



END MILL CATALOG

2019





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Icon Key

| | | | | | | | | | | |
|----------------|-------------------------|---------------------------|------------------------------------|--|--|--|-----------------------|------------------------|-----------------------------|-----------------------|
| HM | HSS | HSS-E | HSS-PM | $\begin{matrix} +.0001 \\ -.0015 \end{matrix}$ | $\begin{matrix} +.003 \\ -.000 \end{matrix}$ | $\begin{matrix} +.005 \\ -.000 \end{matrix}$ | e8 | k10 | | |
| Carbide | High Speed Steel | High Speed Cobalt | High Speed Powder Metallurgy Steel | Tolerance | Tolerance | Tolerance | e8 diameter tolerance | k10 diameter tolerance | Slotting, Ramping, Plunging | Slotting, Ramping |
| | | | | | | | | | | |
| Blank space | Ball nose | Finishing (side cutting) | Roughing | Slotting | Slotting P9 tolerance | Extra short cut length | Short cut length | Medium cut length | Long cut length | Extra long cut length |
| | | | | | | | | | | |
| Straight shank | Weldon shank | DIN 1835B | DIN 6535HA | DIN 6535HB Weldon shank | Unequal helix | 30° helix angle, 12° rake | 30° helix angle | 37° helix angle | 38° helix angle | 45° helix angle |
| | | | | | | | | | | |
| Bright finish | Titanium Carbon Nitride | Aluminum Titanium Nitride | Zirconium | 2-flute | 3-flute | 4-flute | 5-flute | 4-8 flute | | |

You may have noticed a change. Although our products are still the same, our style numbers and eCodes are different. To help you find the end mill you are currently using, an EDP number conversion chart can be found on page 57.

SOLID CARBIDE END MILLS

INTRODUCTION

Dormer Pramet's new range of Solid Carbide End Mills represent a new direction in our branding of end mill products all under the Dormer brand name. These solid carbide end mills are suited for the most common milling operations such as slotting, plunging, side and face milling, as well as ramping and copy milling in a wide range of materials.

FEATURES AND BENEFITS

- Consistent performance and repeatability in multiple material applications across a diverse array of machines and conditions.
- This solid carbide end mill family offers ranges of uncoated and coated end mills with options for square end, ball nosed, and radius corners as well as various length options.
- The designs of these products enable them to deliver high quality and performance at an exceptional value. Some styles are specifically designed as material or application specific products. See AMG tables for running parameters in the different materials.

TOOL MATERIAL

Premium micrograin carbide provides an excellent combination of hardness and toughness, resulting in high wear resistance and long consistent tool life.

COATINGS

- A Zirconium Nitride (ZrN) coating on some products offer improved performance in milling aluminum (including high silica aluminum).
- Multi-layer Aluminum Titanium Nitride (AlTiN) coating on some products offer improved cutting edge stability, outstanding wear protection, higher hot hardness and increased tool life.

SHANKS

High precision (h6) shanks are offered as standard on most cutters. Cylindrical shanks are made to DIN 6535 HA but on some of the variable helix designs a Weldon shank design is used. These are made to DIN 6535 HB.

GEOMETRY

- New 2-flute aluminum cutters introduced offer excellent performance in aluminum, aluminum alloys and other non-ferrous materials. This geometry when coupled with the ZrN coating promotes excellent chip evacuation, improves material removal rates and improves surface finishes.
- New variable helix design cutters introduced with radius corners offer increased stability and lower harmonics during the milling process. This reduces the possibility of vibrations and lowers the risk of chipping at the cutting edges or corners. Increased stability also allows these cutters to be used in a wide variety of materials and applications where conventional type cutters do not perform as well.

HSS, HSS-E & HSS-E-PM END MILLS

INTRODUCTION

Dormer Pramet's new range of High Speed Steel End Mills represent a new direction in our branding of end mill products all under the Dormer name. These end mills are suited for most general milling operations such as slotting, plunging, side and face milling, as well as ramping and copy milling depending on the style selected.

FEATURES AND BENEFITS

- Consistent performance and repeatability in multiple material applications across a diverse array of machines and adverse conditions.
- The designs of these products enable them to deliver good quality and performance at an exceptional value.
- This HSS end mill family offers ranges and length options of mostly uncoated end mills with options for square end and ball nosed end, as well as scalloped fine & roughing profile cutters.

TOOL MATERIAL

Manufactured from premium grades of HSS, HSS-E and HSS-E-PM materials.

- HSS tools will flex slightly under pressure and absorb more shock which can be advantageous when rigidity or tool holding is not optimal and vibrations are present.
- HSS-E (HSCo) tool substrate is harder and more wear resistant but will not withstand the shock and vibrations that HSS substrates will absorb which can cause chipping or tool breakage if conditions are not stable.
- HSS-E-PM tools are produced with powder metallurgy technology. These substrates have a finer grain structure resulting in a material with superior edge strength and toughness but similar to HSCo a rigid set-up and good tool holding is important to avoid excess shock and vibrations that can cause cutting edges to chip or fracture.

SHANKS

All cutters in this range are offered with standard Weldon shanks. Weldon type holders are typically used for most HSS cutters but higher quality tool holding with HSS-E or HSS-E-PM cutters can provide better results.

GEOMETRY

- 2-flute, 3-flute, 4-flute and multi-flute end mills are offered in various tool substrates.
- Most end mills in this range have a 30° helix angle for general purpose milling in a wide variety of materials.
- Some styles have a higher 38° Helix to facilitate chip flow when milling aluminum and other non-ferrous materials.
- Various lengths are available to offer longer than standard cut-lengths for milling deeper pockets.
- P9 slotting tolerance end mills are offered in 2-flute and 3-flute options. HSS-E scalloped roughing cutters are available in coarse and fine profile styles to allow for maximum metal removal in a single pass.

COATINGS

- Most HSS, HSS-E & HSS-E-PM end mills in this range are offered as uncoated products.
- Some of our scalloped roughing coarse and fine profile cutters are also offered as coated products.
- The Titanium Carbon Nitride (TiCN) coating on these products will lower the coefficient of friction and improve wear resistance which allows for better chip flow and longer tool life.

Visual Index - End Mills

| # of Flutes | Type of Cut | Depth/Width of Cut | Alpha Code | Feed Per Tooth (Ft) Dia Inches | | | | | | | | | | | |
|-------------|-------------|--------------------------------|------------|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | | | 1/8 | 5/32 | 3/16 | 1/4 | 5/16 | 13/32 | 1/2 | 9/16 | 5/8 | 11/16 | 3/4 | 1" |
| >4 | | ↓ 1.5 ↔ 0.05 | A | | | | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | | |
| | | | B | | | | 0.002 | 0.002 | 0.002 | 0.003 | 0.003 | 0.004 | 0.004 | | |
| | | | C | | | | 0.003 | 0.003 | 0.004 | 0.004 | 0.005 | 0.005 | 0.006 | 0.007 | |
| 3-4 | | ↓ 1.5 ↔ 0.1 | A | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 | 0.003 | 0.004 | 0.004 | 0.005 | |
| | | | B | 0.001 | 0.002 | 0.002 | 0.003 | 0.003 | 0.004 | 0.004 | 0.005 | 0.005 | 0.006 | 0.007 | |
| | | | C | 0.001 | 0.002 | 0.002 | 0.003 | 0.004 | 0.005 | 0.006 | 0.006 | 0.007 | 0.008 | 0.009 | |
| 3-4 | | ↓ 1 ↔ 0.5 | A | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | |
| | | | B | 0.003 | 0.000 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.003 | 0.003 | 0.004 | |
| | | | C | 0.000 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.003 | 0.004 | 0.004 | 0.005 | |
| 2-3 | | ↓ 0.5 ↔ 1 | A | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.003 | |
| | | | B | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.003 | 0.004 | |
| | | | C | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.003 | 0.004 | 0.004 | 0.005 | 0.005 | |
| 3-4 | | ↓ 0.5 ↔ 1 ↓ 1 ↔ 0.5 | B | | | | 0.001 | 0.002 | 0.003 | 0.003 | 0.003 | 0.004 | 0.004 | 0.004 | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| 2 & 4 | | ↓ 0.1 - 0.5mm ↔ 0.1 - 0.5mm | A | | | | | | | | | | | | |
| | | | B | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.003 | 0.003 | | | |
| | | | C | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.003 | 0.003 | 0.004 | | | |
| 4-5 | | ↓ 0.01 - 0.1 ↔ ≤ 1 | A | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.003 | 0.004 | |
| | | | B | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.003 | 0.003 | 0.003 | 0.004 | 0.004 | 0.005 |
| | | | C | 0.001 | 0.001 | 0.001 | 0.002 | 0.003 | 0.003 | 0.004 | 0.004 | 0.004 | 0.004 | 0.007 | 0.01 |

How To Use This Chart to Find Cutting Feed Rate (IPR):

1. Find your Alpha Code on the AMG Chart (example: 279U : U is the Alpha Code).
2. Find the closest diameter for your cutting application on the chart.
3. Select the type of cut and # of flutes to find your Ft Range.

| Application Material Groups (AMG) | | | Hardness HRC | ISO |
|-----------------------------------|--|--|--------------|-----|
| 1. Steel | 1.1 Magnetic soft steel | 12L14, 12L15 | <120 HB | P 1 |
| | 1.2 Structural Steel/ case carburising steel | 1005-1025, 1214, 1215, A36 | <200 HB | P 1 |
| | 1.3 Plain Carbon steel | 1030-1060, 1050-1060, 1144-1146 | <24 | P 2 |
| | 1.4 Alloy steel | 4140,4340,52100,8620 H11-H41,A2,D2,01,P20,420 | <24 | P 3 |
| | 1.5 Alloy steel/ Hardened and tempered steel | 4140,4340,52100,8620 H11-H41,A2,D2,01,P20,420 | >24<38 | P 4 |
| | 1.6 Alloy steel/ Hardened and tempered steel | 4140,4340,52100,8620 H11-H41,A2,D2,01,P20,420 | >38 | H 1 |
| | 1.7 Alloy steel Hardened | A2-D2, H10-H41, L1-L6, M1-M42, T1 | 49-55 | H 3 |
| | 1.8 Alloy steel Hardened | A2-D2, H10-H41, L1-L6, M1-M42, T1 | 55-63 | H 4 |
| 2. Stainless Steel | 2.1 Free machining Stainless Steel | 200, 303, 416, 420F, 430F, 440 | <24 | M 1 |
| | 2.2 Austenitic | 301, 302, 304, 316, 321, 330, CUSTOM 455, AM-350 | <24 | M 3 |
| | 2.3 Ferritic + Austenitic, Martensitic | 318-329, 400-446, DUPLEX | <32 | M 2 |
| | 2.4 Precipitation Hardened | 15-5PH, Custom 450 17-4PH | <32 | S 2 |
| 3. Cast Iron | 3.1 Lamellar graphite | Grey, G10, Gg40, J431C, A48 CLASS 20 | <150 HB | K 1 |
| | 3.2 Lamellar graphite | Grey, GG25-Gg40, J158, A48 CLASS 40-60 | >150 HB<32 | K 2 |
| | 3.3 Nodular graphite/ Malleable Cast Iron | A220, A436, A439, A602, Black, GGG40-GGG70 | <200 HB | K 3 |
| | 3.4 Nodular graphite/ Malleable Cast Iron | Black Gts/Gtw, J434C | >200 HB<32 | K 4 |
| 4. Titanium | 4.1 Titanium, unalloyed | Commercially Pure | <200 HB | S 1 |
| | 4.2 Titanium, alloyed | 6Al4V, 6A14V-2Sn, Monel, Monel K | <28 | S 2 |
| | 4.3 Titanium, alloyed | 6Al4V-4Mo, 7A14V-4Mo, 4911-4967 | >28<38 | S 3 |
| 5. Nickel | 5.1 Nickel, unalloyed | Commercially Pure, 17644, 200, 5553 | <150 HB | S 1 |
| | 5.2 Nickel, alloyed | Monel 400, Hastelloy C, Inconel 625, Waspaloy | <28 | S 2 |
| | 5.3 Nickel, alloyed | Inconel 718, Nimonic 75-95, Rene 41, Inconel 825, A286 | >28<38 | S 3 |
| 6. Copper | 6.1 Copper | Commercially Pure | <100 HB | N 3 |
| | 6.2 B-Brass, Bronze | 314-340, 350-370 | <200 HB | N 4 |
| | 6.3 α-Brass | Alloyed Cu + Al + Fe, Long Chipping | <200 HB | N 3 |
| | 6.4 High Strength Bronze | Ampco 18-25 | <49 | N 4 |
| 7. Aluminium Magnesium | 7.1 Al, Mg, unalloyed | Commercially Pure | <100 HB | N 1 |
| | 7.2 Al alloyed, Si<0.5% | 6061 T6, 7075, 314-340 | <150 HB | N 1 |
| | 7.3 Al alloyed, Si>0.5%<10% | 6061 T6, 380-390 | <120 HB | N 1 |
| | 7.4 Al alloyed, Si>10% Mg alloys | Magnesium Whisker Reinforced | <120 HB | N 2 |
| 8. Synthetic Materials | 8.1 Thermoplastics | Ultradid, Polystrol | --- | O |
| | 8.2 Thermosetting plastics | Bakelit, Pertinax | --- | O |
| | 8.3 Reinforced plastic materials | CFK, GFKAFK | --- | O |
| 9. Hard Mat. | 9.1 Cermets (Metal-ceramics) | Ferrotic | <54 | H |
| 10. Graphite | 10.1 Standard graphite | | --- | O |

Visual Index - End Mills

| Tool Material: | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM |
|-------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Application: | | | | | | | | | | | | | | | | | | |
| Number of Flutes: | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 |
| Cut Length: | | | | | | | | | | | | | | | | | | |
| Helix: | $\lambda 45^\circ$ | $\lambda 45^\circ$ | $\lambda 37^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ |
| Shank: | | | | | | | | | | | | | | | | | | |
| Finish/Coating: | | ZrN | ZrN | | | AlTiN | | | | AlTiN | | AlTiN | | AlTiN | | | | |
| Direction: | | | | | | | | | | | | | | | | | | |
| Style: | S106 | S206 | S207 | S116 | S108 | S208 | S109 | S110 | S111 | S211 | S112 | S212 | S113 | S213 | S114 | S115 | S115 | |
| Range: | 1/4 - 1.0" | 1/4 - 1.0" | 1/8 - 1.0" | 1/8 - 1/2 | 1/16 - 1" | 1/16 - 5/8 | 2.00 - 25.00 | 1/8 - 1/2 | 1/8 - 1/2 | 1/8 - 1/2 | 1/16 - 1/2 | 1/16 - 1/2 | 2.00 - 20.00 | 3.00 - 12.00 | 1/8 - 5/8 | 1/8 - 1/2 | 1/8 - 1/2 | |
| Page # | 11 | 11 | 12 | 13 | 14 | 14 | 15 | 16 | 17 | 17 | 18 | 18 | 19 | 19 | 20 | 21 | 21 | |
| 1.1 | | | | 289B | 289B | 400B | 289B | 269B | 249B | 361B | 289B | 400B | 289B | 400B | 269B | 249B | | |
| 1.2 | | | | 223B | 223B | 298B | 223B | 212B | 200B | 269B | 223B | 298B | 223B | 298B | 212B | 200B | | |
| 1.3 | | | | 223B | 223B | 298B | 223B | 212B | 200B | 269B | 223B | 298B | 223B | 298B | 212B | 200B | | |
| 1.4 | | | | 180B | 180B | 259B | 180B | 171B | 161B | 239B | 180B | 259B | 180B | 259B | 170B | 161B | | |
| 1.5 | | | | 161B | 161B | 230B | 161B | 152B | 144B | 200B | 161B | 230B | 161B | 230B | 152B | 144B | | |
| 1.6 | | | | 148B | 148B | 200B | 148B | 140B | 131B | 180B | 148B | 200B | 148B | 200B | 140B | 131B | | |
| 1.7 | | | | | | | | | | | | | | | | | | |
| 1.8 | | | | | | | | | | | | | | | | | | |
| 2.1 | | | | 200A | 200A | 325A | 200A | 190A | 180A | 298A | 200A | 325A | 200A | 325A | 190A | 180A | | |
| 2.2 | | | | 141A | 141A | 223A | 141A | 125A | 108A | 180A | 141A | 223A | 141A | 223A | 125A | 108A | | |
| 2.3 | | | | 108A | 108A | 174A | 108A | 103A | 98A | 171A | 108A | 174A | 108A | 174A | 103A | 98A | | |
| 2.4 | | | | 89A | 89A | 131A | 89A | 78A | 66A | 131A | 89A | 131A | 89A | 131A | 78A | 82A | | |
| 3.1 | | | | 374B | 374B | 551B | 374B | 336A | 298B | 499B | 374B | 551B | 374B | 551B | 336A | 298B | | |
| 3.2 | | | | 318B | 318B | 525B | 318B | 284B | 249B | 400B | 318B | 525B | 318B | 525B | 284B | 249B | | |
| 3.3 | | | | 318B | 318B | 525B | 318B | 284B | 249B | 400B | 318B | 525B | 318B | 525B | 284B | 249B | | |
| 3.4 | | | | 249B | 249B | 374B | 249B | 225B | 200B | 341B | 249B | 374B | 249B | 374B | 225B | 200B | | |
| 4.1 | | | | | | | 230B | | | 200B | | 230B | | 230B | | | | |
| 4.2 | | | | | | | 200B | | | 180B | | 200B | | 200B | | | | |
| 4.3 | | | | | | | 190B | | | 174B | | 190B | | 190B | | | | |
| 5.1 | | | | | | | 230B | | | 200B | | 230B | | 230B | | 148B | | |
| 5.2 | | | | | | | 161A | | | 141A | | 161A | | 161A | | | | |
| 5.3 | | | | | | | 98A | | | 85A | | 98A | | 98A | | | | |
| 6.1 | | | 900C | 649C | 649C | | 649C | 617C | 584C | | 649C | | 649C | | 617C | 584C | | |
| 6.2 | | | 750C | 499C | 499C | | 499C | 474C | 449C | | 499C | | 499C | | 474C | 449C | | |
| 6.3 | | | 530C | 499C | 499C | | 499C | 474C | 449C | | 499C | | 499C | | 474C | 449C | | |
| 6.4 | | | 140C | 125B | 125B | | 125B | 117B | 108B | | 125B | | 125B | | 117B | 108B | | |
| 7.1 | 2100C | 2100C | 1850C | 1499C | 1499C | | 1499C | 1424C | 1348C | | 1499C | | 1499C | | 1424C | 1348C | | |
| 7.2 | 2100C | 2100C | 1560C | 1499C | 1499C | | 1499C | 1424C | 1348C | | 1499C | | 1499C | | 1424C | 1348C | | |
| 7.3 | 1750C | 1750C | 750C | 649C | 649C | | 649C | 617C | 584C | | 649C | | 649C | | 617C | 584C | | |
| 7.4 | 915C | 915C | 500C | 400B | 400B | | 400B | 380B | 361B | | 400B | | 400B | | 380B | 361B | | |
| 8.1 | 1325C | 1325C | 1325C | | | | | | | | | | | | | | | |
| 8.2 | 600C | 600C | 600C | | | | | | | | | | | | | | | |
| 8.3 | | | 328C | | | | | | | | | | | | | | | |
| 9.1 | | | | | | | | | | | | | | | | | | |
| 10.1 | | | | | | | | | | | | | | | | | | |

