 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 INCONNEL	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 End Mill
- 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	\$ 9.39
ZR304A008020L	0.1250	1/8	3.175	3	3/4	0.020	1/8	\$ 9.39
ZR304A008030L	0.1250	1/8	3.175	3	3/4	0.030	1/8	\$ 9.39
ZR304A012010L	0.1875	3/16	4.763	3	1 1/8	0.010	3/16	\$ 14.05
ZR304A012020L	0.1875	3/16	4.763	3	1 1/8	0.020	3/16	\$ 14.05
ZR304A012030L	0.1875	3/16	4.763	3	1 1/8	0.030	3/16	\$ 14.05
ZR304A016010L	0.2500	1/4	6.350	3	1 1/8	0.010	1/4	\$ 20.05
ZR304A016020L	0.2500	1/4	6.350	3	1 1/8	0.020	1/4	\$ 20.05
ZR304A016030L	0.2500	1/4	6.350	3	1 1/8	0.030	1/4	\$ 20.05
ZR304A016045L	0.2500	1/4	6.350	3	1 1/8	0.045	1/4	\$ 20.05
ZR304A020020L	0.3125	5/16	7.938	3	1 1/8	0.020	5/16	\$ 26.86
ZR304A020030L	0.3125	5/16	7.938	3	1 1/8	0.030	5/16	\$ 26.86
ZR304A020045L	0.3125	5/16	7.938	3	1 1/8	0.045	5/16	\$ 26.86
ZR304A024010L	0.3750	3/8	9.525	3 1/2	1 1/8	0.010	3/8	\$ 31.08
ZR304A024020L	0.3750	3/8	9.525	3 1/2	1-1/2	0.020	3/8	\$ 31.08
ZR304A024030L	0.3750	3/8	9.525	3 1/2	1-1/2	0.030	3/8	\$ 31.08
ZR304A024045L	0.3750	3/8	9.525	3 1/2	1-1/2	0.045	3/8	\$ 31.08
ZR304A032015L	0.5000	1/2	12.700	4	1 1/2	0.015	1/2	\$ 54.52
ZR304A032020L	0.5000	1/2	12.700	4	1 1/2	0.020	1/2	\$ 54.52
ZR304A032030L	0.5000	1/2	12.700	4	1 1/2	0.030	1/2	\$ 54.52
ZR304A032060L	0.5000	1/2	12.700	4	1 1/2	0.060	1/2	\$ 54.52
ZR304A032090L	0.5000	1/2	12.700	4	1 1/2	0.090	1/2	\$ 54.52
ZR304A032125L	0.5000	1/2	12.700	4	1 1/2	0.125	1/2	\$ 54.52
ZR304A040030L	0.6250	5/8	15.875	5	2 1/4	0.030	5/8	\$ 106.75
ZR304A040060L	0.6250	5/8	15.875	5	2 1/4	0.060	5/8	\$ 106.75
ZR304A040090L	0.6250	5/8	15.875	5	2 1/4	0.090	5/8	\$ 106.75
ZR304A048030L	0.7500	3/4	19.050	5	2 1/4	0.030	3/4	\$ 134.74
ZR304A048060L	0.7500	3/4	19.050	5	2 1/4	0.060	3/4	\$ 134.74
ZR304A048090L	0.7500	3/4	19.050	5	2 1/4	0.090	3/4	\$ 134.74
ZR304A048125L	0.7500	3/4	19.050	5	2 1/4	0.125	3/4	\$ 134.74
ZR304A064030L	1.0000	1	25.400	5	2 1/4	0.030	1	\$ 206.78
ZR304A064060L	1.0000	1	25.400	5	2 1/4	0.060	1	\$ 206.78
ZR304A064090L	1.0000	1	25.400	5	2 1/4	0.090	1	\$ 206.78
ZR304A064125L	1.0000	1	25.400	5	2 1/4	0.125	1	\$ 206.78

