



Diameters:
0.125" - 1.000"
6mm - 16mm

Overall Lengths:
1.50" - 5.00"
57mm - 92mm

Helix Angles:
30°, 38°, 40°

Number of Flutes:
2, 3, 4

Grades:
IN2005
IN2003
IN1005
IN2006



Multi-Purpose Ball Nose and Bull Nose Endmills Variable Pitch Ball Nose Endmills for Machining Hard Materials

Ingersoll is extending the 45U/45B...46B/47B ball nose solid carbide endmills to include metric 40 degree end mills for machining aluminum. Ingersoll has also updated the existing inch series of chatter free ball nose endmills with a new chatter free metric series in grade IN2006 for hard materials up to 65 HRC. The new endmills are available in a diameter range of 3 to 16 mm.

FEATURES:

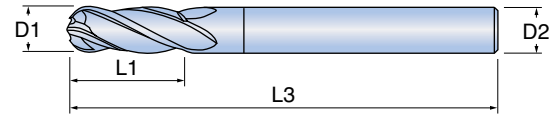
- 2, 3 and 4 flutes with a 30° Helix
- 4 flutes with 38° helix angle
- Short and medium length ball nose endmills
- Medium length bull nose style
- Variable pitch for chatter free machining
- Up to 2XD depth of cut and 3XD relieved neck
- Special geometry for machining hard materials
- Low cutting forces
- Available in IN2006 for long tool life

The new 47B_RQ Endmills in grade IN2006 will provide advantageous performance, especially in the die and mold industry.



PRO•ROUNDS™ SERIES 45B_RB

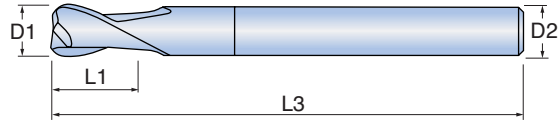
BALL NOSE SOLID CARBIDE END MILLS, 30° HELIX, MULTI-PURPOSE, 2 FLUTES, IN2005



| Cutter Number | Helix (Deg) | D1 Diameter | Z Flutes | R Radius | L3 Overall Length | L1 Cut Length | D2 Shank Size/Style |
|----------------|-------------|-------------|----------|----------|-------------------|---------------|---------------------|
| 45B-1201R4RB15 | 30.0 | 0.125 | 2 | 0.063 | 1.50 | 0.19 | .125" Cyl |
| 45B-1802R5RB20 | 30.0 | 0.188 | 2 | 0.094 | 2.00 | 0.25 | .188" Cyl |
| 45B-2503R6RB25 | 30.0 | 0.250 | 2 | 0.125 | 2.50 | 0.31 | .250" Cyl |
| 45B-3103R7RB25 | 30.0 | 0.312 | 2 | 0.157 | 2.50 | 0.38 | .312" Cyl |
| 45B-3704R8RB25 | 30.0 | 0.375 | 2 | 0.188 | 3.00 | 0.44 | .375" Cyl |
| 45B-4305R9RB27 | 30.0 | 0.438 | 2 | 0.219 | 2.75 | 0.50 | .438" Cyl |
| 45B-5005S4RB30 | 30.0 | 0.500 | 2 | 0.250 | 3.00 | 0.56 | .500" Cyl |

PRO•ROUNDS™ SERIES 45U

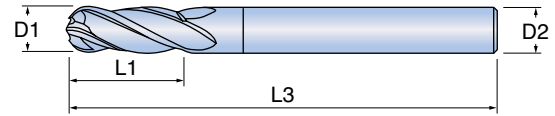
BULL NOSE SOLID CARBIDE ENDMILLS, 2-FLUTES, 30° HELIX, IN2003



