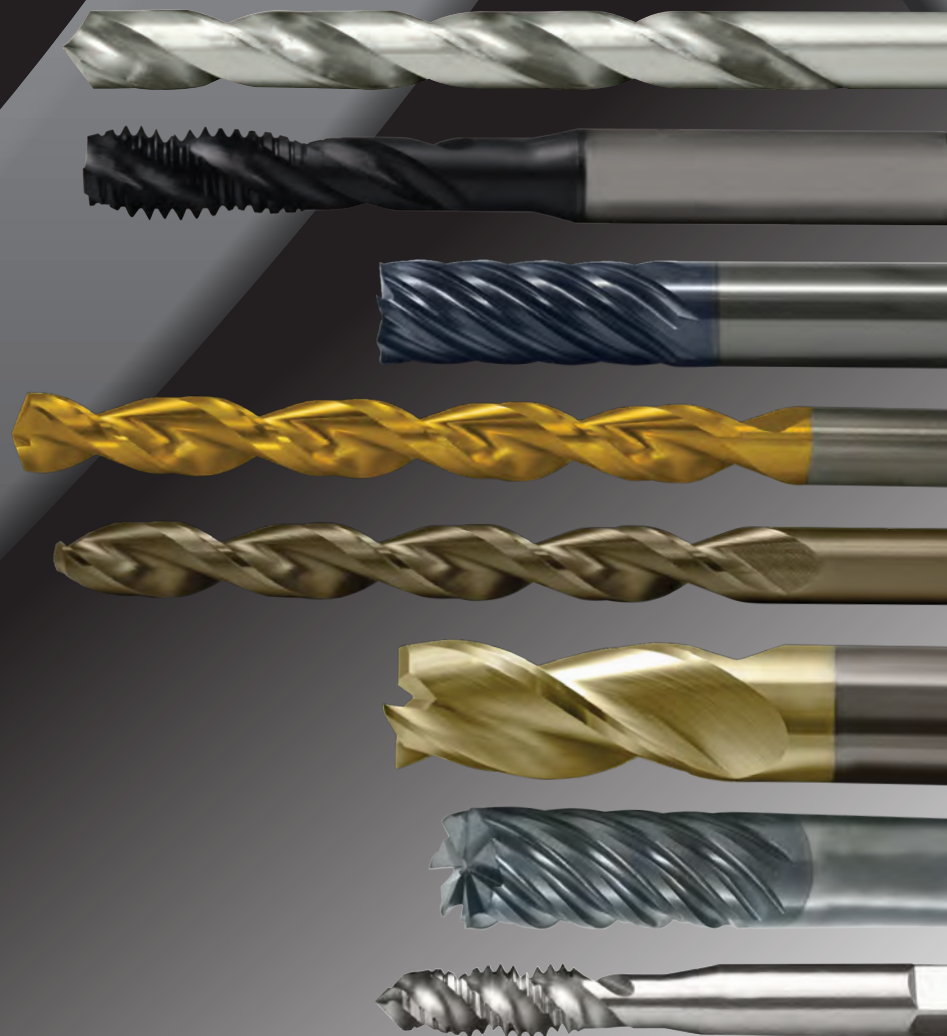




2024 UPDATE

**Holemaking
Threading
Milling**



2024 UPDATE

2021

Product Index

****Items are being OBSOLETEd, only available until inventory is depleted.**

Index

| Screw Machine / Stub Length Drills | | | | | Tool Material | | | | Application | | | | | Point | | | | Surface Treatment | | | | | | | |
|------------------------------------|--------------------|--|---------------------|-----|---------------|--------|---------|-----|-------------|-----------|-----------|-------------|-----------------|----------------|------|------------|--------------|-------------------|------------|--------|-------------|-------|-----|------|-------|
| Style | Page | | Type | Set | HSS | Cobalt | Carbide | TCT | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | 118° | 118° Split | 118° 4-facet | 118° K-Notch | 135° Split | Bright | Black Oxide | Straw | TiN | TiCN | TiAlN |
| 2120 | 22 | | General Purpose | yes | • | | | | • | | | | | | • | | | | | • | | | | | |
| **2175 | 24 | | Wide Land Parabolic | | | • | | | • | | | | | | | | | | | • | | • | • | | • |
| 2330 | 27 | | NAS907-C Heavy Duty | yes | • | | | | • | • | | | | | | | | | | • | • | | | | |
| 2133 | 30 | | NAS907-K Heavy Duty | | | • | | | • | | | | | | | | | | | • | | • | | | • |
| 1765 | 34 | | Carbide Spade Drill | | | | • | | • | | | | | • | | | | | | • | | | | | |
| 1767 | 35 | | Carbide Stub Length | | | | • | | • | | | | | • | | | | | | • | | | | | |

| Jobber Drills | | | | | Tool Material | | | | Application | | | | | Point | | | | Surface Treatment | | | | | | | |
|---------------|--------------------|--|--------------------------|-----|---------------|--------|---------|-----|-------------|-----------|-----------|-------------|-----------------|----------------|------|------------|--------------|-------------------|------------|--------|-------------|-------|-----|------|-------|
| Style | Page | | Type | Set | HSS | Cobalt | Carbide | TCT | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | 118° | 118° Split | 118° 4-facet | 118° K-Notch | 135° Split | Bright | Black Oxide | Straw | TiN | TiCN | TiAlN |
| 2001, 2002 | 37 | | General Purpose | yes | • | | | | • | | | | | | • | | | | | • | • | | | | • |
| **2020 | 45 | | Low Helix | | | • | | | • | | | | | | • | | | | | • | | | | | |
| 2012 | 47 | | High Helix | | | • | | | • | | | | | | • | | | | | • | | | | | |
| 2065 | 49 | | Parabolic | | • | | | | • | | | | | | | | | • | | • | | | • | | |
| **2075 | 51 | | Wide Land Parabolic | yes | | • | | | • | • | | | | | | | | | | • | | • | • | | • |
| 2006 | 55 | | Left Hand | | • | | | | • | | | | | | • | | | | | • | | | | | |
| 2228 | 56 | | NAS907-A General Purpose | | • | | | | • | | | | | | | | • | | | • | | | | | |
| 2222 | 58 | | NAS907-B Heavy Duty | yes | • | | | | • | • | | | | | | | | | | • | • | | | | |
| 2213 | 61 | | NAS907-J Heavy Duty | yes | | • | | | • | | | | | | | | | | | • | | • | | | |
| 2011 | 66 | | Cotter Pin Heavy Duty | | • | | | | • | | | | | | | | | | | • | | • | | | |
| 3780 | 67 | | Q-AMD Short Flute | yes | | • | | | • | | | | | | | | | | | • | | • | | | |
| 2727 | 70 | | Carbide Tipped | | | | | • | • | | | | | | • | | | | | • | | | | | |
| 1766 | 71 | | Straight Flute | | | | • | | • | | | | | • | | | | | | • | | | | | |
| 1727 | 73 | | Carbide Heavy Duty | | | | • | | • | | | | | • | | | | | | • | | | | | |

*Tool Material is Premium HSS

****Items are being OBSOLETED, only available until inventory is depleted.**

| Common Shank Drills | | | | | Tool Material | | | | Application | | | | Point | | | | Surface Treatment | | | | | | | | |
|---------------------|------|--|--------------------------------|-----|---------------|--------|---------|-----|-------------|-----------|-----------|-------------|-----------------|----------------|------|------------|-------------------|--------------|------------|--------|-------------|-------|-----|------|------|
| Style | Page | | Type | Set | HSS | Cobalt | Carbide | TCT | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | 118° | 118° Split | 118° 4-facet | 118° K-Notch | 135° Split | Bright | Black Oxide | Straw | TIN | TICN | TAIN |
| 6100 | 76 | | External Coolant Single Margin | | | • | | | | | | | | | | | | | | | | | | | |
| 6200 | 77 | | Internal Coolant Single Margin | | | • | | | | | | | | | | | | | | | | | | | |
| 6300 | 78 | | Internal Coolant Double Margin | | | • | | | | | | | | | | | | | | | | | | | |
| 6400 | 79 | | Internal Coolant Double Margin | | | • | | | | | | | | | | | | | | | | | | | |

OBSOLETE







| Taper Length Drills | | | | | Tool Material | | | | Application | | | | Point | | | | Surface Treatment | | | | | | | | |
|---------------------|--------------------|--|-----------------------------------|-----|---------------|--------|---------|-----|-------------|-----------|-----------|-------------|-----------------|----------------|------|------------|-------------------|--------------|------------|--------|-------------|-------|-----|------|------|
| Style | Page | | Type | Set | HSS | Cobalt | Carbide | TCT | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | 118° | 118° Split | 118° 4-facet | 118° K-Notch | 135° Split | Bright | Black Oxide | Straw | TIN | TICN | TAIN |
| 2745 | 80 | | Carbide Tipped Heavy Duty, Tanged | | | | | • | | | | | | | | | | | | | | | | | |
| **2510 | 81 | | General Purpose | yes | • | | | | | | | | | | | | | | | | | | | | |
| **2550 | 85 | | High Helix | | • | | | | | | | | | | | | | | | | | | | | |
| 2513 | 87 | | Heavy Duty, Tanged | | | • | | | | | | | | | | | | | | | | | | | |
| **2540 | 88 | | Auto. Tanged Shank Heavy Duty | | | • | | | | | | | | | | | | | | | | | | | |
| **2565 | 89 | | Parabolic, Tanged | | | • | | | | | | | | | | | | | | | | | | | |
| **2575 | 91 | | Wide Land Parabolic | | | • | | | | | | | | | | | | | | | | | | | |

| Aircraft Extension Drills | | | | | Tool Material | | | | Application | | | | Point | | | | Surface Treatment | | | | | | | | |
|---------------------------|--------------------|--|---------------------|-----|---------------|--------|---------|-----|-------------|-----------|-----------|-------------|-----------------|----------------|------|------------|-------------------|--------------|------------|--------|-------------|-------|-----|------|------|
| Style | Page | | Type | Set | HSS | Cobalt | Carbide | TCT | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | 118° | 118° Split | 118° 4-facet | 118° K-Notch | 135° Split | Bright | Black Oxide | Straw | TIN | TICN | TAIN |
| 3957 | 94 | | NAS907-B 6" and 12" | | | • | | | | | | | | | | | | | | | | | | | |
| 3722 | 96 | | NAS907-J 6" and 12" | | | • | | | | | | | | | | | | | | | | | | | |

| Extra Length Drills | | | | | Tool Material | | | | Application | | | | Point | | | | Surface Treatment | | | | | | | | |
|---------------------|--------------------|--|--------------|-----|---------------|--------|---------|-----|-------------|-----------|-----------|-------------|-----------------|----------------|------|------------|-------------------|--------------|------------|--------|-------------|-------|-----|------|------|
| Style | Page | | Type | Set | HSS | Cobalt | Carbide | TCT | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | 118° | 118° Split | 118° 4-facet | 118° K-Notch | 135° Split | Bright | Black Oxide | Straw | TIN | TICN | TAIN |
| 950E | 98 | | Extra Length | | • | | | | | | | | | | | | | | | | | | | | |

****Items are being OBSOLETE, only available until inventory is depleted.**

| Reamers | | | | Tool Material | | Application | | | | | Hole | | Surface Treatment | | | | | | | | | |
|---------|---------------------|--|--|---------------|-----|-------------|---------|-------|-----------|-----------|-------------|-----------------|-------------------|------------|-----------|--------|-------------|-------|-----|------|-------|--|
| Style | Page |  | Type | Set | HSS | Cobalt | Carbide | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Blind Hole | Thru Hole | Bright | Black Oxide | Straw | TIN | TICN | TiAIN | |
| 1730 | 113 |  | Straight Shank, Straight Flute | | | | • | • | • | • | • | | | | • | • | | | | | | |
| 4001 | 114 |  | Straight Shank, Straight Flute | yes | • | | | • | • | • | • | | | | • | • | | | | | | |
| 4030 | 118 |  | Straight Shank, Spiral Flute | | • | | | • | • | • | • | | | • | | • | | | | | | |
| 4005 | 119 |  | Taper Shank, Straight Flute | | • | | | • | • | • | • | | | | • | • | | | | | | |
| 4703 | 120 |  | Straight Shank, Straight Flute | | • | | | • | • | • | • | | | | • | • | | | | | | |
| 616 | 121 |  | Taper Shank, Bridge Reamer | | • | | | • | • | • | • | | | | | | • | | | | | |
| 618 | 121 |  | Taper Shank, Car Reamer | | • | | | • | • | • | • | | | | | | • | | | | | |
| 642 | 122 |  | Taper Pipe Reamer | | • | | | • | • | • | • | | | | | | • | | | | | |
| 650 | 122 |  | High Spiral Spirex Taper Pin | | • | | | • | • | • | • | | | | | | • | | | | | |
| 657 | 123 |  | Taper Pin Straight Shank, Straight Flute | | • | | | • | • | • | • | | | | | | • | | | | | |
| 659 | 123 |  | Taper Pin Straight Shank, Helical Flute | | • | | | • | • | • | • | | | | | | • | | | | | |

| Counterbores | | | | Tool Material | | Application | | | | | Helix | | Surface Treatment | | | | | | | | | |
|--------------|---------------------|---|---|---------------|-----|-------------|---------|-------|-----------|-----------|-------------|-----------------|-------------------|------------|-----------|--------|-------------|-------|-----|------|-------|--|
| Style | Page |  | Type | Set | HSS | Cobalt | Carbide | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Blind Hole | Thru Hole | Bright | Black Oxide | Straw | TIN | TICN | TiAIN | |
| 879 | 124 |  | Straight Shank C'bore & Spot Facer | | • | | | • | • | • | • | | | | | | • | | | | | |
| 884 | 125 |  | Short Aircraft Type | | • | | | • | • | • | • | | | | | | • | | | | | |
| 879P | 126 |  | Interchangeable Pilot for Style 879 & 884 | | • | | | • | • | • | • | | | | | | • | | | | | |
| 655 | 127 |  | Clearance or Taper Router | | • | | | • | • | • | • | | | | | | • | | | | | |
| 183 | 128 |  | 3 Flute Continuous Pilot | yes | • | | | • | • | • | • | | | | | | • | | | | | |

Product Index

****Items are being OBSOLETEd, only available until inventory is depleted.**

Index

| Straight Flute | | | | | Tool Material | Blank | Chamfer | Application | Hole | Surface Treatment | | | | | | | | | | | | | | | | | | | |
|----------------|---------------------|--|-----------------------------------|-----|---------------|-------|---------|-------------|------------|-------------------|------|-----------|---------------|-------|-----------|-----------|-------------|-----------------|----------------|-------|------|--------|-------------|-----|------|-------|-------|--------------------|----------|
| Style | Page | | Type | Set | HSS | HSS-E | 302A | 311 | DIN / ANSI | Taper | Plug | Bottoming | Mod Bottoming | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Blind | Thru | Bright | Black Oxide | TiN | TiCN | TiAlN | AlCrN | Oxide over Nitride | Hardlube |
| 1001 | 162 | | General Purpose | yes | • | | • | | | • | | | | • | • | • | • | | | | • | • | • | | | | | | |
| 1002 | 162 | | General Purpose | yes | • | | • | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| 1003 | 162 | | General Purpose | yes | • | | • | | | | | • | | • | • | • | • | | | | • | • | • | | | | | | |
| 1004 | 162 | | Set (Styles: 1001, 1002, 1003) | yes | • | | • | | | • | • | • | | • | • | • | • | | | | • | • | • | | | | | | |
| 1002L | 168 | | General Purpose - Left Hand | | • | | • | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| CI-1000 | 169 | | Cast Iron | | | • | • | | | | | | • | • | • | • | • | | | | • | • | • | | | | • | | |

| Spiral Point | | | | | Tool Material | Blank | Chamfer | Application | Hole | Surface Treatment | | | | | | | | | | | | | | | | | | | |
|--------------|---------------------|--|-------------------------|-----|---------------|-------|---------|-------------|------------|-------------------|------|-----------|---------------|-------|-----------|-----------|-------------|-----------------|----------------|-------|------|--------|-------------|-----|------|-------|-------|--------------------|----------|
| Style | Page | | Type | Set | HSS | HSS-E | 302A | 311 | DIN / ANSI | Taper | Plug | Bottoming | Mod Bottoming | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Blind | Thru | Bright | Black Oxide | TiN | TiCN | TiAlN | AlCrN | Oxide over Nitride | Hardlube |
| 1011 | 170 | | General Purpose | | • | | • | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| 1053 | 173 | | Low Shear | | • | | • | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| 1012 | 174 | | Bottoming | | • | | • | | | | | • | | • | • | • | • | | | | • | • | • | | | | | | |
| 1011E | 175 | | 6" Extended Length | | • | | 303-A | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| T-101 | 175 | | Stainless Steel & Steel | | • | • | | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| PRO-961SP | 176 | | Universal | | • | | | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| PRO-861SP | | | Universal | | • | | | | | | | • | | | • | • | • | • | | | | • | • | • | | | • | | |
| PER-862SP | 178 | | Stainless Steel | | • | | | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| PER-960SP | | | Stainless Steel | | • | | | | | | | • | | | • | • | • | • | | | | • | • | • | | | | | • |



****Items are being OBSOLETE, only available until inventory is depleted.**

| Spiral Flute | | | | Tool Material | Blank | Chamfer | Application | Hole | Surface Treatment | | | | | | | | | | | | | | | | | | | | |
|--------------|------|--|-------------------------|---------------|-------|---------|-------------|------|-------------------|-------|------|-----------|---------------|-------|-----------|-----------|-------------|-----------------|----------------|-------|------|--------|-------------|-----|------|-------|-------|--------------------|----------|
| Style | Page | | Type | Set | HSS | HSS-E | 302A | 311 | DIN / ANSI | Taper | Plug | Bottoming | Mod Bottoming | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Blind | Thru | Bright | Black Oxide | TiN | TiCN | TiAlN | AlCrN | Oxide over Nitride | Hardlube |
| 1093 | 180 | | General Purpose | | • | • | | | | | • | | | • | • | • | | | | • | | • | • | | | | | | |
| 1094 | 180 | | General Purpose | | • | • | | | | | | • | | • | • | • | | | | • | | • | • | | | | | | |
| 1095 | 181 | | Heavy Duty | | • | • | | | | | | | | • | • | • | | | | • | | • | • | | | | | | |
| 1096 | 181 | | Heavy Duty | | • | • | | | | | | | | • | • | • | | | | • | | • | • | | | | | | |
| **B-101 | 182 | | Stainless Steel & Steel | | • | • | | | | | | | | • | • | • | | | | • | | • | • | | | | | | |
| PRO-981SF | 183 | | Universal | | • | • | | | | | | | | • | • | • | | | | • | | • | • | | | | | | |
| PRO-892SF | 183 | | Universal | | • | • | | | | | | | | • | • | • | | | | • | | • | • | | | | | | |
| PER-893SF | 185 | | Stainless Steel | | • | • | | | | | | | | • | • | • | | | | • | | • | • | | | | | | |
| PER-980SF | 185 | | Stainless Steel | | • | • | | | | | | | | • | • | • | | | | • | | • | • | | | | | | |

| Form | | | | Tool Material | Blank | Chamfer | Application | Hole | Surface Treatment | | | | | | | | | | | | | | | | | | | | |
|-------|------|--|-----------------|---------------|-------|---------|-------------|------|-------------------|-------|------|-----------|---------------|-------|-----------|-----------|-------------|-----------------|----------------|-------|------|--------|-------------|-----|------|-------|-------|--------------------|----------|
| Style | Page | | Type | Set | HSS | HSS-E | 302A | 311 | DIN / ANSI | Taper | Plug | Bottoming | Mod Bottoming | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Blind | Thru | Bright | Black Oxide | TiN | TiCN | TiAlN | AlCrN | Oxide over Nitride | Hardlube |
| 1091 | 187 | | General Purpose | | • | • | | | | | • | | | • | • | • | | | | • | | • | • | | | | | | |
| 1092 | 187 | | General Purpose | | • | • | | | | | | • | | • | • | • | | | | • | | • | • | | | | | | |

| Pipe | | | | Tool Material | Blank | Chamfer | Application | Hole | Surface Treatment | | | | | | | | | | | | | | | | | | | | |
|-------|------|--|-------------------------|---------------|-------|---------|-------------|------|-------------------|-------|------|-----------|---------------|-------|-----------|-----------|-------------|-----------------|----------------|-------|------|--------|-------------|-----|------|-------|-------|--------------------|----------|
| Style | Page | | Type | Set | HSS | HSS-E | 302A | 311 | DIN / ANSI | Taper | Plug | Bottoming | Mod Bottoming | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Blind | Thru | Bright | Black Oxide | TiN | TiCN | TiAlN | AlCrN | Oxide over Nitride | Hardlube |
| 965 | 188 | | NPT Medium Hook | | • | • | | | | | | | | • | • | • | | | | • | | • | • | | | | | | |
| 975 | 188 | | NPTF Medium Hook | | • | • | | | | | | | | • | • | • | | | | • | | • | • | | | | | | |
| 964B | 189 | | NPT Interrupted Thread | | • | • | | | | | | | | • | • | • | | | | • | | • | • | | | | | | |
| 966B | 189 | | NPTF Interrupted Thread | | • | • | | | | | | | | • | • | • | | | | • | | • | • | | | | | | |
| 963B | 190 | | NPS | | • | • | | | | | | | | • | • | • | | | | • | | • | • | | | | | | |
| 967B | 190 | | NPSF | | • | • | | | | | | | | • | • | • | | | | • | | • | • | | | | | | |







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Product Index

****Items are being OBSOLETED, only available until inventory is depleted.**

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| Thread Mills | | | | Tool Material | | Thread | | | | | | | | | | Application | | Coolant | | Surface Treatment | | | | | | | |
|-----------------|---------------------|---|--------------------------|---------------|---------|---------|-----|-----|-----|------|---------------|-------------|------|------|-----|-------------|-----------|-----------|-------------|-------------------|----------------|-----|------|-------|-------|----------|--|
| Style | Page | | Type | HSS | Co-balt | Carbide | UNC | UNF | NPT | NPTF | Metric Coarse | Metric Fine | BSPP | BSPT | DIN | Steel | Stainless | Cast Iron | Non-Ferrous | Special Alloy | Hardened Steel | Non | Thru | TiAIN | AlCrN | Hardlube | |
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| CMTM3, CMTMM3 | 192 | | Mini | | | • | • | • | | | • | • | | | | • | • | • | • | • | • | • | | | • | | |
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| CTMBPT, CTMBPTC | 195 |  | British Pipe Parallel | | | • | | | | | | | | | | • | • | • | • | • | • | • | • | | • | | |

****Items are being OBSOLETE, only available until inventory is depleted.**

| Dies | | | | Tool Material | | Surface Treatment | | | | | | | | | |
|------------------|---------------------|---|---|---------------------|-----|-------------------|-------|--------|-------------|-----|------|-------|-------|--------------------|----------|
| Style | Page | | Type | Set | HSS | Carbon Steel | Steel | Bright | Black Oxide | TiN | TiCN | TiAlN | AlCrN | Oxide over Nitride | Hardtube |
| 0650, 0650M, 492 | 196 |  | Hexagon Rethreading | yes | • | • | | • | | | | | | | |
| 0660 | | | Taper Pipe | | • | • | | • | | | | | | | |
| 0610, 0710 | 198 |  | Round Adjustable | | • | • | | • | | | | | | | |
| 0710M | | | Round Adjustable | | • | | | • | | | | | | | |
| 0620 | | | Round Adjustable - Pipe | | • | | | • | | | | | | | |
| 222 | 200 |  | Die Stock, Adjustable | | | | | | | | | | | | |
| **224 | 200 |  | Die Stock, Built-in Workpiece Guide | | | | | | | | | | | | |
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| 0552 | |  | Die Set: Guide | | | | | • | • | | | | | | |
| 0553 | |  | Die Set: Collet (cap and guide) | | | | | • | • | | | | | | |
| 0554 | |  | Die Set Assembly (0550,0553,0551,0552) | | | | | • | • | | | | | | |
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Wrenches

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| 243 | 203 |  | Slip T-Handle Wrench | | | | |

Product Index

****Items are being OBSOLETEd, only available until inventory is depleted.**

High Speed Steel

| Style | Page | Image | Type | No. of Flutes | End Work | | | Application | | | | | Machining | | | | | Surface Treatment | | | | |
|----------|---------------------|-------|--------------------------|---------------|----------|------|--------------------|-----------------|-------|-----------|-----------|-------------|-----------------|----------------|------|---------|----------|-------------------|----------|---------|----------------|--------|
| | | | | | Square | Ball | Chamfer | Radius/Rounding | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Slot | Profile | Plunging | Ramping | Drilling | Chamfer | Slot w/ Radius | Bright |
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| **HMD-2B | 233 | | Miniature | 2 | | • | | • | • | • | | | • | • | • | | | • | • | | | |
| **HMD-4 | 234 | | Miniature | 4 | • | | | • | • | • | | | • | • | • | | | | • | | | |
| **HMG-2 | 235 | | Miniature | 2 | • | | | • | • | • | | | • | • | • | | | | • | | | |
| **HMG-2B | 236 | | Miniature | 2 | | • | | • | • | • | | | • | • | • | | | • | • | | | |
| **HMG-4 | 237 | | Miniature | 4 | • | | | • | • | • | | | • | • | • | | | | • | | | |
| **HD-2 | 238 | | Finisher | 2 | • | | | • | • | • | | | • | • | • | | | | • | • | • | |
| **HD-2B | 240 | | Finisher | 2 | | • | | • | • | • | | | • | • | • | | | • | • | • | | |
| **HD-3 | 241 | | Finisher | 3 | • | | | • | • | • | | | • | • | • | | | | • | • | • | |
| **HD-4C | 242 | | Finisher | 4 | • | | | • | • | • | | | • | • | • | | | | • | • | • | |
| **HG-2 | 243 | | Finisher | 2 | • | | | • | • | • | | | • | • | • | | | | • | • | • | |
| **HG-2M | 246 | | Finisher | 2 | • | | | • | • | • | | | • | • | • | | | | • | | | |
| **HG-2B | 247 | | Finisher | 2 | | • | | • | • | • | | | • | • | • | | | | • | • | • | |
| **HG-2K | 248 | | Keyway | 2 | • | | | • | • | • | | | • | • | • | | | | • | • | • | |
| **HG-2KS | 249 | | Keyway Cutter | 2 | • | | | • | • | • | | | • | | | | | | • | | | |
| **HGN-2 | 250 | | Finisher - Extended Neck | 2 | • | | | • | • | • | | | • | • | • | | | | • | | | |
| **HGN-2B | 251 | | Finisher - Extended Neck | 2 | | • | | • | • | • | | | • | • | • | | | | • | | | |
| **HGA-2 | 252 | | Finisher - High Helix | 2 | • | | | • | • | • | | | • | • | • | | | | • | • | • | |
| HPDM-2 | 253 | | Finisher - Drill Mill | 2 | | | <i>Pointed end</i> | • | • | • | | | • | • | • | | | | • | • | • | |
| **HG-3 | 254 | | General Purpose | 3 | • | | | • | • | • | | | • | • | • | | | | • | • | • | |

Index

****Items are being OBSOLETEd, only available until inventory is depleted.**

| High Speed Steel (continued) | | | | End Work | | | Application | | | | | Machining | | | | | Surface Treatment | | | | | | | | |
|------------------------------|---------------------|-------|-----------------------|---------------|--------|------|-------------|-----------------|---------|---------------------|-----------|-----------------|-----------------|----------------|------|---------|-------------------|---------|----------|---------|----------------|--------|-----|------|-------|
| Style | Page | Image | Type | No. of Flutes | Square | Ball | Chamfer | Radius/Rounding | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Slot | Profile | Plunging | Ramping | Drilling | Chamfer | Slot w/ Radius | Bright | TiN | TiCN | TiAlN |
| | | | | | | | | | **HG-4C | 255 | | General Purpose | M | • | | | • | • | • | | | | | • | |
| HG-4MC | 258 | | General Purpose | 4 | • | | | • | • | • | | | | | | | • | | | | | • | • | • | |
| **HG-4B | 259 | | General Purpose | 4 | | • | | • | • | • | | | | | | | • | | | | | • | • | • | |
| **HG-4LL | 260 | | Left Hand Helix / Cut | 4 | • | | | • | • | • | | | | | | | • | | | | | • | • | • | |
| **CRE | 261 | | Corner Radius | 4 | | | • | • | • | • | | | | | • | | | | | | | • | • | • | |