Applicable Working Material

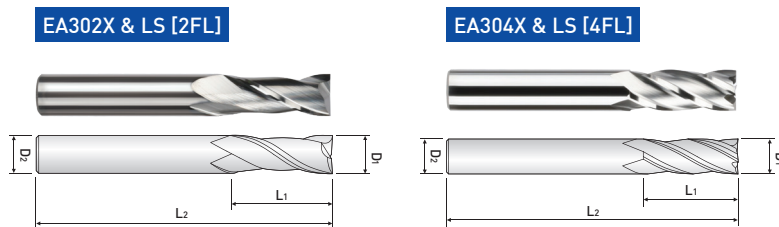
○ : GOOD ◎ : BEST

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 (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	
ZR304A	◎	◎	◎	◎	◎	○								◎	○							

# Extra Long | Square End

## 2&4 Flute / Extra Long Length / Uncoated

- Center Cutting - Micro Grain Carbide End Mill
- Extra Long Overall 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	
EA302008X	EA304008X	0.1250	1/8	3.175	3	1	1/8	\$9.78
EA302012X	EA304012X	0.1875	3/16	4.763	3	1 1/8	3/16	\$12.56
EA302012LS	EA304012LS	0.1875	3/16	4.763	4	1 1/2	3/16	\$17.14
EA302016X	EA304016X	0.2500	1/4	6.350	4	1 1/2	1/4	\$19.95
EA302016LS	EA304016LS	0.2500	1/4	6.350	6	1 1/2	1/4	\$32.53
EA302020X	EA304020X	0.3125	5/16	7.938	4	1 5/8	5/16	\$24.07
EA302024X	EA304024X	0.3750	3/8	9.525	4	1 3/4	3/8	\$30.77
EA302024LS	EA304024LS	0.3750	3/8	9.525	6	2	3/8	\$45.76
EA302028X	EA304028X	0.4375	7/16	11.113	6	2	7/16	\$56.42
EA302032X	EA304032X	0.5000	1/2	12.700	6	2	1/2	\$66.93
EA302032LS	EA304032LS	0.5000	1/2	12.700	6	3	1/2	\$69.91
EA302040X	EA304040X	0.6250	5/8	15.875	6	3	5/8	\$115.34
EA302048X	EA304048X	0.7500	3/4	19.050	6	3	3/4	\$143.54
EA302064X	EA304064X	1.0000	1	25.400	6	3	1	\$235.92

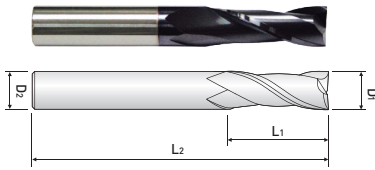
Applicable Working Material

○ : GOOD ◎ : BEST

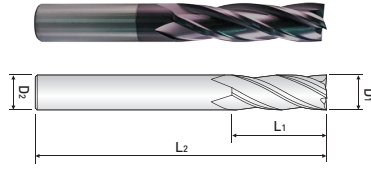
SERIES	CARBON STEELS LOW (1010, 1018)	CARBON STEELS MED (1025, 1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140, 4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONEL	TITANIUM (6A14V)	HARDENED STEELS 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	○	○	○	○	○	○																

# 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 End Mill
- 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				
ZA302008X	ZA304008X	0.1250	1/8	3.175	3	1	1/8	\$11.79
ZA302012X	ZA304012X	0.1875	3/16	4.763	3	1 1/8	3/16	\$15.14
ZA302012LS	ZA304012LS	0.1875	3/16	4.763	4	1 1/2	3/16	\$20.86
ZA302016X	ZA304016X	0.2500	1/4	6.350	4	1 1/2	1/4	\$26.51
ZA302016LS	ZA304016LS	0.2500	1/4	6.350	6	1 1/2	1/4	\$42.37
ZA302020X	ZA304020X	0.3125	5/16	7.938	4	1 5/8	5/16	\$32.23
ZA302024X	ZA304024X	0.3750	3/8	9.525	4	1 3/4	3/8	\$37.85
ZA302024LS	ZA304024LS	0.3750	3/8	9.525	6	2	3/8	\$58.03
ZA302028X	ZA304028X	0.4375	7/16	11.113	6	2	7/16	\$70.15
ZA302032X	ZA304032X	0.5000	1/2	12.700	6	2	1/2	\$76.17
ZA302032LS	ZA304032LS	0.5000	1/2	12.700	6	3	1/2	\$79.00
ZA302040X	ZA304040X	0.6250	5/8	15.875	6	3	5/8	\$132.93
ZA302048X	ZA304048X	0.7500	3/4	19.050	6	3	3/4	\$164.24
ZA302064X	ZA304064X	1.0000	1	25.400	6	3	1	\$259.81
	ZA304064LS	1.0000	1	25.400	7	4	1	\$301.77