| Cutter Number | Helix (Deg) | D1 Diameter | Z Flutes | R Radius | L3 Overall Length | L1 Cut Length | D2 Shank Size/Style |
|-----------------|-------------|-------------|----------|----------|-------------------|---------------|---------------------|
| 45U-0600R0RB01 | 30.0 | 0.062 | 2 | 0.015 | 2.50 | 0.03 | .125" Cyl |
| 45U-0900R1RB03 | 30.0 | 0.093 | 2 | 0.031 | 3.00 | 0.08 | .125" Cyl |
| 45U-1200R4RB03 | 30.0 | 0.125 | 2 | 0.031 | 3.00 | 0.08 | .125" Cyl |
| 45U-2501R6RB06 | 30.0 | 0.250 | 2 | 0.062 | 3.00 | 0.12 | .250" Cyl |
| 45U-2501R6RB061 | 30.0 | 0.250 | 2 | 0.062 | 4.00 | 0.16 | .250" Cyl |
| 45U-3701R8RB06 | 30.0 | 0.375 | 2 | 0.062 | 4.00 | 0.16 | .375" Cyl |
| 45U-3701R8RB061 | 30.0 | 0.375 | 2 | 0.062 | 5.00 | 0.16 | .375" Cyl |
| 45U-5002S4RB12 | 30.0 | 0.500 | 2 | 0.125 | 5.00 | 0.25 | .500" Cyl |

PRO•ROUNDS™ SERIES 46B_RB 3 FLUTES

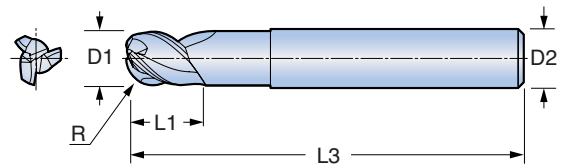
BALL NOSE SOLID CARBIDE END MILLS,
MULTI-PURPOSE, 3 FLUTES, IN2005



| Cutter Number | Helix (Deg) | D1 Diameter | Z Flutes | R Radius | L3 Overall Length | L1 Cut Length | D2 Shank Size/Style |
|----------------|-------------|-------------|----------|----------|-------------------|---------------|---------------------|
| 46B-1201R4RB15 | 30.0 | 0.125 | 3 | 0.063 | 1.50 | 0.19 | .125" Cyl |
| 46B-1802R5RB20 | 30.0 | 0.188 | 3 | 0.094 | 2.00 | 0.25 | .188" Cyl |
| 46B-2503R6RB25 | 30.0 | 0.250 | 3 | 0.125 | 2.50 | 0.31 | .250" Cyl |
| 46B-3103R7RB25 | 30.0 | 0.312 | 3 | 0.157 | 2.50 | 0.38 | .312" Cyl |
| 46B-3704R8RB25 | 30.0 | 0.375 | 3 | 0.188 | 3.00 | 0.44 | .375" Cyl |
| 46B-5005S4RB30 | 30.0 | 0.500 | 3 | 0.250 | 3.00 | 0.56 | .500" Cyl |
| 46B-6206S6RB35 | 30.0 | 0.625 | 3 | 0.313 | 3.50 | 0.69 | .625" Cyl |

PRO•ROUNDS™ SERIES 46BRH

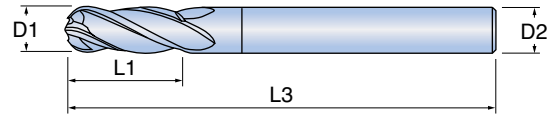
BALL NOSE SOLID CARBIDE ENDMILLS,
40° HELIX FOR ALUM., 3 FLUTES, METRIC, IN1005



| Cutter Number | Helix (Deg) | D1 Diameter | Z Flutes | R Radius | L3 Overall Length | L1 Cut Length | D2 Shank Size/Style |
|----------------|-------------|-------------|----------|----------|-------------------|---------------|---------------------|
| 46B00203UDRH06 | 40.0 | 2.000 | 3 | 1.000 | 60.00 | 3.00 | 6mm Cyl |
| 46B00345T9RH06 | 40.0 | 3.000 | 3 | 1.500 | 60.00 | 4.50 | 6mm Cyl |
| 46B00406U1RH06 | 40.0 | 4.000 | 3 | 1.500 | 65.00 | 4.50 | 6mm Cyl |
| 46B00575U1RH06 | 40.0 | 5.000 | 3 | 2.500 | 65.00 | 7.50 | 6mm Cyl |
| 46B00609T7RH07 | 40.0 | 6.000 | 3 | 3.000 | 75.00 | 9.00 | 6mm Cyl |
| 46B00812T0RH07 | 40.0 | 8.000 | 3 | 4.000 | 75.00 | 12.00 | 8mm Cyl |
| 46B01015T1RH08 | 40.0 | 10.000 | 3 | 5.000 | 80.00 | 15.00 | 10mm Cyl |
| 46B01218T2RH09 | 40.0 | 12.000 | 3 | 6.000 | 90.00 | 18.00 | 12mm Cyl |
| 46B01624T3RH10 | 40.0 | 16.000 | 3 | 8.000 | 100.00 | 24.00 | 16mm Cyl |