Visual Index - End Mills

| Tool Material: | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM | HM |
|-------------------|-----------|------------|------------|-----------|-----------|-----------|--------------|--------------|-----------|-----------|----------|----------|------------|------------|--------------|--------------|
| Application: | | | | | | | | | | | | | | | | |
| Number of Flutes: | Z 2 | Z 3 | Z 3 | Z 4 | Z 4 | Z 4 | Z 4 | Z 4 | Z 4 | Z 4 | Z 4 | Z 4 | Z 4 | Z 4 | Z 4 | Z 4 |
| Cut Length: | | | | | | | | | | | | | | | | |
| Helix: | λ30° | λ30° | λ30° | λ30° | λ30° | λ30° | λ30° | λ30° | λ30° | λ30° | λ30° | λ30° | λ30° | λ30° | λ30° | λ30° |
| Shank: | | | | | | | | | | | | | | | | |
| Finish/Coating: | ATIN | | ATIN | | | ATIN | | ATIN | | ATIN | | ATIN | | ATIN | | ATIN |
| Direction: | | | | | | | | | | | | | | | | |
| Style: | S215 | S121 | S221 | S129 | S134 | S234 | S135 | S235 | S136 | S236 | S137 | S237 | S138 | S238 | S139 | S239 |
| Range: | 1/8 - 1/2 | 1/16 - 1/2 | 1/16 - 1/2 | 1/8 - 1/2 | 1/16 - 1" | 1/16 - 1" | 2.00 - 25.00 | 2.00 - 20.00 | 1/8 - 3/4 | 1/8 - 3/4 | 1/8 - 1" | 1/8 - 1" | 1/16 - 3/4 | 1/16 - 3/4 | 2.00 - 12.00 | 2.00 - 12.00 |
| Page # | 21 | 22 | 22 | 23 | 24 | 24 | 25 | 25 | 26 | 26 | 27 | 27 | 28 | 28 | 29 | 29 |
| 1.1 | 361B | 289B | 400B | 361B | 361B | 499B | 361B | 499B | 343B | 474B | 325B | 449B | 361B | 499B | 361B | 499B |
| 1.2 | 269B | 223B | 298B | 325B | 325B | 449B | 325B | 449B | 312B | 425B | 298B | 400B | 325B | 449B | 325B | 449B |
| 1.3 | 269B | 223B | 298B | 325B | 325B | 449B | 325B | 449B | 312B | 425B | 298B | 400B | 325B | 449B | 325B | 449B |
| 1.4 | 239B | 180B | 259B | 298B | 298B | 423B | 298B | 423B | 287B | 406B | 276B | 390B | 298B | 423B | 298B | 423B |
| 1.5 | 200B | 161B | 230B | 249B | 249B | 400B | 249B | 400B | 238B | 380B | 226B | 361B | 249B | 400B | 249B | 400B |
| 1.6 | 180B | 148B | 200B | 230B | 230B | 328B | 230B | 328B | 205B | 313B | 180B | 298B | 230B | 328B | 230B | 328B |
| 1.7 | | | | | | | | | | | | | | | | |
| 1.8 | | | | | | | | | | | | | | | | |
| 2.1 | 298A | 200A | 325A | 239A | 239A | 351A | 239A | 351A | 220A | 338A | 200A | 325A | 239A | 351A | 239A | 351A |
| 2.2 | 180A | 141A | 223A | 171A | 171A | 276A | 171A | 276A | 156A | 251A | 141A | 226A | 171A | 276A | 171A | 276A |
| 2.3 | 171A | 108A | 174A | 131A | 131A | 200A | 131A | 200A | 123A | 182A | 115A | 164A | 131A | 200A | 131A | 200A |
| 2.4 | 89A | | | 105A | 105A | 164A | 105A | 164A | 97A | 140A | 89A | 115A | 98A | 148A | 98A | 148A |
| 3.1 | 499B | 374B | 551B | 449B | 449B | 699B | 449B | 699B | 405B | 650B | 361B | 600B | 449B | 699B | 449B | 699B |
| 3.2 | 400B | 318B | 525B | 377B | 377B | 649B | 377B | 649B | 338B | 578B | 298B | 508B | 377B | 649B | 377B | 649B |
| 3.3 | 400B | 318B | 525B | 377B | 377B | 649B | 377B | 649B | 338B | 578B | 298B | 508B | 377B | 649B | 377B | 649B |
| 3.4 | 341B | 249B | 374B | 279B | 279B | 430B | 279B | 430B | 254B | 415B | 230B | 400B | 279B | 430B | 279B | 430B |
| 4.1 | 200B | | 230B | | | 259B | | 259B | | 245B | | 230B | | 259B | | 259B |
| 4.2 | 180B | | 200B | | | 230B | | 230B | | 220B | | 210B | | 230B | | 230B |
| 4.3 | 174B | | 190B | | | 200B | | 200B | | 190B | | 180B | | 200B | | 200B |
| 5.1 | 200B | | 230B | | | 266B | | 266B | | 251B | | 236B | | 266B | | 266B |
| 5.2 | 141A | | 161A | | | 200A | | 200A | | 190A | | 180A | | 200A | | 200A |
| 5.3 | 85A | | 98A | | | 131A | | 131A | | 123A | | 115A | | 131A | | 131A |
| 6.1 | | 649C | | 679C | 679C | | 679C | | 646C | | 613C | | 679C | | 679C | |
| 6.2 | | 499C | | 574C | 574C | | 574C | | 546C | | 518C | | 574C | | 574C | |
| 6.3 | | 499C | | 574C | 574C | | 574C | | 546C | | 518C | | 574C | | 574C | |
| 6.4 | | 125B | | 144B | 144B | | 144B | | 138B | | 131B | | 144B | | 144B | |
| 7.1 | | 1499C | | 1601C | 1601C | | 1601C | | 1525C | | 1450C | | 1601C | | 1601C | |
| 7.2 | | 1499C | | 1601C | 1601C | | 1601C | | 1525C | | 1450C | | 1601C | | 1601C | |
| 7.3 | | 649C | | 708C | 708C | | 708C | | 674C | | 640C | | 708C | | 708C | |
| 7.4 | | 400B | | 479B | 479B | | 479B | | 455B | | 430B | | 479B | | 479B | |
| 8.1 | | | | | | | | | | | | | | | | |
| 8.2 | | | | | | | | | | | | | | | | |
| 8.3 | | | | | | | | | | | | | | | | |
| 9.1 | | | | | | | | | | | | | | | | |
| 10.1 | | | | | | | | | | | | | | | | |

Visual Index - End Mills

| Tool Material: | HM | HM | HM | HM | HM | HM | HM | HM | HSS-E PM | HSS | HSS | HSS | HSS-E | HSS-E PM | HSS | |
|-------------------|--------------------|--------------------|--------------------|--------------------|-------------|-------------|-------------|-------------|---|--------------------|--------------------|--------------------|--------------------|--------------------|---|--------------------|
| Application: | | | | | | | | | | | | | | | | |
| Number of Flutes: | Z 4 | Z 4 | Z 4 | Z 4 | Z 4 | Z 4 | Z 4 | Z 5 | Z 5 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 | Z 2 |
| Cut Length: | | | | | | | | | | | | | | | | |
| Helix: | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | λ^* | λ^* | λ^* | λ^* | $\lambda 30^\circ$ $\gamma 12^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ $\gamma 12^\circ$ | $\lambda 30^\circ$ |
| Shank: | | | | | | | | | | | | | | | | |
| Finish/Coating: | | | | | | | | | | | | | | | | |
| Direction: | | | | | | | | | | | | | | | | |
| Style: | S146 | S246 | S147 | S247 | S223HA | S223HB | S248HA | S248HB | C110 | C600 | C601 | C602 | C603 | C123 | C604 | |
| Range: | 1/4 - 5/8 | 1/4 - 5/8 | 1/8 - 5/8 | 1/8 - 5/8 | 1/8 - 1.0" | 1/8 - 1.0" | 5/16 - 1.0" | 5/16 - 1.0" | 1.00 - 50.00 | 1/8 - 3/4 | 1/8 - 1.1/2 | 1/8 - 1" | 1/8 - 1" | 1/16 - 40.00 | 1/8 - 3/4 | |
| Page # | 30 | 30 | 31 | 31 | 32 | 32 | 33 | 33 | 34 | 36 | 37 | 38 | 39 | 40 | 42 | |
| 1.1 | 343B | 450B | 325B | 400B | 650B | 650B | 650B | 650B | 197A | 98A | 98A | 98A | 164A | 180A | 112S | |
| 1.2 | 312B | 412B | 298B | 374B | 650B | 650B | 650B | 650B | 164A | 89A | 89A | 89A | 131A | 148A | 89S | |
| 1.3 | 312B | 412B | 298B | 374B | 525B | 525B | 462B | 462B | 131B | 75B | 75B | 75B | 115B | 131B | 79T | |
| 1.4 | 287B | 387B | 276B | 351B | 525B | 525B | 462B | 462B | 115B | | | | 98B | 115B | | |
| 1.5 | 238B | 363B | 226B | 325B | 440B | 440B | 515B | 515B | | | | | | | | |
| 1.6 | 205B | 288B | 180B | 249B | 360B | 360B | 515B | 515B | | | | | | | | |
| 1.7 | | | | | 250B | 250B | 515B | 515B | | | | | | | | |
| 1.8 | | | | | 250B | 250B | 515B | 515B | | | | | | | | |
| 2.1 | 220A | 288A | 200A | 226A | 525B | 525B | 525B | 525B | 98F | | | | 75F | 82F | | |
| 2.2 | 156A | 233A | 141A | 190A | 400B | 400B | 400B | 400B | | | | | | | | |
| 2.3 | 123A | 176A | 115A | 151A | 232B | 232B | 232B | 232B | | | | | | | | |
| 2.4 | | 135A | | 121A | 172B | 172B | 172B | 172B | | | | | | | | |
| 3.1 | 405B | 500B | 361B | 499B | 770C | 770C | 455C | 455C | 115A | 82A | 82A | 82A | 92A | 98A | 89S | |
| 3.2 | 338B | 540N | 298B | 430B | 715C | 715C | 365C | 365C | 98A | 66A | 66A | 66A | 75A | 82A | 72S | |
| 3.3 | 338B | 540B | 298B | 430B | 715C | 715C | 300C | 300C | 164B | 82B | 82B | 82B | 131B | 148B | 89T | |
| 3.4 | 255B | 384B | 230B | 338B | 473C | 473C | 220C | 220C | 98B | | | | 82B | 98B | | |
| 4.1 | | 230B | | 200B | 325A | 325A | 665A | 665A | 115D | 59D | 59D | 59D | 92D | 98D | 62V | |
| 4.2 | | 210B | | 190B | 270A | 270A | 525A | 525A | 82D | 49D | 49D | 49D | 75D | 82D | 49V | |
| 4.3 | | 180B | | | 220A | 220A | 265A | 265A | | | | | | | | |
| 5.1 | | 238B | | 210B | 515A | 515A | 665A | 665A | 197D | 98D | 98D | 98D | 157D | 164D | 108V | |
| 5.2 | | 176A | | | 525A | 525A | 525A | 525A | 49C | 20C | 20C | 20C | 43C | 49C | 20U | |
| 5.3 | | | | | 265A | 265A | 265A | 265A | | | | | | | | |
| 6.1 | 646C | | 613C | 699C | | | | | 279C | 180C | 180C | 180C | 410C | 262C | 200U | |
| 6.2 | 602C | | 518C | 571C | | | | | 279C | 197C | 197C | 197C | 410C | 262C | 223U | |
| 6.3 | 546C | | 518C | 571C | | | | | 279C | 197C | 197C | 197C | 410C | 262C | 223U | |
| 6.4 | 137B | | 131B | 180B | | | | | | | | | | | | |
| 7.1 | 1526C | | 1450C | 1650C | | | | | 722E | 197E | 197E | 197E | 984E | 656E | 243X | |
| 7.2 | 1526C | | 1450C | 1650C | | | | | 722E | 180E | 180E | 180E | 984E | 656E | 194X | |
| 7.3 | 674C | | 640C | 708C | | | | | 279E | 115E | 115E | 115E | 295E | 262E | 144X | |
| 7.4 | 455B | | 430B | 410B | | | | | | | | | | | | |
| 8.1 | | | | | | | | | 295C | 197C | 197C | 197C | 410C | 262C | 200U | |
| 8.2 | | | | | | | | | | | | | | | | |
| 8.3 | | | | | | | | | | | | | | | | |
| 9.1 | | | | | | | | | | | | | | | | |
| 10.1 | | | | | | | | | | | | | | | | |

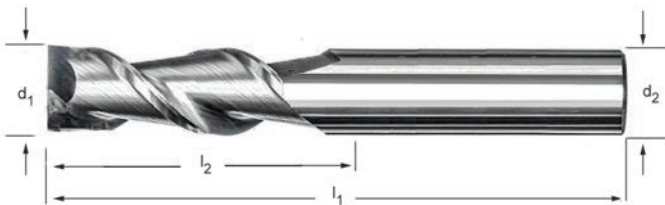
Visual Index - End Mills

| Tool Material: | HSS | HSS | HSS | HSS-E | HSS-E | HSS-E | HSS-E | HSS-E | HSS-E | HSS-E | HSS | HSS | HSS-E PM | HSS-E PM | HSS | HSS-E |
|-------------------|----------------------|----------------------|----------------------|---|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---|---|----------------------|----------------------|
| Application: | | | | | | | | | | | | | | | | |
| Number of Flutes: | Z 2 | Z 2 | Z 3 | Z 3 | Z 4-8 | Z 4-8 | Z 4-8 | Z 4-8 | Z 4-8 | Z 4-8 | Z 4 | Z 4 | Z 4-8 | Z 4-8 | Z 4-8 | Z 4-8 |
| Cut Length: | | | | | | | | | | | | | | | | |
| Helix: | $\lambda 38^\circ$ | $\lambda 38^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ $\gamma 12^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ $\gamma 12^\circ$ | $\lambda 30^\circ$ $\gamma 12^\circ$ | $\lambda 30^\circ$ | $\lambda 30^\circ$ |
| Shank: | | | | DIN 1835B | | | | | | | | | DIN 1835B | DIN 1835B | | |
| Finish/Coating: | | | | | | TiCN | | TiCN | | | | | | | | |
| Direction: | $+0.003$ -0.000 | $+0.003$ -0.000 | $+0.003$ -0.000 | e8 | $+0.005$ -0.000 | $+0.005$ -0.000 | $+0.005$ -0.000 | $+0.005$ -0.000 | $+0.005$ -0.000 | $+0.005$ -0.000 | $+0.005$ -0.000 | $+0.003$ -0.000 | k10 | k10 | $+0.003$ -0.000 | $+0.003$ -0.000 |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| Style: | C605 | C606 | C607 | C346 | C608 | C609 | C610 | C611 | C612 | C613 | C614 | C615 | C247 | C273 | C617 | C618 |
| Range: | 1/4 - 1" | 1/4 - 3/4 | 1/8 - 1" | 3.00 - 20.00 | 1/4 - 1" | 1/4 - 1" | 1/4 - 1" | 1/4 - 1" | 1/4 - 1" | 1/4 - 3/4 | 1/8 - 3/4 | 1/8 - 1" | 2.00 - 50.00 | 2.00 - 40.00 | 1/8 - 1" | 1/8 - 1" |
| Page # | 43 | 44 | 45 | 46 | 47 | 47 | 48 | 48 | 49 | 50 | 51 | 52 | 53 | 55 | 56 | 57 |
| 1.1 | 164A | 148A | | 148A | 164G | 197G | 164G | 197G | 148G | 148G | 115S | 164S | 180S | 164S | 115S | 164S |
| 1.2 | 131A | 118A | 131A | 115A | 131G | 184G | 131G | 184G | 118G | 118G | 92S | 131S | 148S | 164S | 92S | 131S |
| 1.3 | 115B | 102B | 115B | 98B | 115H | 161H | 115H | 161H | 102H | 102H | 79T | 115T | 131T | 115T | 79T | 115T |
| 1.4 | | | 98B | 82B | 98H | 138H | 98H | 138H | 89H | 89H | 69T | 98T | 115T | 98T | 69T | 98T |
| 1.5 | | | 66C | | | | | | | | | | | | | |
| 1.6 | | | | | | | | | | | | | | | | |
| 1.7 | | | | | | | | | | | | | | | | |
| 1.8 | | | | | | | | | | | | | | | | |
| 2.1 | 75F | 66F | | 66F | 75L | 105L | 75L | 105L | 66L | 66L | 52Y | 75Y | 82Y | 33Y | 52Y | 75Y |
| 2.2 | 62F | 56F | 62F | | | | | | | | | | | | | |
| 2.3 | | | | | | | | | | | | | | | | |
| 2.4 | | | | | | | | | | | | | | | | |
| 3.1 | | | | 82A | 92G | 128G | 92G | 128G | 82G | 82G | 92S | 92S | 98S | 82S | 92S | 92S |
| 3.2 | | | 75A | 66A | 75G | 105G | 75G | 105G | 66G | 66G | 75S | 75S | 82S | 66S | 75S | 75S |
| 3.3 | | | 131B | 115B | 131H | 184H | 131H | 184H | 118H | 118H | 92T | 131T | 148T | 131T | 92T | 131T |
| 3.4 | | | 82B | 66B | 82H | 128H | 82H | 128H | 72H | 72H | 56T | 82T | 82T | 82T | 56T | 82T |
| 4.1 | 92D | 82D | 92D | 82D | 92J | 128J | 92J | 128J | 82J | 82J | 62V | 92V | 98V | 82V | 62V | 92V |
| 4.2 | | | 75D | 66D | 75J | 105J | 75J | 105J | 66J | 66J | 52V | 75V | 82V | 66V | 52V | 75V |
| 4.3 | | | 33D | | | | | | | | | | | | | |
| 5.1 | 157D | 141D | | 148D | 157J | 220J | 157J | 220J | 141J | 141J | 108V | 157V | 164V | 148V | 108V | 157V |
| 5.2 | | | 43C | 33C | 43I | 59I | 43I | 59I | 36I | 36I | 20U | 43U | 49U | 33U | 20U | 43U |
| 5.3 | | | 20D | | | | | | | | | | | | | |
| 6.1 | 410C | 367C | | 230C | 410I | 574I | 410I | 574I | 367I | 367I | 203U | 410U | 262U | 230U | 203U | 410U |
| 6.2 | | | 410C | 230C | 410I | 574I | 410I | 574I | 367I | 367I | 223U | 410U | 262U | 230U | 223U | 410U |
| 6.3 | | | 410C | 230C | 410I | 574I | 410I | 574I | 367I | 367I | 223U | 410U | 262U | 230U | 223U | 410U |
| 6.4 | | | 49C | | | | | | | | | | | | | |
| 7.1 | 984E | 886E | | 590E | | | | | | | 984X | 656X | 590X | | | 984X |
| 7.2 | 984E | 886E | | 590E | 984K | 1378K | 984K | 1378K | 886K | 886K | 197X | 984X | 656X | 590X | 197X | 984X |
| 7.3 | 295E | 266E | 295E | | 295K | 413K | 295K | 413K | 266K | 266K | 148X | 295X | 262X | 230X | 148X | 295X |
| 7.4 | | | 197A | | | | | | | | | | | | | |
| 8.1 | 410C | 367C | | 230C | 410I | 574I | 410I | 574I | 367I | 367I | 203U | 410U | 262U | 230U | 203U | 410U |
| 8.2 | | | 410C | | | | | | | | | | | | | |
| 8.3 | | | | | | | | | | | | | | | | |
| 9.1 | | | | | | | | | | | | | | | | |
| 10.1 | | | | | | | | | | | | | | | | |

Regular length, Square End, 45° Helix

S106 Double gullet flute design allows for fast, efficient evacuation of chips in soft and non-ferrous materials

S206 Zirconium coating increases surface hardness, improves chip evacuation and tool life allowing for higher removal rates in soft and non-ferrous materials