Applicable Working Material

○ : GOOD ◎ : BEST

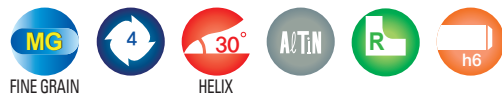
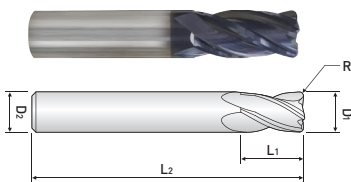
SERIES	CARBON STEELS LOW (1010, 1018)	CARBON STEELS MED (1035, 1045)	CARBON STEELS HIGH (1045)	ALLOY STEELS (4140, 4340)	DIE STEELS	STAINLESS STEELS 300	STAINLESS STEELS 400	STAINLESS STEELS 17-4 PH	CAST IRON	ALUMINUM (6061, 7075)	ALUMINUM CASTINGS	NICKEL ALLOYS INCONNEL	TITANIUM (6A14V)	HARDENED STEELS 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	◎	◎	◎	◎	◎	○								◎	○						

# Extra Long | Corner Radius | ALTiN Coated

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

ZR304X & LS [4FL]

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



4 FL. SERIES #	D			L2	L1	R	D2	LIST PRICE
	DECIMAL INCH	FRACTION INCH	METRIC MM	Overall Length INCH	Flute Length INCH	Corner Radius INCH	Shank Diameter INCH	
ZR304A016010X	0.2500	1/4	6.350	4	1 1/2	0.010	1/4	\$27.34
ZR304A016020X	0.2500	1/4	6.350	4	1 1/2	0.020	1/4	\$27.34
ZR304A016030X	0.2500	1/4	6.350	4	1 1/2	0.030	1/4	\$27.34
ZR304A016045X	0.2500	1/4	6.350	4	1 1/2	0.045	1/4	\$27.34
ZR304A016010LS	0.2500	1/4	6.350	6	1 1/2	0.010	1/4	\$46.60
ZR304A016020LS	0.2500	1/4	6.350	6	1 1/2	0.020	1/4	\$46.60
ZR304A016030LS	0.2500	1/4	6.350	6	1 1/2	0.030	1/4	\$46.60
ZR304A016045LS	0.2500	1/4	6.350	6	1 1/2	0.045	1/4	\$46.60
ZR304A020020X	0.3125	5/16	7.938	4	1 5/8	0.020	5/16	\$33.24
ZR304A020030X	0.3125	5/16	7.938	4	1 5/8	0.030	5/16	\$33.24
ZR304A020045X	0.3125	5/16	7.938	4	1 5/8	0.045	5/16	\$33.24
ZR304A024010X	0.3750	3/8	9.525	4	1 3/4	0.010	3/8	\$39.02
ZR304A024020X	0.3750	3/8	9.525	4	1 3/4	0.020	3/8	\$39.02
ZR304A024030X	0.3750	3/8	9.525	4	1 3/4	0.030	3/8	\$39.02
ZR304A024045X	0.3750	3/8	9.525	4	1 3/4	0.045	3/8	\$39.02
ZR304A024010LS	0.3750	3/8	9.525	6	2	0.010	3/8	\$63.84
ZR304A024020LS	0.3750	3/8	9.525	6	2	0.020	3/8	\$63.84
ZR304A024030LS	0.3750	3/8	9.525	6	2	0.030	3/8	\$63.84
ZR304A024045LS	0.3750	3/8	9.525	6	2	0.045	3/8	\$63.84
ZR304A032010X	0.5000	1/2	12.700	6	2	0.010	1/2	\$73.93
ZR304A032015X	0.5000	1/2	12.700	6	2	0.015	1/2	\$73.93
ZR304A032020X	0.5000	1/2	12.700	6	2	0.020	1/2	\$73.93
ZR304A032030X	0.5000	1/2	12.700	6	2	0.030	1/2	\$73.93
ZR304A032060X	0.5000	1/2	12.700	6	2	0.060	1/2	\$73.93
ZR304A032010LS	0.5000	1/2	12.700	6	3	0.010	1/2	\$78.42
ZR304A032015LS	0.5000	1/2	12.700	6	3	0.015	1/2	\$78.42
ZR304A032020LS	0.5000	1/2	12.700	6	3	0.020	1/2	\$78.42
ZR304A032030LS	0.5000	1/2	12.700	6	3	0.030	1/2	\$78.42
ZR304A032060LS	0.5000	1/2	12.700	6	3	0.060	0.5	\$78.42
ZR304A040030X	0.6250	5/8	15.875	6	3	0.030	0.625	\$129.02
ZR304A040060X	0.6250	5/8	15.875	6	3	0.060	5/8	\$129.02
ZR304A040090X	0.6250	5/8	15.875	6	3	0.090	5/8	\$129.02
ZR304A048030X	0.7500	3/4	19.050	6	3	0.030	3/4	\$159.40
ZR304A048060X	0.7500	3/4	19.050	6	3	0.060	3/4	\$159.40
ZR304A048090X	0.7500	3/4	19.050	6	3	0.090	3/4	\$159.40
ZR304A064030X	1.0000	1	25.400	6	3	0.030	1	\$252.16
ZR304A064060X	1.0000	1	25.400	6	3	0.060	1	\$252.16