PRO•ROUNDS™ SERIES 47B_RB 4 FLUTES

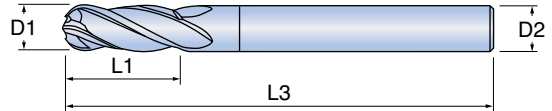
BALL NOSE SOLID CARBIDE END MILLS, 30° HELIX, MULTI-PURPOSE, 4 FLUTES, IN2005



| Cutter Number | Helix (Deg) | D1 Diameter | Z Flutes | R Radius | L3 Overall Length | L1 Cut Length | D2 Shank Size/Style |
|----------------|-------------|-------------|----------|----------|-------------------|---------------|---------------------|
| 47B-1202R4RB22 | 30.0 | 0.125 | 4 | 0.063 | 2.25 | 0.25 | .125" Cyl |
| 47B-1803R5RB25 | 30.0 | 0.188 | 4 | 0.094 | 2.50 | 0.38 | .188" Cyl |
| 47B-2505R6RB40 | 30.0 | 0.250 | 4 | 0.125 | 4.00 | 0.50 | .250" Cyl |
| 47B-3107R7RB40 | 30.0 | 0.312 | 4 | 0.157 | 4.00 | 0.75 | .312" Cyl |
| 47B-0308R8RB40 | 30.0 | 0.375 | 4 | 0.188 | 4.00 | 0.88 | .375" Cyl |
| 47B-5010S4RB45 | 30.0 | 0.500 | 4 | 0.250 | 4.50 | 1.00 | .500" Cyl |
| 47B-6212S6RB50 | 30.0 | 0.625 | 4 | 0.313 | 5.00 | 1.25 | .625" Cyl |
| 47B-7515R8RB50 | 30.0 | 0.750 | 4 | 0.375 | 5.00 | 1.50 | .750" Cyl |

PRO•ROUNDS™ SERIES 47B_RB

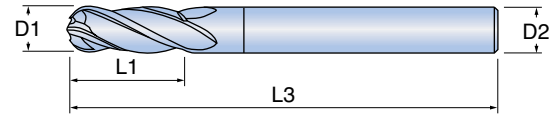
BALL NOSE SOLID CARBIDE END MILLS, 30° HELIX, MULTI-PURPOSE, 4 FLUTES, IN2005



| Cutter Number | Helix (Deg) | D1 Diameter | Z Flutes | R Radius | L3 Overall Length | L1 Cut Length | D2 Shank Size/Style |
|----------------|-------------|-------------|----------|----------|-------------------|---------------|---------------------|
| 47B-1201R4RB15 | 30.0 | 0.125 | 4 | 0.063 | 1.50 | 0.19 | .125" Cyl |
| 47B-1205R4RB15 | 30.0 | 0.125 | 4 | 0.063 | 1.50 | 0.50 | .125" Cyl |
| 47B-1806R5RB20 | 30.0 | 0.188 | 4 | 0.094 | 2.00 | 0.50 | .188" Cyl |
| 47B-2507R6RB25 | 30.0 | 0.250 | 4 | 0.125 | 2.50 | 0.63 | .250" Cyl |
| 47B-3108R7RB25 | 30.0 | 0.312 | 4 | 0.157 | 2.50 | 0.75 | .312" Cyl |
| 47B-3710R8RB30 | 30.0 | 0.375 | 4 | 0.188 | 3.00 | 0.81 | .375" Cyl |
| 47B-4310R9RB30 | 30.0 | 0.438 | 4 | 0.219 | 3.00 | 1.00 | .438" Cyl |
| 47B-5010S4RB30 | 30.0 | 0.500 | 4 | 0.250 | 3.00 | 1.00 | .500" Cyl |
| 47B-6212S6RB35 | 30.0 | 0.625 | 4 | 0.313 | 3.50 | 1.00 | .625" Cyl |
| 47B-7515S7RB40 | 30.0 | 0.750 | 4 | 0.375 | 4.00 | 1.25 | .750" Cyl |