M = Multi Flute

| Cobalt | | | | End Work | | | Application | | | | | Machining | | | | | Surface Treatment | | | | | | | | |
|----------|---------------------|-------|------------------------------|---------------|--------|------|-------------|--------|----------|---------------------|-----------|--------------------|-----------------|----------------|------|---------|-------------------|---------|----------|---------|----------------|--------|-----|------|-------|
| Style | Page | Image | Type | No. of Flutes | Square | Ball | Chamfer | Radius | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Slot | Profile | Plunging | Ramping | Drilling | Chamfer | Slot w/ Radius | Bright | TiN | TiCN | TiAlN |
| | | | | | | | | | **HMDC-2 | 262 | | Miniature End Mill | 2 | • | | | • | • | • | | | | • | • | • |
| **HMDC-4 | 263 | | Miniature End Mill | 4 | • | | | • | • | • | | | | | | | • | | | | | • | • | • | |
| **HDC-2 | 264 | | Finisher | 2 | • | | | • | • | • | | | | | | | • | | | | | • | • | • | |
| **HDC-4C | 265 | | Finisher | 4 | • | | | • | • | • | | | | | | | • | | | | | • | • | • | |
| **HGC-2 | 266 | | Finisher | 2 | • | | | • | • | • | | | | | • | • | • | • | | | | • | • | • | |
| **HGC-2B | 268 | | Finisher | 2 | | • | | • | • | • | | | | | • | • | • | • | | | | • | • | • | |
| **HGC-4C | 269 | | Finisher | M | • | | | • | • | • | | | | | | | • | | | | | • | • | • | |
| **HGC-4B | 271 | | Finisher | M | | • | | • | • | • | | | | | | | • | | | | | • | • | • | |
| **RG6 | 272 | | Rougher Fine Pitch | M | • | | | • | • | • | | | | | | | • | | | | | • | • | • | |
| **RG8 | 273 | | Rougher Coarse Pitch | M | | • | | • | • | • | | | | | | | • | | | | | • | • | • | |
| **RG9 | 275 | | Rougher - Extra Coarse Pitch | 3 | | • | | • | • | • | | | | | | | • | | | | | • | • | • | |

M = Multi Flute

Product Index

****Items are being OBSOLETEd, only available until inventory is depleted.**

Powdered Metal

| Style | Page | Image | Type | No. of Flutes | End Work | | | | Application | | | | | Machining | | | | | Surface Treatment | | | | |
|-----------|---------------------|-------|----------------------------------|---------------|----------|------|---------|--------|-------------|-----------|-----------|-------------|-----------------|----------------|------|---------|----------|---------|-------------------|---------|----------------|--------|-----|
| | | | | | Square | Ball | Chamfer | Radius | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Slot | Profile | Plunging | Ramping | Drilling | Chamfer | Slot w/ Radius | Bright | TiN |
| **PM-4DE | 276 | | Finisher | 4 | • | | | | • | • | • | • | • | | | | | | | • | • | • | |
| **PM-2 | 277 | | Finisher | 2 | • | | | | • | • | • | • | • | | | | | | | • | • | • | |
| **PM-3 | 278 | | Finisher | 3 | • | | | | • | • | • | • | • | | | | | | | • | • | • | |
| **PM-4 | 279 | | Finisher | M | • | | | | • | • | • | • | • | | | | | | | • | • | • | |
| **PM-4B | 281 | | Finisher | 4 | | • | | | • | • | • | • | • | | | | | | | • | • | • | |
| **PM-539R | 282 | | Finisher High Helix | 3 | • | | • | | • | • | • | • | • | | | | | | • | • | • | | |
| **PM-539L | 283 | | Finisher - Left - High Helix/Cut | 3 | • | | | | • | • | • | • | • | | | | | | | • | • | • | |
| **PMRC-C | 284 | | Rougher Coarse Profile | M | • | | | | • | • | • | • | • | | | | | | | • | • | • | |
| **PMRF-C | 285 | | Rougher Fine Profile | M | • | | | | • | • | • | • | • | | | | | | | • | • | • | • |
| **PM-538R | 286 | | Rougher Coarse Profile | 3 | • | | | • | • | • | • | • | • | | | | | | | • | • | • | |
| **PM-538L | 287 | | Rougher - Left Low Helix/Cut | 3 | • | | | • | • | • | • | • | • | | | | | | | • | • | • | |

M = Multi Flute

Carbide

Tolerances for Solid Carbide End Mills
Cutting Diameter: 1/32" through 1": +0.000 - 0.002
Shank Diameter: h6

| Style | Page | Image | Type | No. of Flutes | End Work | | | | Application | | | | | Machining | | | | | Surface Treatment | | | | |
|-------------|---------------------|-------|---------------------------------|---------------|----------|------|---------|--------|-------------|-----------|-----------|-------------|-----------------|----------------|------|---------|----------|---------|-------------------|---------|----------------|--------|------|
| | | | | | Square | Ball | Chamfer | Radius | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Slot | Profile | Plunging | Ramping | Drilling | Chamfer | Slot w/ Radius | Bright | TiCN |
| CEM-V-4R | 288 | | Variable Index Ferrous Material | 4 | • | | | | • | • | • | • | • | | | | | | | • | • | • | • |
| CEM-V-4B | 291 | | Variable Index Ferrous Material | 4 | | • | | | • | • | • | • | • | | | | | | | • | • | • | • |
| CEM-V2-5R | 292 | | Variable Index Ferrous Material | 5 | • | | | | • | • | • | • | • | | | | | | | • | • | • | • |
| CEM-V3-7R | 294 | | Steel Material | 7 | • | | | | • | • | • | • | • | | | | | | | • | • | • | • |
| CEM-V3-7RCB | 296 | | Steel Material | 7 | • | | | | • | • | • | • | • | | | | | | | • | • | • | • |
| CEM-HPDE-5 | 297 | | Steel Material | 5 | • | | | | • | • | • | • | • | | | | | | | • | • | • | • |
| CEM-EMS-3 | 298 | | Steel Material | 3 | • | | | | • | • | • | • | • | | | | | | | • | • | • | • |
| CEM-EMS-5 | 299 | | Steel Material | 5 | • | | | | • | • | • | • | • | | | | | | | • | • | • | • |







****Items are being OBSOLETE, only available until inventory is depleted.**

| Carbide (continued) | | | | End Work | | | | Application | | | | | Machining | | | | | Surface Treatment | | | | | | | | |
|---------------------|---------------------|--|-------------------|---------------|--------|------|---------|-------------|-------|-----------|-----------|-------------|-----------------|----------------|------|---------|----------|-------------------|----------|---------|----------------|--------|------|-------|-------|-----|
| Style | Page | | Type | No. of Flutes | Square | Ball | Chamfer | Radius | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Slot | Profile | Plunging | Ramping | Drilling | Chamfer | Slot w/ Radius | Bright | TiCN | TiAlN | AlCrN | ZrN |
| CEM-AM2 | 300 | | Aluminum Material | 2 | • | | | | • | | | • | | | • | | • | • | • | | | • | | | | • |
| CEM-AM3 | 301 | | Aluminum Material | 3 | • | | | | | | | • | | | • | | • | • | • | | | • | | | | • |
| CEM-RS | 303 | | Rougher | 4 | • | | | | • | • | | | | • | | | • | | | | | • | | • | | |
| CEM-RA | 304 | | Rougher | 3 | • | | | | • | | | • | | | • | | • | • | | | | • | | • | | |
| CEM-DE2 | 305 | | General Purpose | 2 | • | | | | • | • | • | | | | • | | • | • | | | | • | | • | | |
| CEM-DE2B | 306 | | General Purpose | 2 | | • | | | • | • | • | | | | • | | • | • | | | | • | | • | | |
| CEM-DE4 | 307 | | General Purpose | 4 | • | | | | • | • | • | | | | • | | • | | | | | • | | • | | |
| CEM-DE4B | 308 | | General Purpose | 4 | | • | | | • | • | • | | | | • | | • | | | | | • | | • | | |
| CMCE-2 CMCE-2AL | 309 | | Miniature | 2 | • | | | | • | • | • | • | • | • | • | • | • | • | | | | • | | • | | • |
| CEM-SE2 | 311 | | General Purpose | 2 | • | | | • | • | • | • | • | | | • | | • | • | • | | | • | | • | | |
| CEM-SE2B | 313 | | General Purpose | 2 | | • | | | • | • | • | • | | | • | | • | • | | | | • | | • | | |
| CEM-SE3 | 315 | | General Purpose | 3 | • | | | • | • | • | • | • | | | • | | • | • | | | | • | | • | | |
| CMCE-4 CMCE-4AL | 316 | | Miniature | 4 | • | | | | • | • | • | • | • | • | • | • | • | • | | | | • | | • | | • |
| CEM-SE4 | 318 | | General Purpose | 4 | • | | | • | • | • | • | • | | | • | | • | | | | | • | | • | | |
| CEM-SE4B | 321 | | General Purpose | 4 | | • | | | • | • | • | • | | | • | | • | | | | | • | | • | | |
| CEM-SEST2 | 323 | | Straight Flute | 2 | | | | | • | • | • | • | | | • | | • | | • | | | • | | • | | |
| CEM-EG2 | 323 | | Engraving Tool | 2 | | • | | | • | | • | • | | | • | | | | | | | • | | • | | |
| CEM-CH2 | 324 | | Chamfer Tool | 2 | | | • | | • | | • | | | | | | | | | | | • | | • | | |
| CEM-CH2D | 324 | | Chamfer Tool | 2 | | | • | | • | | • | | | | | | | | | | | • | | • | | |
| CEM-CH4 | 325 | | Chamfer Tool | 4 | | | • | | • | | • | | | | | | | | | | | • | | • | | |
| CEM-CH4D | 325 | | Chamfer Tool | 4 | | | • | | • | | • | | | | | | | | | | | • | | • | | |

M = Multi Flute

****Items are being OBSOLETEd, only available until inventory is depleted.**

Other Tools

| Other Tools | | | | Tool Material | | | | Application | | | | | | | |
|-------------|------|-------------------------|---|-------------------|-----|--------|---------|-------------|-------|-----------|-----------|-------------|-----------------|----------------|--|
| Style | Page | | Type | Set | HSS | Cobalt | Carbide | TCT | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | |
| 192 | 347 | Screw Extractor |  | Ezy-Out® | yes | • | | | • | | • | | | | |
| 850 | 348 | Tool Bits |  | Square | | • | | | • | | • | | | | |
| 855 | | | | Square | | • | | | • | | • | | | | |
| 860 | | | | Square | | • | | | | • | | • | | | |
| **3507 | | | | Square | | • | | | | | • | | • | | |
| 851 | 349 | Tool Bits |  | Rectangular | | • | | | • | | • | | | | |
| 856 | | | | Rectangular | | • | | | | • | | • | | | |
| 861 | | | | Rectangular | | • | | | | | • | | • | | |
| **3517 | | | | Rectangular | | • | | | | | • | | • | | |
| 902 | 350 | Blanks |  | Oversize | | • | | | • | | • | | • | | |
| 903 | | | | Undersize | | • | | | | • | | • | | • | |
| 321 | 351 | Milling Cutter and Saws |  | Woodruff Key Seat | | • | | | • | | • | | • | | |
| 326 | 352 | | | Plain Metal | | • | | | | • | | • | | • | |
| | 353 | Metal Cases |  | Empty | | | | | | | | | | | |



The name you've trusted since 1874 for quality cutting tools.

Cleveland is a superior cutting tooling brand providing solutions to industry for over 140 years. During their long history, they've earned a reputation for the highest quality tools, outstanding customer service, and expert engineering technical advice.

Whatever your tooling need, whether you're drilling, threading, or milling, contact your Greenfield distributor for the ultimate in product and support solutions.



The  Cleveland tradition continues today at Greenfield Industries.



Seneca, South Carolina manufacturing facility and U.S. headquarters.



Greenfield Industries' U.S. facility includes over 233,000 square feet for sales, engineering, manufacturing, and recycling. Our Cleveland brand is manufactured and shipped from Seneca, SC globally.



We have a unique ability to successfully custom-design products to meet our customers' needs. Our customer service, sales, and engineering staff is always ready to assist with your tooling requirements.

The uncompromising commitment to quality, along with the hard work of our employees, Cleveland products continue to be a trusted name for over 140 years.

Quality product by quality people.

Knowledgeable and informed sales and engineering staff.

State-of-the-art machinery.

Manufactured in the U.S.A.

Our exclusive raw material developed for our manufacturing allows Greenfield to lead the industry in unparalleled drills, end mills, taps, dies, and other specialty manufactured tools.





A History of Excellence



1874

Cleveland Twist Drill established in Cleveland, Ohio.

1912

Greenfield founded.



1995

Greenfield Industries purchases Cleveland Twist Drill.

2009

Greenfield Industries is acquired by TDC.

2014

TDC establishes Greenfield US and Canadian headquarters moving headquarters to Seneca, S.C., USA.

2024

WALTER Surface Technology acquired Greenfield U.S.A., Canada, & Mexico headquarters



CLEVELAND

The Cleveland® brand is well-known throughout the world for its wide selection of premium cutting tools for drilling, countersinking, reaming, threading, and milling operations. Its roots go back to the 1870's, when Cleveland Twist Drill was established as a premier cutting tool company in the United States. Cleveland has always been famous for the quality and reliability of its tools, and the company grew to be one of the largest high-speed steel toolmakers in the US, expanding to overseas markets.

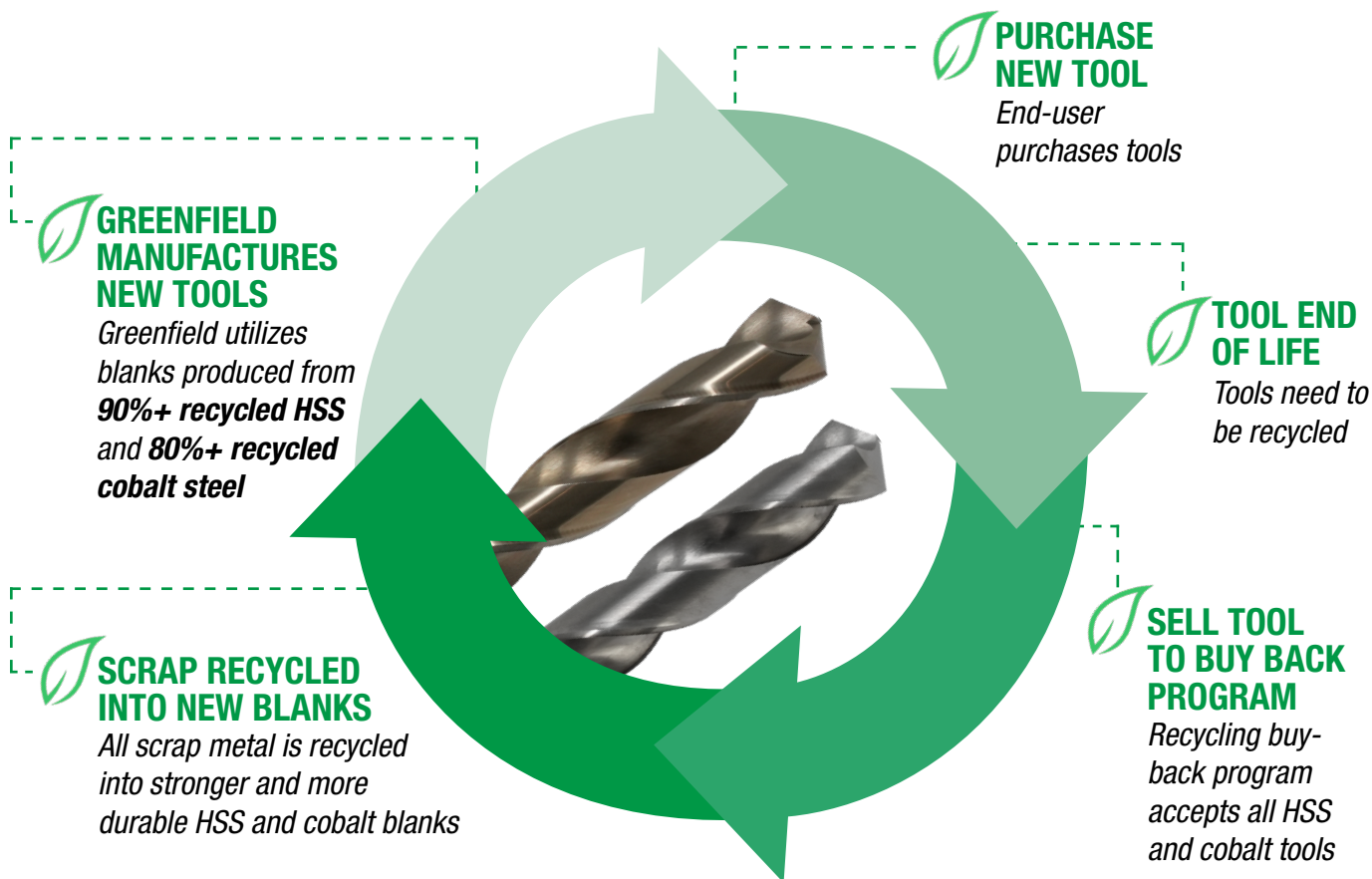
In 1995, Cleveland Twist Drill was acquired by Greenfield Industries Inc. (GFII), a U.S. based manufacturer of precision cutting tools.



Benefits of drills made with recycled materials

RECYCLED HSS and Cobalt material is SUPERIOR to virgin material, as the more the product has been processed, the more HOMOGENOUS the material becomes, which helps prevent voids in the material with REDUCED CRACKING and BREAKING.

CIRCULAR JOURNEY OF OUR DRILL BITS



Stronger, longer lasting tools

Keeps metal out of landfills

Reduces new raw material extraction from the earth

Conserves energy

Reduces pollution

Recuperate costs by selling used materials to buy-back program



Call: (706) 305-7371

dparadis@greentech-smr.com

GreenTech was founded in 2012. They supply large volume, special recycled metals that can be further processed by global operations. GreenTech buys non-ferrous material that is industry specific from end-users, scrap and metal recyclers (including brokers), and local consumers.

Whether an industrial facility, manufacturing plant or a local shop, your business will realize the following benefits; raw material/ore preservation, energy conservation and cost stabilization. Contact us for a quote on your material or for a **free** evaluation.



Page 2



Page 158



Page 228

Page 346

Holemaking



Drills, Reamers, Counterbores

Threading



Thread Mills, Taps

Milling



End Mills

Other Tools



Screw Extractors, Saws, etc.

Our Cleveland brand is manufactured in high speed steel, cobalt, and carbide, as well as other materials, allowing us to provide quality products for a wide range of industries with our variety of tools.



Medical



Aerospace



Energy



Automotive

Metal Cutting Safety

(read this before using Cleveland® products)

Modern metal cutting operations involve high energy, high spindle or cutter speeds, and high temperatures and cutting forces. Hot, flying chips may be projected from the workpiece during metal-cutting. Although advanced cutting tool materials are designed and manufactured to withstand the high cutting forces and temperatures that normally occur in these operations, they are susceptible to fragmenting in service, particularly if they are subjected to over-stress, severe impact or otherwise abused. Therefore, precautions should be taken to adequately protect workers, observers and equipment against hot, flying chips, fragmented cutting tools, broken work pieces or other similar projectiles. Machines should be fully guarded and personal protective equipment should be used at all times.

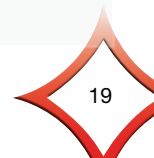
When grinding advanced cutting tool materials, a suitable means for collection and disposal of dust, mist or sludge should be provided. Overexposure to dust or mist containing metallic particles can be hazardous to health particularly if exposure continues over an extended period of time and may cause eye, skin and mucous membrane irritation and temporary or permanent respiratory disease. Certain existing pulmonary and skin conditions may be aggravated by exposure to dust or mist. Adequate ventilation, respiratory protection and eye protection should be provided when grinding and workers should avoid breathing of and prolonged skin contact with dust or mist.

General Industry Safety and Health Regulations, Part 1910, U.S. Department of Labor, published in Title 29 of the Code of Federal Regulations should be consulted. Obtain from Cleveland® and read the applicable Material Safety Data Sheet before grinding.

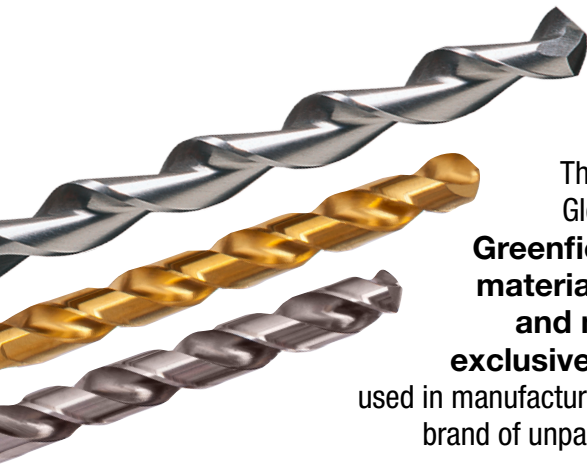
Cutting tools are only one part of the worker-machine-tool system. Many variables exist in machining operations, including the metal removal rate; the workpiece size, shape, strength and rigidity; the chucking and fixturing; the load carrying capability of centers; the cutter and spindle speed and torque limitations; the holder and boring bar overhang; the available power; and the condition of the tooling and the machine. A safe metal cutting operation must take all of these variables, and others, into consideration.

Cleveland® has no control over the end use of its products or the environment into which those products are placed. Cleveland® urges that its customers adhere to the recommended standards of use of their metal cutting operations. The information included throughout this catalog under the heading "Technical Data" and other recommendations on machining practices referred to herein are only advisory in nature and do not constitute representations or warranties and are not necessarily appropriate for any particular work environment or application.

WARNING: This product contains Cobalt and/or Nickel and/or Lead a chemical known to the state of California to cause cancer or birth defects or other reproductive harm. For more information: www.P65Warnings.ca.gov



Cleveland offers an extensive array of holemaking tools. The Cleveland brand is known for performance tools that run faster, longer, and with more precision than competitive tools. This Holemaking section includes: screw machine length, stub length, jobber length, taper length, AC extension, extra length, taper shank, as well as miscellaneous drills, reamers, and counterbores. We have a large selection of surface treatments, and industry specific application products.



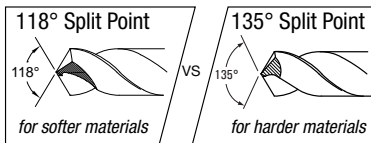
Through GreenTech Global Recycling all **Greenfield Industries materials are refined and made into the exclusive raw material** used in manufacturing the Cleveland brand of unparalleled products.

TECH TIP

Split Point versus Traditional Point

The right drill bit can help you work smarter & faster, and even save you money — if you know which features to look for.

If you're drilling by hand, choose a drill with a split point: it drills on contact.



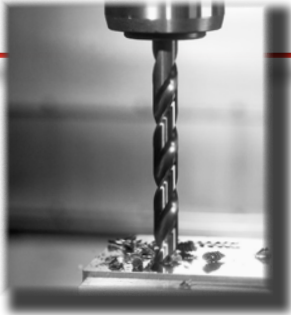
You'll get a faster start and there's no walking. And you're less likely to need a center punch to get started, thanks to the split point's four cutting edges. Those extra edges cause the split point to drill rounder holes faster,

while generating less heat with less force. That means you're working faster and getting more holes per charge with your cordless drill. The split point tool is versatile: it also performs well in presses, CNC machines, and more.

The heavy duty construction of split point drill bits make them a great choice when you work with hard materials like cast iron, stainless steel and alloy steels. Split point bits are available from Greenfield Industries in cobalt and High Speed steel.

You can expect a longer life from Greenfield Industries' heavy duty split point drill, with fewer broken bits.

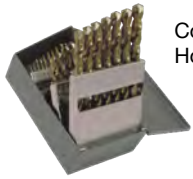




Holemaking Product Index 2

- Screw Machine Length Drills
- Stub Length Drills
- Jobber Length Drills
- Taper Length Drills
- AC Extension Drills
- Extra Length Drills
- Taper Shank Drills
- Miscellaneous Drills
- Reamers
- Counterbores

Cost Saving Sets



Complete list of Holemaking Sets **130**

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TECH TIPS

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- Benefits of 2133 Cobalt Screw Machine Drill **30**
- Bright vs. Surface Treated Tools **43**
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- Clearance or Taper Router **127**

Surface Treatment



Additional treatments available upon request.



General Purpose

Style: 2120

Screw Machine Length

High Speed Steel

Note

* 1-1/16" through 1-1/4" drills have 1" diameter reduced shank.