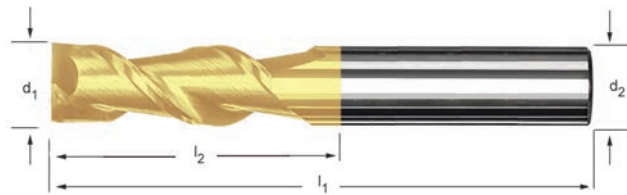
| d_1 Ø Inch | d_1 decimal Inch | d_2 Ø Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S106 | S206 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|---------|---------|
| 1/4 | 0.2500 | 1/4 | 1 | 2-1/2 | 2 | 1 | 7648490 | 7648497 |
| 5/16 | 0.3125 | 5/16 | 1 | 3 | 2 | 1 | 7648491 | 7648498 |
| 3/8 | 0.3750 | 3/8 | 1 | 2-1/2 | 2 | 1 | 7648492 | 7648499 |
| 1/2 | 0.5000 | 1/2 | 1-1/4 | 3 | 2 | 1 | 7648493 | 7648500 |
| 5/8 | 0.6250 | 5/8 | 1-5/8 | 3-1/2 | 2 | 1 | 7648494 | 7648501 |
| 3/4 | 0.7500 | 3/4 | 1-3/4 | 4 | 2 | 1 | 7648495 | 7648502 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 2 | 1 | 7648496 | 7648503 |

Solid Carbide 2-Flute End Mill



Regular Length, Square End, 37° Helix

S207 Unique flute design along with the Zirconium coating allow for faster speeds and feeds in soft and non-ferrous materials



S207

HM



ZrN

Z
2

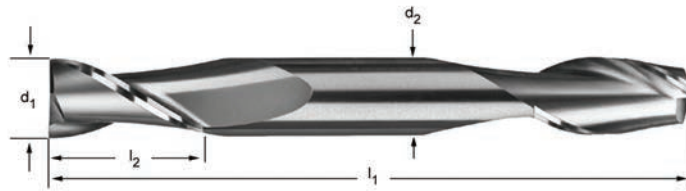



1/8 - 1"

| d_1 Ø Inch | d_1 decimal Inch | d_2 Ø Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S207 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|-------------|
| 1/8 | 0.1250 | 1/8 | 1/2 | 1-1/2 | 2 | 1 | 7648504 |
| 1/8 | 0.1250 | 1/8 | 3/4 | 2" | 2 | 1 | 7648505 |
| 5/32 | 0.1563 | 5/32 | 9/16 | 2" | 2 | 1 | 7648506 |
| 3/16 | 0.1875 | 3/16 | 3/4 | 2" | 2 | 1 | 7648507 |
| 3/16 | 0.1875 | 3/16 | 1-1/8 | 3" | 2 | 1 | 7648508 |
| 1/4 | 0.2500 | 1/4 | 1" | 2-1/2 | 2 | 1 | 7648509 |
| 1/4 | 0.2500 | 1/4 | 1-1/2 | 4" | 2 | 1 | 7648510 |
| 5/16 | 0.3125 | 5/16 | 3/4 | 2-1/2 | 2 | 1 | 7648511 |
| 5/16 | 0.3125 | 5/16 | 1-5/8 | 4" | 2 | 1 | 7648512 |
| 3/8 | 0.3750 | 3/8 | 1" | 2-1/2 | 2 | 1 | 7648513 |
| 3/8 | 0.3750 | 3/8 | 2" | 4" | 2 | 1 | 7648514 |
| 7/16 | 0.4375 | 7/16 | 1" | 2-1/2 | 2 | 1 | 7648515 |
| 7/16 | 0.4375 | 7/16 | 2" | 4" | 2 | 1 | 7648516 |
| 1/2 | 0.5000 | 1/2 | 1" | 3" | 2 | 1 | 7648517 |
| 1/2 | 0.5000 | 1/2 | 3" | 6" | 2 | 1 | 7648518 |
| 9/16 | 0.5625 | 9/16 | 1-1/4 | 3" | 2 | 1 | 7648519 |
| 5/8 | 0.6250 | 5/8 | 1-5/8 | 3-1/2 | 2 | 1 | 7648520 |
| 5/8 | 0.6250 | 5/8 | 2-1/4 | 5" | 2 | 1 | 7648521 |
| 3/4 | 0.7500 | 3/4 | 1-3/4 | 4" | 2 | 1 | 7648522 |
| 3/4 | 0.7500 | 3/4 | 3" | 6" | 2 | 1 | 7648523 |
| 1" | 1.0000 | 1" | 1-1/2 | 4" | 2 | 1 | 7648524 |
| 1" | 1.0000 | 1" | 4" | 6" | 2 | 1 | 7648525 |

Regular Length, Square End, Double End, 30° Helix

S116 Double end provides two cutting ends in one tool. Bright finish improves chip flow in soft and non-ferrous materials.



S116

HM



Z
2



1/8 - 1/2

| d_1 Ø Inch | d_1 decimal Inch | d_2 Ø Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S116 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|---------|
| 1/8 | 0.1250 | 3/8 | 3/8 | 3" | 2 | 1 | 7648650 |
| 5/32 | 0.1562 | 3/8 | 7/16 | 3" | 2 | 1 | 7648651 |
| 3/16 | 0.1875 | 3/8 | 1/2 | 3" | 2 | 1 | 7648652 |
| 1/4 | 0.2500 | 3/8 | 5/8 | 3" | 2 | 1 | 7648653 |
| 5/16 | 0.3125 | 3/8 | 3/4 | 3.1/2 | 2 | 1 | 7648654 |
| 3/8 | 0.3750 | 3/8 | 3/4 | 3.1/2 | 2 | 1 | 7648655 |
| 1/2 | 0.5000 | 1/2 | 1" | 4" | 2 | 1 | 7648656 |

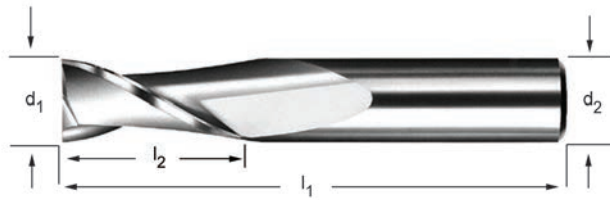
Solid Carbide 2-Flute End Mill



Regular Length, Square End, 30° Helix

S108 Bright finish improves chip flow in soft and non-ferrous materials.

S208 ALTiN coating increases surface hardness, improves chip flow and tool life allowing higher metal removal rates.



| d_1 ∅ Inch | d_1 decimal Inch | d_2 ∅ Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S108 | S208 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|---------|---------|
| 1/16 | 0.0625 | 1/8 | 1/4 | 1.1/2 | 2 | 1 | 7648526 | 7648544 |
| 5/64 | 0.0781 | 1/8 | 1/4 | 1.1/2 | 2 | 1 | 7648527 | 7648545 |
| 3/32 | 0.0938 | 1/8 | 3/8 | 1.1/2 | 2 | 1 | 7648528 | 7648546 |
| 1/8 | 0.1250 | 1/8 | 1/2 | 1.1/2 | 2 | 1 | 7648529 | 7648547 |
| 9/64 | 0.1406 | 3/16 | 9/16 | 2" | 2 | 1 | 7648530 | — |
| 5/32 | 0.1562 | 3/16 | 9/16 | 2" | 2 | 1 | 7648531 | 7648548 |
| 11/64 | 0.1719 | 3/16 | 9/16 | 2" | 2 | 1 | 7648532 | — |
| 3/16 | 0.1875 | 3/16 | 5/8 | 2" | 2 | 1 | 7648533 | 7648549 |
| 7/32 | 0.2188 | 1/4 | 5/8 | 2.1/2 | 2 | 1 | 7648534 | 7648550 |
| 1/4 | 0.2500 | 1/4 | 3/4 | 2.1/2 | 2 | 1 | 7648535 | 7648551 |
| 5/16 | 0.3125 | 5/16 | 7/8 | 2.1/2 | 2 | 1 | 7648536 | 7648552 |
| 3/8 | 0.3750 | 3/8 | 7/8 | 2.1/2 | 2 | 1 | 7648537 | 7648553 |
| 7/16 | 0.4375 | 7/16 | 1" | 2.1/2 | 2 | 1 | 7648538 | 7648554 |
| 1/2 | 0.5000 | 1/2 | 1" | 3" | 2 | 1 | 7648539 | 7648555 |
| 9/16 | 0.5625 | 9/16 | 1.1/4 | 3.1/2 | 2 | 1 | 7648540 | 7648556 |
| 5/8 | 0.6250 | 5/8 | 1.1/4 | 3.1/2 | 2 | 1 | 7648541 | 7648557 |
| 3/4 | 0.7500 | 3/4 | 1.1/2 | 4" | 2 | 1 | 7648542 | — |
| 1" | 1.0000 | 1" | 1.1/2 | 4" | 2 | 1 | 7648543 | — |

Regular Length, Square End, 30° Helix

S109 Bright finish improves chip flow in soft and non-ferrous materials.



S109

HM



Z
2



2.00 - 25.00

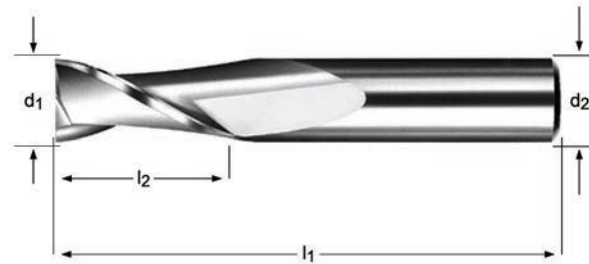
| d_1 Ø mm | d_1 decimal Inch | d_2 Ø mm | l_2 mm | l_1 mm | # of Flutes | Pack Qty | S109 |
|------------------|--------------------------|------------------|-------------|-------------|----------------|-------------|---------|
| 2.00 | 0.0787 | 3.0 | 6.0 | 38.0 | 2 | 1 | 7648558 |
| 2.50 | 0.0984 | 3.0 | 7.0 | 38.0 | 2 | 1 | 7648559 |
| 3.00 | 0.1181 | 3.0 | 12.0 | 38.0 | 2 | 1 | 7648560 |
| 4.00 | 0.1575 | 4.0 | 14.0 | 50.0 | 2 | 1 | 7648561 |
| 4.50 | 0.1772 | 5.0 | 14.0 | 50.0 | 2 | 1 | 7648562 |
| 5.00 | 0.1969 | 5.0 | 16.0 | 50.0 | 2 | 1 | 7648563 |
| 6.00 | 0.2362 | 6.0 | 19.0 | 63.0 | 2 | 1 | 7648564 |
| 7.00 | 0.2756 | 8.0 | 19.0 | 63.0 | 2 | 1 | 7648565 |
| 8.00 | 0.3150 | 8.0 | 20.0 | 63.0 | 2 | 1 | 7648566 |
| 9.00 | 0.3543 | 10.0 | 22.0 | 70.0 | 2 | 1 | 7648567 |
| 10.00 | 0.3937 | 10.0 | 22.0 | 70.0 | 2 | 1 | 7648568 |
| 11.00 | 0.4331 | 11.0 | 25.0 | 70.0 | 2 | 1 | 7648569 |
| 12.00 | 0.4724 | 12.0 | 25.0 | 75.0 | 2 | 1 | 7648570 |
| 14.00 | 0.5512 | 14.0 | 30.0 | 88.0 | 2 | 1 | 7648571 |
| 16.00 | 0.6299 | 16.0 | 32.0 | 88.0 | 2 | 1 | 7648572 |
| 20.00 | 0.7874 | 20.0 | 38.0 | 100.0 | 2 | 1 | 7648573 |
| 25.00 | 0.9843 | 25.0 | 38.0 | 100.0 | 2 | 1 | 7648574 |

Solid Carbide 2-Flute End Mill




Long Length, Square End, 30° Helix

S110 Bright finish improves chip flow in soft and non-ferrous materials.



S110

HM




Z
2



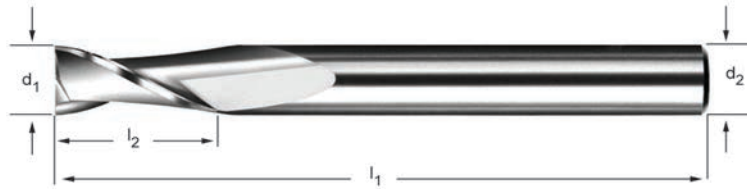

1/8 - 1/2

| d_1 Ø Inch | d_1 decimal Inch | d_2 Ø Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S110 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|---------|
| 1/8 | 0.1250 | 1/8 | 3/4 | 2" | 2 | 1 | 7648575 |
| 3/16 | 0.1875 | 3/16 | 3/4 | 2.1/2 | 2 | 1 | 7648576 |
| 1/4 | 0.2500 | 1/4 | 1.1/8 | 3" | 2 | 1 | 7648577 |
| 3/8 | 0.3750 | 3/8 | 1.1/8 | 3" | 2 | 1 | 7648578 |
| 1/2 | 0.5000 | 1/2 | 2" | 4" | 2 | 1 | 7648579 |

Extra Long Length, Square End, 30° Helix

S111 Bright finish improves chip flow in soft and non-ferrous materials.

S211 ALTiN coating increases surface hardness, improves chip flow and tool life allowing higher metal removal rates.



| d_1 Ø Inch | d_1 decimal Inch | d_2 Ø Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S111 | S211 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|-------------|-------------|
| 1/8 | 0.1250 | 1/8 | 1" | 3" | 2 | 1 | 7648580 | 7648586 |
| 3/16 | 0.1875 | 3/16 | 1.1/8 | 3" | 2 | 1 | 7648581 | 7648587 |
| 1/4 | 0.2500 | 1/4 | 1.1/2 | 4" | 2 | 1 | 7648582 | 7648588 |
| 5/16 | 0.3125 | 5/16 | 1.5/8 | 4" | 2 | 1 | 7648583 | — |
| 3/8 | 0.3750 | 3/8 | 1.3/4 | 4" | 2 | 1 | 7648584 | 7648589 |
| 1/2 | 0.5000 | 1/2 | 3" | 6" | 2 | 1 | 7648585 | 7648590 |

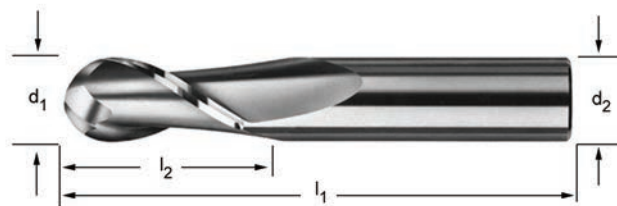
Solid Carbide 2-Flute End Mill



Regular Length, Ball Nose, 30° Helix

S112 Ball nose for cutting internal part radius. Bright finish improves chip flow in soft or non-ferrous materials.

S212 Ball nose for cutting internal part radius. ALTiN coating increases surface hardness, improves chip flow and tool life, allowing higher metal removal rates.

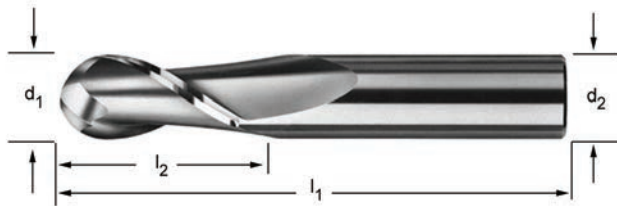


| d_1 Ø Inch | d_1 decimal Inch | d_2 Ø Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S112 | S212 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|-------------|-------------|
| 1/16 | 0.0625 | 1/8 | 1/4 | 1.1/2 | 2 | 1 | 7648591 | 7648601 |
| 3/32 | 0.0938 | 1/8 | 3/8 | 1.1/2 | 2 | 1 | 7648592 | — |
| 1/8 | 0.1250 | 1/8 | 1/2 | 1.1/2 | 2 | 1 | 7648593 | 7648602 |
| 5/32 | 0.1562 | 3/16 | 9/16 | 2" | 2 | 1 | 7648594 | — |
| 3/16 | 0.1875 | 3/16 | 5/8 | 2" | 2 | 1 | 7648595 | 7648603 |
| 7/32 | 0.2188 | 1/4 | 5/8 | 2.1/2 | 2 | 1 | 7648596 | 7648604 |
| 1/4 | 0.2500 | 1/4 | 3/4 | 2.1/2 | 2 | 1 | 7648597 | 7648605 |
| 5/16 | 0.3125 | 5/16 | 7/8 | 2.1/2 | 2 | 1 | 7648598 | 7648606 |
| 3/8 | 0.3750 | 3/8 | 7/8 | 2.1/2 | 2 | 1 | 7648599 | 7648607 |
| 1/2 | 0.5000 | 1/2 | 1" | 3" | 2 | 1 | 7648600 | 7648608 |

Regular Length, Ball Nose, 30° Helix

S113 Ball nose for cutting internal part radius. Bright finish improves chip flow in soft or non-ferrous materials.

S213 Ball nose for cutting internal part radius. ALTiN coating increases surface hardness, improves chip flow and tool life, allowing higher metal removal rates.



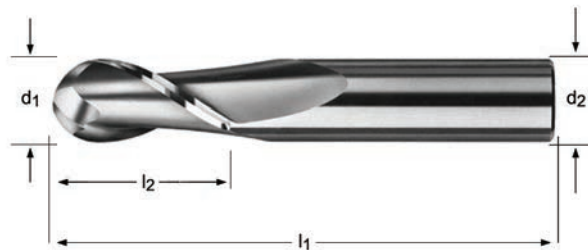
| d_1 Ø mm | d_1 decimal Inch | d_2 Ø mm | l_2 mm | l_1 mm | # of Flutes | Pack Qty | S113 | S213 |
|------------------|--------------------------|------------------|-------------|-------------|----------------|-------------|-------------|-------------|
| 2.00 | 0.0787 | 3.0 | 6.0 | 38.0 | 2 | 1 | 7648609 | — |
| 2.50 | 0.0984 | 3.0 | 6.0 | 38.0 | 2 | 1 | 7648610 | — |
| 3.00 | 0.1181 | 3.0 | 12.0 | 38.0 | 2 | 1 | 7648611 | 7648622 |
| 4.00 | 0.1575 | 4.0 | 14.0 | 50.0 | 2 | 1 | 7648612 | 7648623 |
| 5.00 | 0.1969 | 5.0 | 16.0 | 50.0 | 2 | 1 | 7648613 | 7648624 |
| 6.00 | 0.2362 | 6.0 | 19.0 | 63.0 | 2 | 1 | 7648614 | 7648625 |
| 7.00 | 0.2756 | 8.0 | 19.0 | 63.0 | 2 | 1 | 7648615 | 7648626 |
| 8.00 | 0.3150 | 8.0 | 19.0 | 63.0 | 2 | 1 | 7648616 | 7648627 |
| 9.00 | 0.3543 | 10.0 | 22.0 | 70.0 | 2 | 1 | 7648617 | 7648628 |
| 10.00 | 0.3937 | 10.0 | 22.0 | 70.0 | 2 | 1 | 7648618 | 7648629 |
| 12.00 | 0.4724 | 12.0 | 25.0 | 75.0 | 2 | 1 | 7648619 | 7648630 |
| 16.00 | 0.6299 | 16.0 | 32.0 | 88.0 | 2 | 1 | 7648620 | — |
| 20.00 | 0.7874 | 20.0 | 38.0 | 100.0 | 2 | 1 | 7648621 | — |

Solid Carbide 2-Flute End Mill



Long Length, Ball Nose, 30° Helix

S114 Ball nose for cutting internal part radius. Bright finish improves chip flow in soft or non-ferrous materials.



S114

HM




Z
2




1/8 - 5/8

| d_1 Ø Inch | d_1 decimal Inch | d_2 Ø Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S114 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|---------|
| 1/8 | 0.1250 | 1/8 | 3/4 | 2" | 2 | 1 | 7648631 |
| 3/16 | 0.1875 | 3/16 | 3/4 | 2.1/2 | 2 | 1 | 7648632 |
| 1/4 | 0.2500 | 1/4 | 1.1/8 | 3" | 2 | 1 | 7648633 |
| 5/16 | 0.3125 | 5/16 | 1.1/8 | 3" | 2 | 1 | 7648634 |
| 3/8 | 0.3750 | 3/8 | 1.1/8 | 3" | 2 | 1 | 7648635 |
| 1/2 | 0.5000 | 1/2 | 2" | 4" | 2 | 1 | 7648636 |
| 5/8 | 0.6250 | 5/8 | 2.1/4 | 5" | 2 | 1 | 7648637 |

Extra Long Length, Ball Nose, 30° Helix

S115 Ball nose for cutting internal part radius. Bright finish improves chip flow in soft or non-ferrous materials.