PRO•ROUNDS™ SERIES 47B_RB

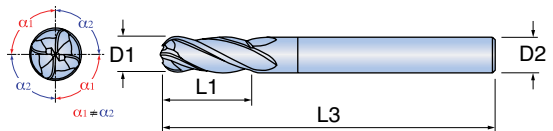
BALL NOSE SOLID CARBIDE END MILLS, 30° HELIX, MULTI-PURPOSE, 4 FLUTES, IN2005



| Cutter Number | Helix (Deg) | D1 Diameter | Z Flutes | R Radius | L3 Overall Length | L1 Cut Length | D2 Shank Size/Style |
|----------------|-------------|-------------|----------|----------|-------------------|---------------|---------------------|
| 47B-1802R5RB20 | 30.0 | 0.188 | 4 | 0.094 | 2.00 | 0.25 | .188" Cyl |
| 47B-2503R6RB25 | 30.0 | 0.250 | 4 | 0.125 | 2.50 | 0.31 | .250" Cyl |
| 47B-3103R7RB25 | 30.0 | 0.312 | 4 | 0.157 | 2.50 | 0.38 | .312" Cyl |
| 47B-3704R8RB25 | 30.0 | 0.375 | 4 | 0.188 | 2.50 | 0.44 | .375" Cyl |
| 47B-4305R9RB27 | 30.0 | 0.438 | 4 | 0.219 | 2.75 | 0.50 | .438" Cyl |
| 47B-5005S4RB30 | 30.0 | 0.500 | 4 | 0.250 | 3.00 | 0.56 | .500" Cyl |
| 47B-6206S6RB35 | 30.0 | 0.625 | 4 | 0.313 | 3.50 | 0.69 | .625" Cyl |

PRO•ROUNDS™ SERIES 47B_RQ

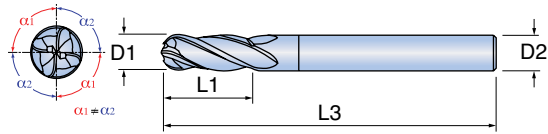
BALL NOSE SOLID CARBIDE END MILLS, 38° HELIX, VARIABLE-PITCH, INCH, 4 FLUTES, IN2005



| Cutter Number | Helix (Deg) | D1 Diameter | Z Flutes | R Radius | L3 Overall Length | L1 Cut Length | D2 Shank Size/Style |
|----------------|-------------|-------------|----------|----------|-------------------|---------------|---------------------|
| 47B-1250R4RQ20 | 38.0 | 0.125 | 4 | 0.063 | 2.00 | 0.50 | .125" Cyl |
| 47B-1862R5RQ22 | 38.0 | 0.188 | 4 | 0.094 | 2.25 | 0.63 | .188" Cyl |
| 47B-2575R6RQ25 | 38.0 | 0.250 | 4 | 0.125 | 2.50 | 0.75 | .250" Cyl |
| 47B-3175R7RQ25 | 38.0 | 0.312 | 4 | 0.156 | 2.50 | 0.75 | .312" Cyl |
| 47B-3787R8RQ25 | 38.0 | 0.375 | 4 | 0.187 | 2.50 | 0.88 | .375" Cyl |
| 47B-4387R9RQ25 | 38.0 | 0.438 | 4 | 0.218 | 2.50 | 0.88 | .438" Cyl |
| 47B-5012S4RQ30 | 38.0 | 0.500 | 4 | 0.250 | 3.00 | 1.25 | .500" Cyl |
| 47B-6212S6RQ35 | 38.0 | 0.625 | 4 | 0.312 | 3.50 | 1.25 | .625" Cyl |
| 47B-7515S7RQ40 | 38.0 | 0.750 | 4 | 0.375 | 4.00 | 1.50 | .750" Cyl |
| 47B-1015S1RQ40 | 38.0 | 1.000 | 4 | 0.500 | 4.00 | 1.50 | 1.000" Cyl |