Operating parameters: See Technical section

ASME
B94.11M

HSS

118°

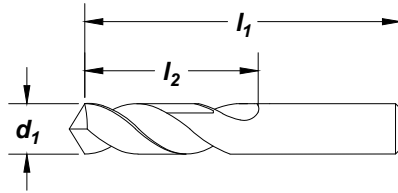
Helix
Regular
21° to 34°

Straight
Shank

*
Reduced
Shank

Surface
Treatment

Bright



Feature:

Short length design for improved accuracy and rigidity.

| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | order no. 2120 |
|--|-------------------|--|--|-----------------------------|
| 60 | .0400 | 1.375 | .500 | C04356 |
| 59 | .0410 | 1.375 | .500 | C04357 |
| 58 | .0420 | 1.375 | .500 | C04359 |
| 57 | .0430 | 1.375 | .500 | C04360 |
| 56 | .0465 | 1.375 | .500 | C04363 |
| 3/64 | .0469 | 1.375 | .500 | C04364 |
| 55 | .0520 | 1.625 | .625 | C04368 |
| 54 | .0550 | 1.625 | .625 | C04370 |
| 53 | .0595 | 1.625 | .625 | C04374 |
| 1/16 | .0625 | 1.625 | .625 | C04376 |
| 52 | .0635 | 1.688 | .688 | C04378 |
| 51 | .0670 | 1.688 | .688 | C04381 |
| 50 | .0700 | 1.688 | .688 | C04383 |
| 49 | .0730 | 1.688 | .688 | C04386 |
| 48 | .0760 | 1.688 | .688 | C04388 |
| 5/64 | .0781 | 1.688 | .688 | C04390 |
| 47 | .0785 | 1.750 | .750 | C04391 |
| 46 | .0810 | 1.750 | .750 | C04394 |
| 45 | .0820 | 1.750 | .750 | C04395 |
| 44 | .0860 | 1.750 | .750 | C04398 |
| 43 | .0890 | 1.750 | .750 | C04401 |
| 42 | .0935 | 1.750 | .750 | C04404 |
| 3/32 | .0938 | 1.750 | .750 | C04405 |
| 41 | .0960 | 1.813 | .813 | C04407 |
| 40 | .0980 | 1.813 | .813 | C04409 |
| 39 | .0995 | 1.813 | .813 | C04411 |
| 38 | .1015 | 1.813 | .813 | C04412 |
| 37 | .1040 | 1.813 | .813 | C04414 |
| 36 | .1065 | 1.813 | .813 | C04416 |
| 7/64 | .1094 | 1.813 | .813 | C04418 |
| 35 | .1100 | 1.875 | .875 | C04419 |
| 34 | .1110 | 1.875 | .875 | C04421 |
| 33 | .1130 | 1.875 | .875 | C04422 |
| 32 | .1160 | 1.875 | .875 | C04424 |
| 31 | .1200 | 1.875 | .875 | C04426 |
| 1/8 | .1250 | 1.875 | .875 | C04428 |
| 30 | .1285 | 1.938 | .938 | C04431 |
| 29 | .1360 | 1.938 | .938 | C04434 |
| 28 | .1405 | 1.938 | .938 | C04436 |
| 9/64 | .1406 | 1.938 | .938 | C04437 |

| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | order no. 2120 |
|--|-------------------|--|--|-----------------------------|
| 27 | .1440 | 2.063 | 1.000 | C04439 |
| 26 | .1470 | 2.063 | 1.000 | C04441 |
| 25 | .1495 | 2.063 | 1.000 | C04443 |
| 24 | .1520 | 2.063 | 1.000 | C04445 |
| 23 | .1540 | 2.063 | 1.000 | C04447 |
| 5/32 | .1562 | 2.063 | 1.000 | C04448 |
| 22 | .1570 | 2.125 | 1.063 | C04449 |
| 21 | .1590 | 2.125 | 1.063 | C04451 |
| 20 | .1610 | 2.125 | 1.063 | C04452 |
| 19 | .1660 | 2.125 | 1.063 | C04455 |
| 18 | .1695 | 2.125 | 1.063 | C04458 |
| 11/64 | .1719 | 2.125 | 1.063 | C04459 |
| 17 | .1730 | 2.188 | 1.125 | C04460 |
| 16 | .1770 | 2.188 | 1.125 | C04462 |
| 15 | .1800 | 2.188 | 1.125 | C04464 |
| 14 | .1820 | 2.188 | 1.125 | C04466 |
| 13 | .1850 | 2.188 | 1.125 | C04467 |
| 3/16 | .1875 | 2.188 | 1.125 | C04470 |
| 12 | .1890 | 2.250 | 1.188 | C04471 |
| 11 | .1910 | 2.250 | 1.188 | C04473 |
| 10 | .1935 | 2.250 | 1.188 | C04475 |
| 9 | .1960 | 2.250 | 1.188 | C04476 |
| 8 | .1990 | 2.250 | 1.188 | C04478 |
| 7 | .2010 | 2.250 | 1.188 | C04480 |
| 13/64 | .2031 | 2.250 | 1.188 | C04481 |
| 6 | .2040 | 2.375 | 1.250 | C04482 |
| 5 | .2055 | 2.375 | 1.250 | C04484 |
| 4 | .2090 | 2.375 | 1.250 | C04487 |
| 3 | .2130 | 2.375 | 1.250 | C04489 |
| 7/32 | .2188 | 2.375 | 1.250 | C04491 |
| 2 | .2210 | 2.438 | 1.313 | C04493 |
| 1 | .2280 | 2.438 | 1.313 | C04496 |
| A | .2340 | 2.438 | 1.313 | C04499 |
| 15/64 | .2344 | 2.438 | 1.313 | C04500 |
| B | .2380 | 2.500 | 1.375 | C04502 |
| C | .2420 | 2.500 | 1.375 | C04504 |
| D | .2460 | 2.500 | 1.375 | C04506 |
| 1/4 | .2500 | 2.500 | 1.375 | C04509 |
| F | .2570 | 2.625 | 1.438 | C04513 |
| G | .2610 | 2.625 | 1.438 | C04515 |

continued on next page



Style: 2120 (continued)

General Purpose

| drill diameter d ₁ fraction wire/let | decimal equiv. | overall length l ₁ (in) | flute length l ₂ (in) | order no. 2120 |
|---|-------------------|--|--|-----------------------------|
| 17/64 | .2656 | 2.625 | 1.438 | C04517 |
| H | .2660 | 2.688 | 1.500 | C04519 |
| I | .2720 | 2.688 | 1.500 | C04522 |
| J | .2770 | 2.688 | 1.500 | C04524 |
| K | .2810 | 2.688 | 1.500 | C04526 |
| 9/32 | .2812 | 2.688 | 1.500 | C04531 |
| L | .2900 | 2.750 | 1.563 | C04530 |
| M | .2950 | 2.750 | 1.563 | C04533 |
| 19/64 | .2969 | 2.750 | 1.563 | C04535 |
| N | .3020 | 2.813 | 1.625 | C04537 |
| 5/16 | .3125 | 2.813 | 1.625 | C04542 |
| O | .3160 | 2.938 | 1.688 | C04544 |
| P | .3230 | 2.938 | 1.688 | C04547 |
| 21/64 | .3281 | 2.938 | 1.688 | C04550 |
| Q | .3320 | 3.000 | 1.688 | C04552 |
| R | .3390 | 3.000 | 1.688 | C04555 |
| 11/32 | .3438 | 3.000 | 1.688 | C04557 |
| S | .3480 | 3.063 | 1.750 | C04560 |
| T | .3580 | 3.063 | 1.750 | C04563 |
| 23/64 | .3594 | 3.063 | 1.750 | C04565 |
| U | .3680 | 3.125 | 1.813 | C04569 |
| 3/8 | .3750 | 3.125 | 1.813 | C04572 |
| V | .3770 | 3.250 | 1.875 | C04573 |
| W | .3860 | 3.250 | 1.875 | C04578 |
| 25/64 | .3906 | 3.250 | 1.875 | C04580 |
| X | .3970 | 3.313 | 1.938 | C04582 |
| Y | .4040 | 3.313 | 1.938 | C04584 |
| 13/32 | .4062 | 3.313 | 1.938 | C04585 |
| Z | .4130 | 3.375 | 2.000 | C04586 |
| 27/64 | .4219 | 3.375 | 2.000 | C04588 |
| 7/16 | .4375 | 3.438 | 2.063 | C04591 |
| 29/64 | .4531 | 3.563 | 2.125 | C04594 |
| 15/32 | .4688 | 3.625 | 2.125 | C04596 |
| 31/64 | .4844 | 3.688 | 2.188 | C04599 |
| 1/2 | .5000 | 3.750 | 2.250 | C04601 |
| 33/64 | .5156 | 3.875 | 2.375 | C04604 |

| drill diameter d ₁ fraction wire/let | decimal equiv. | overall length l ₁ (in) | flute length l ₂ (in) | order no. 2120 |
|---|-------------------|--|--|-----------------------------|
| 17/32 | .5312 | 3.875 | 2.375 | C04606 |
| 35/64 | .5469 | 4.000 | 2.500 | C04609 |
| 9/16 | .5625 | 4.000 | 2.500 | C04612 |
| 37/64 | .5781 | 4.125 | 2.625 | C04614 |
| 19/32 | .5938 | 4.125 | 2.625 | C04617 |
| 39/64 | .6094 | 4.250 | 2.750 | C04619 |
| 5/8 | .6250 | 4.250 | 2.750 | C04622 |
| 41/64 | .6406 | 4.500 | 2.875 | C04625 |
| 21/32 | .6562 | 4.500 | 2.875 | C04627 |
| 43/64 | .6719 | 4.625 | 2.875 | C04630 |
| 11/16 | .6875 | 4.625 | 2.875 | C04632 |
| 45/64 | .7031 | 4.750 | 3.000 | C04634 |
| 23/32 | .7188 | 4.750 | 3.000 | C04636 |
| 47/64 | .7344 | 5.000 | 3.125 | C04638 |
| 3/4 | .7500 | 5.000 | 3.125 | C04640 |
| 49/64 | .7656 | 5.125 | 3.250 | C04641 |
| 25/32 | .7812 | 5.125 | 3.250 | C04643 |
| 51/64 | .7969 | 5.250 | 3.375 | C04645 |
| 13/16 | .8125 | 5.250 | 3.375 | C04647 |
| 53/64 | .8281 | 5.375 | 3.500 | C04649 |
| 27/32 | .8438 | 5.375 | 3.500 | C04650 |
| 55/64 | .8594 | 5.500 | 3.500 | C04652 |
| 7/8 | .8750 | 5.500 | 3.500 | C04654 |
| 57/64 | .8906 | 5.625 | 3.625 | C04656 |
| 29/32 | .9062 | 5.625 | 3.625 | C04658 |
| 59/64 | .9219 | 5.750 | 3.750 | C04659 |
| 15/16 | .9375 | 5.750 | 3.750 | C04661 |
| 61/64 | .9531 | 5.875 | 3.875 | C04663 |
| 31/32 | .9688 | 5.875 | 3.875 | C04665 |
| 63/64 | .9844 | 6.000 | 4.000 | C04667 |
| 1 | 1.0000 | 6.000 | 4.000 | C04668 |
| 1-1/16* | 1.0625 | 6.250 | 4.000 | C04675 |
| 1-1/8* | 1.1250 | 6.375 | 4.000 | C04683 |
| 1-3/16* | 1.1875 | 6.625 | 4.250 | C04690 |
| 1-1/4* | 1.2500 | 6.750 | 4.375 | C04697 |

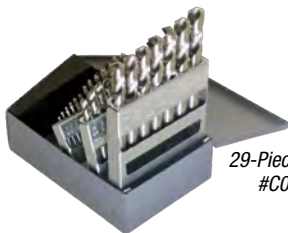
* 1-1/16" through 1-1/4" drills have 1" shank.

Screw Machine Length
High Speed Steel

SET

Style: 2120

General Purpose



29-Piece Set
#C00980

| no. of pieces | surface treatment | size range | order number 2120 |
|------------------|----------------------|----------------------------|-----------------------------|
| 29 | Bright | 1/16" through 1/2" x 1/64" | C00980 |
| 26 | Bright | letter A through Z | C01332 |

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | | | | >45 |
| Bright | | | | | | | | | | | |

= Best Performance = Acceptable



Wide Land Parabolic Q-Cobalt™

Styles: **2175, 2175-TN, 2175-TC, 2175-TA**

Note
Operating parameters: See Technical section

ASME
B94.11M

M42
Cobalt

135° Split

Helix
High
35° to 45°

Straight
Shank

Surface
Treatment

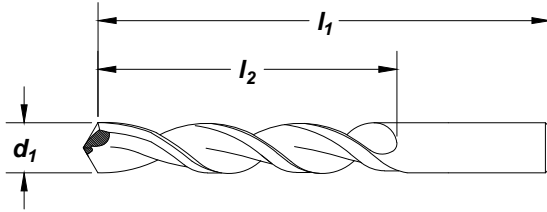
Straw
Oxide

TiN

TiCN

TiAlN

****Items are being OBSOLETED, only available until inventory is depleted.**



Feature:

Effective deep hole drilling in a wide array of materials. Available coating for extended tool life and productivity. Shorter design for accuracy and rigidity.

Screw Machine Length

Cobalt

| drill diameter | | decimal equivalent | overall length l ₁ (in) | flute length l ₂ (in) | order number | | | |
|----------------|-------------|--------------------|---------------------------------------|-------------------------------------|---------------------|----------------|-----------------|------------------|
| fraction | wire/letter | | | | 2175 straw oxide | 2175-TN TiN | 2175-TC TiCN | 2175-TA TiAlN |
| 1/16 | | .0625 | 1.625 | .625 | C14200 | C14321 | C15250 | C15050 |
| | 52 | .0635 | 1.688 | .688 | **C14318 | C14439 | - | - |
| | 51 | .0670 | 1.688 | .688 | **C14317 | **C14438 | - | - |
| | 50 | .0700 | 1.688 | .688 | **C14316 | **C14437 | - | - |
| | 49 | .0730 | 1.688 | .688 | **C14315 | **C14436 | - | - |
| 5/64 | 48 | .0760 | 1.688 | .688 | **C14314 | C14435 | - | - |
| | | .0781 | 1.688 | .688 | C14201 | C14322 | C15251 | C15051 |
| | 47 | .0785 | 1.750 | .750 | **C14313 | C14434 | - | - |
| | 46 | .0810 | 1.750 | .750 | **C14312 | **C14433 | - | - |
| | 45 | .0820 | 1.750 | .750 | **C14311 | C14432 | - | - |
| 3/32 | 44 | .0860 | 1.750 | .750 | **C14310 | C14431 | - | - |
| | 43 | .0890 | 1.750 | .750 | **C14309 | C14430 | - | - |
| | 42 | .0935 | 1.750 | .750 | **C14308 | C14429 | - | - |
| | | .0938 | 1.750 | .750 | C14202 | C14323 | C15252 | C15052 |
| | 41 | .0960 | 1.813 | .813 | **C14307 | **C14428 | - | - |
| 7/64 | 40 | .0980 | 1.813 | .813 | C14280 | C14402 | C15330 | C15130 |
| | 39 | .0995 | 1.813 | .813 | C14279 | C14401 | C15329 | C15129 |
| | 38 | .1015 | 1.813 | .813 | C14278 | C14400 | C15328 | C15128 |
| | 37 | .1040 | 1.813 | .813 | C14277 | C14399 | C15327 | C15127 |
| | 36 | .1065 | 1.813 | .813 | C14276 | C14398 | C15326 | C15126 |
| 1/8 | | .1094 | 1.813 | .813 | C14203 | C14324 | C15253 | C15053 |
| | 35 | .1100 | 1.875 | .875 | C14275 | C14397 | C15325 | C15125 |
| | 34 | .1110 | 1.875 | .875 | C14274 | C14396 | C15324 | C15124 |
| | 33 | .1130 | 1.875 | .875 | C14273 | C14395 | C15323 | C15123 |
| | 32 | .1160 | 1.875 | .875 | C14272 | C14393 | C15322 | C15122 |
| 9/64 | 31 | .1200 | 1.875 | .875 | C14271 | C14392 | C15321 | C15121 |
| | | .1250 | 1.875 | .875 | C14204 | C14325 | C15254 | C15054 |
| | 30 | .1285 | 1.938 | .938 | C14270 | C14391 | C15320 | C15120 |
| | 29 | .1360 | 1.938 | .938 | C14269 | C14390 | C15319 | C15119 |
| | 28 | .1405 | 1.938 | .938 | C14268 | C14389 | C15318 | C15118 |
| 5/32 | | .1406 | 1.938 | .938 | C14205 | C14326 | C15255 | C15055 |
| | 27 | .1440 | 2.063 | 1.000 | C14267 | C14388 | C15317 | C15117 |
| | 26 | .1470 | 2.063 | 1.000 | C14266 | C14387 | C15316 | C15116 |
| | 25 | .1495 | 2.063 | 1.000 | C14265 | C14386 | C15315 | C15115 |
| | 24 | .1520 | 2.063 | 1.000 | C14264 | C14385 | C15314 | C15114 |
| 11/64 | 23 | .1540 | 2.063 | 1.000 | C14263 | C14384 | C15313 | C15113 |
| | | .1562 | 2.063 | 1.000 | C14206 | C14327 | C15256 | C15056 |
| | 22 | .1570 | 2.125 | 1.063 | C14262 | C14383 | C15312 | C15112 |
| | 21 | .1590 | 2.125 | 1.063 | C14261 | C14382 | C15311 | C15111 |
| | 20 | .1610 | 2.125 | 1.063 | C14260 | C14381 | C15310 | C15110 |
| 11/64 | 19 | .1660 | 2.125 | 1.063 | C14259 | C14380 | C15309 | C15109 |
| | 18 | .1695 | 2.125 | 1.063 | C14258 | C14379 | C15308 | C15108 |
| | | .1719 | 2.125 | 1.063 | C14207 | C14328 | C15257 | C15057 |

continued on next page



Styles: **2175, 2175-TN, 2175-TC, 2175-TA** (cont'd)

****Items are being OBSOLETEd, only available until inventory is depleted.**

| drill diameter | | decimal equivalent | overall length l ₁ (in) | flute length l ₂ (in) | order number | | | |
|----------------|-------------------------------|--------------------|---------------------------------------|-------------------------------------|---------------------|----------------|-----------------|------------------|
| fraction | d ₁ wire/letter | | | | 2175 straw oxide | 2175-TN TiN | 2175-TC TiCN | 2175-TA TiAlN |
| | 17 | .1730 | 2.188 | 1.125 | C14257 | C14378 | C15307 | C15107 |
| | 16 | .1770 | 2.188 | 1.125 | C14256 | C14377 | C15306 | C15106 |
| | 15 | .1800 | 2.188 | 1.125 | C14255 | C14376 | C15305 | C15105 |
| | 14 | .1820 | 2.188 | 1.125 | C14254 | C14375 | C15304 | C15104 |
| 3/16 | 13 | .1850 | 2.188 | 1.125 | C14253 | C14374 | C15303 | C15103 |
| | | .1875 | 2.188 | 1.125 | C14208 | C14329 | C15258 | C15058 |
| | 12 | .1890 | 2.250 | 1.188 | C14252 | C14373 | C15302 | C15102 |
| | 11 | .1910 | 2.250 | 1.188 | C14251 | C14372 | C15301 | C15101 |
| | 10 | .1935 | 2.250 | 1.188 | C14250 | C14371 | C15300 | C15100 |
| | 9 | .1960 | 2.250 | 1.188 | C14249 | C14370 | C15299 | C15099 |
| | 8 | .1990 | 2.250 | 1.188 | C14248 | C14369 | C15298 | C15098 |
| 13/64 | 7 | .2010 | 2.250 | 1.188 | C14247 | C14368 | C15297 | C15097 |
| | | .2031 | 2.250 | 1.188 | C14209 | C14330 | C15259 | C15059 |
| | 6 | .2040 | 2.375 | 1.250 | C14246 | C14367 | C15296 | C15096 |
| | 5 | .2055 | 2.375 | 1.250 | C14245 | C14366 | C15295 | C15095 |
| | 4 | .2090 | 2.375 | 1.250 | C14244 | C14365 | C15294 | C15094 |
| 7/32 | 3 | .2130 | 2.375 | 1.250 | C14243 | C14364 | C15293 | C15093 |
| | | .2188 | 2.375 | 1.250 | C14210 | C14331 | C15260 | C15060 |
| | 2 | .2210 | 2.438 | 1.313 | C14242 | C14363 | C15292 | C15092 |
| | 1 | .2280 | 2.438 | 1.313 | C14241 | C14362 | C15291 | C15091 |
| 15/64 | A | .2340 | 2.438 | 1.313 | — | **C14403 | **C15331 | **C15131 |
| | | .2344 | 2.438 | 1.313 | C14211 | C14332 | C15261 | C15061 |
| | B | .2380 | 2.500 | 1.375 | **C14282 | — | **C15332 | **C15132 |
| | C | .2420 | 2.500 | 1.375 | **C14283 | **C14405 | **C15333 | **C15133 |
| | D | .2460 | 2.500 | 1.375 | C14284 | — | C15334 | C15134 |
| 1/4 | E | .2500 | 2.500 | 1.375 | C14212 | C14333 | C15262 | C15062 |
| | | .2570 | 2.625 | 1.438 | C14286 | — | C15335 | C15135 |
| 17/64 | G | .2610 | 2.625 | 1.438 | C14287 | — | C15336 | C15136 |
| | | .2656 | 2.625 | 1.438 | C14213 | C14334 | C15263 | C15063 |
| | H | .2660 | 2.688 | 1.500 | C14288 | **C14409 | C15337 | C15137 |
| | I | .2720 | 2.688 | 1.500 | **C14289 | **C14410 | **C15338 | **C15138 |
| | J | .2770 | 2.688 | 1.500 | **C14290 | **C14411 | **C15339 | **C15139 |
| 9/32 | K | .2810 | 2.688 | 1.500 | C14291 | — | C15340 | C15140 |
| | | .2812 | 2.688 | 1.500 | C14214 | C14335 | C15264 | C15064 |
| | L | .2900 | 2.750 | 1.563 | C14292 | **C14413 | C15341 | C15141 |
| 19/64 | M | .2950 | 2.750 | 1.563 | — | **C14414 | **C15342 | **C15142 |
| | | .2969 | 2.750 | 1.563 | C14215 | C14336 | C15265 | C15065 |
| 5/16 | N | .3020 | 2.813 | 1.625 | **C14294 | **C14415 | **C15343 | **C15143 |
| | | .3125 | 2.813 | 1.625 | C14216 | C14337 | C15266 | C15066 |
| | O | .3160 | 2.938 | 1.688 | — | **C14416 | **C15344 | **C15144 |
| 21/64 | P | .3230 | 2.938 | 1.688 | C14296 | **C14417 | C15345 | C15145 |
| | | .3281 | 2.938 | 1.688 | C14217 | C14338 | C15267 | C15067 |
| | Q | .3320 | 3.000 | 1.688 | C14297 | C14418 | C15346 | C15146 |
| 11/32 | R | .3390 | 3.000 | 1.688 | C14298 | C14419 | C15347 | C15147 |
| | | .3438 | 3.000 | 1.688 | C14218 | C14339 | C15268 | C15068 |

Screw Machine Length
Cobalt

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| TiN | ★ | | ★ | | | | | | | ★ | | | |
| TiCN | ★ | | ★ | | ★ | ★ | | ★ | ★ | | | | |
| TiAlN | | | | | ★ | ★ | | ★ | ★ | | | | |

★ = Best Performance ◆ = Acceptable

****Items are being OBSOLETEED, only available until inventory is depleted.**

Screw Machine Length

Cobalt

| fraction | drill diameter | | decimal equivalent | overall length l ₁ (in) | flute length l ₂ (in) | order number | | | |
|----------|----------------|-------------|--------------------|---------------------------------------|-------------------------------------|---------------------|----------------|-----------------|------------------|
| | d ₁ | wire/letter | | | | 2175 straw oxide | 2175-TN TiN | 2175-TC TiCN | 2175-TA TiAlN |
| | | S | .3480 | 3.063 | 1.750 | C14299 | C14420 | C15348 | C15148 |
| | | T | .3580 | 3.063 | 1.750 | **C14300 | C14421 | **C15349 | **C15149 |
| 23/64 | | | .3594 | 3.063 | 1.750 | C14219 | C14340 | C15269 | C15069 |
| | | U | .3680 | 3.125 | 1.813 | C14301 | **C14422 | C15350 | C15150 |
| 3/8 | | | .3750 | 3.125 | 1.813 | C14220 | C14341 | C15270 | C15070 |
| | | V | .3770 | 3.250 | 1.875 | C14302 | **C14423 | C15351 | C15151 |
| | | W | .3860 | 3.250 | 1.875 | **C14303 | C14424 | **C15352 | **C15152 |
| 25/64 | | | .3906 | 3.250 | 1.875 | C14221 | C14342 | C15271 | C15071 |
| | | X | .3970 | 3.313 | 1.938 | **C14304 | C14425 | **C15353 | **C15153 |
| | | Y | .4040 | 3.313 | 1.938 | **C14305 | **C14426 | **C15354 | **C15154 |
| 13/32 | | | .4062 | 3.313 | 1.938 | C14222 | C14343 | C15272 | C15072 |
| | | Z | .4130 | 3.375 | 2.000 | C14306 | — | C15355 | C15155 |
| 27/64 | | | .4219 | 3.375 | 2.000 | C14223 | C14344 | C15273 | C15073 |
| 7/16 | | | .4375 | 3.438 | 2.063 | C14224 | C14345 | C15274 | C15074 |
| 29/64 | | | .4531 | 3.563 | 2.125 | C14225 | C14346 | C15275 | C15075 |
| 15/32 | | | .4688 | 3.625 | 2.125 | C14226 | C14347 | C15276 | C15076 |
| 31/64 | | | .4844 | 3.688 | 2.188 | C14227 | C14348 | C15277 | C15077 |
| 1/2 | | | .5000 | 3.750 | 2.250 | C14228 | C14349 | C15278 | C15078 |
| 33/64 | | | .5156 | 3.875 | 2.375 | C14229 | C14350 | C15279 | C15079 |
| 17/32 | | | .5312 | 3.875 | 2.375 | C14230 | C14351 | C15280 | C15080 |
| 35/64 | | | .5469 | 4.000 | 2.500 | C14231 | C14352 | C15281 | C15081 |
| 9/16 | | | .5625 | 4.000 | 2.500 | C14232 | C14353 | C15282 | C15082 |
| 37/64 | | | .5781 | 4.125 | 2.625 | C14233 | C14354 | C15283 | C15083 |
| 19/32 | | | .5938 | 4.125 | 2.625 | C14234 | C14355 | C15284 | C15084 |
| 39/64 | | | .6094 | 4.250 | 2.750 | C14235 | C14356 | C15285 | C15085 |
| 5/8 | | | .6250 | 4.250 | 2.750 | C14236 | C14357 | C15286 | C15086 |
| 41/64 | | | .6406 | 4.500 | 2.875 | C14237 | C14358 | C15287 | C15087 |
| 21/32 | | | .6562 | 4.500 | 2.875 | C14238 | C14359 | C15288 | C15088 |
| 43/64 | | | .6719 | 4.625 | 2.875 | C14239 | C14360 | C15289 | C15089 |
| 11/16 | | | .6875 | 4.625 | 2.875 | C14240 | C14361 | C15290 | C15090 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| TiN | ★ | | ★ | | | | | ★ | ★ | ★ | | | |
| TiCN | ☆ | | ☆ | | ★ | ★ | | ★ | ★ | ☆ | | | |
| TiAlN | | | | | ☆ | ☆ | | ☆ | ☆ | | | | |

☆ = Best Performance ★ = Acceptable



Style: **2330**

Note
Operating parameters: See Technical section

NAS 907
TYPE C

HSS

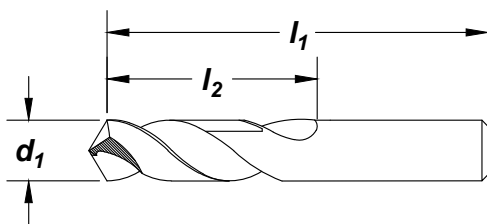
135° Split

Helix
Regular
21° to 34°

Straight
Shank

Surface
Treatment

Bright



Screw Machine Length

High Speed Steel

Feature:

Heavy duty design for tougher materials.

| drill diameter | | wire | decimal equivalent | overall length | | flute length | | order number |
|----------------|----------------|------|--------------------|---------------------|---------------------|--------------|--------|--------------|
| fraction | d ₁ | | | l ₁ (in) | l ₂ (in) | 2330 | | |
| *3/64 | | | .0469 | 1.375 | .500 | | C70250 | |
| 1/16 | | | .0625 | 1.625 | .625 | | C70251 | |
| | | 52 | .0635 | 1.688 | .688 | | C70356 | |
| | | 51 | .0670 | 1.688 | .688 | | C70355 | |
| | | 50 | .0700 | 1.688 | .688 | | C70354 | |
| | | 49 | .0730 | 1.688 | .688 | | C70353 | |
| | | 48 | .0760 | 1.688 | .688 | | C70352 | |
| 5/64 | | | .0781 | 1.688 | .688 | | C70252 | |
| | | 47 | .0785 | 1.750 | .750 | | C70351 | |
| | | 46 | .0810 | 1.750 | .750 | | C70350 | |
| | | 45 | .0820 | 1.750 | .750 | | C70349 | |
| | | 44 | .0860 | 1.750 | .750 | | C70348 | |
| | | 43 | .0890 | 1.750 | .750 | | C70347 | |
| | | 42 | .0935 | 1.750 | .750 | | C70346 | |
| 3/32 | | | .0938 | 1.750 | .750 | | C70253 | |
| | | 41 | .0960 | 1.813 | .813 | | C70345 | |
| | | 40 | .0980 | 1.813 | .813 | | C70344 | |
| | | 39 | .0995 | 1.813 | .813 | | C70343 | |
| | | 38 | .1015 | 1.813 | .813 | | C70342 | |
| | | 37 | .1040 | 1.813 | .813 | | C70341 | |
| | | 36 | .1065 | 1.813 | .813 | | C70340 | |
| 7/64 | | | .1094 | 1.813 | .813 | | C70254 | |
| | | 35 | .1100 | 1.875 | .875 | | C70339 | |
| | | 34 | .1110 | 1.875 | .875 | | C70338 | |
| | | 33 | .1130 | 1.875 | .875 | | C70337 | |
| | | 32 | .1160 | 1.875 | .875 | | C70336 | |
| | | 31 | .1200 | 1.875 | .875 | | C70335 | |
| 1/8 | | | .1250 | 1.875 | .875 | | C70255 | |
| | | 30 | .1285 | 1.938 | .938 | | C70334 | |
| | | 29 | .1360 | 1.938 | .938 | | C70333 | |
| | | 28 | .1405 | 1.938 | .938 | | C70332 | |
| 9/64 | | | .1406 | 1.938 | .938 | | C70256 | |

*Not split point.