S215 Ball nose for cutting internal part radius. ALTiN coating increases surface hardness, improves chip flow and tool life, allowing higher metal removal rates.



| d_1 Ø Inch | d_1 decimal Inch | d_2 Ø Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S115 | S215 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|-------------|-------------|
| 1/8 | 0.1250 | 1/8 | 1" | 3" | 2 | 1 | 7648638 | 7648644 |
| 3/16 | 0.1875 | 3/16 | 1.1/8 | 3" | 2 | 1 | 7648639 | 7648645 |
| 1/4 | 0.2500 | 1/4 | 1.1/2 | 4" | 2 | 1 | 7648640 | 7648646 |
| 5/16 | 0.3125 | 5/16 | 1.5/8 | 4" | 2 | 1 | 7648641 | 7648647 |
| 3/8 | 0.3750 | 3/8 | 1.3/4 | 4" | 2 | 1 | 7648642 | 7648648 |
| 1/2 | 0.5000 | 1/2 | 3" | 6" | 2 | 1 | 7648643 | 7648649 |

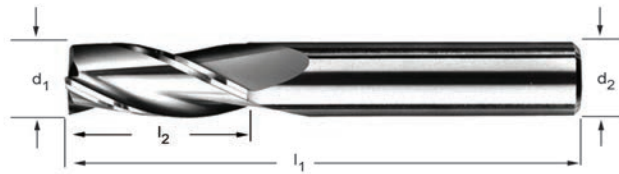
Solid Carbide 3-Flute End Mill



Regular Length, Square End, 30° Helix

S121 3-flute design for less chatter. Bright finish improves chip flow in soft or non-ferrous materials.

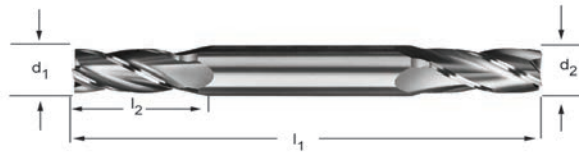
S221 3-flute design for less chatter. ALTiN coating increases surface hardness, improves chip flow and tool life allowing higher metal removal rates.



| d_1 ∅ Inch | d_1 decimal Inch | d_2 ∅ Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S121 | S221 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|---------|---------|
| 1/16 | 0.0625 | 1/8 | 1/4 | 1.1/2 | 3 | 1 | 7648657 | 7648666 |
| 3/32 | 0.0938 | 1/8 | 3/8 | 1.1/2 | 3 | 1 | 7648658 | 7648667 |
| 1/8 | 0.1250 | 1/8 | 1/2 | 1.1/2 | 3 | 1 | 7648659 | 7648668 |
| 5/32 | 0.1562 | 3/16 | 9/16 | 2" | 3 | 1 | 7648660 | 7648669 |
| 3/16 | 0.1875 | 3/16 | 5/8 | 2" | 3 | 1 | 7648661 | 7648670 |
| 1/4 | 0.2500 | 1/4 | 3/4 | 2.1/2 | 3 | 1 | 7648662 | 7648671 |
| 5/16 | 0.3125 | 5/16 | 7/8 | 2.1/2 | 3 | 1 | 7648663 | 7648672 |
| 3/8 | 0.3750 | 3/8 | 7/8 | 2.1/2 | 3 | 1 | 7648664 | 7648673 |
| 1/2 | 0.5000 | 1/2 | 1" | 3" | 3 | 1 | 7648665 | 7648674 |

Square End, Double End, 30° Helix

S129 Regular Length. Double end provides two cutting ends in one tool. Bright finish improves chip flow in soft and non-ferrous materials.



S129

HM



Z
4



1/8 - 1/2

| d_1 Ø Inch | d_1 decimal Inch | d_2 Ø Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S129 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|---------|
| 1/8 | 0.1250 | 3/8 | 3/8 | 3" | 4 | 1 | 7648719 |
| 5/32 | 0.1562 | 3/8 | 7/16 | 3" | 4 | 1 | 7648720 |
| 3/16 | 0.1875 | 3/8 | 1/2 | 3" | 4 | 1 | 7648721 |
| 1/4 | 0.2500 | 3/8 | 5/8 | 3" | 4 | 1 | 7648722 |
| 5/16 | 0.3125 | 3/8 | 3/4 | 3.1/2 | 4 | 1 | 7648723 |
| 3/8 | 0.3750 | 3/8 | 3/4 | 3.1/2 | 4 | 1 | 7648724 |
| 1/2 | 0.5000 | 1/2 | 1" | 4" | 4 | 1 | 7648725 |

Solid Carbide 4-Flute End Mill



Regular Length, Square End, 30° Helix

S134 Bright finish improves chip flow in soft or non-ferrous materials.

S234 ALTiN coating increases surface hardness, improves chip flow and tool life allowing higher metal removal rates.

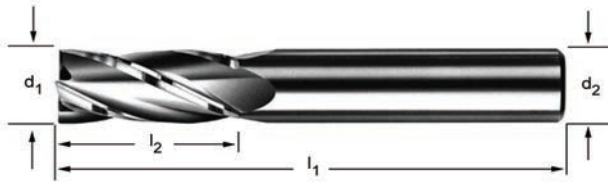


| d_1 ∅ Inch | d_1 decimal Inch | d_2 ∅ Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S134 | S234 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|---------|---------|
| 1/16 | 0.0625 | 1/8 | 1/4 | 1.1/2 | 4 | 1 | 7648726 | 7648748 |
| 5/64 | 0.0781 | 1/8 | 1/4 | 1.1/2 | 4 | 1 | 7648727 | 7648749 |
| 3/32 | 0.0938 | 1/8 | 3/8 | 1.1/2 | 4 | 1 | 7648728 | 7648750 |
| 7/64 | 0.1094 | 1/8 | 3/8 | 1.1/2 | 4 | 1 | 7648729 | 7648751 |
| 1/8 | 0.1250 | 1/8 | 1/2 | 1.1/2 | 4 | 1 | 7648730 | 7648752 |
| 9/64 | 0.1406 | 3/16 | 9/16 | 2" | 4 | 1 | 7648731 | 7648753 |
| 5/32 | 0.1562 | 3/16 | 9/16 | 2" | 4 | 1 | 7648732 | 7648754 |
| 11/64 | 0.1719 | 3/16 | 9/16 | 2" | 4 | 1 | 7648733 | 7648755 |
| 3/16 | 0.1875 | 3/16 | 5/8 | 2" | 4 | 1 | 7648734 | 7648756 |
| 13/64 | 0.2031 | 1/4 | 5/8 | 2.1/2 | 4 | 1 | 7648735 | 7648757 |
| 7/32 | 0.2188 | 1/4 | 5/8 | 2.1/2 | 4 | 1 | 7648736 | 7648758 |
| 1/4 | 0.2500 | 1/4 | 3/4 | 2.1/2 | 4 | 1 | 7648737 | 7648759 |
| 5/16 | 0.3125 | 5/16 | 7/8 | 2.1/2 | 4 | 1 | 7648738 | 7648760 |
| 3/8 | 0.3750 | 3/8 | 7/8 | 2.1/2 | 4 | 1 | 7648739 | 7648761 |
| 7/16 | 0.4375 | 7/16 | 1" | 2.1/2 | 4 | 1 | 7648740 | 7648762 |
| 1/2 | 0.5000 | 1/2 | 1" | 3" | 4 | 1 | 7648741 | 7648763 |
| 9/16 | 0.5625 | 9/16 | 1.1/4 | 3.1/2 | 4 | 1 | 7648742 | 7648764 |
| 5/8 | 0.6250 | 5/8 | 1.1/4 | 3.1/2 | 4 | 1 | 7648743 | 7648765 |
| 11/16 | 0.6875 | 3/4 | 1.1/2 | 4" | 4 | 1 | 7648744 | 7648766 |
| 3/4 | 0.7500 | 3/4 | 1.1/2 | 4" | 4 | 1 | 7648745 | 7648767 |
| 7/8 | 0.8750 | 7/8 | 1.1/2 | 4" | 4 | 1 | 7648746 | 7648768 |
| 1" | 1.0000 | 1" | 1.1/2 | 4" | 4 | 1 | 7648747 | 7648769 |

Regular Length, Square End, 30° Helix

S135 Bright finish improves chip flow in soft or non-ferrous materials.

S235 AlTiN coating increases surface hardness, improves chip flow and tool life allowing higher metal removal rates.



| d_1 Ø mm | d_1 decimal Inch | d_2 Ø mm | l_2 mm | l_1 mm | # of Flutes | Pack Qty | S135 | S235 |
|------------------|--------------------------|------------------|-------------|-------------|----------------|-------------|-------------|-------------|
| 2.00 | 0.0787 | 3.0 | 6.0 | 38.0 | 4 | 1 | 7648770 | 7648789 |
| 2.50 | 0.0984 | 3.0 | 7.0 | 38.0 | 4 | 1 | 7648771 | 7648790 |
| 3.00 | 0.1181 | 3.0 | 12.0 | 38.0 | 4 | 1 | 7648772 | 7648791 |
| 3.50 | 0.1378 | 4.0 | 12.0 | 50.0 | 4 | 1 | 7648773 | 7648792 |
| 4.00 | 0.1575 | 4.0 | 14.0 | 50.0 | 4 | 1 | 7648774 | 7648793 |
| 4.50 | 0.1772 | 5.0 | 14.0 | 50.0 | 4 | 1 | 7648775 | 7648794 |
| 5.00 | 0.1969 | 5.0 | 16.0 | 50.0 | 4 | 1 | 7648776 | 7648795 |
| 6.00 | 0.2362 | 6.0 | 19.0 | 63.0 | 4 | 1 | 7648777 | 7648796 |
| 7.00 | 0.2756 | 8.0 | 19.0 | 63.0 | 4 | 1 | 7648778 | 7648797 |
| 8.00 | 0.3150 | 8.0 | 19.0 | 63.0 | 4 | 1 | 7648779 | 7648798 |
| 9.00 | 0.3543 | 10.0 | 22.0 | 70.0 | 4 | 1 | 7648780 | 7648799 |
| 10.00 | 0.3937 | 10.0 | 22.0 | 70.0 | 4 | 1 | 7648781 | 7648800 |
| 11.00 | 0.4331 | 11.0 | 25.0 | 70.0 | 4 | 1 | 7648782 | 7648801 |
| 12.00 | 0.4724 | 12.0 | 25.0 | 75.0 | 4 | 1 | 7648783 | 7648802 |
| 14.00 | 0.5512 | 14.0 | 30.0 | 88.0 | 4 | 1 | 7648784 | 7648803 |
| 16.00 | 0.6299 | 16.0 | 32.0 | 88.0 | 4 | 1 | 7648785 | 7648804 |
| 18.00 | 0.7087 | 18.0 | 36.0 | 100.0 | 4 | 1 | 7648786 | 7648805 |
| 20.00 | 0.7874 | 20.0 | 38.0 | 100.0 | 4 | 1 | 7648787 | 7648806 |
| 25.00 | 0.9843 | 25.0 | 38.0 | 100.0 | 4 | 1 | 7648788 | — |

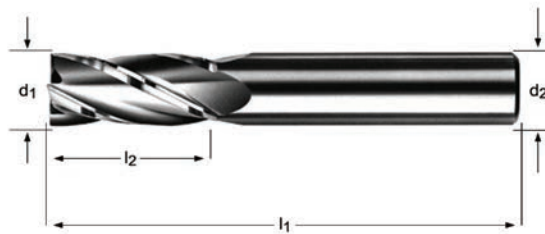
Solid Carbide 4-Flute End Mill



Long Length, Square End, 30° Helix

S136 Bright finish improves chip flow in soft or non-ferrous materials.

S236 AlTiN coating increases surface hardness, improves chip flow and tool life allowing higher metal removal rates.

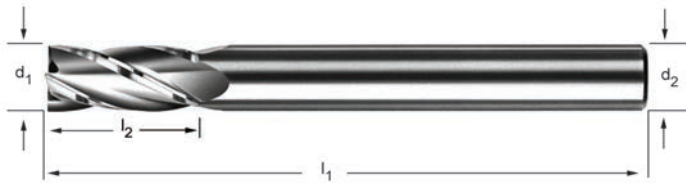


| d_1 ∅ Inch | d_1 decimal Inch | d_2 ∅ Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S136 | S236 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|---------|---------|
| 1/8 | 0.1250 | 1/8 | 3/4 | 2" | 4 | 1 | 7648807 | 7648816 |
| 3/16 | 0.1875 | 3/16 | 3/4 | 2.1/2 | 4 | 1 | 7648808 | 7648817 |
| 1/4 | 0.2500 | 1/4 | 1.1/8 | 3" | 4 | 1 | 7648809 | 7648818 |
| 5/16 | 0.3125 | 5/16 | 1.1/8 | 3" | 4 | 1 | 7648810 | 7648819 |
| 3/8 | 0.3750 | 3/8 | 1.1/8 | 3" | 4 | 1 | 7648811 | 7648820 |
| 7/16 | 0.4375 | 7/16 | 2" | 4" | 4 | 1 | 7648812 | 7648821 |
| 1/2 | 0.5000 | 1/2 | 2" | 4" | 4 | 1 | 7648813 | 7648822 |
| 5/8 | 0.6250 | 5/8 | 2.1/4 | 5" | 4 | 1 | 7648814 | 7648823 |
| 3/4 | 0.7500 | 3/4 | 2.1/4 | 5" | 4 | 1 | 7648815 | 7648824 |

Extra Long Length, Square End, 30° Helix

S137 Bright finish improves chip flow in soft or non-ferrous materials.

S237 AlTiN coating increases surface hardness, improves chip flow and tool life allowing higher metal removal rates.



| d_1 Ø Inch | d_1 decimal Inch | d_2 Ø Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S137 | S237 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|-------------|-------------|
| 1/8 | 0.1250 | 1/8 | 1" | 3" | 4 | 1 | 7648825 | 7648835 |
| 3/16 | 0.1875 | 3/16 | 1.1/8 | 3" | 4 | 1 | 7648826 | 7648836 |
| 1/4 | 0.2500 | 1/4 | 1.1/2 | 4" | 4 | 1 | 7648827 | 7648837 |
| 5/16 | 0.3125 | 5/16 | 1.5/8 | 4" | 4 | 1 | 7648828 | 7648838 |
| 3/8 | 0.3750 | 3/8 | 1.3/4 | 4" | 4 | 1 | 7648829 | 7648839 |
| 7/16 | 0.4375 | 7/16 | 3" | 6" | 4 | 1 | 7648830 | 7648840 |
| 1/2 | 0.5000 | 1/2 | 3" | 6" | 4 | 1 | 7648831 | 7648841 |
| 5/8 | 0.6250 | 5/8 | 3" | 6" | 4 | 1 | 7648832 | 7648842 |
| 3/4 | 0.7500 | 3/4 | 3" | 6" | 4 | 1 | 7648833 | 7648843 |
| 1" | 1.0000 | 1" | 3" | 6" | 4 | 1 | 7648834 | 7648844 |

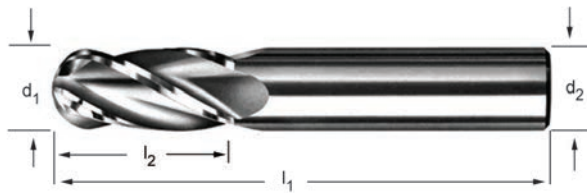
Solid Carbide 4-Flute End Mill



Regular Length, Ball Nose, 30° Helix

S138 Ball nose for cutting internal part radius. Bright finish improves chip flow in soft or non-ferrous materials.

S238 Ball nose for cutting internal part radius. AlTiN coating increases surface hardness, improves chip flow and tool life allowing higher metal removal rates.

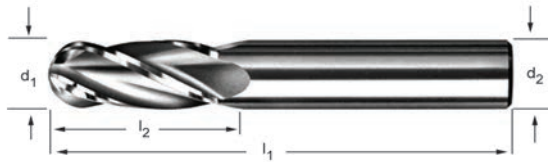


| d_1 Ø Inch | d_1 decimal Inch | d_2 Ø Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S138 | S238 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|---------|---------|
| 1/16 | 0.0625 | 1/8 | 1/4 | 1.1/2 | 4 | 1 | 7648845 | 7648857 |
| 3/32 | 0.0938 | 1/8 | 3/8 | 1.1/2 | 4 | 1 | 7648846 | 7648858 |
| 1/8 | 0.1250 | 1/8 | 1/2 | 1.1/2 | 4 | 1 | 7648847 | 7648859 |
| 5/32 | 0.1562 | 3/16 | 9/16 | 2" | 4 | 1 | 7648848 | 7648860 |
| 3/16 | 0.1875 | 3/16 | 5/8 | 2" | 4 | 1 | 7648849 | 7648861 |
| 1/4 | 0.2500 | 1/4 | 3/4 | 2.1/2 | 4 | 1 | 7648850 | 7648862 |
| 5/16 | 0.3125 | 5/16 | 7/8 | 2.1/2 | 4 | 1 | 7648851 | 7648863 |
| 3/8 | 0.3750 | 3/8 | 7/8 | 2.1/2 | 4 | 1 | 7648852 | 7648864 |
| 7/16 | 0.4375 | 7/16 | 1" | 2.1/2 | 4 | 1 | 7648853 | 7648865 |
| 1/2 | 0.5000 | 1/2 | 1" | 3" | 4 | 1 | 7648854 | 7648866 |
| 5/8 | 0.6250 | 5/8 | 1.1/4 | 3.1/2 | 4 | 1 | 7648855 | 7648867 |
| 3/4 | 0.7500 | 3/4 | 1.1/2 | 4" | 4 | 1 | 7648856 | 7648868 |

Regular Length, Ball Nose, 30° Helix

S139 Ball nose for cutting internal part radius. Bright finish improves chip flow in soft or non-ferrous materials.

S239 Ball nose for cutting internal part radius. AlTiN coating increases surface hardness, improves chip flow and tool life allowing higher metal removal rates.



| d_1 Ø mm | d_1 decimal Inch | d_2 Ø mm | l_2 mm | l_1 mm | # of Flutes | Pack Qty | S139 | S239 |
|------------------|--------------------------|------------------|-------------|-------------|----------------|-------------|---------|---------|
| 2.00 | 0.0787 | 3.0 | 6.0 | 38.0 | 4 | 1 | 7648877 | 7648878 |
| 3.00 | 0.1181 | 3.0 | 12.0 | 38.0 | 4 | 1 | 7648876 | 7648879 |
| 4.00 | 0.1575 | 4.0 | 14.0 | 50.0 | 4 | 1 | 7648875 | 7648880 |
| 4.50 | 0.1772 | 5.0 | 14.0 | 50.0 | 4 | 1 | 7648874 | — |
| 5.00 | 0.1969 | 5.0 | 16.0 | 50.0 | 4 | 1 | 7648873 | 7648881 |
| 6.00 | 0.2362 | 6.0 | 19.0 | 63.0 | 4 | 1 | 7648872 | 7648882 |
| 8.00 | 0.3150 | 8.0 | 19.0 | 63.0 | 4 | 1 | 7648871 | 7648883 |
| 10.00 | 0.3937 | 10.0 | 22.0 | 70.0 | 4 | 1 | 7648870 | 7648884 |
| 12.00 | 0.4724 | 12.0 | 25.0 | 75.0 | 4 | 1 | 7648869 | 7648885 |

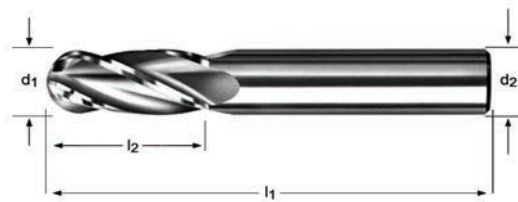
Solid Carbide 4-Flute End Mill



Long Length, Ball Nose, 30° Helix

S146 Ball nose for cutting internal part radius. Bright finish improves chip flow in soft or non-ferrous materials.