PRO•ROUNDS™ SERIES 47BRQ

BALL NOSE SOLID CARBIDE END MILLS, 38° HELIX, VARIABLE-PITCH, METRIC, 4 FLUTES, IN2006



| Cutter Number | Helix (Deg) | D1 Diameter | Z Flutes | R Radius | L3 Overall Length | L1 Cut Length | D2 Shank Size/Style |
|----------------|-------------|-------------|----------|----------|-------------------|---------------|---------------------|
| 47B03006T7RQ57 | 38.0 | 3.000 | 4 | 1.500 | 57.00 | 6.00 | 6mm Cyl |
| 47B04008T7RQ57 | 38.0 | 4.000 | 4 | 2.000 | 57.00 | 8.00 | 6mm Cyl |
| 47B05010T7RQ57 | 38.0 | 5.000 | 4 | 2.500 | 57.00 | 10.00 | 6mm Cyl |
| 47B06012T7RQ57 | 38.0 | 6.000 | 4 | 2.500 | 57.00 | 12.00 | 6mm Cyl |
| 47B08016T0RQ63 | 38.0 | 8.000 | 4 | 4.000 | 63.00 | 16.00 | 8mm Cyl |
| 47B10020T1RQ72 | 38.0 | 10.000 | 4 | 5.000 | 72.00 | 20.00 | 10mm Cyl |
| 47B12024T2RQ83 | 38.0 | 12.000 | 4 | 6.000 | 83.00 | 24.00 | 12mm Cyl |
| 47B16032T3RQ92 | 38.0 | 16.000 | 4 | 8.000 | 92.00 | 32.00 | 16mm Cyl |

PRO•ROUNDS™ TEST REPORT

| | INGERSOLL | Competitor |
|-----------------------|-----------------------|-----------------------|
| Tool | 47B10020T1RQ72 IN2006 | Ball Nose |
| Tool Diameter (mm) | 10 | 10 |
| No. of Flutes | 4 | 4 |
| Carbide Grade | IN2006 | TiAN |
| Material Type | H13(1.2344) 52-55 HRc | H13(1.2344) 52-55 HRc |
| Cutting Speed (m/min) | 226 | 226 |
| Spindle Speed (rpm) | 7200 | 7200 |
| Depth of Cut (mm) | 15 | 15 |
| Width of Cut (mm) | 0.25 | 0.25 |
| Feed per Tooth (mm/t) | 0.125 | 0.125 |
| Table Feed (mm/min) | 3600 | 3600 |
| Coolant | Emulsion | Emulsion |
| Tool Life (min) | 92 | 75 |

PRO•ROUNDS™ OPERATING GUIDELINES

ROUND LINE - STANDARD END MILLS - Series 45B, 45D, 45J, 45M, 45N, 45P, 45X, 46D, 47C, 47D, 47J, 47N, 48C, 48D, 48J, 48N, 48U, 49D, 49J