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | ◆ | | | ☆ | ☆ | ◆ | | | |

☆ = Best Performance ◆ = Acceptable



Screw Machine Length

High Speed Steel

| fraction | drill diameter | | decimal equivalent | overall length | | flute length | | order number |
|----------|----------------|------|--------------------|---------------------|---------------------|---------------------|---------------------|--------------|
| | d ₁ | wire | | l ₁ (in) | l ₂ (in) | l ₂ (in) | l ₂ (in) | |
| | | | | | | | | 2330 |
| | | 27 | .1440 | 2.063 | 1.000 | | | C70331 |
| | | 26 | .1470 | 2.063 | 1.000 | | | C70330 |
| | | 25 | .1495 | 2.063 | 1.000 | | | C70329 |
| | | 24 | .1520 | 2.063 | 1.000 | | | C70328 |
| | | 23 | .1540 | 2.063 | 1.000 | | | C70327 |
| 5/32 | | | .1562 | 2.063 | 1.000 | | | C70257 |
| | | 22 | .1570 | 2.125 | 1.063 | | | C70326 |
| | | 21 | .1590 | 2.125 | 1.063 | | | C70325 |
| | | 20 | .1610 | 2.125 | 1.063 | | | C70324 |
| | | 19 | .1660 | 2.125 | 1.063 | | | C70323 |
| | | 18 | .1695 | 2.125 | 1.063 | | | C70322 |
| 11/64 | | | .1719 | 2.125 | 1.063 | | | C70258 |
| | | 17 | .1730 | 2.188 | 1.125 | | | C70321 |
| | | 16 | .1770 | 2.188 | 1.125 | | | C70320 |
| | | 15 | .1800 | 2.188 | 1.125 | | | C70319 |
| | | 14 | .1820 | 2.188 | 1.125 | | | C70318 |
| | | 13 | .1850 | 2.188 | 1.125 | | | C70317 |
| 3/16 | | | .1875 | 2.188 | 1.125 | | | C70259 |
| | | 12 | .1890 | 2.250 | 1.188 | | | C70316 |
| | | 11 | .1910 | 2.250 | 1.188 | | | C70315 |
| | | 10 | .1935 | 2.250 | 1.188 | | | C70314 |
| | | 9 | .1960 | 2.250 | 1.188 | | | C70313 |
| | | 8 | .1990 | 2.250 | 1.188 | | | C70312 |
| | | 7 | .2010 | 2.250 | 1.188 | | | C70311 |
| 13/64 | | | .2031 | 2.250 | 1.188 | | | C70260 |
| | | 6 | .2040 | 2.375 | 1.250 | | | C70310 |
| | | 5 | .2055 | 2.375 | 1.250 | | | C70309 |
| | | 4 | .2090 | 2.375 | 1.250 | | | C70308 |
| | | 3 | .2130 | 2.375 | 1.250 | | | C70307 |
| 7/32 | | | .2188 | 2.375 | 1.250 | | | C70261 |
| | | 2 | .2210 | 2.438 | 1.313 | | | C70306 |
| | | 1 | .2280 | 2.438 | 1.313 | | | C70305 |
| | | A | .2340 | 2.438 | 1.313 | | | C70280 |
| 15/64 | | | .2344 | 2.438 | 1.313 | | | C70262 |
| | | B | .2380 | 2.500 | 1.375 | | | C70281 |
| | | C | .2420 | 2.500 | 1.375 | | | C70282 |
| | | D | .2460 | 2.500 | 1.375 | | | C70283 |
| 1/4 | | | .2500 | 2.500 | 1.375 | | | C70263 |
| | | E | .2500 | 2.500 | 1.375 | | | C70263 |
| | | F | .2570 | 2.625 | 1.438 | | | C70284 |
| | | G | .2610 | 2.625 | 1.438 | | | C70285 |
| 17/64 | | | .2656 | 2.625 | 1.438 | | | C70264 |
| | | H | .2660 | 2.688 | 1.500 | | | C70286 |
| | | I | .2720 | 2.688 | 1.500 | | | C70287 |
| | | J | .2770 | 2.688 | 1.500 | | | C70288 |
| 9/32 | | | .2812 | 2.688 | 1.500 | | | C70265 |
| | | K | .2812 | 2.688 | 1.500 | | | C70289 |
| | | L | .2900 | 2.750 | 1.563 | | | C70290 |
| | | M | .2950 | 2.750 | 1.563 | | | C70291 |
| 19/64 | | | .2969 | 2.750 | 1.563 | | | C70266 |
| | | N | .3020 | 2.813 | 1.625 | | | C70292 |
| 5/16 | | | .3125 | 2.813 | 1.625 | | | C70267 |
| | | O | .3160 | 2.813 | 1.688 | | | C70293 |
| | | P | .3230 | 2.813 | 1.688 | | | C70294 |
| 21/64 | | | .3281 | 2.813 | 1.688 | | | C70268 |
| | | Q | .3320 | 3.000 | 1.688 | | | C70295 |
| | | R | .3390 | 3.000 | 1.688 | | | C70296 |
| 11/32 | | | .3438 | 3.000 | 1.688 | | | C70269 |
| | | S | .3480 | 3.063 | 1.750 | | | C70297 |

continued on next page



Style: 2330 (continued)

| drill diameter | | wire | decimal equivalent | overall length l ₁ (in) | flute length l ₂ (in) | order number 2330 |
|----------------|----------------|------|--------------------|---------------------------------------|-------------------------------------|-----------------------------|
| fraction | d ₁ | | | | | |
| 23/64 | | T | .3580 | 3.063 | 1.750 | C70298 |
| | | | .3594 | 3.063 | 1.750 | C70270 |
| | | U | .3680 | 3.125 | 1.813 | C70299 |
| 3/8 | | | .3750 | 3.125 | 1.813 | C70271 |
| | | V | .3770 | 3.250 | 1.875 | C70300 |
| | | W | .3860 | 3.250 | 1.875 | C70301 |
| 25/64 | | | .3906 | 3.250 | 1.875 | C70272 |
| | | X | .3970 | 3.313 | 1.938 | C70302 |
| | | Y | .4040 | 3.313 | 1.938 | C70303 |
| 13/32 | | | .4062 | 3.313 | 1.938 | C70273 |
| | | Z | .4130 | 3.375 | 2.000 | C70304 |
| 27/64 | | | .4219 | 3.375 | 2.000 | C70274 |
| 7/16 | | | .4375 | 3.438 | 2.063 | C70275 |
| 29/64 | | | .4531 | 3.563 | 2.125 | C70276 |
| 15/32 | | | .4688 | 2.625 | 2.125 | C70277 |
| 31/64 | | | .4844 | 3.688 | 2.188 | C70278 |
| 1/2 | | | .5000 | 3.750 | 2.250 | C70279 |

Screw Machine Length
High Speed Steel

SET

Style: 2330



29-Piece Set
#C70368

| no. of pieces | surface treatment | size range | order number |
|---------------|-------------------|----------------------------|--------------|
| | | | 2330 |
| 15 | Bright | 1/16" through 1/2" x 1/32" | C70370 |
| 21 | Bright | 1/16" through 3/8" x 1/64" | C70369 |
| 29 | Bright | 1/16" through 1/2" x 1/64" | C70368 |

| | | | | | | | | | | | | |
|---------------------------|-----------------|--------------------|-------|------------------------|-------------|------------|------------------------|---------|---------------------------------|------------------------------|----------|-----------------------------|
| Material Reference | | Steel (HRc) | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
| | | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | 18-22 | 22-32 | | | >45 |
| | Bright | | | | | | | | | | | |

= Best Performance = Acceptable

Note
Operating parameters: See Technical section

ASME
B94.11M

DIN
1897

M42
Cobalt

135° Split

Helix
Regular
21° to 34°

Straight
Shank

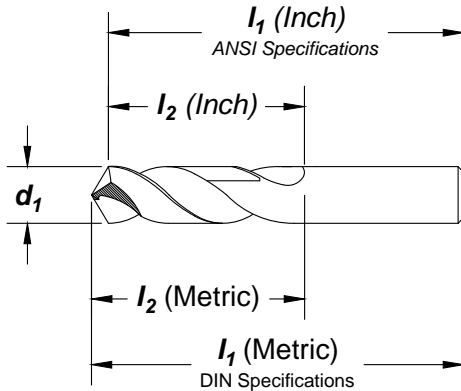
Surface
Treatment

Straw
Oxide

TiCN

Screw Machine Length

Cobalt



Feature:

Highly heat resistant substrate for tough to machine materials.

| drill diameter | | | overall length | | flute length | | order number | | |
|----------------|-------------|------|--------------------|-------|--------------|------|--------------|---------------------|-----------------|
| fraction | wire/letter | mm | decimal equivalent | in | mm | in | mm | 2133 straw oxide | 2133-TC TiCN |
| | *60 | | .0400 | 1.375 | | .500 | | C14501 | - |
| | *59 | | .0410 | 1.375 | | .500 | | C14502 | - |
| | *58 | | .0420 | 1.375 | | .500 | | C14504 | - |
| | *57 | | .0430 | 1.375 | | .500 | | C14505 | - |
| | *56 | | .0465 | 1.375 | | .500 | | C14508 | - |
| *3/64 | | | .0469 | 1.375 | | .500 | | C14509 | - |
| | | *1.2 | .0472 | | 30.00 | | 8.00 | C14835 | - |
| | *55 | | .0520 | 1.625 | | .625 | | C14513 | - |
| | *54 | | .0550 | 1.625 | | .625 | | C14515 | - |
| | | *1.5 | .0591 | | 32.00 | | 9.00 | C14838 | - |
| | *53 | | .0595 | 1.625 | | .625 | | C14519 | - |
| 1/16 | | | .0625 | 1.625 | | .625 | | C14521 | C14846 |
| | | 1.6 | .0630 | | 34.00 | | 10.00 | C14748 | - |
| | 52 | | .0635 | 1.688 | | .688 | | C14523 | - |
| | 51 | | .0670 | 1.688 | | .688 | | C14526 | - |
| | 50 | | .0700 | 1.688 | | .688 | | C14528 | - |
| | 49 | | .0730 | 1.688 | | .688 | | C14531 | - |
| | 48 | | .0760 | 1.688 | | .688 | | C14533 | - |
| 5/64 | | | .0781 | 1.688 | | .688 | | C14535 | C14847 |
| | 47 | | .0785 | 1.750 | | .750 | | C14536 | - |
| | | 2.0 | .0787 | | 38.00 | | 12.00 | C14800 | C14749 |
| | 46 | | .0810 | 1.750 | | .750 | | C14539 | - |
| | 45 | | .0820 | 1.750 | | .750 | | C14540 | - |
| | 44 | | .0860 | 1.750 | | .750 | | C14543 | - |
| | 43 | | .0890 | 1.750 | | .750 | | C14546 | - |
| | 42 | | .0935 | 1.750 | | .750 | | C14549 | - |
| 3/32 | | | .0938 | 1.750 | | .750 | | C14550 | C14848 |
| | | 2.4 | .0945 | | 43.00 | | 14.00 | C14790 | - |
| | 41 | | .0960 | 1.813 | | .813 | | C14552 | - |
| | | 2.45 | .0965 | 1.692 | 43.00 | .551 | 14.00 | C14789 | - |
| | 40 | | .0980 | 1.813 | | .813 | | C14554 | - |

*Not split point.

continued on next page

TECH TIP

Benefits of 2133 Cobalt Screw Machine Drill

- Cobalt provides high heat resistance for tough applications.
- Short flutes provide enhanced rigidity and drill more accurate holes.



Styles: 2133, 2133-TC (continued)

Screw Machine Length
Cobalt

| drill diameter | | overall length | | | | flute length | | order number | |
|----------------|----------------|----------------|--------------------|----------------|-------|----------------|-------|--------------|---------|
| fraction | d ₁ | mm | decimal equivalent | l ₁ | | l ₂ | | 2133 | 2133-TC |
| | wire/letter | | | in | mm | in | mm | straw oxide | TiCN |
| | | 2.5 | .0984 | 1.693 | 43.00 | .551 | 14.00 | C14820 | C14750 |
| | 39 | | .0995 | 1.813 | | .813 | | C14556 | - |
| | 38 | | .1015 | 1.813 | | .813 | | C14557 | - |
| | | 2.6 | .1024 | 1.693 | 43.00 | .551 | 14.00 | C14840 | C14730 |
| | 37 | | .1040 | 1.813 | | .813 | | C14559 | - |
| | 36 | | .1065 | 1.813 | | .813 | | C14561 | - |
| 7/64 | | | .1094 | 1.813 | | .813 | | C14562 | C14849 |
| | 35 | | .1100 | 1.875 | | .875 | | C14563 | - |
| | | 2.8 | .1102 | | 46.00 | | 16.00 | C14841 | - |
| | 34 | | .1110 | 1.875 | | .875 | | C14565 | - |
| | 33 | | .1130 | 1.875 | | .875 | | C14566 | - |
| | 32 | | .1160 | 1.875 | | .875 | | C14568 | - |
| | | 3.0 | .1181 | | 46.00 | | 16.00 | C14821 | C14751 |
| | 31 | | .1200 | 1.875 | | .875 | | C14570 | - |
| | | 3.1 | .1220 | | 49.00 | | 18.00 | C14822 | C14752 |
| 1/8 | | | .1250 | 1.875 | | .875 | | C14572 | C14850 |
| | | 3.2 | .1260 | | 49.00 | | 18.00 | C14801 | C14753 |
| | 30 | | .1285 | 1.938 | | .938 | | C14574 | - |
| | | 3.3 | .1299 | | 49.00 | | 18.00 | C14802 | C14754 |
| | 29 | | .1360 | 1.938 | | .938 | | C14577 | - |
| | | 3.5 | .1378 | | 52.00 | | 20.00 | C14803 | C14755 |
| | 28 | | .1405 | 1.938 | | .938 | | C14579 | - |
| 9/64 | | | .1406 | 1.938 | | .938 | | C14580 | C14851 |
| | 27 | | .1440 | 2.063 | | 1.000 | | C14582 | - |
| | | 3.7 | .1457 | | 52.00 | | 20.00 | C14823 | - |
| | 26 | | .1470 | 2.063 | | 1.000 | | C14584 | - |
| | 25 | | .1495 | 2.063 | | 1.000 | | C14585 | - |
| | 24 | | .1520 | 2.063 | | 1.000 | | C14587 | - |
| | 23 | | .1540 | 2.063 | | 1.000 | | C14589 | - |
| 5/32 | | | .1562 | 2.063 | | 1.000 | | C14590 | C14852 |
| | 22 | | .1570 | 2.125 | | 1.063 | | C14591 | - |
| | | 4.0 | .1575 | | 55.00 | | 22.00 | C14824 | C14756 |
| | 21 | | .1590 | 2.125 | | 1.063 | | C14593 | - |
| | 20 | | .1610 | 2.125 | | 1.063 | | C14594 | - |
| | | 4.1 | .1614 | | 55.00 | | 22.00 | C14825 | C14757 |
| | | 4.2 | .1654 | | 55.00 | | 22.00 | C14804 | C14758 |
| | 19 | | .1660 | 2.125 | | 1.063 | | C14597 | - |
| | 18 | | .1695 | 2.125 | | 1.063 | | C14599 | - |
| 11/64 | | | .1719 | 2.125 | | 1.063 | | C14600 | C14853 |
| | 17 | | .1730 | 2.188 | | 1.125 | | C14601 | - |
| | 16 | | .1770 | 2.188 | | 1.125 | | C14603 | - |
| | | 4.5 | .1772 | | 58.00 | | 24.00 | C14805 | C14759 |
| | 15 | | .1800 | 2.188 | | 1.125 | | C14605 | - |
| | | 4.6 | .1811 | | 58.00 | | 24.00 | C14842 | C14728 |
| | 14 | | .1820 | 2.188 | | 1.125 | | C14607 | - |
| | 13 | | .1850 | 2.188 | | 1.125 | | C14608 | - |
| 3/16 | | | .1875 | 2.188 | | 1.125 | | C14610 | C14854 |
| | | 4.8 | .1890 | | 62.00 | | 26.00 | C14806 | C14760 |
| | 12 | | .1890 | 2.250 | | 1.188 | | C14611 | - |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Straw | ★ | | ★ | | ★ | ★ | | ★ | ★ | | | | |
| TiCN | ☆ | | ☆ | | ☆ | ☆ | | ☆ | ☆ | ☆ | ★ | ★ | |

☆ = Best Performance ★ = Acceptable



Screw Machine Length

Cobalt

| drill diameter | | | overall length | | | | flute length | | order number | |
|----------------|-------------------------------|-----|-----------------------|----------------|-------|----------------|--------------|---------------------|-----------------|--|
| fraction | d ₁ wire/letter | mm | decimal equivalent | l ₁ | | l ₂ | | 2133 straw oxide | 2133-TC TiCN | |
| | | | | in | mm | in | mm | | | |
| | 11 | | .1910 | 2.250 | | 1.188 | | C14613 | - | |
| | | 4.9 | .1929 | | 62.00 | | 26.00 | C14826 | - | |
| | 10 | | .1935 | 2.250 | | 1.188 | | C14615 | - | |
| | 9 | | .1960 | 2.250 | | 1.188 | | C14616 | - | |
| | | 5.0 | .1969 | | 62.00 | | 26.00 | C14827 | C14761 | |
| | 8 | | .1990 | 2.250 | | 1.188 | | C14618 | - | |
| | | 5.1 | .2008 | | 62.00 | | 26.00 | C14807 | C14762 | |
| | 7 | | .2010 | 2.250 | | 1.188 | | C14620 | - | |
| 13/64 | | | .2031 | 2.250 | | 1.188 | | C14621 | C14855 | |
| | 6 | | .2040 | 2.375 | | 1.250 | | C14622 | - | |
| | 5 | | .2055 | 2.375 | | 1.250 | | C14624 | - | |
| | | 5.3 | .2087 | 2.440 | 62.00 | 1.023 | 26.00 | C14625 | - | |
| | 4 | | .2090 | 2.375 | | 1.250 | | C14626 | - | |
| | 3 | | .2130 | 2.375 | | 1.250 | | C14628 | - | |
| | | 5.5 | .2165 | | 66.00 | | 28.00 | C14828 | C14786 | |
| 7/32 | | | .2188 | 2.375 | | 1.250 | | C14630 | C14856 | |
| | | 5.6 | .2205 | | 66.00 | | 28.00 | C14843 | - | |
| | 2 | | .2210 | 2.438 | | 1.313 | | C14632 | - | |
| | | 5.7 | .2244 | | 66.00 | | 28.00 | C14844 | - | |
| | 1 | | .2280 | 2.438 | | 1.313 | | C14634 | - | |
| | A | | .2340 | 2.438 | | 1.313 | | C14637 | - | |
| 15/64 | | | .2344 | 2.438 | | 1.313 | | C14638 | C14857 | |
| | | 6.0 | .2362 | | 66.00 | | 28.00 | C14829 | C14763 | |
| | B | | .2380 | 2.500 | | 1.375 | | C14640 | - | |
| | | 6.1 | .2402 | | 70.00 | | 31.00 | C14869 | - | |
| | C | | .2420 | 2.500 | | 1.375 | | C14642 | - | |
| | D | | .2460 | 2.500 | | 1.375 | | C14644 | - | |
| 1/4, E | | | .2500 | 2.500 | | 1.375 | | C14646 | C14858 | |
| | | 6.5 | .2559 | | 70.00 | | 31.00 | C14808 | C14764 | |
| | F | | .2570 | 2.625 | | 1.438 | | C14649 | - | |
| | | 6.6 | .2598 | | 70.00 | | 31.00 | C14809 | - | |
| | G | | .2610 | 2.625 | | 1.438 | | C14651 | - | |
| 17/64 | | | .2656 | 2.625 | | 1.438 | | C14653 | C14859 | |
| | H | | .2660 | 2.688 | | 1.500 | | C14654 | - | |
| | | 6.8 | .2677 | | 74.00 | | 34.00 | C14810 | C14765 | |
| | I | | .2720 | 2.688 | | 1.500 | | C14657 | - | |
| | | 7.0 | .2756 | | 74.00 | | 34.00 | C14830 | C14766 | |
| | J | | .2770 | 2.688 | | 1.500 | | C14659 | - | |
| | K | | .2810 | 2.688 | | 1.500 | | C14661 | - | |
| 9/32 | | | .2812 | 2.688 | | 1.500 | | C14664 | C14860 | |
| | | 7.3 | .2874 | 2.913 | 74.00 | 1.338 | 34.00 | C14663 | - | |
| | L | | .2900 | 2.750 | | 1.563 | | C14665 | - | |
| | | 7.4 | .2913 | | 74.00 | | 34.00 | C14811 | - | |
| | M | | .2950 | 2.750 | | 1.563 | | C14667 | - | |
| | | 7.5 | .2953 | | 74.00 | | 34.00 | C14831 | C14787 | |
| 19/64 | | | .2969 | 2.750 | | 1.563 | | C14669 | - | |
| | N | | .3020 | 2.813 | | 1.625 | | C14671 | - | |
| 5/16 | | | .3125 | 2.813 | | 1.625 | | C14675 | C14861 | |
| | | 8.0 | .3150 | | 79.00 | | 37.00 | C14812 | C14767 | |
| | O | | .3160 | 2.938 | | 1.688 | | C14677 | - | |
| | | 8.1 | .3189 | | 79.00 | | 37.00 | C14670 | - | |
| | P | | .3230 | 2.938 | | 1.688 | | C14680 | - | |
| 21/64 | | | .3281 | 2.938 | | 1.688 | | C14682 | - | |
| | Q | | .3320 | 3.000 | | 1.688 | | C14684 | - | |
| | | 8.5 | .3346 | | 79.00 | | 37.00 | C14813 | C14768 | |
| | R | | .3390 | 3.000 | | 1.688 | | C14687 | - | |

continued on next page



Styles: 2133, 2133-TC (continued)

| fraction | drill diameter | | decimal equivalent | overall length | | flute length | | order number | |
|----------|----------------------------|------|--------------------|-------------------|--------|-------------------|-------|------------------|--------------|
| | d ₁ wire/letter | mm | | l ₁ in | mm | l ₂ in | mm | 2133 straw oxide | 2133-TC TiCN |
| 11/32 | | | .3438 | 3.000 | | 1.688 | | C14689 | C14862 |
| | S | | .3480 | 3.063 | | 1.750 | | C14691 | - |
| | | 9.0 | .3543 | | 84.00 | | 40.00 | C14814 | C14769 |
| | T | | .3580 | 3.063 | | 1.750 | | C14694 | - |
| 23/64 | | | .3594 | 3.063 | | 1.750 | | C14696 | - |
| | | 9.3 | .3661 | 3.375 | 85.72 | 2.000 | 50.80 | C14871 | - |
| | U | | .3680 | 3.125 | | 1.813 | | C14699 | - |
| | | 9.5 | .3740 | | 84.00 | | 40.00 | C41872 | C14770 |
| 3/8 | | | .3750 | 3.125 | | 1.813 | | C14702 | C14863 |
| | V | | .3770 | 3.250 | | 1.875 | | C14703 | - |
| | W | | .3860 | 3.250 | | 1.875 | | C14707 | - |
| 25/64 | | | .3906 | 3.250 | | 1.875 | | C14709 | - |
| | | 10.0 | .3937 | | 89.00 | | 43.00 | C14815 | C14771 |
| | X | | .3970 | 3.313 | | 1.938 | | C14711 | - |
| | Y | | .4040 | 3.313 | | 1.938 | | C14713 | - |
| 13/32 | | | .4062 | 3.313 | | 1.938 | | C14715 | C14864 |
| | Z | | .4130 | 3.375 | | 2.000 | | C14716 | - |
| | | 10.5 | .4134 | | 89.00 | | 43.00 | C14816 | C14788 |
| 27/64 | | | .4219 | 3.375 | | 2.000 | | C14718 | - |
| | | 11.0 | .4331 | | 95.00 | | 47.00 | C14817 | C14772 |
| 7/16 | | | .4375 | 3.438 | | 2.063 | | C14721 | C14865 |
| | | 11.5 | .4528 | | 95.00 | | 47.00 | C14832 | C14773 |
| 29/64 | | | .4531 | 3.563 | | 2.125 | | C14724 | - |
| 15/32 | | | .4688 | 3.625 | | 2.125 | | C14726 | C14867 |
| | | 12.0 | .4724 | | 102.00 | | 51.00 | C14818 | C14774 |
| 31/64 | | | .4844 | 3.688 | | 2.188 | | C14729 | - |
| | | 12.5 | .4921 | | 102.00 | | 51.00 | C14819 | C14775 |
| 1/2 | | | .5000 | 3.750 | | 2.250 | | C14731 | C14866 |

Screw Machine Length
Cobalt

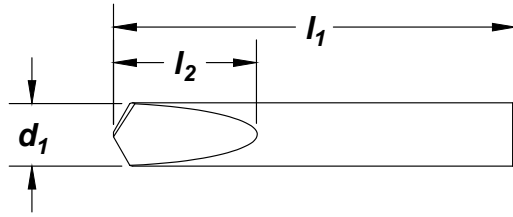
| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Straw | ◆ | | ◆ | | ◆ | ◆ | | ◆ | ◆ | | | | |
| TiCN | ☆ | | ☆ | | ☆ | ☆ | | ☆ | ☆ | ☆ | ◆ | ◆ | |

☆ = Best Performance ◆ = Acceptable



Spade Drill
Style: 1765

| | | | |
|---------|------|-------------------|--------|
| Carbide | 118° | Surface Treatment | Bright |
|---------|------|-------------------|--------|

Stub Length
Carbide


| cutting diameter d_1 fraction | decimal equivalent | overall length l_1 | flute length l_2 | order number 1765 |
|---------------------------------------|-----------------------|-------------------------|-----------------------|-----------------------------|
| 1/32 | .0313 | 1-1/2 | 3/16 | C89705 |
| 1/16 | .0625 | 1-1/2 | 5/16 | C89706 |
| 3/32 | .0938 | 1-1/2 | 3/8 | C89707 |
| 1/8 | .1250 | 1-1/2 | 7/16 | C89708 |
| 5/32 | .1562 | 2 | 15/32 | C89709 |
| 3/16 | .1875 | 2 | 9/16 | C89710 |
| 7/32 | .2188 | 2 | 19/32 | C89711 |
| 1/4 | .2500 | 2 | 11/16 | C89712 |
| 9/32 | .2812 | 2-1/2 | 3/4 | C89714 |
| 5/16 | .3125 | 2-1/2 | 7/8 | C89715 |
| 11/32 | .3438 | 2-1/2 | 15/16 | C89716 |
| 3/8 | .3750 | 2-1/2 | 1-1/16 | C89713 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | ◆ | ☆ | ◆ | ◆ | | | ☆ | ◆ | | | | ◆ |