Applicable Working Material

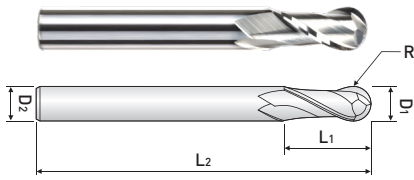
○ : GOOD ◎ : BEST

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 INCONNEL	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	
ZR304A	◎	◎	◎	◎	◎	○								◎	○							

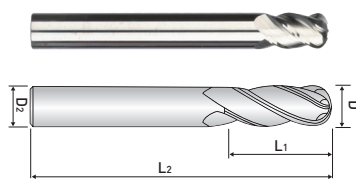


# Extra Long | Ball End

BA302X & LS [2FL]



BA304X & LS [4FL]



2&4 Flute / Extra Long Length / ALTiN Coating

- Center Cutting - Micro Grain Carbide End Mill
- Extra Long Overall 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	
BA302008X	BA304008X	0.1250	1/8	3.175	3	1	1/8	\$11.88
BA302012X	BA304012X	0.1875	3/16	4.763	3	1 1/8	3/16	\$15.50
BA302012LS	BA304012LS	0.1875	3/16	4.763	4	1 1/2	3/16	\$20.91
BA302016X	BA304016X	0.2500	1/4	6.350	4	1 1/2	1/4	\$22.86
BA302016LS	BA304016LS	0.2500	1/4	6.350	6	1 1/2	1/4	\$29.68
BA302020X	BA304020X	0.3125	5/16	7.938	4	1 5/8	5/16	\$27.01
BA302024X	BA304024X	0.3750	3/8	9.525	4	1 3/4	3/8	\$32.87
BA302024LS	BA304024LS	0.3750	3/8	9.525	6	2	3/8	\$58.33
BA302028X	BA304028X	0.4375	7/16	11.113	6	2	7/16	\$60.06
BA302032X	BA304032X	0.5000	1/2	12.700	6	2	1/2	\$70.13
BA302032LS	BA304032LS	0.5000	1/2	12.700	6	3	1/2	\$109.96
BA302040X	BA304040X	0.6250	5/8	15.875	6	3	5/8	\$124.00
BA302048X	BA304048X	0.7500	3/4	19.050	6	3	3/4	\$154.35
BA302064X	BA304064X	1.0000	1	25.400	6	3	1	\$247.83

Applicable Working Material

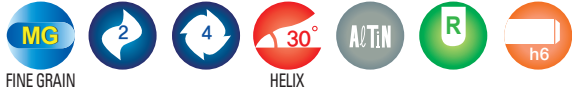
○ : GOOD ◎ : BEST

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 (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	
BA Series	○	○	○	○	○	○																