S246 Ball nose for cutting internal part radius. AlTiN coating increases surface hardness, improves chip flow and tool life allowing higher metal removal rates.



| d_1 ∅ Inch | d_1 decimal Inch | d_2 ∅ Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S146 | S246 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|---------|---------|
| 1/4 | 0.2500 | 1/4 | 1.1/8 | 3" | 4 | 1 | 7648886 | 7648890 |
| 3/8 | 0.3750 | 3/8 | 1.1/8 | 3" | 4 | 1 | 7648887 | 7648891 |
| 1/2 | 0.5000 | 1/2 | 2" | 4" | 4 | 1 | 7648888 | 7648892 |
| 5/8 | 0.6250 | 5/8 | 2.1/4 | 5" | 4 | 1 | 7648889 | 7648893 |

Extra Long Length, Ball Nose, 30° Helix

S147 Ball nose for cutting internal part radius. Bright finish improves chip flow in soft or non-ferrous materials.

S247 Ball nose for cutting internal part radius. AlTiN coating increases surface hardness, improves chip flow and tool life allowing higher metal removal rates.



| d_1 Ø Inch | d_1 decimal Inch | d_2 Ø Inch | l_2 Inch | l_1 Inch | # of Flutes | Pack Qty | S147 | S247 |
|--------------------|--------------------------|--------------------|---------------|---------------|----------------|-------------|-------------|-------------|
| 1/8 | 0.1250 | 1/8 | 1" | 3" | 4 | 1 | 7648894 | 7648901 |
| 3/16 | 0.1875 | 3/16 | 1.1/8 | 3" | 4 | 1 | 7648895 | 7648902 |
| 1/4 | 0.2500 | 1/4 | 1.1/2 | 4" | 4 | 1 | 7648896 | 7648903 |
| 5/16 | 0.3125 | 5/16 | 1.5/8 | 4" | 4 | 1 | 7648897 | 7648904 |
| 3/8 | 0.3750 | 3/8 | 1.3/4 | 4" | 4 | 1 | 7648898 | 7648905 |
| 1/2 | 0.5000 | 1/2 | 3" | 6" | 4 | 1 | 7648899 | 7648906 |
| 5/8 | 0.6250 | 5/8 | 3" | 6" | 4 | 1 | 7648900 | 7648907 |

Solid Carbide 4-Flute End Mill



Regular length, Corner Radius, Unequal Helix

S223HA ALTiN coating increases hardness, and improves tool life allowing higher metal removal rates. These unequal helix cutters with corner radii are designed for higher speeds and deeper cuts. Provides superior workpiece finishes by eliminating vibrations and harmonics. Excellent for milling tough alloys and hardened steels.

S223HB S223HB has a Weldon shank.



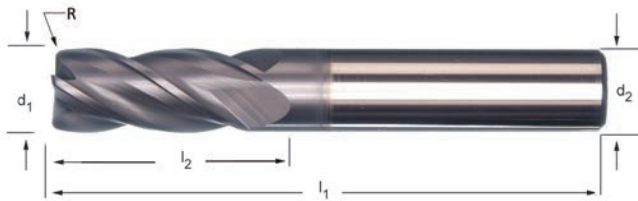
| d ₁ Ø Inch | d ₁ decimal Inch | d ₂ Ø Inch | l ₂ Inch | l ₁ Inch | R Radius | # of Flutes | Pack Qty | S223HA | S223HB |
|-----------------------------|-----------------------------------|-----------------------------|------------------------|------------------------|-------------|----------------|-------------|-----------|-----------|
| 1/8 | 0.1250 | 1/8 | 3/8 | 1-1/2 | .015 | 4 | 1 | 7648675 | 7648697 |
| 1/8 | 0.1250 | 1/8 | 3/8 | 1-1/2 | .030 | 4 | 1 | 7648676 | 7648698 |
| 3/16 | 0.1875 | 3/16 | 7/16 | 2" | .015 | 4 | 1 | 7648677 | 7648699 |
| 3/16 | 0.1875 | 3/16 | 7/16 | 2" | .030 | 4 | 1 | 7648678 | 7648700 |
| 1/4 | 0.2500 | 1/4 | 5/8 | 2-1/2 | .015 | 4 | 1 | 7648679 | 7648701 |
| 1/4 | 0.2500 | 1/4 | 5/8 | 2-1/2 | .030 | 4 | 1 | 7648680 | 7648702 |
| 5/16 | 0.3125 | 1/4 | 1/2 | 2" | .015 | 4 | 1 | 7648681 | 7648703 |
| 5/16 | 0.3125 | 1/4 | 1/2 | 2" | .030 | 4 | 1 | 7648682 | 7648704 |
| 3/8 | 0.3750 | 3/8 | 7/8 | 2-1/2 | .015 | 4 | 1 | 7648683 | 7648705 |
| 3/8 | 0.3750 | 3/8 | 7/8 | 2-1/2 | .030 | 4 | 1 | 7648684 | 7648706 |
| 7/16 | 0.4375 | 7/16 | 5/8 | 2-1/2 | .020 | 4 | 1 | 7648685 | 7648707 |
| 7/16 | 0.4375 | 7/16 | 5/8 | 2-1/2 | .045 | 4 | 1 | 7648686 | 7648708 |
| 1/2 | 0.5000 | 1/2 | 1-1/4 | 3" | .030 | 4 | 1 | 7648687 | 7648709 |
| 1/2 | 0.5000 | 1/2 | 1-1/4 | 3" | .060 | 4 | 1 | 7648688 | 7648710 |
| 9/16 | 0.5625 | 9/16 | 1-1/8 | 3-1/2 | .045 | 4 | 1 | 7648689 | 7648711 |
| 9/16 | 0.5625 | 9/16 | 1-1/8 | 3-1/2 | .060 | 4 | 1 | 7648690 | 7648712 |
| 5/8 | 0.6250 | 5/8 | 1-1/4 | 3-1/2 | .060 | 4 | 1 | 7648691 | 7648713 |
| 5/8 | 0.6250 | 5/8 | 1-1/4 | 5" | .090 | 4 | 1 | 7648692 * | 7648714 * |
| 3/4 | 0.7500 | 3/4 | 1-1/2 | 4" | .030 | 4 | 1 | 7648693 | 7648715 |
| 3/4 | 0.7500 | 3/4 | 1-1/2 | 4" | .060 | 4 | 1 | 7648694 | 7648716 |
| 1" | 1.0000 | 1" | 2-1/4 | 5" | .030 | 4 | 1 | 7648695 * | 7648717 * |
| 1" | 1.0000 | 1" | 2-1/4 | 5" | .090 | 4 | 1 | 7648696 * | 7648718 * |

* Will require a reduction of 30% - 60% in cutting speed.

Regular length, Corner Radius, Unequal Helix

S248HA ALTiN coating increases hardness, and improves tool life allowing higher metal removal rates. These unequal helix cutters with corner radii are designed for higher speeds and deeper cuts. Provides superior workpiece finishes by eliminating vibrations and harmonics. Excellent for milling tough alloys and hardened steels.

S248HB S248HB has Weldon Shank



| d_1 Ø Inch | d_1 decimal Inch | d_2 Ø Inch | l_2 Inch | l_1 Inch | R Radius | # of Flutes | Pack Qty | S248HA | S248HB |
|--------------------|--------------------------|--------------------|---------------|---------------|-------------|----------------|-------------|-----------|-----------|
| 5/16 | 0.3125 | 5/16 | 13/16 | 2-1/2 | .015 | 5 | 1 | 7648908 | 7648927 |
| 5/16 | 0.3125 | 5/16 | 13/16 | 2-1/2 | .030 | 5 | 1 | 7648909 | 7648928 |
| 3/8 | 0.3750 | 3/8 | 7/8 | 2-1/2 | .015 | 5 | 1 | 7648910 | 7648929 |
| 3/8 | 0.3750 | 3/8 | 7/8 | 2-1/2 | .030 | 5 | 1 | 7648911 | 7648930 |
| 7/16 | 0.4375 | 7/16 | 5/8 | 2-1/2 | .020 | 5 | 1 | 7648912 | 7648931 |
| 7/16 | 0.4375 | 7/16 | 5/8 | 2-1/2 | .045 | 5 | 1 | 7648913 | 7648932 |
| 1/2 | 0.5000 | 1/2 | 1 | 3 | .030 | 5 | 1 | 7648914 | 7648933 |
| 1/2 | 0.5000 | 1/2 | 1-1/4 | 3 | .030 | 5 | 1 | 7648915 | 7648934 |
| 1/2 | 0.5000 | 1/2 | 1-1/4 | 3 | .060 | 5 | 1 | 7648916 | 7648935 |
| 9/16 | 0.5625 | 9/16 | 1-1/8 | 3-1/2 | .020 | 5 | 1 | 7648917 | 7648936 |
| 9/16 | 0.5625 | 9/16 | 1-1/8 | 3-1/2 | .045 | 5 | 1 | 7648918 | 7648937 |
| 9/16 | 0.5625 | 9/16 | 1-1/8 | 3-1/2 | .060 | 5 | 1 | 7648919 | 7648938 |
| 5/8 | 0.6250 | 5/8 | 1-1/4 | 3-1/2 | .045 | 5 | 1 | 7648920 | 7648939 |
| 5/8 | 0.6250 | 5/8 | 1-1/4 | 3-1/2 | .060 | 5 | 1 | 7648921 | 7648940 |
| 5/8 | 0.6250 | 5/8 | 1-1/4 | 3-1/2 | .090 | 5 | 1 | 7648922 | 7648941 |
| 3/4 | 0.7500 | 3/4 | 1-1/2 | 4 | .030 | 5 | 1 | 7648923 | 7648942 |
| 3/4 | 0.7500 | 3/4 | 1-1/2 | 4 | .060 | 5 | 1 | 7648924 | 7648943 |
| 1 | 1.0000 | 1 | 2-1/4 | 5 | .030 | 5 | 1 | 7648925 * | 7648944 * |
| 1 | 1.0000 | 1 | 2-1/4 | 5 | .090 | 5 | 1 | 7648926 * | 7648945 * |

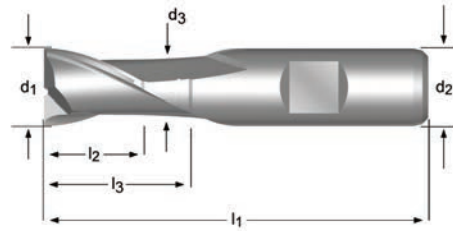
* Will require a reduction of 30% - 60% in cutting speed.

HSS-PM 2-Flute End Mill



Stub Length, Square End, Weldon Shank, 30° Helix

C110 Powdered Metal. P9 slotting tolerance.



HSS-E
PM

P9



Z
2



1.00 - 50.00

| d_1 Ø Inch | d_1 Ø mm | d_2 Ø _{h6} mm | l_2 mm | l_1 mm | # of Flutes | l_3 mm | d_3 Ø mm | Pack Qty | C110 |
|--------------------|------------------|--------------------------------|-------------|-------------|----------------|-------------|------------------|-------------|-------------------------|
| 1/16 | 1.00 | 6 | 2.5 | 47 | 2 | - | - | 1 | 0353165 |
| | 1.50 | 6 | 3 | 47 | 2 | - | - | 1 | 0353172 |
| | 1.59 | 6 | 3 | 47 | 2 | - | - | 1 | 0639795 |
| 3/32 | 1.80 | 6 | 4 | 48 | 2 | - | - | 1 | 0353189 |
| | 2.00 | 6 | 4 | 48 | 2 | - | - | 1 | 0353301 |
| | 2.38 | 6 | 5 | 49 | 2 | - | - | 1 | 0639801 |
| | 2.50 | 6 | 5 | 49 | 2 | - | - | 1 | 0353318 |
| | 2.80 | 6 | 5 | 49 | 2 | - | - | 1 | 0353325 |
| 1/8 | 3.00 | 6 | 5 | 49 | 2 | - | - | 1 | 0353370 |
| | 3.18 | 6 | 6 | 50 | 2 | - | - | 1 | 0639818 |
| | 3.50 | 6 | 6 | 50 | 2 | - | - | 1 | 0353387 |
| | 3.80 | 6 | 7 | 51 | 2 | - | - | 1 | 0353394 |
| | 4.00 | 6 | 7 | 51 | 2 | - | - | 1 | 0353424 |
| | 4.50 | 6 | 7 | 51 | 2 | - | - | 1 | 0353431 |
| | 4.76 | 6 | 8 | 52 | 2 | - | - | 1 | 0639825 |
| 3/16 | 4.80 | 6 | 8 | 52 | 2 | - | - | 1 | 0353448 ¹⁾²⁾ |
| | 5.00 | 6 | 8 | 52 | 2 | - | - | 1 | 0353455 |
| | 5.50 | 6 | 8 | 52 | 2 | - | - | 1 | 0353462 |
| | 5.75 | 6 | 8 | 52 | 2 | - | - | 1 | 0353479 ¹⁾²⁾ |
| | 6.00 | 6 | 8 | 52 | 2 | - | - | 1 | 0353486 |
| | 6.35 | 10 | 10 | 60 | 2 | - | - | 1 | 0639832 |
| | 6.50 | 10 | 10 | 60 | 2 | - | - | 1 | 0353493 |
| 1/4 | 6.75 | 10 | 10 | 60 | 2 | - | - | 1 | 0629031 |
| | 7.00 | 10 | 10 | 60 | 2 | - | - | 1 | 0353509 |
| | 7.50 | 10 | 10 | 60 | 2 | - | - | 1 | 0353516 |
| | 7.75 | 10 | 11 | 61 | 2 | - | - | 1 | 0573495 ¹⁾²⁾ |
| | 7.94 | 10 | 11 | 61 | 2 | - | - | 1 | 0639849 |
| | 8.00 | 10 | 11 | 61 | 2 | - | - | 1 | 0353523 |
| | 8.50 | 10 | 11 | 61 | 2 | - | - | 1 | 0353530 |

¹⁾ Diameter tolerance h10

²⁾ Slot not in P9 tolerance

³⁾ Available in HSCo only

| d ₁ ∅ Inch | d ₁ ∅ mm | d ₂ ∅ _{h₆} mm | l ₂ mm | l ₁ mm | # of Flutes | l ₃ mm | d ₃ ∅ mm | Pack Qty | C110 |
|-----------------------------|---------------------------|--|----------------------|----------------------|----------------|----------------------|---------------------------|-------------|-------------------------|
| 3/8 | 9.00 | 10 | 11 | 61 | 2 | - | - | 1 | 0353547 |
| | 9.50 | 10 | 11 | 61 | 2 | - | - | 1 | 0353554 |
| | 9.52 | 10 | 13 | 63 | 2 | 22.5 | 9.5 | 1 | 0639856 |
| | 9.70 | 10 | 13 | 63 | 2 | 22.5 | 9.5 | 1 | 0573501 ¹⁾²⁾ |
| 13/32 | 10.00 | 10 | 13 | 63 | 2 | 22.5 | 9.5 | 1 | 0353196 |
| | 10.32 | 12 | 13 | 70 | 2 | - | - | 1 | 0639863 |
| | 10.50 | 12 | 13 | 70 | 2 | - | - | 1 | 0353202 |
| 7/16 | 11.00 | 12 | 13 | 70 | 2 | - | - | 1 | 0353219 |
| | 11.11 | 12 | 13 | 70 | 2 | - | - | 1 | 0639870 |
| | 11.50 | 12 | 13 | 70 | 2 | - | - | 1 | 0573433 |
| | 11.70 | 12 | 16 | 73 | 2 | 27.5 | 11.5 | 1 | 0573440 ¹⁾²⁾ |
| 1/2 | 12.00 | 12 | 16 | 73 | 2 | 27.5 | 11.5 | 1 | 0353226 |
| | 12.50 | 12 | 16 | 73 | 2 | 27.5 | 11.5 | 1 | 0573457 |
| | 12.70 | 12 | 16 | 73 | 2 | 27.5 | 11.5 | 1 | 0639887 |
| | 13.00 | 12 | 16 | 73 | 2 | 27.5 | 11.5 | 1 | 0353233 |
| 17/32 | 13.49 | 12 | 16 | 73 | 2 | 27.5 | 11.5 | 1 | 0639894 |
| | 13.70 | 12 | 16 | 73 | 2 | 27.5 | 11.5 | 1 | 0573464 ¹⁾²⁾ |
| | 14.00 | 12 | 16 | 73 | 2 | 27.5 | 11.5 | 1 | 0353240 |
| 9/16 | 14.29 | 12 | 16 | 73 | 2 | 27.5 | 11.5 | 1 | 0639900 |
| | 15.00 | 12 | 16 | 73 | 2 | 27.5 | 11.5 | 1 | 0353257 |
| 5/8 | 15.70 | 16 | 19 | 79 | 2 | 30.5 | 15.5 | 1 | 0573471 ¹⁾²⁾ |
| | 15.88 | 16 | 19 | 79 | 2 | 30.5 | 15.5 | 1 | 0639917 |
| | 16.00 | 16 | 19 | 79 | 2 | 30.5 | 15.5 | 1 | 0353264 |
| 11/16 | 17.00 | 16 | 19 | 79 | 2 | 30.5 | 15.5 | 1 | 0353271 |
| | 17.46 | 16 | 19 | 79 | 2 | 30.5 | 15.5 | 1 | 0639924 |
| | 17.70 | 16 | 19 | 79 | 2 | 30.5 | 15.5 | 1 | 0628942 |
| | 18.00 | 16 | 19 | 79 | 2 | 30.5 | 15.5 | 1 | 0353288 |
| 3/4 | 19.00 | 16 | 19 | 79 | 2 | 30.5 | 15.5 | 1 | 0353295 |
| | 19.05 | 20 | 22 | 88 | 2 | 37.5 | 18.5 | 1 | 0639931 |
| | 19.70 | 20 | 22 | 88 | 2 | 37.5 | 19.5 | 1 | 0628959 |
| | 20.00 | 20 | 22 | 88 | 2 | 37.5 | 19.5 | 1 | 0353332 |
| 7/8 | 21.70 | 20 | 22 | 88 | 2 | 37.5 | 19.5 | 1 | 0628966 |
| | 22.00 | 20 | 22 | 88 | 2 | 37.5 | 19.5 | 1 | 0353349 |
| | 22.22 | 20 | 22 | 88 | 2 | 37.5 | 19.5 | 1 | 0639948 |
| | 24.00 | 25 | 26 | 102 | 2 | 45.5 | 23.5 | 1 | 0573488 |
| | 24.70 | 25 | 26 | 102 | 2 | 45.5 | 24.5 | 1 | 0628973 |
| 1" | 25.00 | 25 | 26 | 102 | 2 | 45.5 | 24.5 | 1 | 0353356 |
| | 25.40 | 25 | 26 | 102 | 2 | 45.5 | 24.5 | 1 | 0621929 |
| | 26.00 | 25 | 26 | 102 | 2 | 45.5 | 24.5 | 1 | 0628980 |
| | 28.00 | 25 | 26 | 102 | 2 | 45.5 | 24.5 | 1 | 0353363 |
| 1.1/8 | 28.58 | 25 | 26 | 102 | 2 | 45.5 | 24.5 | 1 | 0639962 |
| | 30.00 | 25 | 26 | 102 | 2 | 45.5 | 24.5 | 1 | 0353400 |
| 1.1/4 | 31.75 | 32 | 32 | 112 | 2 | 51.5 | 31.5 | 1 | 0639979 |
| | 32.00 | 32 | 32 | 112 | 2 | 51.5 | 31.5 | 1 | 0353417 |
| | 35.00 | 32 | 32 | 112 | 2 | 51.5 | 31.5 | 1 | 0639986 ¹⁾³⁾ |
| | 36.00 | 32 | 32 | 112 | 2 | 51.5 | 31.5 | 1 | 0628997 ¹⁾³⁾ |
| | 40.00 | 40 | 38 | 130 | 2 | 59.5 | 39.0 | 1 | 0629000 ¹⁾³⁾ |
| | 45.00 | 40 | 38 | 130 | 2 | 59.5 | 38.0 | 1 | 0629017 ¹⁾³⁾ |
| | 50.00 | 50 | 45 | 147 | 2 | 66.5 | 48.0 | 1 | 0629024 ¹⁾³⁾ |

¹⁾ Diameter tolerance h10

²⁾ Slot not in P9 tolerance

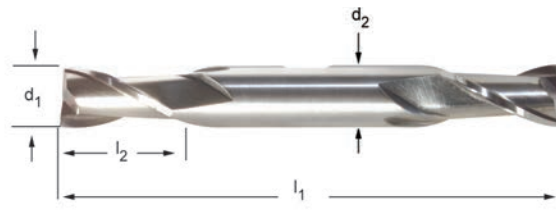
³⁾ Available in HSCo only

HSS 2-Flute End Mill



Regular Length, Square End, Weldon Shank, 30° Helix

C600 Double end provides two cutting ends in one tool. Bright finish improves chip flow in soft or non-ferrous materials.