☆ = Best Performance ◆ = Acceptable



Style: **1767**

Stub Length

ASME
B94.11M

Carbide

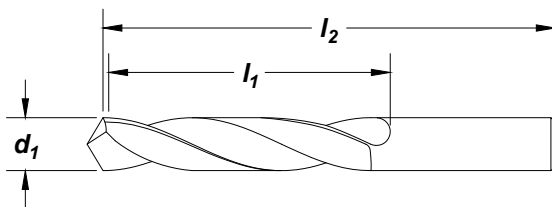
118° 4-Facet

Helix
Regular
21° to 34°

Straight
Shank

Surface
Treatment

Bright



Stub Length

Carbide

| fraction | cutting diameter d_1 | | decimal equivalent | overall length l_1 | flute length l_2 | order number 1767 |
|----------|---------------------------|----|-----------------------|----------------------------|--------------------------|--------------------------------|
| | wire/let | | | | | |
| | | 60 | .0400 | 1-1/2 | 3/8 | C89675 |
| | | 59 | .0410 | 1-1/2 | 3/8 | C89674 |
| | | 58 | .0420 | 1-1/2 | 3/8 | C89673 |
| | | 57 | .0430 | 1-1/2 | 3/8 | C89672 |
| | | 56 | .0465 | 1-1/2 | 3/8 | C89671 |
| | | 55 | .0520 | 1-1/2 | 3/8 | C89670 |
| | | 54 | .0550 | 1-1/2 | 3/8 | C89669 |
| | | 53 | .0595 | 1-1/2 | 3/8 | C89668 |
| 1/16 | | | .0625 | 2 | 5/8 | C89676 |
| | | 52 | .0635 | 2 | 5/8 | C89667 |
| | | 51 | .0670 | 2 | 5/8 | C89666 |
| | | 50 | .0700 | 2 | 5/8 | C89665 |
| | | 49 | .0730 | 2 | 5/8 | C89664 |
| | | 48 | .0760 | 2 | 5/8 | C89663 |
| 5/64 | | | .0781 | 2 | 5/8 | C89677 |
| | | 47 | .0785 | 2 | 5/8 | C89662 |
| | | 46 | .0810 | 2 | 5/8 | C89661 |
| | | 45 | .0820 | 2 | 5/8 | C89660 |
| | | 44 | .0860 | 2 | 5/8 | C89659 |
| | | 43 | .0890 | 2 | 5/8 | C89658 |
| | | 42 | .0935 | 2 | 5/8 | C89657 |
| 3/32 | | | .0938 | 2 | 5/8 | C89678 |
| | | 41 | .0960 | 2 | 5/8 | C89656 |
| | | 40 | .0980 | 2 | 5/8 | C89655 |
| | | 39 | .0995 | 2 | 5/8 | C89654 |
| | | 38 | .1015 | 2 | 5/8 | C89653 |
| | | 37 | .1040 | 2 | 5/8 | C89652 |
| | | 36 | .1065 | 2 | 5/8 | C89651 |
| 7/64 | | | .1094 | 2 | 5/8 | C89679 |
| | | 35 | .1100 | 2 | 5/8 | C89650 |
| | | 34 | .1110 | 2 | 5/8 | C89649 |
| | | 33 | .1130 | 2 | 5/8 | C89648 |
| | | 32 | .1160 | 2 | 5/8 | C89647 |
| | | 31 | .1200 | 2 | 5/8 | C89646 |
| 1/8 | | | .1250 | 2 | 5/8 | C89680 |
| | | 30 | .1285 | 2 | 5/8 | C89645 |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | | | | | | | | | | | | | |

= Best Performance = Acceptable



Stub Length

Style: 1767 (continued)

Stub Length

Carbide

| fraction | cutting diameter d ₁ | | decimal equivalent | overall length l ₁ | flute length l ₂ | order number 1767 |
|----------|------------------------------------|--|-----------------------|-------------------------------------|-----------------------------------|--------------------------------|
| | wire/let | | | | | |
| 9/64 | 29 | | .1360 | 2 | 5/8 | C89644 |
| | | | .1406 | 2 | 5/8 | C89681 |
| | 28 | | .1405 | 2 | 5/8 | C89643 |
| | 27 | | .1440 | 2 | 5/8 | C89642 |
| | 26 | | .1470 | 2 | 5/8 | C89641 |
| | 25 | | .1495 | 2-1/2 | 3/4 | C89640 |
| | 24 | | .1520 | 2-1/2 | 3/4 | C89639 |
| | 23 | | .1540 | 2-1/2 | 3/4 | C89638 |
| 5/32 | | | .1562 | 2-1/2 | 3/4 | C89682 |
| | 22 | | .1570 | 2-1/2 | 3/4 | C89637 |
| | 21 | | .1590 | 2-1/2 | 3/4 | C89636 |
| | 20 | | .1610 | 2-1/2 | 3/4 | C89635 |
| | 19 | | .1660 | 2-1/2 | 3/4 | C89634 |
| | 18 | | .1695 | 2-1/2 | 3/4 | C89633 |
| 11/64 | | | .1719 | 2-1/2 | 3/4 | C89683 |
| | 17 | | .1730 | 2-1/2 | 3/4 | C89632 |
| | 16 | | .1770 | 2-1/2 | 3/4 | C89631 |
| | 15 | | .1800 | 2-1/2 | 3/4 | C89630 |
| | 14 | | .1820 | 2-1/2 | 3/4 | C89629 |
| | 13 | | .1850 | 2-1/2 | 3/4 | C89628 |
| 3/16 | | | .1875 | 2-1/2 | 3/4 | C89684 |
| | 12 | | .1890 | 2-1/2 | 3/4 | C89627 |
| | 11 | | .1910 | 2-1/2 | 3/4 | C89626 |
| | 10 | | .1935 | 2-1/2 | 3/4 | C89625 |
| | 9 | | .1960 | 2-1/2 | 3/4 | C89624 |
| | 8 | | .1990 | 2-1/2 | 3/4 | C89623 |
| | 7 | | .2010 | 2-1/2 | 3/4 | C89622 |
| 13/64 | | | .2031 | 2-1/2 | 3/4 | C89685 |
| | 6 | | .2040 | 2-1/2 | 3/4 | C89621 |
| | 5 | | .2055 | 2-1/2 | 3/4 | C89620 |
| | 4 | | .2090 | 2-1/2 | 3/4 | C89619 |
| | 3 | | .2130 | 2-1/2 | 1 | C89618 |
| 7/32 | | | .2188 | 2-1/2 | 1 | C89686 |
| | 2 | | .2210 | 2-1/2 | 1 | C89617 |
| | 1 | | .2280 | 2-1/2 | 1 | C89616 |
| 15/64 | | | .2344 | 2-1/2 | 1 | C89687 |
| 1/4 | | | .2500 | 2-1/2 | 1 | C89688 |
| 17/64 | | | .2656 | 2-1/2 | 1 | C89689 |
| 9/32 | | | .2812 | 2-1/2 | 1 | C89690 |
| 19/64 | | | .2969 | 2-3/4 | 1-1/4 | C89691 |
| 5/16 | | | .3125 | 2-3/4 | 1-1/4 | C89692 |
| 21/64 | | | .3281 | 2-3/4 | 1-1/4 | C89693 |
| 11/32 | | | .3438 | 3 | 1-1/4 | C89694 |
| 23/64 | | | .3594 | 3 | 1-1/4 | C89695 |
| 3/8 | | | .3750 | 3 | 1-1/4 | C89696 |
| 25/64 | | | .3906 | 3 | 1-1/4 | C89697 |
| 13/32 | | | .4062 | 3 | 1-1/4 | C89698 |
| 27/64 | | | .4219 | 3 | 1-1/4 | C89699 |
| 7/16 | | | .4375 | 3 | 1-1/4 | C89700 |
| 29/64 | | | .4531 | 3 | 1-1/4 | C89701 |
| 15/32 | | | .4688 | 3 | 1-1/4 | C89702 |
| 31/64 | | | .4844 | 3 | 1-1/4 | C89703 |
| 1/2 | | | .5000 | 3 | 1-1/4 | C89704 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | ◆ | ☆ | ◆ | ◆ | | | ☆ | ☆ | ◆ | | | ◆ |

☆ = Best Performance ◆ = Acceptable



Styles: **2002, 2001, 2002-TC**

General Purpose

Note
Operating parameters:
See Technical section

ASME
B94.11M

DIN
338

HSS

118°

Helix
Regular
21° to 34°

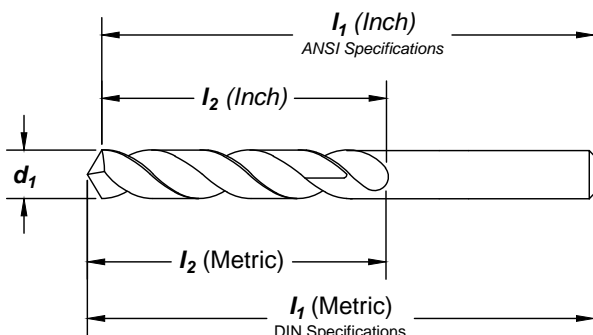
Straight
Shank

Surface
Treatment

Bright

Black
Oxide

TiCN



Jobber Length

High Speed Steel

| drill diameter | | overall length | | flute length | | order number | | | |
|----------------|-------------------------------|-----------------------|----------------------|----------------------|----------------------|----------------------|----------------|---------------------|-----------------|
| fraction | d ₁ wire/letter | decimal equivalent | I ₁ in | I ₁ mm | I ₂ in | I ₂ mm | 2002 bright | 2001 black oxide | 2002-TC TiCN |
| | 80 | .0135 | .750 | | .125 | | C01799 | C01012 | — |
| | | 0.35 | .0138 | 19.00 | | 3.00 | — | C01013 | — |
| | 79 | .0145 | .750 | | .188 | | C01801 | C01014 | — |
| | | 0.38 | .0150 | 19.00 | | 4.00 | — | C01015 | — |
| 1/64 | | .0156 | .750 | | .188 | | C01803 | C01016 | — |
| | | 0.40 | .0157 | 20.00 | | 5.00 | — | C01017 | — |
| | 78 | .0160 | .875 | | .188 | | C01805 | C01018 | — |
| | | 0.42 | .0165 | 20.00 | | 5.00 | — | C01019 | — |
| | | 0.45 | .0177 | 20.00 | | 5.00 | — | C01020 | — |
| | 77 | .0180 | .875 | | .188 | | C01808 | C01021 | — |
| | | 0.48 | .0189 | 20.00 | | 5.00 | — | C01022 | — |
| | | 0.50 | .0197 | 22.00 | | 6.00 | — | C01023 | — |
| | 76 | .0200 | .875 | | .188 | | C01811 | C01024 | — |
| | 75 | .0210 | 1.000 | | .250 | | C01812 | C01025 | — |
| | | 0.55 | .0217 | 24.00 | | 7.00 | — | C01026 | — |
| | 74 | .0225 | 1.000 | | .250 | | C01814 | C01027 | — |
| | | 0.60 | .0236 | 24.00 | | 7.00 | — | C01028 | — |
| | 73 | .0240 | 1.125 | | .313 | | C01816 | C01029 | — |
| | 72 | .0250 | 1.125 | | .313 | | C01817 | C01030 | — |
| | | 0.65 | .0256 | 26.00 | | 8.00 | — | C01031 | — |
| | 71 | .0260 | 1.250 | | .375 | | C01819 | C01032 | — |
| | | 0.70 | .0276 | 28.00 | | 9.00 | — | C01033 | — |
| | 70 | .0280 | 1.250 | | .375 | | C01821 | C01034 | — |
| | 69 | .0292 | 1.375 | | .500 | | C01822 | C01035 | — |
| | | 0.75 | .0295 | 28.00 | | 9.00 | — | C01036 | — |
| | 68 | .0310 | 1.375 | | .500 | | C01824 | C01037 | — |
| 1/32 | | .0312 | 1.375 | | .500 | | C01825 | C01038 | — |

continued on next page

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | | | | | | | | | | ◆ | | | |
| Black Oxide | ◆ | | | | ◆ | | | ◆ | | | | | |
| TiCN | ☆ | | ☆ | | ☆ | | | ☆ | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



General Purpose

Styles: 2002, 2001, 2002-TC (continued)

Jobber Length

High Speed Steel

| fraction | drill diameter | | decimal equivalent | overall length | | flute length | | order number | | |
|----------|-------------------------------|------|--------------------|----------------------|-------|----------------------|-------|----------------|---------------------|-----------------|
| | d ₁ wire/letter | mm | | l ₁ in | mm | l ₂ in | mm | 2002 bright | 2001 black oxide | 2002-TC TiCN |
| | | 0.80 | .0315 | | 30.00 | | 10.00 | - | C01039 | - |
| | 67 | | .0320 | 1.375 | | .500 | | C01827 | C01040 | - |
| | 66 | | .0330 | 1.375 | | .500 | | C01828 | C01041 | - |
| | | 0.85 | .0335 | | 30.00 | | 10.00 | - | C01042 | - |
| | 65 | | .03 50 | 1.500 | | .625 | | C01830 | C01043 | - |
| | | 0.90 | .0354 | | 32.00 | | 11.00 | - | C01044 | - |
| | 64 | | .0360 | 1.500 | | .625 | | C01832 | C01045 | - |
| | 63 | | .0370 | 1.500 | | .625 | | C01833 | C01046 | - |
| | | 0.95 | .0374 | | 32.00 | | 11.00 | - | C01047 | - |
| | 62 | | .0380 | 1.500 | | .625 | | C01835 | C01048 | - |
| | 61 | | .0390 | 1.500 | | .688 | | C01836 | C01049 | - |
| | | 1.00 | .0394 | | 34.00 | | 12.00 | C72200 | C71200 | C73200 |
| | 60 | | .0400 | 1.625 | | .688 | | C72160 | C71160 | - |
| | 59 | | .0410 | 1.625 | | .688 | | C72159 | C71159 | - |
| | | 1.05 | .0413 | | 34.00 | | 12.00 | - | C71201 | - |
| | 58 | | .0420 | 1.625 | | .688 | | C72158 | C71158 | - |
| | 57 | | .0430 | 1.750 | | .750 | | C72157 | C71157 | - |
| | | 1.10 | .0433 | | 36.00 | | 14.00 | C72202 | C71202 | - |
| | | 1.15 | .0453 | | 36.00 | | 14.00 | - | C71203 | - |
| | 56 | | .0465 | 1.750 | | .750 | | C72156 | C71156 | - |
| 3/64 | | | .0469 | 1.750 | | .750 | | C72003 | C71003 | C73003 |
| | | 1.20 | .0472 | | 38.00 | | 16.00 | C72204 | C71204 | - |
| | | 1.25 | .0492 | | 38.00 | | 16.00 | - | C71205 | - |
| | | 1.30 | .0512 | | 38.00 | | 16.00 | C72206 | C71206 | - |
| | 55 | | .0520 | 1.875 | | .875 | | C72155 | C71155 | - |
| | | 1.35 | .0531 | | 40.00 | | 18.00 | - | C71207 | - |
| | 54 | | .0550 | 1.875 | | .875 | | C72154 | C71154 | - |
| | | 1.40 | .0551 | | 40.00 | | 18.00 | C72208 | C71208 | - |
| | | 1.45 | .0571 | | 40.00 | | 18.00 | - | C71209 | - |
| | | 1.50 | .0591 | | 40.00 | | 18.00 | C72210 | C71210 | C73210 |
| | 53 | | .0595 | 1.875 | | .875 | | C72153 | C71153 | - |
| | | 1.55 | .0610 | | 43.00 | | 20.00 | - | C71211 | - |
| 1/16 | | | .0625 | 1.875 | | .875 | | C72004 | C71004 | C73004 |
| | | 1.60 | .0630 | | 43.00 | | 20.00 | C72212 | C71212 | C73212 |
| | 52 | | .0635 | 1.875 | | .875 | | C72152 | C71152 | C73152 |
| | | 1.65 | .0650 | | 43.00 | | 20.00 | - | C71213 | - |
| | | 1.70 | .0669 | | 43.00 | | 20.00 | C72214 | C71214 | - |
| | 51 | | .0670 | 2.000 | | 1.000 | | C72151 | C71151 | C73151 |
| | | 1.75 | .0689 | | 46.00 | | 22.00 | - | C71215 | - |
| | 50 | | .0700 | 2.000 | | 1.000 | | C72150 | C71150 | C73150 |
| | | 1.80 | .0709 | | 46.00 | | 22.00 | C72216 | C71216 | - |
| | | 1.85 | .0728 | | 46.00 | | 22.00 | - | C71217 | - |
| | 49 | | .0730 | 2.000 | | 1.000 | | C72149 | C71149 | C73149 |
| | | 1.90 | .0748 | | 46.00 | | 22.00 | C72218 | C71218 | - |
| | 48 | | .0760 | 2.000 | | 1.000 | | C72148 | C71148 | C73148 |
| | | 1.95 | .0767 | 1.929 | 49.00 | .945 | 24.00 | - | C71219 | - |
| 5/64 | | | .0781 | 2.000 | 50.80 | 1.000 | 25.40 | C72005 | C71005 | C73005 |
| | 47 | | .0785 | 2.000 | 50.80 | 1.000 | 25.40 | C72147 | C71147 | C73147 |
| | | 2.00 | .0787 | 1.929 | 49.00 | .945 | 24.00 | C72220 | C71220 | C73220 |
| | | 2.05 | .0807 | 1.929 | 49.00 | .945 | 24.00 | - | C71221 | - |
| | 46 | | .0810 | 2.125 | | 1.125 | | C72146 | C71146 | C73146 |
| | 45 | | .0820 | 2.125 | | 1.125 | | C72145 | C71145 | C73145 |
| | | 2.10 | .0827 | | 49.00 | | 24.00 | C72222 | C71222 | - |
| | | 2.15 | .0846 | | 53.00 | | 27.00 | - | C71223 | - |
| | 44 | | .0860 | 2.125 | | 1.125 | | C72144 | C71144 | C73144 |
| | | 2.20 | .0866 | | 53.00 | | 27.00 | C72224 | C71224 | - |
| | | 2.25 | .0886 | | 53.00 | | 27.00 | - | C71225 | - |

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Styles: 2002, 2001, 2002-TC (continued)

General Purpose

| fraction | drill diameter | | decimal equivalent | overall length | | flute length | | order number | | |
|----------|-------------------------------|-------|--------------------|----------------------|-------|----------------------|--------|----------------|---------------------|-----------------|
| | d ₁ wire/letter | mm | | l ₁ in | mm | l ₂ in | mm | 2002 bright | 2001 black oxide | 2002-TC TiCN |
| | 43 | | .0890 | 2.250 | | 1.250 | | C72143 | C71143 | C73143 |
| | | 2.30 | .0906 | | 53.00 | | 27.00 | C72226 | C71226 | - |
| | | 2.35 | .0925 | | 53.00 | | 27.00 | - | C71227 | - |
| 3/32 | 42 | | .0935 | 2.250 | | 1.250 | | C72142 | C71142 | C73142 |
| | | | .0938 | 2.250 | | 1.250 | | C72006 | C71006 | C73006 |
| | | 2.40 | .0945 | | 57.00 | | 30.00 | C72228 | C71228 | C73228 |
| | 41 | | .0960 | 2.375 | | 1.375 | | C72141 | C71141 | C73141 |
| | | 2.45 | .0964 | | 57.00 | | 30.00 | - | C71229 | - |
| | 40 | | .0980 | 2.375 | | 1.375 | | C72140 | C71140 | C73140 |
| | | 2.50 | .0984 | | 57.00 | | 30.00 | C72230 | C71230 | C73230 |
| | 39 | | .0995 | 2.375 | | 1.375 | | C72139 | C71139 | C73139 |
| | 38 | | .1015 | 2.500 | | 1.438 | | C72138 | C71138 | C73138 |
| | | 2.60 | .1024 | | 57.00 | | 30.00 | C72231 | C71231 | - |
| | 37 | | .1040 | 2.500 | | 1.438 | | C72137 | C71137 | C73137 |
| | | 2.70 | .1062 | | 61.00 | | 33.00 | C72232 | C71232 | - |
| | 36 | | .1065 | 2.500 | | 1.438 | | C72136 | C71136 | C73136 |
| | 7/64 | | .1094 | 2.625 | | 1.500 | | C72007 | C71007 | C73007 |
| | 35 | | .1100 | 2.625 | | 1.500 | | C72135 | C71135 | C73135 |
| | | 2.80 | .1102 | | 61.00 | | 33.00 | C72233 | C71233 | - |
| | 34 | | .1110 | 2.625 | | 1.500 | | C72134 | C71134 | C73134 |
| | 33 | | .1130 | 2.625 | | 1.500 | | C72133 | C71133 | C73133 |
| | | 2.90 | .1142 | | 61.00 | | 33.00 | C72234 | C71234 | - |
| | 32 | | .1160 | 2.750 | | 1.625 | | C72132 | C71132 | C73132 |
| | | 3.00 | .1181 | | 61.00 | | 33.00 | C72235 | C71235 | C73235 |
| | 31 | | .1200 | 2.750 | | 1.625 | | C72131 | C71131 | C73131 |
| | | 3.10 | .1220 | | 65.00 | | 36.00 | C72236 | C71236 | - |
| 1/8 | | .1250 | 2.750 | | 1.625 | | C72008 | C71008 | C73008 | |
| | | 3.20 | .1260 | | 66.00 | | 37.00 | C72237 | C71237 | C73237 |
| | 30 | | .1285 | 2.750 | | 1.625 | | C72130 | C71130 | C73130 |
| | | 3.30 | .1299 | | 67.00 | | 38.00 | C72238 | C71238 | C73238 |
| | | 3.40 | .1339 | | 70.00 | | 39.00 | C72239 | C71239 | - |
| | 29 | | .1360 | 2.875 | | 1.750 | | C72129 | C71129 | C73129 |
| | | 3.50 | .1378 | | 70.00 | | 39.00 | C72240 | C71240 | C73240 |
| | 28 | | .1405 | 2.875 | | 1.750 | | C72128 | C71128 | C73128 |
| | 9/64 | | .1406 | 2.875 | | 1.750 | | C72009 | C71009 | C73009 |
| | | 3.60 | .1417 | | 70.00 | | 39.00 | C72241 | C71241 | C73241 |
| | 27 | | .1440 | 3.000 | | 1.875 | | C72127 | C71127 | C73127 |
| | | 3.70 | .1457 | | 70.00 | | 39.00 | C72242 | C71242 | - |
| | 26 | | .1470 | 3.000 | | 1.875 | | C72126 | C71126 | C73126 |
| | 25 | | .1495 | 3.000 | | 1.875 | | C72125 | C71125 | C73125 |
| | | 3.80 | .1496 | | 75.00 | | 43.00 | C72243 | C71243 | - |
| | 24 | | .1520 | 3.125 | | 2.000 | | C72124 | C71124 | C73124 |
| | | 3.90 | .1535 | | 75.00 | | 43.00 | C72244 | C71244 | - |
| | 23 | | .1540 | 3.125 | | 2.000 | | C72123 | C71123 | C73123 |
| | 5/32 | | .1562 | 3.125 | | 2.000 | | C72010 | C71010 | C73010 |
| | 22 | | .1570 | 3.125 | | 2.000 | | C72122 | C71122 | C73122 |
| | | 4.00 | .1575 | | 75.00 | | 43.00 | C72245 | C71245 | C73245 |
| | 21 | | .1590 | 3.250 | | 2.125 | | C72121 | C71121 | C73121 |
| | 20 | | .1610 | 3.250 | | 2.125 | | C72120 | C71120 | C73120 |

Jobber Length
High Speed Steel

continued on next page

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | | | | | | | | | | | | | |
| Black Oxide | ★ | | | | ★ | | | ★ | | | | | |
| TiCN | ★ | | ★ | | ★ | | | ★ | | ★ | | | |

★ = Best Performance ◆ = Acceptable



General Purpose

Styles: 2002, 2001, 2002-TC (continued)

Jobber Length

High Speed Steel

| fraction | drill diameter | | decimal equivalent | overall length | | flute length | | order number | | |
|----------|----------------|------|--------------------|----------------|--------|--------------|-------|--------------|------------------|--------------|
| | wire/letter | mm | | in | mm | in | mm | 2002 bright | 2001 black oxide | 2002-TC TiCN |
| | | 4.10 | .1614 | | 75.00 | | 43.00 | C72246 | C71246 | C73246 |
| | | 4.20 | .1654 | | 75.00 | | 43.00 | C72247 | C71247 | C73247 |
| | 19 | | .1660 | 3.250 | | 2.125 | | C72119 | C71119 | C73119 |
| | | 4.30 | .1692 | | 80.00 | | 47.00 | C72248 | C71248 | C73248 |
| | 18 | | .1695 | 3.250 | | 2.125 | | C72118 | C71118 | C73118 |
| 11/64 | | | .1719 | 3.250 | | 2.125 | | C72011 | C71011 | C73011 |
| | 17 | | .1730 | 3.375 | | 2.188 | | C72117 | C71117 | C73117 |
| | | 4.40 | .1732 | | 80.00 | | 47.00 | C72249 | C71249 | - |
| | 16 | | .1770 | 3.375 | | 2.188 | | C72116 | C71116 | C73116 |
| | | 4.50 | .1772 | | 80.00 | | 47.00 | C72250 | C71250 | C73250 |
| | 15 | | .1800 | 3.375 | | 2.188 | | C72115 | C71115 | C73115 |
| | | 4.60 | .1811 | | | 1.850 | 47.00 | C72251 | C71251 | - |
| | 14 | | .1820 | 3.375 | | 2.188 | | C72114 | C71114 | C73114 |
| | 13 | | .1850 | 3.500 | | 2.313 | | C72113 | C71113 | C73113 |
| | | 4.70 | .1850 | | 80.00 | | 47.00 | C72252 | C71252 | - |
| 3/16 | | | .1875 | 3.500 | | 2.313 | | C72012 | C71012 | C73012 |
| | 12 | | .1890 | 3.500 | | 2.313 | | C72112 | C71112 | C73112 |
| | | 4.80 | .1890 | | 86.00 | | 52.00 | C72253 | C71253 | C73253 |
| | 11 | | .1910 | 3.500 | | 2.313 | | C72111 | C71111 | C73111 |
| | | 4.90 | .1929 | | 86.00 | | 52.00 | C72254 | C71254 | C73254 |
| | 10 | | .1935 | 3.625 | | 2.438 | | C72110 | C71110 | C73110 |
| | 9 | | .1960 | 3.625 | | 2.438 | | C72109 | C71109 | C73109 |
| | | 5.00 | .1969 | | 86.00 | | 52.00 | C72255 | C71255 | C73255 |
| | 8 | | .1990 | 3.625 | | 2.438 | | C72108 | C71108 | C73108 |
| | | 5.10 | .2008 | | 86.00 | | 52.00 | C72256 | C71256 | C73256 |
| | 7 | | .2010 | 3.625 | | 2.438 | | C72107 | C71107 | C73107 |
| 13/64 | | | .2031 | 3.625 | | 2.438 | | C72013 | C71013 | C73013 |
| | 6 | | .2040 | 3.750 | | 2.500 | | C72106 | C71106 | C73106 |
| | | 5.20 | .2047 | | 86.00 | | 52.00 | C72257 | C71257 | C73257 |
| | 5 | | .2055 | 3.750 | | 2.500 | | C72105 | C71105 | C73105 |
| | | 5.30 | .2087 | | 95.00 | | 64.00 | - | C01181 | - |
| | 4 | | .2090 | 3.750 | | 2.500 | | C72104 | C71104 | C73104 |
| | | 5.40 | .2125 | | 93.00 | | 57.00 | C72259 | C71259 | - |
| | 3 | | .2130 | 3.750 | | 2.500 | | C72103 | C71103 | C73103 |
| | | 5.50 | .2165 | | 93.00 | | 57.00 | C72260 | C71260 | C73260 |
| 7/32 | | | .2188 | 3.750 | | 2.500 | | C72014 | C71014 | C73014 |
| | | 5.60 | .2205 | | 93.00 | | 57.00 | C72261 | C71261 | - |
| | 2 | | .2210 | 3.875 | | 2.625 | | C72102 | C71102 | C73102 |
| | | 5.70 | .2244 | | 93.00 | | 57.00 | C72262 | C71262 | - |
| | 1 | | .2280 | 3.875 | | 2.625 | | C72101 | C71101 | C73101 |
| | | 5.80 | .2283 | | 98.00 | | 67.00 | - | C01192 | - |
| | | 5.90 | .2322 | | 93.00 | | 57.00 | C72264 | C71264 | - |
| | A | | .2340 | 3.875 | | 2.625 | | C72071 | C71071 | C73071 |
| 15/64 | | | .2344 | 3.875 | | 2.625 | | C72015 | C71015 | C73015 |
| | | 6.00 | .2362 | | 93.00 | | 57.00 | C72265 | C71265 | C73265 |
| | B | | .2380 | 4.000 | | 2.750 | | C72072 | C71072 | C73072 |
| | | 6.10 | .2401 | | 101.00 | | 63.00 | C72266 | C71266 | - |
| | C | | .2420 | 4.000 | | 2.750 | | C72073 | C71073 | C73073 |
| | | 6.20 | .2440 | | 101.00 | | 63.00 | C72267 | C71267 | - |
| | D | | .2460 | 4.000 | | 2.750 | | C72074 | C71074 | C73074 |
| | | 6.30 | .2480 | | 101.00 | | 63.00 | C72268 | C71268 | - |
| 1/4 | E | | .2500 | 4.000 | | 2.750 | | C72016 | C71016 | C73016 |
| | | 6.40 | .2520 | | 101.00 | | 63.00 | C72269 | C71269 | - |
| | | 6.50 | .2559 | | 101.00 | | 63.00 | C72270 | C71270 | C73270 |
| | F | | .2570 | 4.125 | | 2.875 | | C72076 | C71076 | C73075 |
| | | 6.60 | .2598 | | 101.00 | | 63.00 | C72271 | C71271 | - |
| | G | | .2610 | 4.125 | | 2.875 | | C72077 | C71077 | C73076 |

continued on next page



Styles: 2002, 2001, 2002-TC (continued)