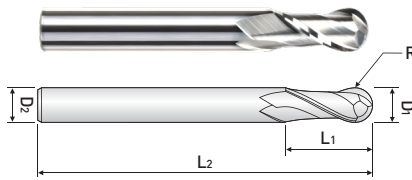
# Extra Long | Ball End | ALTiN Coated

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

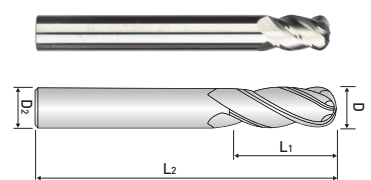
- Center Cutting - Micro Grain Carbide End Mill
- Extra Long Overall Length
- Enhanced Tool Life
- Slotting & Milling



ZB302X & LS [2FL]



ZB304X & 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				
ZB302008X	ZB304008X	0.1250	1/8	3.175	3	1	1/8	\$14.62
ZB302012X	ZB304012X	0.1875	3/16	4.763	3	1 1/8	3/16	\$19.21
ZB302012LS	ZB304012LS	0.1875	3/16	4.763	4	1 1/2	3/16	\$24.75
ZB302016X	ZB304016X	0.2500	1/4	6.350	4	1 1/2	1/4	\$29.87
ZB302016LS	ZB304016LS	0.2500	1/4	6.350	6	1 1/2	1/4	\$35.81
ZB302020X	ZB304020X	0.3125	5/16	7.938	4	1 5/8	5/16	\$36.61
ZB302024X	ZB304024X	0.3750	3/8	9.525	4	1 3/4	3/8	\$46.17
ZB302024LS	ZB304024LS	0.3750	3/8	9.525	6	2	3/8	\$65.59
ZB302028X	ZB304028X	0.4375	7/16	11.113	6	2	7/16	\$88.15
ZB302032X	ZB304032X	0.5000	1/2	12.700	6	2	1/2	\$93.81
ZB302032LS	ZB304032LS	0.5000	1/2	12.700	6	3	1/2	\$117.53
ZB302040X	ZB304040X	0.6250	5/8	15.875	6	3	5/8	\$146.63
ZB302048X	ZB304048X	0.7500	3/4	19.050	6	3	3/4	\$169.64
ZB302064X	ZB304064X	1.0000	1	25.400	6	3	1	\$298.28

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 (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
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.

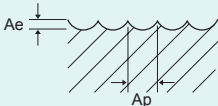
Ae: D1/32~D1/4=.008 inch  
D5/16~D3/4=.012 inch  
Ap: 0.05 X D

## 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



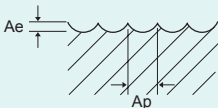
Ae: D1/8~D1/4=.008 inch  
D5/16~D5/8=.012 inch  
Ap: 0.1 X D

## 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

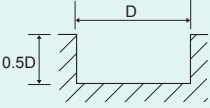
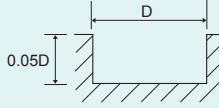


## ZA302 Series

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.

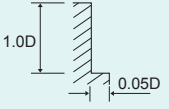
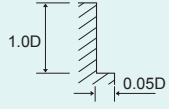
(Up to  $\phi 1/8:0.2D$ )

## 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

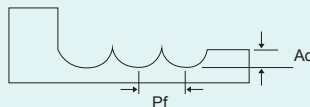
RPM = rev. / min.  
FEED = inch / min.

## 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

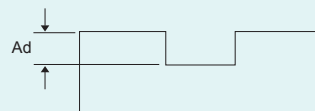
- for 2Flute
  - Reduce Speeds & Feeds 25% for 2FL. Ball nose Long length
  - Reduce Speeds & Feeds 50% for 2FL. Ball nose Extra Long length
- for 4Flute
  - Increase Speeds & Feeds 40% for 4FL, Ball nose Standard & Stub length
  - Reduce Speeds 25% & Increase Feeds 10% for 4FL. Ball nose Long length
  - 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	
			Up to 750N/mm				30 to 38 HRc		38 to 45 HRc			
Hardness												
Strength												
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

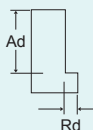
### Note

- 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 750N/mm		Up to 30 HRc		30 to 38 HRc		38 to 45 HRc				
Strength													
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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