C600

HSS



Z
2

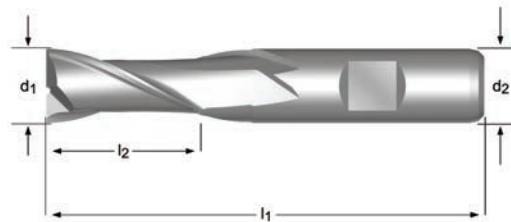



1/8 - 3/4

| d_1 Ø Inch | d_1 decimal Inch | l_2 Inch | l_1 Inch | d_2 Ø Inch | # of Flutes | Pack Qty | C600 |
|--------------------|--------------------------|---------------|---------------|--------------------|----------------|-------------|---------|
| 1/8 | 0.1250 | 3/8 | 3.1/16 | 3/8 | 2 | 1 | 7647759 |
| 5/32 | 0.1562 | 7/16 | 3.1/8 | 3/8 | 2 | 1 | 7647820 |
| 3/16 | 0.1875 | 7/16 | 3.1/4 | 3/8 | 2 | 1 | 7647821 |
| 1/4 | 0.2500 | 1/2 | 3.3/8 | 3/8 | 2 | 1 | 7647822 |
| 9/32 | 0.2812 | 9/16 | 3.3/8 | 3/8 | 2 | 1 | 7647823 |
| 5/16 | 0.3125 | 9/16 | 3.1/2 | 3/8 | 2 | 1 | 7647824 |
| 11/32 | 0.3437 | 9/16 | 3.1/2 | 3/8 | 2 | 1 | 7647825 |
| 3/8 | 0.3750 | 9/16 | 3.1/2 | 3/8 | 2 | 1 | 7647826 |
| 13/32 | 0.4062 | 13/16 | 4.1/8 | 1/2 | 2 | 1 | 7647827 |
| 7/16 | 0.4375 | 13/16 | 4.1/8 | 1/2 | 2 | 1 | 7647828 |
| 1/2 | 0.5000 | 13/16 | 4.1/8 | 1/2 | 2 | 1 | 7647829 |
| 5/8 | 0.6250 | 1.1/8 | 5" | 5/8 | 2 | 1 | 7647830 |
| 3/4 | 0.7500 | 1.5/16 | 5.5/8 | 3/4 | 2 | 1 | 7647831 |

Regular Length, Square End, Weldon Shank, 30° Helix

C601 Bright finish improves chip flow in soft or non-ferrous materials.



C601

HSS



Z
2



1/8 - 1/2

| d ₁ ∅ Inch | d ₁ decimal Inch | l ₂ Inch | l ₁ Inch | d ₂ ∅ Inch | # of Flutes | Pack Qty | C601 |
|-----------------------------|-----------------------------------|------------------------|------------------------|-----------------------------|----------------|-------------|---------|
| 1/8 | 0.1250 | 3/8 | 2.5/16 | 3/8 | 2 | 1 | 7647832 |
| 3/16 | 0.1875 | 7/16 | 2.3/8 | 3/8 | 2 | 1 | 7647833 |
| 1/4 | 0.2500 | 1/2 | 2.7/16 | 3/8 | 2 | 1 | 7647834 |
| 5/16 | 0.3125 | 9/16 | 2.1/2 | 3/8 | 2 | 1 | 7647835 |
| 3/8 | 0.3750 | 9/16 | 2.1/2 | 3/8 | 2 | 1 | 7647836 |
| 7/16 | 0.4375 | 13/16 | 2.11/16 | 3/8 | 2 | 1 | 7647837 |
| 1/2 | 0.5000 | 13/16 | 2.11/16 | 3/8 | 2 | 1 | 7647838 |
| 1/2 | 0.5000 | 1" | 3.1/4 | 1/2 | 2 | 1 | 7647839 |
| 9/16 | 0.5625 | 1.1/8 | 3.3/8 | 1/2 | 2 | 1 | 7647840 |
| 5/8 | 0.6250 | 1.1/8 | 3.3/8 | 1/2 | 2 | 1 | 7647841 |
| 5/8 | 0.6250 | 1.5/16 | 3.3/4 | 5/8 | 2 | 1 | 7647844 |
| 11/16 | 0.6875 | 1.5/16 | 3.5/8 | 1/2 | 2 | 1 | 7647842 |
| 11/16 | 0.6875 | 1.5/16 | 3.3/4 | 5/8 | 2 | 1 | 7647845 |
| 3/4 | 0.7500 | 1.5/16 | 3.5/8 | 1/2 | 2 | 1 | 7647843 |
| 3/4 | 0.7500 | 1.5/16 | 3.3/4 | 5/8 | 2 | 1 | 7647846 |
| 3/4 | 0.7500 | 1.5/16 | 3.7/8 | 3/4 | 2 | 1 | 7647859 |
| 13/16 | 0.8125 | 1.1/2 | 4" | 5/8 | 2 | 1 | 7647847 |
| 7/8 | 0.8750 | 1.1/2 | 4" | 5/8 | 2 | 1 | 7647848 |
| 7/8 | 0.8750 | 1.1/2 | 4.1/8 | 3/4 | 2 | 1 | 7647860 |
| 7/8 | 0.8750 | 1.1/2 | 4.1/8 | 7/8 | 2 | 1 | 7647851 |
| 15/16 | 0.9375 | 1.1/2 | 4" | 5/8 | 2 | 1 | 7647849 |
| 1" | 1.0000 | 1.1/2 | 4" | 5/8 | 2 | 1 | 7647850 |
| 1" | 1.0000 | 1.1/2 | 4.1/8 | 3/4 | 2 | 1 | 7647861 |
| 1" | 1.0000 | 1.1/2 | 4.1/8 | 7/8 | 2 | 1 | 7647852 |
| 1" | 1.0000 | 1.5/8 | 4.1/2 | 1" | 2 | 1 | 7647853 |
| 1.1/8 | 1.1250 | 1.5/8 | 4.1/4 | 3/4 | 2 | 1 | 7647862 |
| 1.1/8 | 1.1250 | 1.5/8 | 4.1/2 | 1" | 2 | 1 | 7647854 |
| 1.1/4 | 1.2500 | 1.5/8 | 4.1/2 | 1" | 2 | 1 | 7647855 |
| 1.1/4 | 1.2500 | 1.5/8 | 4.1/2 | 1.1/4 | 2 | 1 | 7647857 |
| 1.1/2 | 1.5000 | 1.5/8 | 4.1/4 | 3/4 | 2 | 1 | 7647863 |
| 1.1/2 | 1.5000 | 1.5/8 | 4.1/2 | 1" | 2 | 1 | 7647856 |
| 1.1/2 | 1.5000 | 1.5/8 | 4.1/2 | 1.1/4 | 2 | 1 | 7647858 |

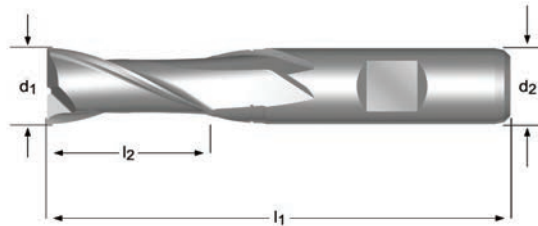
HSS 2-Flute End Mill



Regular Length, Square End, Weldon Shank, 30° Helix

C602

Keyway cutter, close tolerance (+0.0000"/-0.0015").
Bright finish improves chip flow in soft or non-ferrous materials.

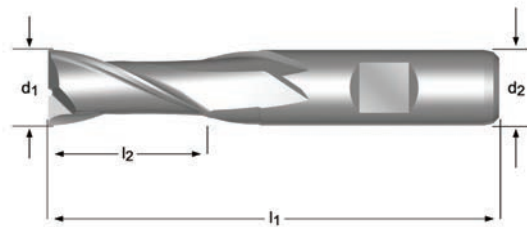


1/8 - 1"

| d_1 Ø Inch | d_1 decimal Inch | l_2 Inch | l_1 Inch | d_2 Ø Inch | # of Flutes | Pack Qty | C602 |
|--------------------|--------------------------|---------------|---------------|--------------------|----------------|-------------|---------|
| 1/8 | 0.1250 | 3/8 | 2.5/16 | 3/8 | 2 | 1 | 7647864 |
| 3/16 | 0.1875 | 7/16 | 2.3/8 | 3/8 | 2 | 1 | 7647865 |
| 1/4 | 0.2500 | 1/2 | 2.7/16 | 3/8 | 2 | 1 | 7647866 |
| 5/16 | 0.3125 | 9/16 | 2.1/2 | 3/8 | 2 | 1 | 7647867 |
| 3/8 | 0.3750 | 9/16 | 2.1/2 | 3/8 | 2 | 1 | 7647868 |
| 1/2 | 0.5000 | 1" | 3.1/4 | 1/2 | 2 | 1 | 7647869 |
| 5/8 | 0.6250 | 1.5/16 | 3.3/4 | 5/8 | 2 | 1 | 7647870 |
| 3/4 | 0.7500 | 1.5/16 | 3.7/8 | 3/4 | 2 | 1 | 7647871 |
| 7/8 | 0.8750 | 1.1/2 | 4.1/8 | 7/8 | 2 | 1 | 7647872 |
| 1" | 1.0000 | 1.5/8 | 4.1/2 | 1" | 2 | 1 | 7647873 |

Regular Length, Square End, Weldon Shank, 30° Helix

C603 Bright finish improves chip flow in soft or non-ferrous materials.



C603

HSS-E

Z
2

1/8 - 1"

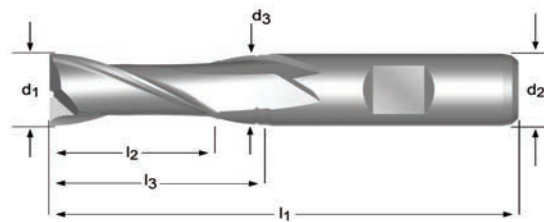
| d ₁ ∅ Inch | d ₁ decimal Inch | l ₂ Inch | l ₁ Inch | d ₂ ∅ Inch | # of Flutes | Pack Qty | C603 |
|-----------------------------|-----------------------------------|------------------------|------------------------|-----------------------------|----------------|-------------|---------|
| 1/8 | 0.1250 | 3/8 | 2.5/16 | 3/8 | 2 | 1 | 7647874 |
| 3/16 | 0.1875 | 7/16 | 2.3/8 | 3/8 | 2 | 1 | 7647875 |
| 1/4 | 0.2500 | 1/2 | 2.7/16 | 3/8 | 2 | 1 | 7647876 |
| 5/16 | 0.3125 | 9/16 | 2.1/2 | 3/8 | 2 | 1 | 7647877 |
| 3/8 | 0.3750 | 9/16 | 2.1/2 | 3/8 | 2 | 1 | 7647878 |
| 1/2 | 0.5000 | 1" | 3.1/4 | 1/2 | 2 | 1 | 7647879 |
| 5/8 | 0.6250 | 1.5/16 | 3.3/4 | 5/8 | 2 | 1 | 7647880 |
| 3/4 | 0.7500 | 1.5/16 | 3.7/8 | 3/4 | 2 | 1 | 7647881 |
| 1" | 1.0000 | 1.5/8 | 4.1/2 | 1" | 2 | 1 | 7647882 |

HSS-PM 2-Flute End Mill



Regular Length, Square End, Weldon Shank, 30° Helix

C123 Powdered Metal. P9 slotting tolerance.



C123

HSS-E
PM

P9

Z
2

1/16 - 40.00

| d_1 Ø Inch | d_1 Ø mm | d_2 Ø _{h6} mm | l_2 mm | l_1 mm | # of Flutes | l_3 mm | d_3 Ø mm | Pack Qty | C123 |
|--------------------|------------------|--------------------------------|-------------|-------------|----------------|-------------|------------------|-------------|-----------------------|
| 1/16 | 1.59 | 6 | 7 | 51 | 2 | — | — | 1 | 0640012 ¹⁾ |
| | 2.00 | 6 | 7 | 51 | 2 | — | — | 1 | 0353646 |
| | 2.50 | 6 | 8 | 52 | 2 | — | — | 1 | 0353653 |
| 1/8 | 3.00 | 6 | 8 | 52 | 2 | — | — | 1 | 0353714 |
| | 3.18 | 6 | 10 | 54 | 2 | — | — | 1 | 0640029 ¹⁾ |
| | 3.50 | 6 | 10 | 54 | 2 | — | — | 1 | 0353721 |
| 5/32 | 3.97 | 6 | 11 | 55 | 2 | — | — | 1 | 0640036 ¹⁾ |
| | 4.00 | 6 | 11 | 55 | 2 | — | — | 1 | 0353769 |
| | 4.50 | 6 | 11 | 55 | 2 | — | — | 1 | 0353776 |
| 3/16 | 4.76 | 6 | 13 | 57 | 2 | — | — | 1 | 0640043 ¹⁾ |
| | 5.00 | 6 | 13 | 57 | 2 | — | — | 1 | 0353790 |
| | 5.50 | 6 | 13 | 57 | 2 | — | — | 1 | 0353806 |
| | 6.00 | 6 | 13 | 57 | 2 | — | — | 1 | 0353813 |
| 1/4 | 6.35 | 10 | 16 | 66 | 2 | — | — | 1 | 0640050 ¹⁾ |
| | 6.50 | 10 | 16 | 66 | 2 | — | — | 1 | 0353820 |
| | 7.00 | 10 | 16 | 66 | 2 | — | — | 1 | 0353837 |
| | 7.50 | 10 | 16 | 66 | 2 | — | — | 1 | 0353844 |
| 5/16 | 7.94 | 10 | 19 | 69 | 2 | — | — | 1 | 0640067 ¹⁾ |
| | 8.00 | 10 | 19 | 69 | 2 | — | — | 1 | 0353851 |
| | 8.50 | 10 | 19 | 69 | 2 | — | — | 1 | 0353868 |
| | 9.00 | 10 | 19 | 69 | 2 | — | — | 1 | 0353875 |
| | 9.50 | 10 | 19 | 69 | 2 | — | — | 1 | 0353882 |
| 3/8 | 9.52 | 10 | 22 | 72 | 2 | 31.5 | 9.5 | 1 | 0640074 ¹⁾ |
| | 10.00 | 10 | 22 | 72 | 2 | 31.5 | 9.5 | 1 | 0353561 |
| | 11.00 | 12 | 22 | 79 | 2 | — | — | 1 | 0353578 |
| | 12.00 | 12 | 26 | 83 | 2 | 37.5 | 11.5 | 1 | 0353585 |
| 1/2 | 12.70 | 12 | 26 | 83 | 2 | 37.5 | 11.5 | 1 | 0640081 ¹⁾ |
| | 13.00 | 12 | 26 | 83 | 2 | 37.5 | 11.5 | 1 | 0353592 |
| | 14.00 | 12 | 26 | 83 | 2 | 37.5 | 11.5 | 1 | 0353608 |

¹⁾ Diameter tolerance -.0005 inches / -.0013 inches

²⁾ Diameter tolerance -.0005 inches / -.0015 inches

³⁾ Available in HSCo only

| d ₁ ∅ Inch | d ₁ ∅ mm | d ₂ ∅ _{h₆} mm | l ₂ mm | l ₁ mm | # of Flutes | l ₃ mm | d ₃ ∅ mm | Pack Qty | C123 |
|-----------------------------|---------------------------|--|----------------------|----------------------|----------------|----------------------|---------------------------|-------------|-----------------------|
| 9/16 | 14.29 | 12 | 26 | 83 | 2 | 37.5 | 11.5 | 1 | 0640098 ¹⁾ |
| | 15.00 | 12 | 26 | 83 | 2 | 37.5 | 11.5 | 1 | 0353615 |
| 5/8 | 15.88 | 16 | 32 | 92 | 2 | 43.5 | 15.5 | 1 | 0640104 ¹⁾ |
| | 16.00 | 16 | 32 | 92 | 2 | 43.5 | 15.5 | 1 | 0353622 |
| | 18.00 | 16 | 32 | 92 | 2 | 43.5 | 15.5 | 1 | 0353639 |
| 3/4 | 19.05 | 20 | 38 | 104 | 2 | 53.5 | 18.5 | 1 | 0640111 ²⁾ |
| | 20.00 | 20 | 38 | 104 | 2 | 53.5 | 19.5 | 1 | 0353660 |
| | 22.00 | 20 | 38 | 104 | 2 | 53.5 | 19.5 | 1 | 0353677 |
| | 25.00 | 25 | 45 | 121 | 2 | 64.5 | 24.5 | 1 | 0353691 |
| 1" | 25.40 | 25 | 45 | 121 | 2 | 64.5 | 24.5 | 1 | 0640128 |
| | 30.00 | 25 | 45 | 121 | 2 | 64.5 | 24.5 | 1 | 0353738 |
| | 32.00 | 32 | 53 | 133 | 2 | 72.5 | 31.5 | 1 | 0353745 |
| | 36.00 | 32 | 53 | 133 | 2 | 72.5 | 31.5 | 1 | 0353752 ³⁾ |
| | 40.00 | 40 | 63 | 155 | 2 | 84.5 | 39.0 | 1 | 0353783 ³⁾ |

¹⁾ Diameter tolerance -.0005 inches / -.0013 inches

²⁾ Diameter tolerance -.0005 inches / -.0015 inches

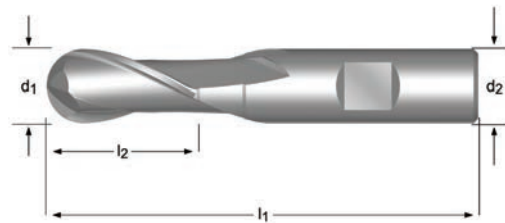
³⁾ Available in HSCo only

HSS 2-Flute End Mill



Regular Length, Ball Nose, Weldon Shank, 30° Helix

C604 Ball nose for cutting internal radius. Bright finish improves chip flow in soft or non-ferrous materials.