| Workpiece Material | Cutting speed vc in/min | | | Feed rate per tooth fz ft/min | | Cutting depth ap recomb. for | Cutting Width |
|---|-------------------------|-----------|-----------|-------------------------------|----------------|---------------------------------|------------------|
| | End mill | | End mill | | End mill in | | |
| | DC in | Full slot | Shoulder | Full slot | | Shoulder | |
| Unalloyed steel P | .125-.250 | 300-600 | 450-800 | .0006 -.0010 | .0018 -.0030 | .050 x D | 40% |
| | .312-.500 | 300-600 | 450-800 | .0025 -.0040 | .0040 -.0055 | .050 x D | 40% |
| | .625-1.00 | 300-600 | 450-800 | .0030 -.0040 | .0060 -.0090 | .050 x D | 40% |
| High Carbon steel < 1100N/mm² P | .125-.250 | 250-500 | 325-725 | .0006 -.0018 | .0007 -.0025 | .030 x D | 30% |
| | .312-.500 | 300-600 | 400-650 | .0020 -.0030 | .0030 -.0040 | .030 x D | 30% |
| | .625-1.00 | 300-600 | 400-650 | .0025 -.0040 | .0040 -.0080 | .030 x D | 30% |
| Alloyed / Tool steel < 1400N/mm² P | .125-.250 | 250-450 | 325-525 | .0006 -.0018 | .0007 -.0020 | .030 x D | 25% |
| | .312-.500 | 250-450 | 325-600 | .0015 -.0028 | .0028 -.0040 | .030 x D | 25% |
| | .625-1.00 | 250-450 | 325-600 | .0020 -.0030 | .0040 -.0070 | .030 x D | 25% |
| Stainless steel M | .125-.250 | 165-300 | 250-450 | .0040 -.0007 | .0040 -.0013 | .030 x D | 30% |
| | .312-.500 | 165-300 | 250-450 | .0015 -.0025 | .0028 -.0040 | .030 x D | 30% |
| | .625-1.00 | 165-300 | 250-450 | .0025 -.0040 | .0040 -.0080 | .030 x D | 30% |
| Gray cast iron K | .125-.250 | 325-525 | 500-975 | .0006 -.0010 | .0018 -.0030 | .030 x D | 40% |
| | .312-.500 | 325-525 | 500-900 | .0025 -.0040 | .0040 -.0055 | .030 x D | 40% |
| | .625-1.00 | 250-550 | 500-900 | .0030 -.0040 | .0060 -.0090 | .030 x D | 40% |
| Cast alloys K | .125-.250 | 250-550 | 400-650 | .0006 -.0018 | .0007 -.0025 | .030 x D | 30% |
| | .312-.500 | 250-550 | 400-650 | .0020 -.0030 | .0030 -.0040 | .030 x D | 30% |
| | .625-1.00 | 250-550 | 400-650 | .0025 -.0040 | .0040 -.0080 | .030 x D | 30% |
| Aluminum N | .125-.250 | 825-2500 | 825-2500 | .0007 -.0015 | .0010 -.0030 | .040 x D | 30% |
| | .312-.500 | 2500-3500 | 3000-5000 | .0035 -.0040 | .0040 -.0070 | .040 x D | 30% |
| | .625-1.00 | 2500-3500 | 5000-6500 | .0060 -.0070 | .0070 -.0090 | .040 x D | 30% |
| Plastics N | .125-.250 | 400-650 | 650-1300 | .0040 -.0018 | .0070 -.0015 | .040 x D | 10% |
| | .312-.500 | 400-650 | 650-1300 | .0020 -.0030 | .0028 -.0040 | .040 x D | 10% |
| | .625-1.00 | 400-650 | 650-1300 | .0028 -.0040 | .0040 -.0080 | .040 x D | 10% |
| Super alloys S | .125-.250 | 65-165 | 100-200 | .0040 -.0060 | .0040 -.0010 | .020 x D | 10% |
| | .312-.500 | 65-165 | 100-200 | .0010 -.0020 | .0020 -.0040 | .020 x D | 10% |
| | .625-1.00 | 65-165 | 100-200 | .0020 -.0030 | .0040 -.0070 | .020 x D | 10% |
| Hardened steel 48 - 54 HRC | .125-.250 | 130-325 | 200-400 | .0006 -.0018 | .0007 -.0020 | .030 x D | 25% |
| | .312-.500 | 130-325 | 200-400 | .0015 -.0028 | .0028 -.0040 | .030 x D | 25% |
| | .625-1.00 | 130-325 | 200-400 | .0020 -.0030 | .0040 -.0070 | .030 x D | 25% |
| Hardened steel 54 - 63 HRC | .125-.250 | 65-165 | 150-250 | .0040 -.0007 | .0040 -.0015 | .027 x D | 20% |
| | .312-.500 | 65-200 | 150-250 | .0010 -.0020 | .0020 -.0030 | .027 x D | 20% |
| | .625-1.00 | 65-200 | 150-250 | .0015 -.0028 | .0030 -.0060 | .027 x D | 20% |
| Hardened steel > 63 HRC | .125-.250 | 65-100 | 100-200 | .0040 -.0040 | .0040 -.0010 | .024 x D | 10% |
| | .312-.500 | 65-130 | 100-200 | .0007 -.0015 | .0015 -.0025 | .024 x D | 10% |
| | .625-1.00 | 65-130 | 100-200 | .0010 -.0025 | .0025 -.0060 | .024 x D | 10% |

General Information:

Machining of aluminum and duroplastics with grade IN05S, any other materials with IN2005 / IN2006. Max. cutting depth of end mills is determined by cutting length a = xxx in; for ball nose cutters max. cutting depth is determined by radius.

Please consider the limitation of max. RPM of the machine! Cutting values refer to n_{max} = 40000 min⁻¹