General Purpose

| fraction | drill diameter | | overall length | | flute length | | order number | | | |
|----------|----------------|------|--------------------|-------|--------------|-------|--------------|------------------|--------------|--------|
| | wire/letter | mm | decimal equivalent | in | mm | in | 2002 bright | 2001 black oxide | 2002-TC TiCN | |
| 17/64 | H | 6.70 | .2638 | | 101.00 | | C72272 | C71272 | - | |
| | | | .2656 | 4.125 | | 2.875 | C72017 | C71017 | C73017 | |
| | | | .2660 | 4.125 | | 2.875 | C72078 | C71078 | C73077 | |
| | I | 6.80 | .2677 | | 109.00 | | C72273 | C71273 | C73273 | |
| | | 6.90 | .2717 | | 109.00 | | C72274 | C71274 | - | |
| | | | .2720 | 4.125 | | 2.875 | C72079 | C71079 | C73078 | |
| | J | 7.00 | .2756 | | 109.00 | | C72275 | C71275 | C73275 | |
| | | | .2770 | 4.125 | | 2.875 | C72080 | C71080 | C73079 | |
| | | 7.10 | .2795 | | 109.00 | | C72276 | C71276 | - | |
| 9/32 | K | | .2812 | 4.250 | | 2.938 | C72018 | C71018 | C73018 | |
| | | | .2812 | 4.250 | | 2.938 | C72081 | C71081 | C73080 | |
| | | 7.20 | .2835 | | 109.00 | | 69.00 | C72277 | C71277 | - |
| | L | 7.30 | .2874 | | 109.00 | | 69.00 | C72278 | C71278 | - |
| | | | .2900 | 4.250 | | 2.938 | C72082 | C71082 | C73081 | |
| | | 7.40 | .2913 | | 109.00 | | 69.00 | C72279 | C71279 | - |
| | M | | .2950 | 4.375 | | 3.063 | C72083 | C71083 | C73082 | |
| | | 7.50 | .2953 | | 109.00 | | 69.00 | C72280 | C71280 | C73280 |
| | | | .2969 | 4.375 | | 3.063 | C72019 | C71019 | C73019 | |
| 19/64 | N | | .3020 | 4.375 | | 3.063 | C72084 | C71084 | C73083 | |
| | | 7.70 | .3031 | | 117.00 | | 75.00 | C72282 | C71282 | - |
| | | 7.80 | .3070 | | 117.00 | | 75.00 | C72283 | C71283 | - |
| 5/16 | O | 7.90 | .3110 | | 117.00 | | 75.00 | C72284 | C71284 | - |
| | | | .3125 | 4.500 | | 3.188 | C72020 | C71020 | C73020 | |
| | | 8.00 | .3150 | | 117.00 | | 75.00 | C72285 | C71285 | C73285 |
| | P | | .3160 | 4.500 | | 3.188 | C72085 | C71085 | C73084 | |
| | | 8.10 | .3189 | | 117.00 | | 75.00 | C72286 | C71286 | - |
| | | 8.20 | .3228 | | 117.00 | | 75.00 | C72287 | C71287 | - |
| 21/64 | Q | | .3230 | 4.625 | | 3.313 | C72086 | C71086 | C73085 | |
| | | | .3281 | 4.625 | | 3.313 | C72021 | C71021 | C73021 | |
| | | 8.40 | .3307 | | 117.00 | | 75.00 | C72289 | C71289 | - |
| | R | | .3320 | 4.750 | | 3.438 | C72087 | C71087 | C73086 | |
| | | 8.50 | .3346 | | 117.00 | | 75.00 | C72290 | C71290 | C73290 |
| | | | .3390 | 4.750 | | 3.438 | C72088 | C71088 | C73087 | |
| 11/32 | S | 8.70 | .3425 | | 125.00 | | 81.00 | C72292 | C71292 | - |
| | | | .3438 | 4.750 | | 3.438 | C72022 | C71022 | C73022 | |
| | | 8.80 | .3464 | | 125.00 | | 3.189 | C72293 | C71293 | - |
| | T | | .3480 | 4.875 | | 3.500 | C72089 | C71089 | C73088 | |
| | | 9.00 | .3543 | | 125.00 | | 81.00 | C72295 | C71295 | C73295 |
| | | | .3580 | 4.875 | | 3.500 | C72090 | C71090 | C73089 | |
| 23/64 | U | | .3594 | 4.875 | | 3.500 | C72023 | C71023 | C73023 | |
| | | 9.20 | .3622 | | 125.00 | | 81.00 | C72297 | C71297 | - |
| | | 9.30 | .3661 | | 125.00 | | 81.00 | C72298 | C71298 | - |
| | V | | .3680 | 5.000 | | 3.625 | C72091 | C71091 | C73090 | |
| | | 9.40 | .3700 | | 125.00 | | 81.00 | C72299 | C71299 | - |
| | | 9.50 | .3740 | | 125.00 | | 81.00 | C72300 | C71300 | C73300 |
| 3/8 | W | | .3750 | 5.000 | | 3.625 | C72024 | C71024 | C73024 | |
| | | | .3770 | 5.000 | | 3.625 | C72092 | C71092 | C73091 | |
| | | 9.60 | .3779 | | 133.00 | | 87.00 | C72301 | C71301 | - |
| | | 9.70 | .3817 | | 133.00 | | 87.00 | C72302 | C71302 | - |
| | | 9.80 | .3858 | | 133.00 | | 87.00 | C72303 | C71303 | - |
| | | | .3860 | 5.125 | | 3.750 | C72093 | C71093 | C73092 | |

Jobber Length

High Speed Steel

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | | | | | | | | | | ◆ | | | |
| Black Oxide | ◆ | | | | ◆ | | | ◆ | | | | | |
| TiCN | ☆ | | ☆ | | ☆ | | | ☆ | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



General Purpose

Styles: 2002, 2001, 2002-TC (continued)

Jobber Length

High Speed Steel

| fraction | drill diameter | | decimal equivalent | overall length | | flute length | | order number | | |
|----------|----------------|-------|--------------------|----------------|--------|--------------|--------|--------------|------------------|--------------|
| | wire/letter | mm | | in | mm | in | mm | 2002 bright | 2001 black oxide | 2002-TC TiCN |
| 25/64 | | | .3906 | 5.125 | | 3.750 | | C72025 | C71025 | C73025 |
| | | 10.00 | .3937 | | 133.00 | | 87.00 | C72305 | C71305 | C73305 |
| | X | | .3970 | | 130.18 | | 95.25 | C72094 | C71094 | C73093 |
| | | 10.20 | .4016 | | 133.00 | | 87.00 | C72306 | C71306 | C73306 |
| | Y | | .4040 | 5.250 | | 3.875 | | C72095 | C71095 | C73094 |
| 13/32 | | | .4062 | 5.250 | | 3.875 | | C72026 | C71026 | C73026 |
| | Z | | .4130 | 5.250 | | 3.875 | | C72096 | C71096 | C73095 |
| | | 10.50 | .4134 | | 133.00 | | 87.00 | C72308 | C71308 | C73308 |
| 27/64 | | | .4219 | 5.375 | | 3.938 | | C72027 | C71027 | C73027 |
| | | 10.80 | .4252 | | 142.00 | | 94.00 | C72309 | C71309 | - |
| | | 11.00 | .4331 | | 142.00 | | 94.00 | C72310 | C71310 | C73310 |
| 7/16 | | | .4375 | 5.500 | | 4.063 | | C72028 | C71028 | C73028 |
| | | 11.20 | .4409 | | 142.00 | | 94.00 | C72311 | C71311 | - |
| | | 11.50 | .4527 | | 142.00 | | 94.00 | C72312 | C71312 | C73312 |
| 29/64 | | | .4531 | 5.625 | | 4.188 | | C72029 | C71029 | C73029 |
| 15/32 | | | .4688 | 5.750 | | 4.313 | | C72030 | C71030 | C73030 |
| | | 12.00 | .4724 | | 151.00 | | 101.00 | C72314 | C71314 | C73314 |
| | | 12.20 | .4803 | | 151.00 | | 101.00 | C72315 | C71315 | - |
| 31/64 | | | .4844 | 5.875 | | 4.375 | | C72031 | C71031 | C73031 |
| | | 12.50 | .4921 | | 151.00 | | 101.00 | C72316 | C71316 | C73316 |
| 1/2 | | | .5000 | 6.000 | | 4.500 | | C72032 | C71032 | C73032 |
| | | 13.00 | .5118 | | 151.00 | | 101.00 | C72319 | C71319 | C73319 |
| 33/64 | | | .5156 | 6.625 | | 4.813 | | - | C71033 | - |
| 17/32 | | | .5312 | 6.625 | | 4.813 | | - | C71034 | - |
| | | 13.50 | .5315 | 160.00 | | | 108.00 | C72321 | C71321 | - |
| 35/64 | | | .5469 | 6.625 | | 4.813 | | - | C71035 | - |
| | | 14.00 | .5512 | 160.00 | | | 108.00 | C72323 | C71323 | C73323 |
| 9/16 | | | .5625 | 6.625 | | 4.813 | | - | C71036 | - |
| | | 14.50 | .5709 | 169.00 | | | 114.00 | C72325 | C71325 | - |
| 37/64 | | | .5781 | 6.625 | | 4.813 | | - | C71037 | - |
| | | 15.00 | .5906 | 169.00 | | | 114.00 | C72327 | C71327 | C73327 |
| 19/32 | | | .5938 | 7.125 | | 5.188 | | - | C71038 | - |
| 39/64 | | | .6094 | 7.125 | | 5.188 | | - | C71039 | - |
| | | 15.50 | .6102 | 178.00 | | | 120.00 | C72329 | C71329 | - |
| 5/8 | | | .6250 | 7.125 | | 5.188 | | - | C71040 | - |
| | | 16.00 | .6299 | 178.00 | | | 120.00 | C72331 | C71331 | C73331 |
| 41/64 | | | .6406 | 7.125 | | 5.188 | | - | C71041 | - |
| | | 16.50 | .6496 | 184.00 | | | 120.00 | C72333 | C71333 | - |
| 21/32 | | | .6562 | 7.125 | | 5.188 | | - | C71042 | - |
| | | 17.00 | .6693 | 184.00 | | | 120.00 | C72335 | C71335 | C73335 |
| 43/64 | | | .6719 | 7.625 | | 5.625 | | - | C71043 | - |
| 11/16 | | | .6875 | 7.625 | | 5.625 | | - | C71044 | - |
| | | 17.50 | .6890 | 191.00 | | | 130.00 | C72337 | C71337 | - |

| no. of pieces | size range | order number | |
|---------------|--|-----------------------|----------------------------|
| | | 2002 bright | 2001 black oxide |
| 15 | 1/16" through 1/2" x 1/3 2" | C72199 | — |
| 20 | #61-#80 | C00937 | — |
| 29 | 1/16" through 1/2" x 1/64" | C72198 | C72197 |
| 26 | letter A through Z | C00939 | — |
| 60 | wire gauge #1 through #60 | C00934 | — |
| 115 | 1/16" through 1/2", letter A through Z, and wire gage #1 through #60 | C01330 | — |
| 25 | 1 mm through 13 mm x 0.5 mm | C72000 | C71000 |
| 50 | 1 mm through 5.9 mm x 0.1 mm | — | C00960 |



115-Piece Set
#C01330



50-Piece Set
#C00690



60-Piece Set
#C00934



25-Piece Set
#C71000



TECH TIPS

Bright versus Surface Treated Tools

- Bright (untreated) series are used in non-ferrous materials.
- Black oxide drills provide better wear life in ferrous materials.



**BLANK
PAGE**



Style: **2020**

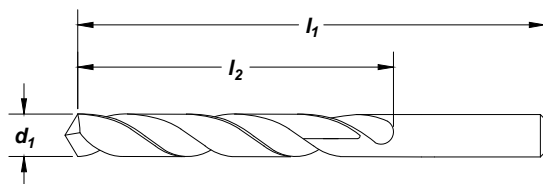
Low Helix

Note

Operating parameters: See Technical section



****Items are being OBSOLETED, only available until inventory is depleted.**



Jobber Length

High Speed Steel

Feature:

Slower helix aids chip removal in horizontal application.

| fraction | drill diameter | | decimal equivalent | overall length | | flute length | | order no. |
|----------|----------------|------|--------------------|----------------|------------|--------------|--|-----------|
| | d_1 | wire | | l_1 (in) | l_2 (in) | 2020 | | |
| | | 60 | .0400 | 1.625 | .688 | **C03457 | | |
| | | 56 | .0465 | 1.750 | .750 | **C03464 | | |
| 1/16 | | | .0625 | 1.875 | .875 | C03477 | | |
| | | 49 | .0730 | 2.000 | 1.000 | **C03487 | | |
| 5/64 | | | .0781 | 2.000 | 1.000 | C03491 | | |
| | | 46 | .0810 | 2.125 | 1.125 | **C03495 | | |
| 3/32 | | | .0938 | 2.250 | 1.250 | C03506 | | |
| 7/64 | | | .1094 | 2.625 | 1.500 | C03519 | | |
| | | 34 | .1110 | 2.625 | 1.500 | **C03522 | | |
| 1/8 | | | .1250 | 2.750 | 1.625 | C03529 | | |
| | | 29 | .1360 | 2.875 | 1.750 | **C03535 | | |
| | | 28 | .1405 | 2.875 | 1.750 | **C03537 | | |
| 9/64 | | | .1406 | 2.875 | 1.750 | C03538 | | |
| | | 27 | .1440 | 3.000 | 1.875 | **C03540 | | |
| | | 26 | .1470 | 3.000 | 1.875 | **C03542 | | |
| | | 25 | .1495 | 3.000 | 1.875 | **C03544 | | |
| | | 23 | .1540 | 3.125 | 2.000 | **C03548 | | |
| 5/32 | | | .1562 | 3.125 | 2.000 | C03549 | | |
| | | 22 | .1570 | 3.125 | 2.000 | **C03550 | | |
| | | 21 | .1590 | 3.250 | 2.125 | **C03552 | | |
| | | 20 | .1610 | 3.250 | 2.125 | **C03553 | | |
| | | 18 | .1695 | 3.250 | 2.125 | **C03559 | | |
| 11/64 | | | .1719 | 3.250 | 2.125 | C03560 | | |
| | | 17 | .1730 | 3.375 | 2.188 | **C03561 | | |
| | | 16 | .1770 | 3.375 | 2.188 | **C03563 | | |
| | | 15 | .1800 | 3.375 | 2.188 | **C03565 | | |
| | | 13 | .1850 | 3.500 | 2.313 | **C03568 | | |
| 3/16 | | | .1875 | 3.500 | 2.313 | C03571 | | |
| | | 12 | .1890 | 3.500 | 2.313 | **C03572 | | |
| | | 11 | .1910 | 3.500 | 2.313 | **C03574 | | |
| | | 10 | .1935 | 3.625 | 2.438 | **C03576 | | |
| | | 9 | .1960 | 3.625 | 2.438 | **C03577 | | |
| | | 8 | .1990 | 3.625 | 2.438 | **C03579 | | |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Bright | ☆ | | | | | | | | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Low Helix
Style: 2020 (continued)
****Items are being OBSOLETEd, only available until inventory is depleted.**
Jobber Length
High Speed Steel

| fraction | drill diameter | | decimal equivalent | overall length l ₁ (in) | flute length l ₂ (in) | order no. 2020 |
|----------|----------------|------|--------------------|---------------------------------------|-------------------------------------|--------------------------|
| | d ₁ | wire | | | | |
| 13/64 | | | .2031 | 3.625 | 2.438 | C03582 |
| | | 6 | .2040 | 3.750 | 2.500 | **C03583 |
| | | 5 | .2055 | 3.750 | 2.500 | **C03585 |
| | | 4 | .2090 | 3.750 | 2.500 | **C03588 |
| | | 3 | .2130 | 3.750 | 2.500 | **C03590 |
| 7/32 | | | .2188 | 3.750 | 2.500 | C03592 |
| | | 2 | .2210 | 3.875 | 2.625 | **C03594 |
| | | 1 | .2280 | 3.875 | 2.625 | **C03597 |
| 15/64 | | | .2344 | 3.875 | 2.625 | C03601 |
| 1/4 | | | .2500 | 4.000 | 2.750 | C03610 |
| 17/64 | | | .2656 | 4.125 | 2.875 | C03618 |
| 9/32 | | | .2812 | 4.250 | 2.938 | C03632 |
| 19/64 | | | .2969 | 4.375 | 3.063 | C03636 |
| 5/16 | | | .3125 | 4.500 | 3.188 | C03643 |
| 21/64 | | | .3281 | 4.625 | 3.313 | C03651 |
| 11/32 | | | .3438 | 4.750 | 3.438 | C03658 |
| 3/8 | | | .3750 | 5.000 | 3.625 | C03673 |
| 25/64 | | | .3906 | 5.125 | 3.750 | C03681 |
| 13/32 | | | .4062 | 5.250 | 3.875 | C03686 |
| 27/64 | | | .4219 | 5.375 | 3.938 | C03689 |
| 7/16 | | | .4375 | 5.500 | 4.063 | C03692 |
| 29/64 | | | .4531 | 5.625 | 4.188 | C03695 |
| 15/32 | | | .4688 | 5.750 | 4.313 | C03697 |
| 1/2 | | | .5000 | 6.000 | 4.500 | C03702 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Bright | ☆ | | | | | | | | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Style: **2012**

High Helix

Note
Operating parameters: See Technical section

ASME
B94.11M

HSS

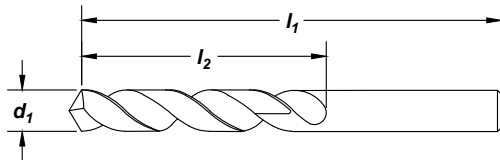
118°

Helix
High
35° to 45°

Straight
Shank

Surface
Treatment

Bright



Jobber Length

High Speed Steel

Feature:

Higher helix for improved chip lifting in softer materials.

| drill diameter | | decimal equiv. | overall length | | order no. |
|----------------------------|-------|----------------|---------------------|---------------------|-----------|
| d ₁ fraction | wire | | l ₁ (in) | l ₂ (in) | |
| 80 | .0135 | .750 | .188 | C02881 | |
| 79 | .0145 | .750 | .188 | C02883 | |
| 78 | .0160 | .875 | .188 | C02887 | |
| 77 | .0180 | .875 | .188 | C02890 | |
| 76 | .0200 | .875 | .188 | C02893 | |
| 75 | .0210 | 1.000 | .250 | C02894 | |
| 74 | .0225 | 1.000 | .250 | C02896 | |
| 73 | .0240 | 1.125 | .313 | C02898 | |
| 72 | .0250 | 1.125 | .313 | C02899 | |
| 71 | .0260 | 1.250 | .375 | C02901 | |
| 70 | .0280 | 1.250 | .375 | C02903 | |
| 69 | .0292 | 1.375 | .500 | C02904 | |
| 68 | .0310 | 1.375 | .500 | C02906 | |
| 1/32 | .0312 | 1.375 | .500 | C02907 | |
| 67 | .0320 | 1.375 | .500 | C02909 | |
| 66 | .0330 | 1.375 | .500 | C02910 | |
| 65 | .0350 | 1.500 | .625 | C02912 | |
| 64 | .0360 | 1.500 | .625 | C02914 | |
| 63 | .0370 | 1.500 | .625 | C02915 | |
| 62 | .0380 | 1.500 | .625 | C02917 | |
| 61 | .0390 | 1.625 | .688 | C02918 | |
| 60 | .0400 | 1.625 | .688 | C02920 | |
| 59 | .0410 | 1.625 | .688 | C02921 | |
| 58 | .0420 | 1.625 | .688 | C02923 | |
| 57 | .0430 | 1.750 | .750 | C02924 | |
| 56 | .0465 | 1.750 | .750 | C02927 | |
| 3/64 | .0469 | 1.750 | .750 | C02928 | |

| drill diameter | | decimal equiv. | overall length | | order no. |
|----------------------------|-------|----------------|---------------------|---------------------|-----------|
| d ₁ fraction | wire | | l ₁ (in) | l ₂ (in) | |
| 55 | .0520 | 1.875 | .875 | C02932 | |
| 54 | .0550 | 1.875 | .875 | C02934 | |
| 53 | .0595 | 1.875 | .875 | C02938 | |
| 1/16 | .0625 | 1.875 | .875 | C02940 | |
| 52 | .0635 | 1.875 | .875 | C02942 | |
| 51 | .0670 | 2.000 | 1.000 | C02945 | |
| 50 | .0700 | 2.000 | 1.000 | C02947 | |
| 49 | .0730 | 2.000 | 1.000 | C02950 | |
| 48 | .0760 | 2.000 | 1.000 | C02952 | |
| 5/64 | .0781 | 2.000 | 1.000 | C02954 | |
| 47 | .0785 | 2.000 | 1.000 | C02955 | |
| 46 | .0810 | 2.125 | 1.125 | C02958 | |
| 45 | .0820 | 2.125 | 1.125 | C02959 | |
| 44 | .0860 | 2.125 | 1.125 | C02962 | |
| 43 | .0890 | 2.250 | 1.250 | C02965 | |
| 42 | .0935 | 2.250 | 1.250 | C02968 | |
| 3/32 | .0938 | 2.250 | 1.250 | C02969 | |
| 41 | .0960 | 2.375 | 1.375 | C02971 | |
| 40 | .0980 | 2.375 | 1.375 | C02973 | |
| 39 | .0995 | 2.375 | 1.375 | C02975 | |
| 38 | .1015 | 2.500 | 1.438 | C02976 | |
| 37 | .1040 | 2.500 | 1.438 | C02978 | |
| 36 | .1065 | 2.500 | 1.438 | C02980 | |
| 7/64 | .1094 | 2.625 | 1.500 | C02982 | |
| 35 | .1100 | 2.625 | 1.500 | C02983 | |
| 34 | .1110 | 2.625 | 1.500 | C02985 | |
| 33 | .1130 | 2.625 | 1.500 | C02986 | |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | | | | | | | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



High Helix

Style: 2012 (continued)

Jobber Length

High Speed Steel

| drill diameter | | decimal equiv. | overall length | | flute length | | order no. |
|-------------------------|------|----------------|---------------------|---------------------|--------------|--------|-----------|
| d ₁ fraction | wire | | l ₁ (in) | l ₂ (in) | 2012 | | |
| | 32 | .1160 | 2.750 | 1.625 | | C02988 | |
| | 31 | .1200 | 2.750 | 1.625 | | C02990 | |
| 1/8 | | .1250 | 2.750 | 1.625 | | C02992 | |
| | 30 | .1285 | 2.750 | 1.625 | | C02995 | |
| | 29 | .1360 | 2.875 | 1.750 | | C02998 | |
| | 28 | .1405 | 2.875 | 1.750 | | C03000 | |
| 9/64 | | .1406 | 2.875 | 1.750 | | C03001 | |
| | 27 | .1440 | 3.000 | 1.875 | | C03003 | |
| | 26 | .1470 | 3.000 | 1.875 | | C03005 | |
| | 25 | .1495 | 3.000 | 1.875 | | C03007 | |
| | 24 | .1520 | 3.125 | 2.000 | | C03009 | |
| | 23 | .1540 | 3.125 | 2.000 | | C03011 | |
| 5/32 | | .1562 | 3.125 | 2.000 | | C03012 | |
| | 22 | .1570 | 3.125 | 2.000 | | C03013 | |
| | 21 | .1590 | 3.250 | 2.125 | | C03015 | |
| | 20 | .1610 | 3.250 | 2.125 | | C03016 | |
| | 19 | .1660 | 3.250 | 2.125 | | C03019 | |
| | 18 | .1695 | 3.250 | 2.125 | | C03022 | |
| 11/64 | | .1719 | 3.250 | 2.125 | | C03023 | |
| | 17 | .1730 | 3.375 | 2.188 | | C03024 | |
| | 16 | .1770 | 3.375 | 2.188 | | C03026 | |
| | 15 | .1800 | 3.375 | 2.188 | | C03028 | |
| | 14 | .1820 | 3.375 | 2.188 | | C03030 | |
| | 13 | .1850 | 3.500 | 2.313 | | C03031 | |
| 3/16 | | .1875 | 3.500 | 2.313 | | C03034 | |
| | 12 | .1890 | 3.500 | 2.313 | | C03035 | |
| | 11 | .1910 | 3.500 | 2.313 | | C03037 | |
| | 10 | .1935 | 3.625 | 2.438 | | C03039 | |
| | 9 | .1960 | 3.625 | 2.438 | | C03040 | |
| | 8 | .1990 | 3.625 | 2.438 | | C03042 | |
| | 7 | .2010 | 3.625 | 2.438 | | C03044 | |
| 13/64 | | .2031 | 3.625 | 2.438 | | C03045 | |
| | 6 | .2040 | 3.750 | 2.500 | | C03046 | |
| | 5 | .2055 | 3.750 | 2.500 | | C03048 | |
| | 4 | .2090 | 3.750 | 2.500 | | C03051 | |
| | 3 | .2130 | 3.750 | 2.500 | | C03053 | |
| 7/32 | | .2188 | 3.750 | 2.500 | | C03055 | |
| | 2 | .2210 | 3.875 | 2.625 | | C03057 | |
| | 1 | .2280 | 3.875 | 2.625 | | C03060 | |
| | A | .2340 | 3.875 | 2.625 | | C03063 | |
| 15/64 | | .2344 | 3.875 | 2.625 | | C03064 | |
| | B | .2380 | 4.000 | 2.750 | | C03066 | |
| | C | .2420 | 4.000 | 2.750 | | C03068 | |

| drill diameter | | decimal equiv. | overall length | | flute length | | order no. |
|-------------------------|------|----------------|---------------------|---------------------|--------------|--------|-----------|
| d ₁ fraction | wire | | l ₁ (in) | l ₂ (in) | 2012 | | |
| | D | .2460 | 4.000 | 2.750 | | C03070 | |
| 1/4 | E | .2500 | 4.000 | 2.750 | | C03073 | |
| | F | .2570 | 4.125 | 2.875 | | C03077 | |
| | G | .2610 | 4.125 | 2.875 | | C03079 | |
| 17/64 | | .2656 | 4.125 | 2.875 | | C03081 | |
| | H | .2660 | 4.125 | 2.875 | | C03083 | |
| | I | .2720 | 4.125 | 2.875 | | C03086 | |
| | J | .2770 | 4.125 | 2.875 | | C03088 | |
| | L | .2900 | 4.250 | 2.938 | | C03094 | |
| 9/32 | | .2812 | 4.250 | 2.938 | | C03095 | |
| | M | .2950 | 4.375 | 3.063 | | C03097 | |
| 19/64 | | .2969 | 4.375 | 3.063 | | C03099 | |
| | N | .3020 | 4.375 | 3.063 | | C03101 | |
| 5/16 | | .3125 | 4.500 | 3.188 | | C03106 | |
| | O | .3160 | 5.750 | 3.188 | | C03108 | |
| | P | .3230 | 4.625 | 3.313 | | C03111 | |
| 21/64 | | .3281 | 4.625 | 3.313 | | C03114 | |
| | Q | .3320 | 4.750 | 3.438 | | C03116 | |
| | R | .3390 | 4.750 | 3.438 | | C03119 | |
| 11/32 | | .3438 | 4.750 | 3.438 | | C03121 | |
| | S | .3480 | 4.875 | 3.500 | | C03124 | |
| | T | .3580 | 4.875 | 3.500 | | C03127 | |
| 23/64 | | .3594 | 4.875 | 3.500 | | C03129 | |
| | U | .3680 | 5.000 | 3.625 | | C03133 | |
| 3/8 | | .3750 | 5.000 | 3.625 | | C03136 | |
| | V | .3770 | 5.000 | 3.625 | | C03137 | |
| | W | .3860 | 5.125 | 3.750 | | C03142 | |
| 25/64 | | .3906 | 5.125 | 3.750 | | C03144 | |
| | X | .3970 | 5.125 | 3.750 | | C03146 | |
| | Y | .4040 | 5.250 | 3.875 | | C03148 | |
| 13/32 | | .4062 | 5.250 | 3.875 | | C03149 | |
| | Z | .4130 | 5.250 | 3.875 | | C03150 | |
| 27/64 | | .4219 | 5.375 | 3.938 | | C03152 | |
| 7/16 | | .4375 | 5.500 | 4.063 | | C03155 | |
| 29/64 | | .4531 | 5.625 | 4.188 | | C03158 | |
| 15/32 | | .4688 | 5.750 | 4.313 | | C03160 | |
| 31/64 | | .4844 | 5.875 | 4.375 | | C03163 | |
| 1/2 | | .5000 | 6.000 | 4.500 | | C03165 | |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | | | | | | | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Styles: **2065, 2065-TN**

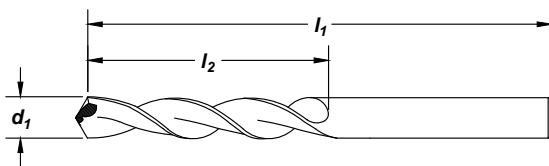
Parabolic

Note

Operating parameters: See Technical section
Adjust the parameters as follows:
double the given feed rate.