C604

HSS




Z
2

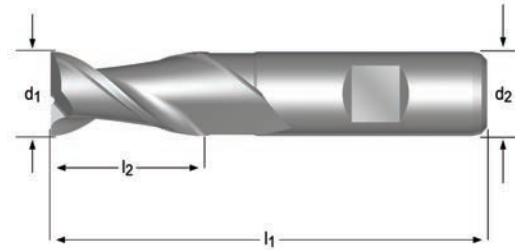



1/8 - 3/4

| d_1 Ø Inch | d_1 decimal Inch | l_2 Inch | l_1 inch | d_2 Ø Inch | # of Flutes | Pack Qty | C604 |
|--------------------|--------------------------|---------------|---------------|--------------------|----------------|-------------|---------|
| 1/8 | 0.1250 | 3/8 | 2.5/16 | 3/8 | 2 | 1 | 7647883 |
| 3/16 | 0.1875 | 1/2 | 2.3/8 | 3/8 | 2 | 1 | 7647884 |
| 1/4 | 0.2500 | 5/8 | 2.7/16 | 3/8 | 2 | 1 | 7647885 |
| 5/16 | 0.3125 | 3/4 | 2.1/2 | 3/8 | 2 | 1 | 7647886 |
| 3/8 | 0.3750 | 3/4 | 2.1/2 | 3/8 | 2 | 1 | 7647887 |
| 7/16 | 0.4375 | 1" | 3.1/4 | 1/2 | 2 | 1 | 7647888 |
| 1/2 | 0.5000 | 1" | 3.1/4 | 1/2 | 2 | 1 | 7647889 |
| 9/16 | 0.5625 | 1.1/8 | 3.3/8 | 1/2 | 2 | 1 | 7647890 |
| 5/8 | 0.6250 | 1.1/8 | 3.3/8 | 1/2 | 2 | 1 | 7647891 |
| 3/4 | 0.7500 | 1.5/16 | 3.5/8 | 1/2 | 2 | 1 | 7647892 |

Regular Length, Square End, Weldon Shank, 37° Helix

C605 High Helix design for aluminum and other non-ferrous materials.



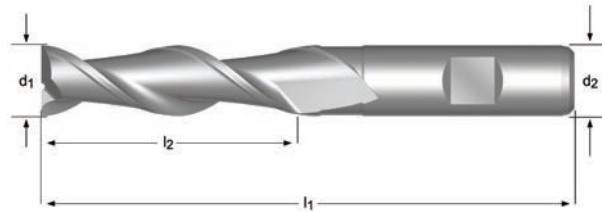
| d_1 Ø Inch | d_1 decimal Inch | l_2 Inch | l_1 Inch | d_2 Ø Inch | # of Flutes | Pack Qty | C605 |
|--------------------|--------------------------|---------------|---------------|--------------------|----------------|-------------|---------|
| 1/4 | 0.2500 | 5/8 | 2.7/16 | 3/8 | 2 | 1 | 7647893 |
| 5/16 | 0.3125 | 3/4 | 2.1/2 | 3/8 | 2 | 1 | 7647894 |
| 3/8 | 0.3750 | 3/4 | 2.1/2 | 3/8 | 2 | 1 | 7647895 |
| 1/2 | 0.5000 | 1.1/4 | 3.1/4 | 1/2 | 2 | 1 | 7647896 |
| 3/4 | 0.7500 | 1.5/8 | 3.7/8 | 3/4 | 2 | 1 | 7647897 |
| 1" | 1.0000 | 2" | 4.1/2 | 1" | 2 | 1 | 7647898 |

HSS 2-Flute End Mill



Long Length, Square End, Weldon Shank, 37° Helix

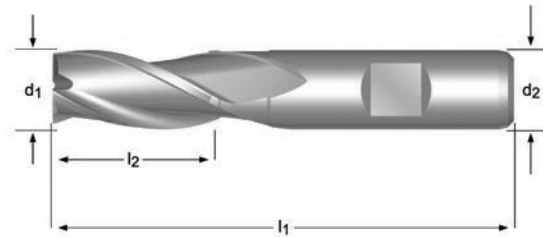
C606 High Helix design for aluminum and other non-ferrous materials.



| d_1 Ø Inch | d_1 decimal Inch | l_2 Inch | l_1 Inch | d_2 Ø Inch | # of Flutes | Pack Qty | C606 |
|--------------------|--------------------------|---------------|---------------|--------------------|----------------|-------------|---------|
| 1/4 | 0.2500 | 1.1/4 | 3.1/16 | 3/8 | 2 | 1 | 7647899 |
| 5/16 | 0.3125 | 1.3/8 | 3.1/8 | 3/8 | 2 | 1 | 7647900 |
| 3/8 | 0.3750 | 1.1/2 | 3.1/4 | 3/8 | 2 | 1 | 7647901 |
| 1/2 | 0.5000 | 2" | 4" | 1/2 | 2 | 1 | 7647902 |
| 3/4 | 0.7500 | 3" | 5.1/4 | 3/4 | 2 | 1 | 7647903 |

Regular Length, Square End, Weldon Shank, 30° Helix

C607 3-flute design for less chatter. Bright finish improves chip flow in soft or non-ferrous materials.



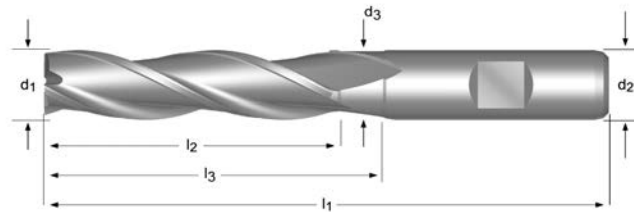
| d_1 Ø Inch | d_1 decimal Inch | l_2 Inch | l_1 Inch | d_2 Ø Inch | # of Flutes | Pack Qty | C607 |
|--------------------|--------------------------|---------------|---------------|--------------------|----------------|-------------|---------|
| 1/8 | 0.1250 | 3/8 | 2.5/16 | 3/8 | 3 | 1 | 7647904 |
| 3/16 | 0.1875 | 1/2 | 2.3/8 | 3/8 | 3 | 1 | 7647905 |
| 1/4 | 0.2500 | 5/8 | 2.7/16 | 3/8 | 3 | 1 | 7647906 |
| 5/16 | 0.3125 | 3/4 | 2.1/2 | 3/8 | 3 | 1 | 7647907 |
| 3/8 | 0.3750 | 3/4 | 2.1/2 | 3/8 | 3 | 1 | 7647908 |
| 7/16 | 0.4375 | 1" | 2.11/16 | 3/8 | 3 | 1 | 7647909 |
| 1/2 | 0.5000 | 1.1/4 | 3.1/4 | 1/2 | 3 | 1 | 7647910 |
| 9/16 | 0.5625 | 1.3/8 | 3.3/8 | 1/2 | 3 | 1 | 7658817 |
| 5/8 | 0.6250 | 1.5/8 | 3.3/4 | 5/8 | 3 | 1 | 7647912 |
| 3/4 | 0.7500 | 1.5/8 | 3.3/4 | 5/8 | 3 | 1 | 7647913 |
| 3/4 | 0.7500 | 1.5/8 | 3.7/8 | 3/4 | 3 | 1 | 7647916 |
| 1" | 1.0000 | 1.7/8 | 4" | 5/8 | 3 | 1 | 7647914 |
| 1" | 1.0000 | 2" | 4.1/2 | 1" | 3 | 1 | 7647915 |

Cobalt 3-Flute End Mill



Long Length, Square End, Weldon Shank, 30° Helix

C346 P9 slotting tolerance. 3 flute design provides less chatter.



C346

HSS-E

P9

Z
3



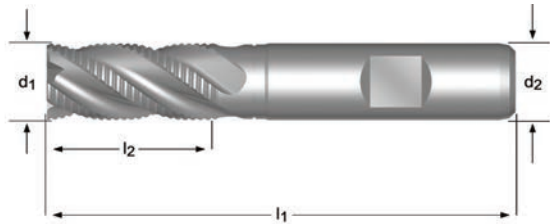
3.00 - 20.00

| d_1 Ø mm | d_2 Ø _{h8} mm | l_2 mm | l_1 mm | # of Flutes | l_3 mm | d_3 Ø mm | Pack Qty | C346 |
|------------------|--------------------------------|-------------|-------------|----------------|-------------|------------------|-------------|---------|
| 3.00 | 6 | 12 | 56 | 3 | - | - | 1 | 0122297 |
| 4.00 | 6 | 19 | 63 | 3 | - | - | 1 | 0122303 |
| 5.00 | 6 | 24 | 68 | 3 | - | - | 1 | 0122310 |
| 6.00 | 6 | 24 | 68 | 3 | - | - | 1 | 0122327 |
| 7.00 | 10 | 30 | 80 | 3 | - | - | 1 | 0126325 |
| 8.00 | 10 | 38 | 88 | 3 | - | - | 1 | 0126332 |
| 9.00 | 10 | 38 | 88 | 3 | - | - | 1 | 0126349 |
| 10.00 | 10 | 45 | 95 | 3 | - | - | 1 | 0126233 |
| 11.00 | 12 | 45 | 102 | 3 | - | - | 1 | 0126240 |
| 12.00 | 12 | 53 | 110 | 3 | - | - | 1 | 0126257 |
| 13.00 | 12 | 53 | 110 | 3 | 64.5 | 11.5 | 1 | 0126264 |
| 15.00 | 12 | 53 | 110 | 3 | 64.5 | 11.5 | 1 | 0126288 |
| 16.00 | 16 | 63 | 123 | 3 | 74.5 | 15.5 | 1 | 0126295 |
| 20.00 | 20 | 75 | 141 | 3 | 90.5 | 19.5 | 1 | 0126318 |

Regular Length, Square End, Roughing, Weldon Shank, 30° Helix

C608 Roughing, Fine Profile, provides a stronger edge and runs longer than conventional coarse profile roughers. Bright finish.

C609 TiCN coating lowers the coefficient of friction and improves wear resistance on the end mill.



| d_1 Ø Inch | d_1 decimal Inch | l_2 Inch | l_1 Inch | d_2 Ø Inch | # of Flutes | Pack Qty | C608 | C609 |
|--------------------|--------------------------|---------------|---------------|--------------------|----------------|-------------|---------|---------|
| 1/4 | 0.2500 | 5/8 | 2.7/16 | 3/8 | 4 | 1 | 7647917 | 7647927 |
| 5/16 | 0.3125 | 3/4 | 2.1/2 | 3/8 | 4 | 1 | 7647918 | 7647928 |
| 3/8 | 0.3750 | 3/4 | 2.1/2 | 3/8 | 4 | 1 | 7647919 | 7647929 |
| 7/16 | 0.4375 | 1.1/4 | 3.1/4 | 1/2 | 4 | 1 | 7647920 | 7647930 |
| 1/2 | 0.5000 | 1.1/4 | 3.1/4 | 1/2 | 4 | 1 | 7647921 | 7647931 |
| 9/16 | 0.5625 | 1.3/8 | 3.3/8 | 1/2 | 4 | 1 | 7647922 | — |
| 5/8 | 0.6250 | 1.5/8 | 3.3/4 | 5/8 | 4 | 1 | 7647923 | 7647932 |
| 3/4 | 0.7500 | 1.5/8 | 3.7/8 | 3/4 | 4 | 1 | 7647924 | 7647933 |
| 7/8 | 0.8750 | 1.7/8 | 4.1/8 | 3/4 | 5 | 1 | 7647925 | — |
| 1" | 1.0000 | 2" | 4.1/2 | 1" | 5 | 1 | 7647926 | 7647934 |

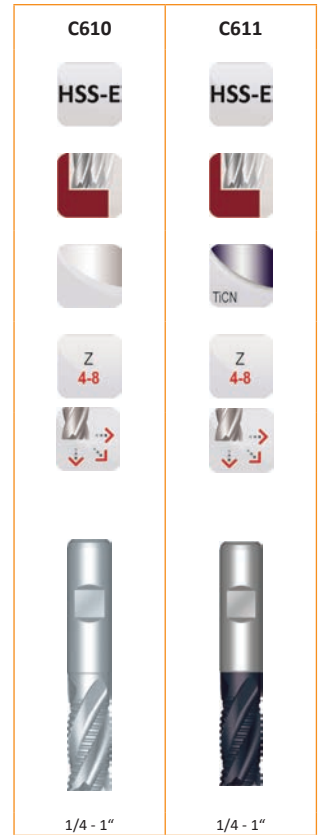
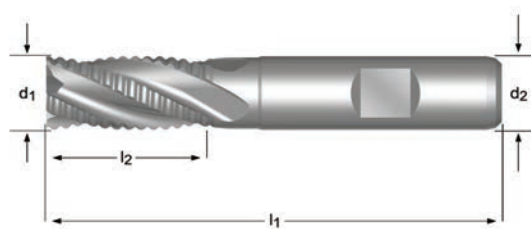
Cobalt Multi-Flute End Mill



Regular Length, Square End, Roughing, Weldon Shank, 30° Helix

C610 Roughing, Coarse Profile, for maximum metal removal in one pass. Bright finish.

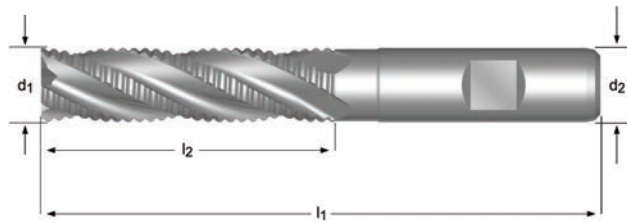
C611 TiCN coating lowers the coefficient of friction and improves wear resistance on the end mill.



| d_1 Ø Inch | d_1 decimal Inch | l_2 Inch | l_1 Inch | d_2 Ø Inch | # of Flutes | Pack Qty | C610 | C611 |
|--------------------|--------------------------|---------------|---------------|--------------------|----------------|-------------|---------|---------|
| 1/4 | 0.2500 | 5/8 | 2.7/16 | 3/8 | 4 | 1 | 7647935 | 7647945 |
| 5/16 | 0.3125 | 3/4 | 2.1/2 | 3/8 | 4 | 1 | 7647936 | 7647946 |
| 3/8 | 0.3750 | 3/4 | 2.1/2 | 3/8 | 4 | 1 | 7647937 | 7647947 |
| 7/16 | 0.4375 | 1.1/4 | 3.1/4 | 1/2 | 4 | 1 | 7647938 | 7647948 |
| 1/2 | 0.5000 | 1.1/4 | 3.1/4 | 1/2 | 4 | 1 | 7647939 | 7647949 |
| 9/16 | 0.5625 | 1.3/8 | 3.3/8 | 1/2 | 4 | 1 | 7647940 | — |
| 5/8 | 0.6250 | 1.5/8 | 3.3/4 | 5/8 | 4 | 1 | 7647941 | 7647950 |
| 3/4 | 0.7500 | 1.5/8 | 3.7/8 | 3/4 | 4 | 1 | 7647942 | 7647951 |
| 7/8 | 0.8750 | 1.7/8 | 4.1/8 | 3/4 | 5 | 1 | 7647943 | 7647952 |
| 1" | 1.0000 | 2" | 4.1/2 | 1" | 5 | 1 | 7647944 | 7647953 |

Long Length, Square End, Roughing, Weldon Shank, 30° Helix

C612 Roughing, Coarse Profile, for maximum metal removal in one pass. Bright finish.



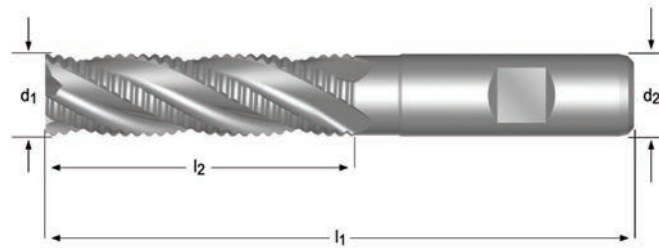
| d_1 Ø Inch | d_1 decimal Inch | l_2 Inch | l_1 Inch | d_2 Ø Inch | # of Flutes | Pack Qty | C612 |
|--------------------|--------------------------|---------------|---------------|--------------------|----------------|-------------|---------|
| 1/4 | 0.2500 | 1.1/4 | 3.1/8 | 3/8 | 4 | 1 | 7647954 |
| 3/8 | 0.3750 | 1.1/2 | 3.1/4 | 3/8 | 4 | 1 | 7647955 |
| 1/2 | 0.5000 | 2" | 4" | 1/2 | 4 | 1 | 7647956 |
| 5/8 | 0.6250 | 2.1/2 | 4.5/8 | 5/8 | 4 | 1 | 7647957 |
| 3/4 | 0.7500 | 3" | 5.1/4 | 3/4 | 4 | 1 | 7647958 |
| 7/8 | 0.8750 | 3.1/2 | 5.3/4 | 3/4 | 6 | 1 | 7647959 |
| 1" | 1.0000 | 4" | 6.1/2 | 1" | 5 | 1 | 7647960 |

Cobalt 4-Flute End Mill




Long Length, Square End, Roughing, Weldon Shank, 30° Helix

C613 Roughing, Fine Profile, provides a stronger edge and runs longer than conventional coarse profile roughers. Bright finish.




C613

HSS-E




Z
4-8

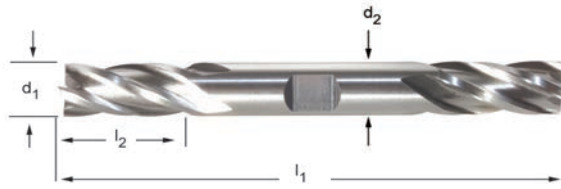


1/4 - 3/4

| d_1 Ø Inch | d_1 decimal Inch | l_2 Inch | l_1 Inch | d_2 Ø Inch | # of Flutes | Pack Qty | C613 |
|--------------------|--------------------------|---------------|---------------|--------------------|----------------|-------------|-------------|
| 1/4 | 0.2500 | 1.1/4 | 3.1/8 | 3/8 | 4 | 1 | 7647961 |
| 3/8 | 0.3750 | 1.1/2 | 3.1/4 | 3/8 | 4 | 1 | 7647962 |
| 1/2 | 0.5000 | 2" | 4" | 1/2 | 4 | 1 | 7647963 |
| 3/4 | 0.7500 | 3" | 5.1/4 | 3/4 | 4 | 1 | 7647964 |

Regular Length, Square End, Weldon Shank, 30° Helix

C614 Double end provides two cutting ends in one tool. Bright finish improves chip flow in soft or non-ferrous materials.



C614

HSS



Z
4



1/8 - 3/4

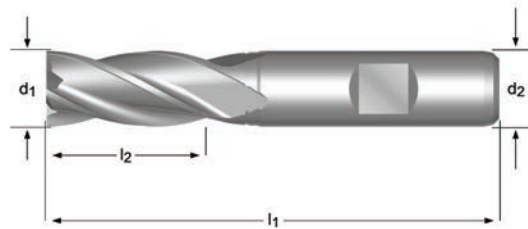
| d_1 Ø Inch | d_1 decimal Inch | l_2 Inch | l_1 Inch | d_2 Ø Inch | # of Flutes | Pack Qty | C614 |
|--------------------|--------------------------|---------------|---------------|--------------------|----------------|-------------|---------|
| 1/8 | 0.1250 | 3/8 | 3.1/16 | 3/8 | 4 | 1 | 7647965 |
| 3/16 | 0.1875 | 1/2 | 3.1/4 | 3/8 | 4 | 1 | 7647966 |
| 1/4 | 0.2500 | 5/8 | 3.3/8 | 3/8 | 4 | 1 | 7647967 |
| 5/16 | 0.3125 | 3/4 | 3.1/2 | 3/8 | 4 | 1 | 7647968 |
| 3/8 | 0.3750 | 3/4 | 3.1/2 | 3/8 | 4 | 1 | 7647969 |
| 1/2 | 0.5000 | 1" | 4.1/8 | 1/2 | 4 | 1 | 7647970 |
| 5/8 | 0.6250 | 1.3/8 | 5" | 5/8 | 4 | 1 | 7647971 |
| 3/4 | 0.7500 | 1.5/8 | 5.5/8 | 3/4 | 4 | 1 | 7647972 |

HSS 4-Flute End Mill



Regular Length, Square End, Weldon Shank, 30° Helix

C615 Bright finish improves chip flow in soft or non-ferrous materials.