Surface Treatment



Jobber Length

High Speed Steel

Feature:

Excels in deep hole drilling without pecking in softer, free machining materials. Drill up to 10x diameter without pecking.

| drill diameter | | wire | decimal equivalent | overall length | | order number | |
|----------------|----------------|------|--------------------|---------------------|---------------------|--------------|-------------|
| fraction | d ₁ | | | l ₁ (in) | l ₂ (in) | 2065 Bright | 2065-TN TiN |
| 1/16 | | | .0625 | 1.875 | .875 | C16029 | C03705 |
| | | 52 | .0635 | 1.875 | .875 | C16219 | - |
| | | 51 | .0670 | 2.000 | 1.000 | C16218 | - |
| | | 50 | .0700 | 2.000 | 1.000 | - | C03708 |
| | | 49 | .0730 | 2.000 | 1.000 | C16216 | - |
| 5/64 | | 48 | .0760 | 2.000 | 1.000 | C16215 | - |
| | | | .0781 | 2.000 | 1.000 | C16030 | C03711 |
| | | 47 | .0785 | 2.000 | 1.000 | C16214 | - |
| | | 46 | .0810 | 2.125 | 1.125 | C16213 | - |
| | | 45 | .0820 | 2.125 | 1.125 | C16212 | - |
| | | 44 | .0860 | 2.125 | 1.125 | C16211 | - |
| 3/32 | | 43 | .0890 | 2.250 | 1.250 | C16210 | - |
| | | 42 | .0935 | 2.250 | 1.250 | C16209 | - |
| | | | .0938 | 2.250 | 1.250 | C16031 | C03718 |
| | | 41 | .0960 | 2.375 | 1.375 | C16208 | - |
| | | 40 | .0980 | 2.375 | 1.375 | C16207 | C03720 |
| | | 39 | .0995 | 2.375 | 1.375 | C16206 | - |
| | | 38 | .1015 | 2.500 | 1.438 | C16205 | C03722 |
| 7/64 | | 37 | .1040 | 2.500 | 1.438 | C16204 | - |
| | | 36 | .1065 | 2.500 | 1.438 | C16203 | C03724 |
| | | | .1094 | 2.625 | 1.500 | C16032 | C03725 |
| | | 35 | .1100 | 2.625 | 1.500 | C16202 | - |
| | | 34 | .1110 | 2.625 | 1.500 | C16201 | - |
| 1/8 | | 33 | .1130 | 2.625 | 1.500 | C16200 | C03728 |
| | | 32 | .1160 | 2.750 | 1.625 | C16199 | - |
| | | 31 | .1200 | 2.750 | 1.625 | C16198 | C03730 |
| | | | .1250 | 2.750 | 1.625 | C16033 | C03731 |
| | | 30 | .1285 | 2.750 | 1.625 | C16197 | C03732 |
| | | 29 | .1360 | 2.875 | 1.750 | C16196 | C03733 |
| | | 28 | .1405 | 2.875 | 1.750 | C16195 | - |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | ◆ | | | | | ☆ | | | |
| TiN | ☆ | | ☆ | | ☆ | | | | | | | | |

☆ = Best Performance ◆ = Acceptable



Parabolic
Styles: 2065, 2065-TN (continued)
Jobber Length
Cobalt

| fraction | drill diameter | | decimal equivalent | overall length | | order number | |
|----------|----------------|------|--------------------|---------------------|---------------------|--------------|-------------|
| | d ₁ | wire | | l ₁ (in) | l ₂ (in) | 2065 Bright | 2065-TN TiN |
| 9/64 | | | .1406 | 2.875 | 1.750 | C16034 | - |
| | | 27 | .1440 | 3.000 | 1.875 | C16194 | - |
| | | 26 | .1470 | 3.000 | 1.875 | C16193 | - |
| | | 25 | .1495 | 3.000 | 1.875 | C16192 | C03738 |
| | | 24 | .1520 | 3.125 | 2.000 | C16191 | - |
| | | 23 | .1540 | 3.125 | 2.000 | C16190 | - |
| 5/32 | | | .1562 | 3.125 | 2.000 | C16035 | C03741 |
| | | 22 | .1570 | 3.125 | 2.000 | C16189 | C03742 |
| | | 21 | .1590 | 3.500 | 2.313 | C16188 | C03743 |
| | | 20 | .1610 | 3.250 | 2.125 | C16187 | - |
| | | 19 | .1695 | 3.250 | 2.125 | C16186 | C03745 |
| | | 18 | .1695 | 3.250 | 2.125 | C16185 | - |
| 11/64 | | | .1719 | 3.250 | 2.125 | C16036 | C03747 |
| | | 17 | .1730 | 3.375 | 2.188 | C16184 | - |
| | | 16 | .1770 | 3.375 | 2.188 | C16183 | - |
| | | 15 | .1800 | 3.375 | 2.188 | C16182 | C03750 |
| | | 14 | .1820 | 3.375 | 2.188 | C16181 | C03751 |
| | | 13 | .1850 | 3.500 | 2.313 | C16180 | C03752 |
| 3/16 | | | .1875 | 3.500 | 2.313 | C16037 | C03753 |
| | | 12 | .1890 | 3.500 | 2.313 | C16179 | - |
| | | 11 | .1910 | 3.500 | 2.313 | C16178 | - |
| | | 10 | .1935 | 3.625 | 2.438 | C16177 | C03756 |
| | | 9 | .1960 | 3.625 | 2.438 | C16176 | - |
| | | 8 | .1990 | 3.625 | 2.438 | C16175 | C03758 |
| | | 7 | .2010 | 3.625 | 2.438 | C16174 | - |
| 13/64 | | | .2031 | 3.625 | 2.438 | C16038 | C03760 |
| | | 6 | .2040 | 3.750 | 2.500 | C16173 | C03761 |
| | | 5 | .2055 | 3.750 | 2.500 | C16172 | C03762 |
| | | 4 | .2090 | 3.750 | 2.500 | C16171 | - |
| | | 3 | .2130 | 3.750 | 2.500 | C16170 | C03764 |
| 7/32 | | | .2188 | 3.750 | 2.500 | C16039 | C03765 |
| | | 2 | .2210 | 3.875 | 2.625 | C16169 | - |
| | | 1 | .2280 | 3.875 | 2.625 | C16168 | - |
| 15/64 | | | .2344 | 3.875 | 2.625 | C16040 | - |
| 1/4 | E | | .2500 | 4.000 | 2.750 | C16041 | C03773 |
| 17/64 | | | .2656 | 4.125 | 2.875 | C16042 | C03776 |
| 9/32 | | | .2812 | 4.250 | 2.938 | C16043 | C03781 |
| 19/64 | | | .2969 | 4.375 | 3.063 | C16044 | C03784 |
| 5/16 | | | .3125 | 4.500 | 3.188 | C16045 | C03786 |
| 21/64 | | | .3281 | 4.625 | 3.313 | C16046 | - |
| 11/32 | | | .3438 | 4.750 | 3.438 | C16047 | - |
| 23/64 | | | .3594 | 4.875 | 3.500 | C16048 | - |
| 3/8 | | | .3750 | 5.000 | 3.625 | C16049 | - |
| 25/64 | | | .3906 | 5.125 | 3.750 | C16050 | - |
| 13/32 | | | .4062 | 5.250 | 3.875 | C16051 | C03801 |
| 27/64 | | | .4219 | 5.375 | 3.938 | C16052 | - |
| 7/16 | | | .4375 | 5.500 | 4.063 | C16053 | C03804 |
| 29/64 | | | .4531 | 5.625 | 4.188 | C16054 | - |
| 15/32 | | | .4688 | 5.750 | 4.313 | C16055 | C03806 |
| 31/64 | | | .4844 | 5.875 | 4.375 | C16056 | C03807 |
| 1/2 | | | .5000 | 6.000 | 4.500 | C16057 | - |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | ◆ | | | | | ☆ | | | |
| TiN | ☆ | | ☆ | | ☆ | | | | | | | | |

☆ = Best Performance ◆ = Acceptable

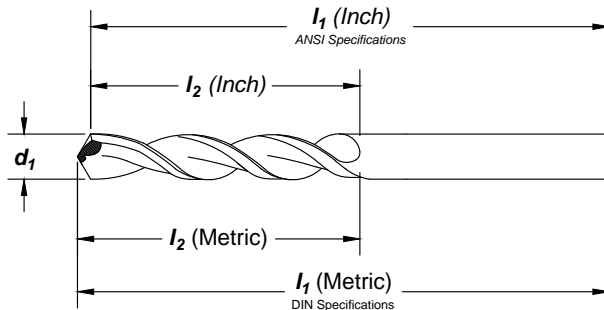


Styles: **2075, 2075-TN, 2075-TC, 2075-TA**

Note
Operating parameters: See Technical section

ASME B94.11M DIN 338 M42 Cobalt 135° Split Helix High 35° to 45° Straight Shank Surface Treatment: Straw Oxide, TiN, TiCN, TiAlN

****Items are being OBSOLETED, only available until inventory is depleted.**



Jobber Length

Cobalt

Feature:

Effective deep hole drilling in a wide array of materials. Available coating for extended tool life and productivity. Up to 7x diameter drilling without pecking.

| drill diameter | | overall length | | flute length | | order number | | | | |
|----------------|----------|----------------|----------------|----------------|----------------|--------------|-------------|----------|---------|--------|
| fraction | wire/let | decimal | I ₁ | I ₂ | I ₂ | 2075 | 2075-TN | 2075-TC | 2075-TA | |
| | | equivalent | in | mm | in | mm | straw oxide | TiN | TiCN | TiAlN |
| | | *1.50 | | 40.00 | | 18.00 | C16584 | C16696 | - | C11360 |
| | | *1.55 | | 43.00 | | 20.00 | **C15540 | - | - | - |
| 1/16 | | .0625 | 1.875 | | 0.875 | | C16555 | C16667 | C16942 | C16972 |
| | | 1.60 | | 43.00 | | 20.00 | C15541 | C13029 | - | C11361 |
| | 52 | .0635 | 1.875 | | 0.875 | | C16554 | C16666 | C13175 | C11452 |
| | | 1.65 | | 43.00 | | 20.00 | **C15542 | - | - | - |
| | 51 | .0670 | 2.000 | | 1.000 | | C16553 | C16665 | C13099 | C11451 |
| | | 1.75 | | 46.00 | | 22.00 | **C15543 | - | - | - |
| | 50 | .0700 | 2.000 | | 1.000 | | C16552 | C16664 | C13098 | C11450 |
| | | 1.80 | | 46.00 | | 22.00 | **C15544 | - | - | - |
| | 49 | .0730 | 2.000 | | 1.000 | | C16551 | C16663 | C13097 | C11449 |
| | | 1.90 | | 46.00 | | 22.00 | **C15545 | - | - | - |
| | 48 | .0760 | 2.000 | | 1.000 | | C16550 | C16661 | C13096 | C11448 |
| 5/64 | | .0781 | 2.000 | | 1.000 | | C16556 | C16668 | C16943 | C16973 |
| | 47 | .0785 | 2.000 | | 1.000 | | C16549 | C16660 | C13095 | C11447 |
| | | 2.00 | | 49.00 | | 24.00 | C16585 | C16697 | - | C11362 |
| | | 2.05 | | 49.00 | | 24.00 | **C15546 | - | - | - |
| | 46 | .0810 | 2.125 | | 1.125 | | C16548 | C16659 | C13094 | C11446 |
| | 45 | .0820 | 2.125 | | 1.125 | | C16547 | C16658 | C13093 | C11445 |
| | | 2.10 | | 49.00 | | 24.00 | **C15547 | - | - | - |
| | | 2.15 | | 53.00 | | 27.00 | **C15548 | - | - | - |
| | 44 | .0860 | 2.125 | | 1.125 | | C16546 | C16657 | C13091 | C11444 |
| | | 2.20 | | 53.00 | | 27.00 | **C15549 | - | - | - |
| | | 2.25 | | 53.00 | | 27.00 | **C15550 | - | - | - |
| | 43 | .0890 | 2.250 | | 1.250 | | C16545 | C16656 | C16944 | C16974 |
| | | 2.30 | | 53.00 | | 27.00 | **C15551 | **C16455 | - | - |
| | | 2.35 | | 53.00 | | 27.00 | **C15552 | - | - | - |
| | 42 | .0935 | 2.250 | | 1.250 | | C16544 | C16655 | C13090 | C11442 |
| 3/32 | | .0938 | 2.250 | 57.15 | 1.250 | 31.75 | C16557 | C16669 | C16945 | C16975 |
| | | 2.40 | | 57.00 | | 30.00 | **C15553 | - | - | - |

*Not split point.

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | ★ | | ★ | | | | | | | | | | |
| TiCN | ☆ | | ☆ | | ★ | ★ | | ★ | ★ | ☆ | | | |
| TiAlN | | | | | ☆ | ☆ | | ☆ | ☆ | | | | |

☆ = Best Performance ★ = Acceptable



****Items are being OBSOLETEED, only available until inventory is depleted.**

Jobber Length

Cobalt

| drill diameter | | decimal | | overall length | | flute length | | order number | | | |
|----------------|----------|---------|------------|----------------|-------|--------------|-------|--------------|----------|---------|----------|
| fraction | wire/let | mm | equivalent | in | mm | in | mm | 2075 | 2075-TN | 2075-TC | 2075-TA |
| | | | | | | | | straw oxide | TiN | TiCN | TiAlN |
| | 41 | | .0960 | 2.375 | | 1.375 | | C16543 | C16654 | C16946 | C16976 |
| | 40 | | .0980 | 2.375 | | 1.375 | | C16542 | C16652 | C16947 | C16977 |
| | | 2.50 | .0984 | | 57.00 | | 30.00 | C16586 | C16698 | - | C11363 |
| | 39 | | .0995 | 2.375 | | 1.375 | | C16541 | C16651 | C16948 | C16978 |
| | 38 | | .1015 | 2.500 | | 1.438 | | C16540 | C16650 | C13089 | C11438 |
| | | 2.60 | .1024 | | 57.00 | | 30.00 | **C15554 | - | - | - |
| | 37 | | .1040 | 2.500 | | 1.438 | | C16539 | C16649 | C13088 | C11437 |
| | 36 | | .1065 | 2.500 | | 1.438 | | C16538 | C16648 | C16949 | C16979 |
| 7/64 | | | .1094 | 2.625 | | 1.500 | | C16558 | C16670 | C16950 | C16980 |
| | 35 | | .1100 | 2.625 | | 1.500 | | C16537 | C16647 | C13087 | C11435 |
| | | 2.80 | .1102 | | 61.00 | | 33.00 | **C15555 | - | - | **C11364 |
| | 34 | | .1110 | 2.625 | | 1.500 | | C16536 | C16646 | C13086 | C11434 |
| | 33 | | .1130 | 2.625 | | 1.500 | | C16535 | C16645 | C13085 | C11433 |
| | | 2.90 | .1142 | | 61.00 | | 33.00 | C15556 | C13030 | - | C11365 |
| | 32 | | .1160 | 2.750 | | 1.625 | | C16534 | C16644 | C13084 | C11432 |
| | | 3.00 | .1181 | | 61.00 | | 33.00 | C16587 | C16699 | - | C11366 |
| | 31 | | .1200 | 2.750 | | 1.625 | | C16533 | C16643 | C13083 | C11431 |
| | | 3.10 | .1220 | | 65.00 | | 36.00 | **C15557 | **C16456 | - | - |
| 1/8 | | | .1250 | 2.750 | | 1.625 | | C16559 | C16671 | C16951 | C16981 |
| | | 3.20 | .1260 | | 65.00 | | 36.00 | **C15558 | **C16457 | - | - |
| | 30 | | .1285 | 2.750 | | 1.625 | | C16532 | C16642 | C16952 | C16982 |
| | | 3.30 | .1299 | | 65.00 | | 36.00 | C15559 | C13031 | - | C11367 |
| | | 3.40 | .1339 | | 70.00 | | 39.00 | **C15560 | - | - | - |
| | 29 | | .1360 | 2.875 | | 1.750 | | C16531 | C16641 | C16953 | C16983 |
| | | 3.50 | .1378 | | 70.00 | | 39.00 | C16588 | C16700 | - | C11368 |
| 9/64 | 28 | | .1405 | 2.875 | | 1.750 | | C16530 | C16640 | C13082 | C11428 |
| | | | .1406 | 2.875 | | 1.750 | | C16560 | C16672 | C13042 | C11400 |
| | 27 | | .1440 | 3.000 | | 1.875 | | C16529 | C16639 | C13081 | C11427 |
| | | 3.70 | .1457 | | 70.00 | | 39.00 | **C15561 | - | - | **C11369 |
| | 26 | | .1470 | 3.000 | | 1.875 | | C16528 | C16638 | C13080 | C11426 |
| | 25 | | .1495 | 3.000 | | 1.875 | | C16527 | C16637 | C13079 | C11425 |
| | 24 | | .1520 | 3.125 | | 2.000 | | C16526 | C16636 | C13078 | C11424 |
| | 23 | | .1540 | 3.125 | | 2.000 | | C16525 | C16635 | C13076 | C11423 |
| 5/32 | | | .1562 | 3.125 | | 2.000 | | C16561 | C16673 | C16954 | C16984 |
| | 22 | | .1570 | 3.125 | | 2.000 | | C16524 | C16634 | C13075 | C11422 |
| | | 4.00 | .1575 | | 75.00 | | 43.00 | C16589 | C16701 | - | C11370 |
| | 21 | | .1590 | 3.500 | | 2.313 | | C16523 | C16633 | C16955 | C16985 |
| | 20 | | .1610 | 3.250 | | 2.125 | | C16522 | C16632 | C13074 | C11420 |
| | | 4.10 | .1614 | | 75.00 | | 43.00 | **C15562 | - | - | - |
| | | 4.20 | .1654 | | 75.00 | | 43.00 | C15563 | C13033 | - | C11371 |
| | 19 | | .1660 | 3.250 | | 2.125 | | C16521 | C16631 | C13073 | C11419 |
| | 18 | | .1695 | 3.250 | | 2.125 | | C16520 | C16630 | C13072 | C11418 |
| 11/64 | | | .1719 | 3.250 | | 2.125 | | C16562 | C16674 | C13043 | C11404 |
| | 17 | | .1730 | 3.375 | | 2.188 | | C16519 | C16629 | C13071 | C11417 |
| | | 4.40 | .1732 | | 80.00 | | 47.00 | **C15581 | - | - | - |
| | 16 | | .1770 | 3.375 | | 2.188 | | C16518 | C16628 | C13070 | C11416 |
| | | 4.50 | .1772 | | 80.00 | | 47.00 | C16590 | C16702 | - | C11373 |
| | 15 | | .1800 | 3.375 | | 2.188 | | C16517 | C16626 | C13069 | C11415 |
| | 14 | | .1820 | 3.375 | | 2.188 | | C16516 | C16625 | C13067 | C11414 |
| | 13 | | .1850 | 3.500 | | 2.313 | | C16515 | C16624 | C13066 | C11413 |
| 3/16 | | | .1875 | 3.500 | | 2.313 | | C16563 | C16675 | C16956 | C16986 |
| | | 4.80 | .1890 | | 86.00 | | 52.00 | **C15564 | - | - | - |
| | 12 | | .1890 | 3.500 | | 2.313 | | C16514 | C16623 | C13065 | C11412 |
| | 11 | | .1910 | 3.500 | | 2.313 | | C16513 | C16622 | C13063 | C11411 |
| | 10 | | .1935 | 3.625 | | 2.438 | | C16512 | C16621 | C13062 | C11410 |
| | 9 | | .1960 | 3.625 | | 2.438 | | C16511 | C16620 | C13061 | C11409 |
| | | 5.00 | .1969 | | 86.00 | | 52.00 | C16591 | C16703 | - | C11374 |
| | 8 | | .1990 | 3.625 | | 2.438 | | C16510 | C16619 | C13060 | C11408 |
| | | 5.10 | .2008 | | 86.00 | | 52.00 | **C15565 | - | - | - |

continued on next page



Styles: **2075, 2075-TN, 2075-TC, 2075-TA** (cont'd)

****Items are being OBSOLETEED, only available until inventory is depleted.**

| drill diameter | | decimal | | overall length | | flute length | | order number | | | |
|----------------|----------|---------|------------|----------------|--------|--------------|-------|---------------------|----------------|-----------------|------------------|
| fraction | wire/let | mm | equivalent | in | mm | in | mm | 2075 straw oxide | 2075-TN TiN | 2075-TC TiCN | 2075-TA TiAlN |
| 13/64 | 7 | | .2010 | 3.625 | | 2.438 | | C16509 | C16618 | C16957 | C16987 |
| | | | .2031 | 3.625 | | 2.438 | | C16564 | C16676 | C16958 | C16988 |
| | 6 | | .2040 | 3.750 | | 2.500 | | C16508 | C16617 | C16959 | C16989 |
| | | 5.20 | .2047 | | 86.00 | | 52.00 | **C16592 | **C16704 | - | - |
| | 5 | | .2055 | 3.750 | | 2.500 | | C16507 | C16616 | C13059 | C11405 |
| | 4 | | .2090 | 3.750 | | 2.500 | | C16506 | C16615 | C16960 | C16990 |
| | 3 | | .2130 | 3.750 | | 2.500 | | C16505 | C16614 | C13058 | C11403 |
| | | 5.50 | .2165 | | 93.00 | | 57.00 | C16593 | C16705 | - | C11375 |
| 7/32 | | | .2188 | 3.750 | | 2.500 | | C16565 | C16677 | C16961 | C16991 |
| | | 5.60 | .2205 | | 93.00 | | 57.00 | **C16594 | **C16706 | - | - |
| | 2 | | .2210 | 3.875 | | 2.625 | | C16504 | C16613 | C13057 | C11402 |
| | | 5.70 | .2244 | | 93.00 | | 57.00 | **C15566 | - | - | - |
| | 1 | | .2280 | 3.875 | | 2.625 | | C16503 | C16612 | C13056 | C11401 |
| | | 5.80 | .2283 | | 93.00 | | 57.00 | **C15582 | - | - | - |
| 15/64 | A | | .2340 | 3.875 | | 2.625 | | C15650 | - | C16430 | - |
| | | | .2344 | 3.875 | | 2.625 | | C16566 | C16678 | C16962 | C16992 |
| | | 6.00 | .2362 | | 93.00 | | 57.00 | C16595 | C16707 | - | C11377 |
| | B | | .2380 | 4.000 | | 2.750 | | C15651 | - | C16431 | - |
| | C | | .2420 | 4.000 | | 2.750 | | C15652 | - | C16432 | - |
| | D | | .2460 | 4.000 | | 2.750 | | C15653 | - | C16433 | - |
| 1/4 | E | | .2500 | 4.000 | | 2.750 | | C16567 | C16679 | C16963 | C16993 |
| | | 6.40 | .2520 | | 101.00 | | 63.00 | **C15567 | - | - | - |
| | | 6.50 | .2559 | | 101.00 | | 63.00 | C16596 | C16708 | - | C11378 |
| | F | | .2570 | 4.125 | | 2.875 | | C15654 | - | C16434 | - |
| | | 6.60 | .2598 | | 101.00 | | 63.00 | **C15568 | - | - | - |
| | G | | .2610 | 4.125 | | 2.875 | | C15655 | - | C16435 | - |
| | | 6.70 | .2638 | | 101.00 | | 63.00 | **C15569 | - | - | - |
| 17/64 | | | .2656 | 4.125 | | 2.875 | | C16568 | C16680 | C16964 | C16994 |
| | H | | .2660 | 4.125 | | 2.875 | | C15656 | - | C16436 | - |
| | | 6.80 | .2677 | | 109.00 | | 69.00 | C16597 | C16709 | - | C11379 |
| | I | | .2720 | 4.125 | | 2.875 | | C15657 | - | C16437 | - |
| | | 7.00 | .2756 | | 109.00 | | 69.00 | C16598 | C16710 | C16965 | C16995 |
| | J | | .2770 | 4.125 | | 2.875 | | C15658 | - | C16438 | - |
| | K | | .2810 | 4.250 | | 2.938 | | C15659 | - | C16439 | - |
| 9/32 | | | .2812 | 4.250 | | 2.938 | | C16569 | C16681 | C16966 | C16996 |
| | | 7.20 | .2835 | | 109.00 | | 69.00 | **C15570 | - | - | - |
| | L | | .2900 | 4.250 | | 2.938 | | C15660 | - | C16440 | - |
| | M | | .2950 | 4.375 | 111.13 | 3.063 | 77.79 | C15661 | - | C16441 | - |
| | | 7.50 | .2953 | | 109.00 | | 69.00 | **C16599 | **C16711 | - | **C11380 |
| 19/64 | | | .2969 | 4.375 | | 3.063 | | C16570 | C16682 | C13044 | C13205 |
| | N | | .3020 | 4.375 | | 3.063 | | C15662 | - | C16442 | - |
| 5/16 | | | .3125 | 4.500 | | 3.188 | | C16571 | C16683 | C16967 | C16997 |
| | | 8.00 | .3150 | | 117.00 | | 75.00 | C16600 | C16712 | - | C11381 |
| | O | | .3160 | 4.500 | | 3.188 | | C15663 | - | C16443 | - |
| | | 8.10 | .3189 | | 117.00 | | 75.00 | **C15572 | - | - | - |
| | | 8.20 | .3228 | | 117.00 | | 75.00 | **C16601 | **C16713 | - | - |
| 21/64 | P | | .3230 | 4.625 | | 3.313 | | C15664 | - | C16444 | - |
| | | | .3281 | 4.625 | | 3.313 | | C16572 | C16684 | C13045 | C13206 |
| | Q | | .3320 | 4.750 | | 3.438 | | C15665 | - | C16445 | - |
| | | 8.50 | .3346 | | 117.00 | | 75.00 | **C16602 | **C16714 | - | **C11382 |
| | | 8.60 | .3386 | | 125.00 | | 81.00 | **C16603 | **C16715 | - | - |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | ★ | | ★ | | | | | | | | | | |
| TiCN | ☆ | | ☆ | | ★ | ★ | | ★ | ★ | ☆ | | | |
| TiAlN | | | | | ☆ | ☆ | | ☆ | ☆ | | | | |