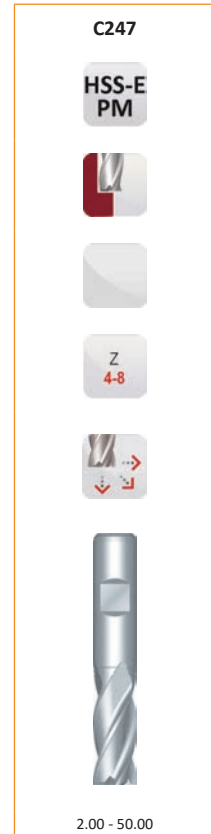
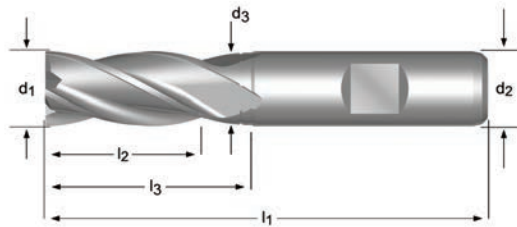


1/8 - 1"

| d_1 ∅ Inch | d_1 decimal Inch | l_2 Inch | l_1 Inch | d_2 ∅ Inch | # of Flutes | Pack Qty | C615 |
|--------------------|--------------------------|---------------|---------------|--------------------|----------------|-------------|---------|
| 1/8 | 0.1250 | 3/8 | 2.5/16 | 3/8 | 4 | 1 | 7647973 |
| 3/16 | 0.1875 | 1/2 | 2.3/8 | 3/8 | 4 | 1 | 7647974 |
| 1/4 | 0.2500 | 5/8 | 2.7/16 | 3/8 | 4 | 1 | 7647975 |
| 5/16 | 0.3125 | 3/4 | 2.1/2 | 3/8 | 4 | 1 | 7647976 |
| 3/8 | 0.3750 | 3/4 | 2.1/2 | 3/8 | 4 | 1 | 7647977 |
| 1/2 | 0.5000 | 1.1/4 | 3.1/4 | 1/2 | 4 | 1 | 7647978 |
| 5/8 | 0.6250 | 1.5/8 | 3.3/4 | 5/8 | 4 | 1 | 7647979 |
| 11/16 | 0.6875 | 1.5/8 | 3.3/4 | 5/8 | 4 | 1 | 7647980 |
| 3/4 | 0.7500 | 1.5/8 | 3.7/8 | 3/4 | 4 | 1 | 7647981 |
| 7/8 | 0.8750 | 1.7/8 | 4.1/8 | 7/8 | 4 | 1 | 7647982 |
| 1" | 1.0000 | 2" | 4.1/2 | 1" | 4 | 1 | 7647983 |

Regular Length, Square End, Weldon Shank, 30° Helix

C247 Powdered Metal. Bright finish improves chip flow in soft or non-ferrous materials.



| d_1 Ø Inch | d_1 Ø mm | d_2 Ø _{h6} mm | l_2 mm | l_1 mm | # of Flutes | l_3 mm | d_3 Ø mm | Pack Qty | C247 |
|--------------------|------------------|--------------------------------|-------------|-------------|----------------|-------------|------------------|-------------|-----------------------|
| | 2.00 | 6 | 7 | 51 | 4 | — | — | 1 | 0354667 |
| | 2.50 | 6 | 8 | 52 | 4 | — | — | 1 | 0354674 |
| | 3.00 | 6 | 8 | 52 | 4 | — | — | 1 | 0354728 |
| 1/8 | 3.18 | 6 | 10 | 54 | 4 | — | — | 1 | 0640142 ¹⁾ |
| | 3.50 | 6 | 10 | 54 | 4 | — | — | 1 | 0354735 |
| | 4.00 | 6 | 11 | 55 | 4 | — | — | 1 | 0354766 |
| | 4.50 | 6 | 11 | 55 | 4 | — | — | 1 | 0354773 |
| 3/16 | 4.76 | 6 | 13 | 57 | 4 | — | — | 1 | 0640159 ¹⁾ |
| | 5.00 | 6 | 13 | 57 | 4 | — | — | 1 | 0354780 |
| | 5.50 | 6 | 13 | 57 | 4 | — | — | 1 | 0354797 |
| | 6.00 | 6 | 13 | 57 | 4 | — | — | 1 | 0354803 |
| 1/4 | 6.35 | 10 | 16 | 66 | 4 | — | — | 1 | 0640166 ¹⁾ |
| | 6.50 | 10 | 16 | 66 | 4 | — | — | 1 | 0354810 |
| | 7.00 | 10 | 16 | 66 | 4 | — | — | 1 | 0354827 |
| | 7.50 | 10 | 16 | 66 | 4 | — | — | 1 | 0354834 |
| 5/16 | 7.94 | 10 | 19 | 69 | 4 | — | — | 1 | 0640173 ¹⁾ |
| | 8.00 | 10 | 19 | 69 | 4 | — | — | 1 | 0354841 |
| | 8.50 | 10 | 19 | 69 | 4 | — | — | 1 | 0354858 |
| | 9.00 | 10 | 19 | 69 | 4 | — | — | 1 | 0354865 |
| | 9.50 | 10 | 19 | 69 | 4 | — | — | 1 | 0354872 |
| 3/8 | 9.52 | 10 | 22 | 72 | 4 | 31.5 | 9.5 | 1 | 0640180 ¹⁾ |
| | 10.00 | 10 | 22 | 72 | 4 | 31.5 | 9.5 | 1 | 0354582 |
| | 11.00 | 12 | 22 | 79 | 4 | — | — | 1 | 0354599 |
| | 12.00 | 12 | 26 | 83 | 4 | 37.5 | 11.5 | 1 | 0354605 |
| 1/2 | 12.70 | 12 | 26 | 83 | 4 | 37.5 | 11.5 | 1 | 0640197 ¹⁾ |
| | 13.00 | 12 | 26 | 83 | 4 | 37.5 | 11.5 | 1 | 0354612 |
| | 14.00 | 12 | 26 | 83 | 4 | 37.5 | 11.5 | 1 | 0354629 |
| 9/16 | 14.29 | 12 | 26 | 83 | 4 | 37.5 | 11.5 | 1 | 0640203 ¹⁾ |
| | 15.00 | 12 | 26 | 83 | 4 | 37.5 | 11.5 | 1 | 0354636 |

¹⁾ Diameter tolerance +.0025 inches / -.0005 inches

²⁾ Not center Cutting

³⁾ Available in HSCo only

HSS-PM Multi-Flute End Mill



| d ₁ ∅ Inch | d ₁ ∅ mm | d ₂ ∅ _{h₆} mm | l ₂ mm | l ₁ mm | # of Flutes | l ₃ mm | d ₃ ∅ mm | Pack Qty | C247 |
|-----------------------------|---------------------------|--|----------------------|----------------------|----------------|----------------------|---------------------------|-------------|-------------------------|
| 5/8 | 15.88 | 16 | 32 | 92 | 4 | 43.5 | 15.5 | 1 | 0640210 ¹⁾ |
| | 16.00 | 16 | 32 | 92 | 4 | 43.5 | 15.5 | 1 | 0354643 |
| | 17.00 | 16 | 32 | 92 | 4 | 43.5 | 15.5 | 1 | 0609316 |
| | 18.00 | 16 | 32 | 92 | 4 | 43.5 | 15.5 | 1 | 0354650 |
| | 19.00 | 16 | 32 | 92 | 4 | 43.5 | 15.5 | 1 | 0609323 |
| 3/4 | 19.05 | 20 | 38 | 104 | 4 | 53.5 | 18.5 | 1 | 0640227 ¹⁾ |
| | 20.00 | 20 | 38 | 104 | 4 | 53.5 | 19.5 | 1 | 0354681 |
| | 21.00 | 20 | 38 | 104 | 4 | 53.5 | 19.5 | 1 | 0609330 |
| | 22.00 | 20 | 38 | 104 | 5 | 53.5 | 19.5 | 1 | 0354698 |
| 7/8 | 22.22 | 20 | 38 | 104 | 5 | 53.5 | 19.5 | 1 | 0640234 ¹⁾ |
| | 23.00 | 20 | 38 | 104 | 5 | 53.5 | 19.5 | 1 | 0609347 |
| | 24.00 | 25 | 45 | 121 | 5 | 64.5 | 23.5 | 1 | 0609354 |
| | 25.00 | 25 | 45 | 121 | 5 | 64.5 | 24.5 | 1 | 0354704 |
| 1" | 25.40 | 25 | 45 | 121 | 5 | 64.5 | 24.5 | 1 | 0640241 ¹⁾ |
| | 26.00 | 25 | 45 | 121 | 6 | 64.5 | 24.5 | 1 | 0609361 |
| | 28.00 | 25 | 45 | 121 | 6 | 64.5 | 24.5 | 1 | 0354711 |
| | 30.00 | 25 | 45 | 121 | 6 | 64.5 | 24.5 | 1 | 0354742 |
| | 32.00 | 32 | 53 | 133 | 6 | 72.5 | 31.5 | 1 | 0354759 |
| | 36.00 | 32 | 53 | 133 | 6 | 72.5 | 31.5 | 1 | 0609378 ²⁾³⁾ |
| | 40.00 | 40 | 63 | 155 | 6 | 84.5 | 39.0 | 1 | 0609385 ²⁾³⁾ |
| | 50.00 | 50 | 75 | 177 | 8 | 96.5 | 48.0 | 1 | 0640258 ²⁾³⁾ |

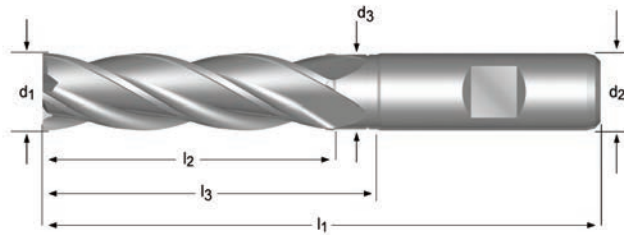
¹⁾ Diameter tolerance +.0025 inches / -.0005 inches

²⁾ Not center Cutting

³⁾ Available in HSCo only

Long Length, Square End, Weldon Shank

C273 Powdered Metal. Bright finish improves chip flow in soft or non-ferrous materials.



| d_1 Ø Inch | d_1 Ø mm | d_2 Ø _{h6} mm | l_2 mm | l_1 mm | # of Flutes | l_3 mm | d_3 Ø mm | Pack Qty | C273 |
|--------------------|------------------|--------------------------------|-------------|-------------|----------------|-------------|------------------|-------------|-------------------------|
| 1/8 | 2.00 | 6 | 10 | 54 | 4 | — | — | 1 | 0354964 |
| | 2.50 | 6 | 12 | 56 | 4 | — | — | 1 | 0354971 |
| | 3.00 | 6 | 12 | 56 | 4 | — | — | 1 | 0355022 |
| | 3.18 | 6 | 15 | 59 | 4 | — | — | 1 | 0640265 ¹⁾ |
| | 3.50 | 6 | 15 | 59 | 4 | — | — | 1 | 0355039 |
| | 4.00 | 6 | 19 | 63 | 4 | — | — | 1 | 0355060 |
| 3/16 | 4.50 | 6 | 19 | 63 | 4 | — | — | 1 | 0355077 |
| | 4.76 | 6 | 24 | 68 | 4 | — | — | 1 | 0640272 ¹⁾ |
| | 5.00 | 6 | 24 | 68 | 4 | — | — | 1 | 0355084 |
| | 5.50 | 6 | 24 | 68 | 4 | — | — | 1 | 0355091 |
| 1/4 | 6.00 | 6 | 24 | 68 | 4 | — | — | 1 | 0355107 |
| | 6.35 | 10 | 30 | 80 | 4 | — | — | 1 | 0640289 ¹⁾ |
| | 7.00 | 10 | 30 | 80 | 4 | — | — | 1 | 0355114 |
| | 8.00 | 10 | 38 | 88 | 4 | — | — | 1 | 0355121 |
| 3/8 | 9.00 | 10 | 38 | 88 | 4 | — | — | 1 | 0355138 |
| | 9.52 | 10 | 45 | 95 | 4 | 54.5 | 9.5 | 1 | 0640296 ¹⁾ |
| | 10.00 | 10 | 45 | 95 | 4 | 54.5 | 9.5 | 1 | 0354889 |
| | 11.00 | 12 | 45 | 102 | 4 | — | — | 1 | 0354896 |
| 1/2 | 12.00 | 12 | 53 | 110 | 4 | 64.5 | 11.5 | 1 | 0354902 |
| | 12.70 | 12 | 53 | 110 | 4 | 64.5 | 11.5 | 1 | 0640302 ¹⁾ |
| | 13.00 | 12 | 53 | 110 | 4 | 64.5 | 11.5 | 1 | 0354919 |
| | 14.00 | 12 | 53 | 110 | 4 | 64.5 | 11.5 | 1 | 0354926 |
| 5/8 | 15.00 | 12 | 53 | 110 | 4 | 64.5 | 11.5 | 1 | 0354933 |
| | 15.88 | 16 | 63 | 123 | 4 | 74.5 | 15.5 | 1 | 0640319 ¹⁾ |
| | 16.00 | 16 | 63 | 123 | 4 | 74.5 | 15.5 | 1 | 0354940 |
| | 18.00 | 16 | 63 | 123 | 4 | 74.5 | 15.5 | 1 | 0354957 |
| 3/4 | 19.05 | 20 | 75 | 141 | 4 | 90.5 | 18.5 | 1 | 0640326 ¹⁾ |
| | 20.00 | 20 | 75 | 141 | 4 | 90.5 | 19.5 | 1 | 0354988 |
| | 22.00 | 20 | 75 | 141 | 5 | 90.5 | 19.5 | 1 | 0354995 |
| | 25.00 | 25 | 90 | 166 | 5 | 109.5 | 24.5 | 1 | 0355008 |
| 1" | 25.40 | 25 | 90 | 166 | 5 | 109.5 | 24.5 | 1 | 0640340 ¹⁾ |
| | 28.00 | 25 | 90 | 166 | 6 | 109.5 | 24.5 | 1 | 0355015 |
| | 30.00 | 25 | 90 | 166 | 6 | 109.5 | 24.5 | 1 | 0355046 |
| | 32.00 | 32 | 106 | 186 | 6 | 125.5 | 31.5 | 1 | 0355053 |
| | 40.00 | 40 | 125 | 217 | 6 | 146.5 | 39.0 | 1 | 0609309 ²⁾³⁾ |

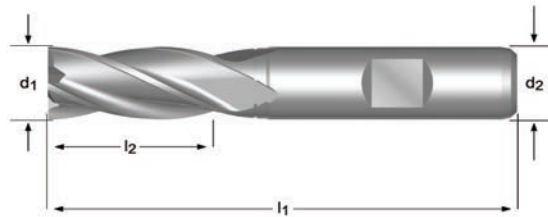
¹⁾ Diameter tolerance +.0025 inches / -.0005 inches • ²⁾ Available in HSCo only • ³⁾ Not Center Cutting

HSS Multi-Flute End Mill



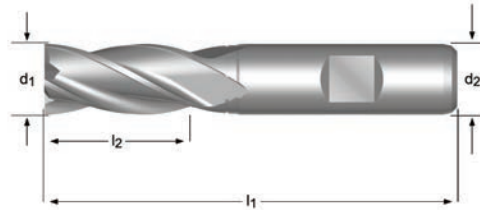
Regular Length, Square End, Weldon Shank, 30° Helix

C617 Multi-flute finishing. Bright finish improves chip flow in soft or non-ferrous materials.



| d ₁ ∅ Inch | d ₁ decimal Inch | l ₂ Inch | l ₁ Inch | d ₂ ∅ Inch | # of Flutes | Pack Qty | C617 |
|-----------------------------|-----------------------------------|------------------------|------------------------|-----------------------------|----------------|-------------|---------|
| 1/8 | 0.1250 | 3/8 | 2.5/16 | 3/8 | 4 | 1 | 7647984 |
| 3/16 | 0.1875 | 1/2 | 2.3/8 | 3/8 | 4 | 1 | 7647985 |
| 1/4 | 0.2500 | 5/8 | 2.7/16 | 3/8 | 4 | 1 | 7647986 |
| 5/16 | 0.3125 | 3/4 | 2.1/2 | 3/8 | 4 | 1 | 7647987 |
| 3/8 | 0.3750 | 3/4 | 2.1/2 | 3/8 | 4 | 1 | 7647988 |
| 7/16 | 0.4375 | 1" | 2.11/16 | 3/8 | 4 | 1 | 7647989 |
| 1/2 | 0.5000 | 1" | 2.11/16 | 3/8 | 4 | 1 | 7647990 |
| 1/2 | 0.5000 | 1.1/4 | 3.1/4 | 1/2 | 4 | 1 | 7647991 |
| 9/16 | 0.5625 | 1.3/8 | 3.3/8 | 1/2 | 4 | 1 | 7647992 |
| 5/8 | 0.6250 | 1.3/8 | 3.3/8 | 1/2 | 4 | 1 | 7647993 |
| 5/8 | 0.6250 | 1.5/8 | 3.3/4 | 5/8 | 4 | 1 | 7647996 |
| 11/16 | 0.6875 | 1.5/8 | 3.5/8 | 1/2 | 4 | 1 | 7647994 |
| 11/16 | 0.6875 | 1.5/8 | 3.3/4 | 5/8 | 4 | 1 | 7647997 |
| 3/4 | 0.7500 | 1.5/8 | 3.5/8 | 1/2 | 4 | 1 | 7647995 |
| 3/4 | 0.7500 | 1.5/8 | 3.3/4 | 5/8 | 4 | 1 | 7647998 |
| 3/4 | 0.7500 | 1.5/8 | 3.7/8 | 3/4 | 4 | 1 | 7648005 |
| 13/16 | 0.8125 | 1.7/8 | 4" | 5/8 | 6 | 1 | 7647999 |
| 7/8 | 0.8750 | 1.7/8 | 4" | 5/8 | 6 | 1 | 7648000 |
| 7/8 | 0.8750 | 1.7/8 | 4.1/8 | 3/4 | 4 | 1 | 7648006 |
| 7/8 | 0.8750 | 1.7/8 | 4.1/8 | 7/8 | 4 | 1 | 7648002 |
| 1" | 1.0000 | 1.7/8 | 4" | 5/8 | 6 | 1 | 7648001 |
| 1" | 1.0000 | 1.7/8 | 4.1/8 | 3/4 | 4 | 1 | 7648007 |
| 1" | 1.0000 | 1.7/8 | 4.1/8 | 7/8 | 4 | 1 | 7648003 |
| 1" | 1.0000 | 2" | 4.1/2 | 1" | 4 | 1 | 7648004 |

C618 Multi-flute finishing for high strength heat resistant materials, stainless and alloy steel, super alloys, and titanium alloys.



| d_1 Ø Inch | d_1 decimal Inch | l_2 Inch | l_1 Inch | d_2 Ø Inch | # of Flutes | Pack Qty | C618 |
|--------------------|--------------------------|---------------|---------------|--------------------|----------------|-------------|---------|
| 1/8 | 0.1250 | 3/8 | 2.5/16 | 3/8 | 4 | 1 | 7648008 |
| 3/16 | 0.1875 | 1/2 | 2.3/8 | 3/8 | 4 | 1 | 7648009 |
| 1/4 | 0.2500 | 5/8 | 2.7/16 | 3/8 | 4 | 1 | 7648010 |
| 5/16 | 0.3125 | 3/4 | 2.1/2 | 3/8 | 4 | 1 | 7648011 |
| 3/8 | 0.3750 | 3/4 | 2.1/2 | 3/8 | 4 | 1 | 7648012 |
| 1/2 | 0.5000 | 1.1/4 | 3.1/4 | 1/2 | 4 | 1 | 7648013 |
| 5/8 | 0.6250 | 1.5/8 | 3.3/4 | 5/8 | 4 | 1 | 7648014 |
| 3/4 | 0.7500 | 1.5/8 | 3.7/8 | 3/4 | 4 | 1 | 7648015 |
| 1" | 1.0000 | 2" | 4.1/2 | 1" | 4 | 1 | 7648016 |

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