☆ = Best Performance ★ = Acceptable



Jobber Length

Cobalt

Wide Land Parabolic Q-Cobalt™

Styles: **2075, 2075-TN, 2075-TC, 2075-TA** (cont'd)

****Items are being OBSOLETEd, only available until inventory is depleted.**

Jobber Length

Cobalt

| fraction | drill diameter | | overall length | | flute length | | order number | | | | |
|----------|----------------|-------|-----------------------|----------|--------------|----------|--------------|---------------------|----------------|-----------------|------------------|
| | d1 wire/let | mm | decimal equivalent | l1 in | mm | l2 in | mm | 2075 straw oxide | 2075-TN TiN | 2075-TC TiCN | 2075-TA TiAlN |
| 11/32 | R | 8.70 | .3390 | 4.750 | 125.00 | 3.438 | 81.00 | C15666 | - | C16446 | - |
| | | | .3425 | | | | | C15573 | C13035 | - | C13215 |
| 23/64 | S | 9.00 | .3438 | 4.750 | | 3.438 | | C16573 | C16685 | C16968 | C16998 |
| | | | | .3480 | 4.875 | | 3.500 | C15667 | - | C16447 | - |
| 25/64 | T | 9.50 | .3543 | | 125.00 | | 81.00 | C16604 | C16716 | - | C11383 |
| | | | | .3580 | 4.875 | | 3.500 | C15668 | - | C16448 | - |
| 3/8 | U | 10.00 | .3594 | 4.875 | | 3.500 | | C16574 | C16686 | C13047 | C13207 |
| | | | | .3680 | 5.000 | | 3.625 | C15669 | - | C16449 | - |
| 25/64 | V | 10.20 | .3740 | | 125.00 | | 81.00 | **C16605 | **C16717 | - | - |
| | | | | .3750 | 5.000 | | 3.625 | C16575 | C16687 | C16969 | C16999 |
| 27/64 | W | 10.80 | .3770 | 5.000 | | 3.625 | | C15670 | - | C16450 | - |
| | | | | .3860 | 5.125 | | 3.750 | C15671 | - | C16451 | - |
| 7/16 | X | 11.00 | .3906 | 5.125 | 133.00 | | 87.00 | C16576 | C16688 | C13048 | C13208 |
| | | | | .3937 | | | | | C16606 | C16718 | - |
| 13/32 | Y | 11.20 | .3970 | 5.125 | 133.00 | | 87.00 | C15672 | - | C16452 | - |
| | | | | .4016 | | | | | C15574 | C13036 | - |
| 15/32 | Z | 11.50 | .4040 | 5.250 | | 3.875 | | C15673 | - | C16453 | - |
| | | | | .4062 | 5.250 | | 3.875 | C16577 | C16689 | C13049 | C13209 |
| 29/64 | | 12.00 | .4130 | 5.250 | | 3.875 | | C15674 | - | C16454 | - |
| | | | | .4134 | | 133.00 | | 87.00 | **C16607 | **C16719 | - |
| 31/64 | | 12.25 | .4219 | 5.375 | | 3.938 | | C16578 | C16690 | C13051 | C13210 |
| | | | | .4252 | | 142.00 | | 94.00 | C15575 | C13037 | - |
| 1/2 | | 12.50 | .4331 | | 142.00 | | 94.00 | C16608 | C16720 | - | C11385 |
| | | | | .4375 | 5.500 | | 4.063 | C16579 | C16691 | C16970 | C17000 |
| 29/64 | | 12.50 | .4409 | | 142.00 | | 94.00 | **C15576 | - | - | - |
| | | | | .4528 | | 142.00 | | 94.00 | **C16609 | **C16721 | - |
| 15/32 | | 12.25 | .4531 | 5.625 | | 4.188 | | C16580 | C16692 | C13052 | C13212 |
| | | | | .4688 | 5.750 | | 4.313 | C16581 | C16693 | C13054 | C13213 |
| 31/64 | | 13.00 | .4724 | | 151.00 | | 101.00 | C16610 | C16722 | - | C11386 |
| | | | | .4823 | | 151.00 | | 101.00 | C15577 | C13038 | - |
| 1/2 | | 13.00 | .4844 | 5.875 | | 4.375 | | C16582 | C16694 | C13055 | C13214 |
| | | | | .4921 | | 151.00 | | 101.00 | C16611 | C16723 | - |
| | | | .5000 | 6.000 | | 4.500 | | C16583 | C16695 | C16971 | C17001 |
| | | | .5118 | | 151.00 | | 101.00 | C15583 | C13040 | - | C11387 |

Wide Land Parabolic Q-Cobalt™

SET

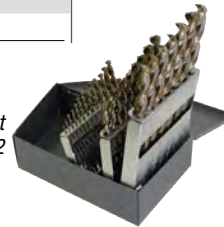
Style: **2075**

| no. of pieces | surface treatment | size range | order number |
|---------------|-------------------|----------------------------|-----------------------|
| 15 | straw oxide | 1/16" through 1/2" x 1/32" | 2075 C00901 |
| 29 | straw oxide | 1/16" through 1/2" x 1/64" | C00902 |

15-Piece Set
#C00901



29-Piece Set
#C00902



| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|-----|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | >38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| TiN | ★ | | ★ | | | | | | | ★ | | | |
| TiCN | ★ | | ★ | | ★ | ★ | | ★ | ★ | | | | |
| TiAlN | | | | | ★ | ★ | | ★ | ★ | | | | |

★ = Best Performance ★ = Acceptable



Style: **2006**

Left Hand

Note
Operating parameters: See Technical section

ASME
B94.11M

HSS

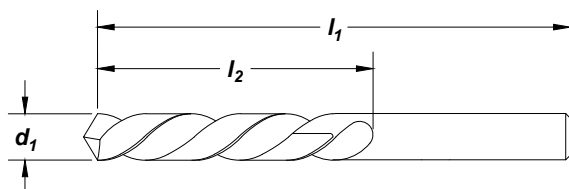
118°

Helix
Regular
21° to 34°

Straight
Shank

Surface
Treatment

Bright



Jobber Length

High Speed Steel

Feature:

Left Hand for reverse spindle application.

| drill diameter | | decimal equivalent | overall length | | flute length | order no. |
|----------------------------|---------------------|--------------------|---------------------|-------------|--------------|-----------|
| d ₁ fraction | l ₁ (in) | | l ₂ (in) | 2006 | | |
| 1/16 | 1.875 | .0625 | .875 | C01401 | | |
| 5/64 | 2.000 | .0781 | 1.000 | C01415 | | |
| 3/32 | 2.250 | .0938 | 1.250 | C01430 | | |
| 7/64 | 2.625 | .1094 | 1.500 | C01443 | | |
| 1/8 | 2.750 | .1250 | 1.625 | C01453 | | |
| 9/64 | 2.875 | .1406 | 1.750 | C01462 | | |
| 5/32 | 3.125 | .1562 | 2.000 | C01473 | | |
| 11/64 | 3.250 | .1719 | 2.125 | C01484 | | |
| 3/16 | 3.500 | .1875 | 2.313 | C01495 | | |
| 13/64 | 3.875 | .2031 | 2.438 | C01506 | | |
| 7/32 | 3.750 | .2188 | 2.500 | C01516 | | |
| 1/4 | 4.000 | .2500 | 2.750 | C01532 | | |
| 17/64 | 4.125 | .2656 | 2.875 | C01538 | | |
| 9/32 | 4.250 | .2812 | 2.938 | C01551 | | |
| 5/16 | 4.500 | .3125 | 3.188 | C01561 | | |
| 3/8 | 5.000 | .3750 | 3.625 | C01588 | | |
| 13/32 | 5.250 | .4062 | 3.875 | C01600 | | |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable

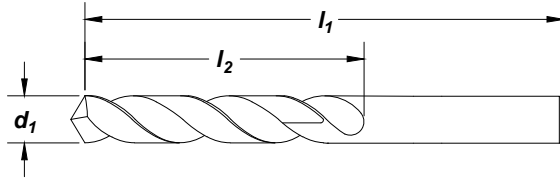


Note
Split point for reduced thrust and easy penetration.
Operating parameters: See Technical section

HSS
NAS 907 TYPE A
118° Split
Helix Regular 21° to 34°
Straight Shank
Surface Treatment
Bright

Jobber Length

High Speed Steel



| drill diameter | | wire | decimal equivalent | overall length | | flute length | order number |
|----------------|----------------|------|--------------------|---------------------|---------------------|--------------|-----------------------|
| fraction | d ₁ | | | l ₁ (in) | l ₂ (in) | | 2228 bright |
| 1/16 | | 52 | .0635 | 1.875 | .875 | C73480 | |
| | | 51 | .0670 | 2.000 | 1.000 | C73479 | |
| | | 50 | .0700 | 2.000 | 1.000 | C73478 | |
| | | 49 | .0730 | 2.000 | 1.000 | C73477 | |
| | | 48 | .0760 | 2.000 | 1.000 | C73476 | |
| 5/64 | | 47 | .0785 | 2.000 | 1.000 | C73401 | |
| | | 46 | .0810 | 2.125 | 1.125 | C73475 | |
| | | 45 | .0820 | 2.125 | 1.125 | C73474 | |
| | | 44 | .0860 | 2.125 | 1.125 | C73473 | |
| | | 43 | .0890 | 2.250 | 1.250 | C73472 | |
| | | 42 | .0935 | 2.250 | 1.250 | C73471 | |
| 3/32 | | 41 | .0938 | 2.250 | 1.250 | C73470 | |
| | | 40 | .0960 | 2.375 | 1.375 | C73402 | |
| | | 39 | .0980 | 2.375 | 1.375 | C73469 | |
| | | 38 | .0995 | 2.375 | 1.375 | C73468 | |
| | | 37 | .1015 | 2.500 | 1.438 | C73467 | |
| 7/64 | | 36 | .1040 | 2.500 | 1.438 | C73466 | |
| | | 35 | .1065 | 2.500 | 1.438 | C73465 | |
| | | 34 | .1094 | 2.625 | 1.500 | C73464 | |
| | | 33 | .1100 | 2.625 | 1.500 | C73403 | |
| | | 32 | .1110 | 2.625 | 1.500 | C73463 | |
| | | 31 | .1130 | 2.625 | 1.500 | C73462 | |
| 1/8 | | 30 | .1160 | 2.750 | 1.625 | C73461 | |
| | | 29 | .1200 | 2.750 | 1.625 | C73460 | |
| | | 28 | .1250 | 2.750 | 1.625 | C73459 | |
| | | 27 | .1285 | 2.750 | 1.625 | C73458 | |
| | | 26 | .1360 | 2.875 | 1.750 | C73457 | |
| 9/64 | | 25 | .1405 | 2.875 | 1.750 | C73456 | |
| | | 24 | .1406 | 2.875 | 1.750 | C73455 | |
| | | 23 | .1440 | 3.000 | 1.875 | C73454 | |
| | | 22 | .1470 | 3.000 | 1.875 | C73453 | |
| | | 21 | .1495 | 3.000 | 1.875 | C73452 | |
| | | 20 | .1520 | 3.125 | 2.000 | C73451 | |
| 5/32 | | 19 | .1540 | 3.125 | 2.000 | C73450 | |
| | | 18 | .1562 | 3.125 | 2.000 | C73449 | |
| | | 17 | .1570 | 3.125 | 2.000 | C73448 | |
| | | 16 | .1590 | 3.250 | 2.125 | C73447 | |
| | | 15 | .1610 | 3.250 | 2.125 | C73446 | |

continued on next page



Style: 2228 (continued)

| drill diameter | | wire | decimal equivalent | overall length l ₁ (in) | flute length l ₂ (in) | order number |
|----------------|----------------|------|--------------------|---------------------------------------|-------------------------------------|----------------|
| fraction | d ₁ | | | | | 2228 bright |
| 11/64 | | | .1719 | 3.250 | 2.125 | C73407 |
| | | 17 | .1730 | 3.375 | 2.188 | C73445 |
| | | 16 | .1770 | 3.375 | 2.188 | C73444 |
| | | 15 | .1800 | 3.375 | 2.188 | C73443 |
| | | 14 | .1820 | 3.375 | 2.188 | C73442 |
| | | 13 | .1850 | 3.500 | 2.313 | C73441 |
| 3/16 | | | .1875 | 3.500 | 2.313 | C73408 |
| | | 12 | .1890 | 3.500 | 2.313 | C73440 |
| | | 11 | .1910 | 3.500 | 2.313 | C73439 |
| | | 10 | .1935 | 3.625 | 2.438 | C73438 |
| | | 9 | .1960 | 3.625 | 2.438 | C73437 |
| | | 8 | .1990 | 3.625 | 2.438 | C73436 |
| | | 7 | .2010 | 3.625 | 2.438 | C73435 |
| 13/64 | | | .2031 | 3.625 | 2.438 | C73409 |
| | | 6 | .2040 | 3.750 | 2.500 | C73434 |
| | | 5 | .2055 | 3.750 | 2.500 | C73433 |
| | | 4 | .2090 | 3.750 | 2.500 | C73432 |
| | | 3 | .2130 | 3.750 | 2.500 | C73431 |
| 7/32 | | | .2188 | 3.750 | 2.500 | C73410 |
| | | 2 | .2210 | 3.875 | 2.625 | C73430 |
| | | 1 | .2280 | 3.875 | 2.625 | C73429 |
| 15/64 | | | .2344 | 3.875 | 2.625 | C73411 |
| 1/4 | | | .2500 | 4.000 | 2.750 | C73412 |
| 17/64 | | | .2656 | 4.125 | 2.875 | C73413 |
| 9/32 | | | .2812 | 4.250 | 2.938 | C73414 |
| 19/64 | | | .2969 | 4.375 | 3.063 | C73415 |
| 5/16 | | | .3125 | 4.500 | 3.188 | C73416 |
| 21/64 | | | .3281 | 4.625 | 3.313 | C73417 |
| 11/32 | | | .3438 | 4.750 | 3.438 | C73418 |
| 23/64 | | | .3594 | 4.875 | 3.500 | C73419 |
| 3/8 | | | .3750 | 5.000 | 3.625 | C73420 |
| 25/64 | | | .3906 | 5.125 | 3.750 | C73421 |
| 13/32 | | | .4062 | 5.250 | 3.875 | C73422 |
| 27/64 | | | .4219 | 5.375 | 3.938 | C73423 |
| 7/16 | | | .4375 | 5.500 | 4.063 | C73424 |
| 29/64 | | | .4531 | 5.625 | 4.188 | C73425 |
| 15/32 | | | .4688 | 5.750 | 4.313 | C73426 |
| 31/64 | | | .4844 | 5.875 | 4.375 | C73427 |
| 1/2 | | | .5000 | 6.000 | 4.500 | C73428 |

Jobber Length

High Speed Steel

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | ◆ | | | | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Aircraft NAS 907, Type B Heavy Duty

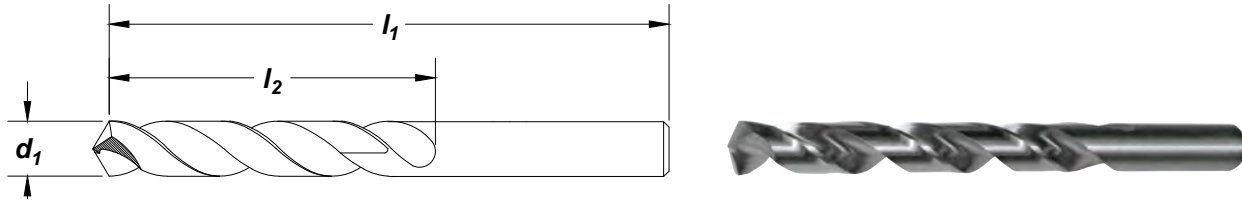


Style: **2222**

Note
Operating parameters: See Technical section

HSS
NAS 907 TYPE B
135° Split
Helix Regular 21° to 34°
Straight Shank
Surface Treatment
Bright

Jobber Length



High Speed Steel

Feature:
Heavy Duty design for tougher materials.

| drill diameter | | decimal | | overall length | | flute length | | order number |
|----------------|-------------------------------|---------|------------|----------------|----------------------|--------------|----------------------|-----------------------|
| fraction | d ₁ wire/letter | mm | equivalent | in | l ₁ mm | in | l ₂ mm | 2222 bright |
| | | * 1.00 | 0.0394 | | 34.00 | | 12.00 | C11800 |
| * 3/64 | | 1.50 | 0.0469 | 1.750 | | 0.750 | | C11600 |
| | | | 0.0591 | | 40.00 | | 18.00 | C11805 |
| 1/16 | | | 0.0625 | 1.875 | | 0.875 | | C11601 |
| | #52 | | 0.0635 | 1.875 | | 0.875 | | C11706 |
| | #51 | | 0.0670 | 2.000 | | 1.000 | | C11705 |
| | #50 | | 0.0700 | 2.000 | | 1.000 | | C11704 |
| | #49 | | 0.0730 | 2.000 | | 1.000 | | C11703 |
| | #48 | | 0.0760 | 2.000 | | 1.000 | | C11702 |
| 5/64 | | | 0.0781 | 2.000 | | 1.000 | | C11602 |
| | #47 | | 0.0785 | 2.000 | | 1.000 | | C11701 |
| | | 2.00 | 0.0787 | | 49.00 | | 24.00 | C11810 |
| | #46 | | 0.0810 | 2.125 | | 1.125 | | C11700 |
| | #45 | | 0.0820 | 2.125 | | 1.125 | | C11699 |
| | #44 | | 0.0860 | 2.125 | | 1.125 | | C11698 |
| | #43 | | 0.0890 | 2.250 | | 1.250 | | C11697 |
| | #42 | | 0.0935 | 2.250 | | 1.250 | | C11696 |
| 3/32 | | | 0.0938 | 2.250 | | 1.250 | | C11603 |
| | #41 | | 0.0960 | 2.375 | | 1.375 | | C11695 |
| | #40 | | 0.0980 | 2.375 | | 1.375 | | C11694 |
| | | 2.50 | 0.0984 | | 57.00 | | 30.00 | C11815 |
| | #39 | | 0.0995 | 2.375 | | 1.375 | | C11693 |
| | #38 | | 0.1015 | 2.500 | | 1.438 | | C11692 |
| | #37 | | 0.1040 | 2.500 | | 1.438 | | C11691 |
| | #36 | | 0.1065 | 2.500 | | 1.438 | | C11690 |
| 7/64 | | | 0.1094 | 2.625 | | 1.500 | | C11604 |
| | #35 | | 0.1100 | 2.625 | | 1.500 | | C11689 |
| | #34 | | 0.1110 | 2.625 | | 1.500 | | C11688 |
| | #33 | | 0.1130 | 2.625 | | 1.500 | | C11687 |
| | #32 | | 0.1160 | 2.750 | | 1.625 | | C11686 |
| | | 3.00 | 0.1181 | | 61.00 | | 33.00 | C11820 |
| | #31 | | 0.1200 | 2.750 | | 1.625 | | C11685 |
| 1/8 | | | 0.1250 | 2.750 | | 1.625 | | C11605 |
| | | 3.20 | 0.1260 | | 65.00 | | 36.00 | C11822 |
| | #30 | | 0.1285 | 2.750 | | 1.625 | | C11684 |
| | #29 | | 0.1360 | 2.875 | | 1.750 | | C11683 |
| | | 3.50 | 0.1378 | | 70.00 | | 39.00 | C11825 |
| | #28 | | 0.1405 | 2.875 | | 1.750 | | C11682 |
| 9/64 | | | 0.1406 | 2.875 | | 1.750 | | C11606 |
| | #27 | | 0.1440 | 3.000 | | 1.875 | | C11681 |
| | #26 | | 0.1470 | 3.000 | | 1.875 | | C11680 |
| | #25 | | 0.1495 | 3.000 | | 1.875 | | C11679 |
| | #24 | | 0.1520 | 3.125 | | 2.000 | | C11678 |
| | #23 | | 0.1540 | 3.125 | | 2.000 | | C11677 |
| 5/32 | | | 0.1562 | 3.125 | | 2.000 | | C11607 |

*Not split point.

continued on next page



Style: 2222 (continued)

| drill diameter | | | overall length | | flute length | | order number | |
|----------------|----------------|------|----------------|----------------|--------------|----------------|--------------|----------------|
| fraction | d ₁ | mm | decimal | l ₁ | | l ₂ | | 2222 bright |
| | wire/letter | | equivalent | in | mm | in | mm | |
| | #22 | | 0.1570 | 3.125 | | 2.000 | | C11676 |
| | | 4.00 | 0.1575 | | 75.00 | | 43.00 | C11830 |
| | #21 | | 0.1590 | 3.250 | | 2.125 | | C11675 |
| | #20 | | 0.1610 | 3.250 | | 2.125 | | C11674 |
| | | 4.10 | 0.1614 | | 75.00 | | 43.00 | C11831 |
| | #19 | | 0.1660 | 3.250 | | 2.125 | | C11673 |
| | #18 | | 0.1695 | 3.250 | | 2.125 | | C11672 |
| 11/64 | | | 0.1719 | 3.250 | | 2.125 | | C11608 |
| | #17 | | 0.1730 | 3.375 | | 2.188 | | C11671 |
| | #16 | | 0.1770 | 3.375 | | 2.188 | | C11670 |
| | | 4.50 | 0.1772 | | 80.00 | | 47.00 | C11835 |
| | #15 | | 0.1800 | 3.375 | | 2.188 | | C11669 |
| | #14 | | 0.1820 | 3.375 | | 2.188 | | C11668 |
| | #13 | | 0.1850 | 3.500 | | 2.313 | | C11667 |
| 3/16 | | | 0.1875 | 3.500 | | 2.313 | | C11609 |
| | #12 | | 0.1890 | 3.500 | | 2.313 | | C11666 |
| | #11 | | 0.1910 | 3.500 | | 2.313 | | C11665 |
| | | 4.90 | 0.1929 | | 86.00 | | 52.00 | C11839 |
| | #10 | | 0.1935 | 3.625 | | 2.438 | | C11664 |
| | #9 | | 0.1960 | 3.625 | | 2.438 | | C11663 |
| | | 5.00 | 0.1969 | | 86.00 | | 52.00 | C11840 |
| | #8 | | 0.1990 | 3.625 | | 2.438 | | C11662 |
| | #7 | | 0.2010 | 3.625 | | 2.438 | | C11661 |
| 13/64 | | | 0.2031 | 3.625 | | 2.438 | | C11610 |
| | #6 | | 0.2040 | 3.750 | | 2.500 | | C11660 |
| | #5 | | 0.2055 | 3.750 | | 2.500 | | C11659 |
| | #4 | | 0.2090 | 3.750 | | 2.500 | | C11658 |
| | #3 | | 0.2130 | 3.750 | | 2.500 | | C11657 |
| | | 5.50 | 0.2165 | | 93.00 | | 57.00 | C11845 |
| 7/32 | | | 0.2188 | 3.750 | | 2.500 | | C11611 |
| | #2 | | 0.2210 | 3.875 | | 2.625 | | C11656 |
| | #1 | | 0.2280 | 3.875 | | 2.625 | | C11655 |
| | A | | 0.2340 | 3.875 | | 2.625 | | C11630 |
| 15/64 | | | 0.2344 | 3.875 | | 2.625 | | C11612 |
| | | 6.00 | 0.2362 | | 93.00 | | 57.00 | C11850 |
| | B | | 0.2380 | 4.000 | | 2.750 | | C11631 |
| | C | | 0.2420 | 4.000 | | 2.750 | | C11632 |
| | D | | 0.2460 | 4.000 | | 2.750 | | C11633 |
| 1/4 | | | 0.2500 | 4.000 | | 2.750 | | C11613 |
| | | 6.50 | 0.2559 | | 101.00 | | 63.00 | C11855 |
| | F | | 0.2570 | 4.125 | | 2.875 | | C11634 |
| | G | | 0.2610 | 4.125 | | 2.875 | | C11635 |
| 17/64 | | | 0.2656 | 4.125 | | 2.875 | | C11614 |
| | H | | 0.2660 | 4.125 | | 2.875 | | C11636 |
| | I | | 0.2720 | 4.125 | | 2.875 | | C11637 |
| | | 7.00 | 0.2756 | | 109.00 | | 69.00 | C11860 |
| | J | | 0.2770 | 4.125 | | 2.875 | | C11638 |
| | K | | 0.2810 | 4.250 | | 2.938 | | C11639 |
| 9/32 | | | 0.2812 | 4.250 | | 2.938 | | C11615 |
| | L | | 0.2900 | 4.250 | | 2.938 | | C11640 |
| | M | | 0.2950 | 4.375 | | 3.063 | | C11641 |

Jobber Length
High Speed Steel

continued on next page

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | ◆ | | | ◆ | ◆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Aircraft NAS 907, Type B
Heavy Duty

Style: **2222** (continued)

Jobber Length

High Speed Steel

| fraction | drill diameter | | decimal equivalent | overall length | | flute length | | order number |
|----------|----------------|-------|--------------------|----------------|--------|--------------|--------|-----------------------|
| | wire/letter | mm | | in | mm | in | mm | |
| | | 7.50 | 0.2953 | | 109.00 | | 69.00 | 2222 bright |
| 19/64 | | | 0.2969 | 4.375 | | 3.063 | | C11865 |
| | N | | 0.3020 | 4.375 | | 3.063 | | C11616 |
| 5/16 | | | 0.3125 | 4.500 | | 3.188 | | C11642 |
| | | 8.00 | 0.3150 | | 117.00 | | 75.00 | C11617 |
| | O | | 0.3160 | 4.500 | | 3.188 | | C11870 |
| | P | | 0.3230 | 4.625 | | 3.313 | | C11643 |
| 21/64 | | | 0.3281 | 4.625 | | 3.313 | | C11644 |
| | Q | | 0.3320 | 4.750 | | 3.438 | | C11618 |
| | | 8.50 | 0.3346 | | 117.00 | | 75.00 | C11645 |
| | R | | 0.3390 | 4.750 | | 3.438 | | C11875 |
| 11/32 | | | 0.3438 | 4.750 | | 3.438 | | C11646 |
| | S | | 0.3480 | 4.875 | | 3.500 | | C11619 |
| | | 9.00 | 0.3543 | | 125.00 | | 81.00 | C11647 |
| | T | | 0.3580 | 4.875 | | 3.500 | | C11880 |
| 23/64 | | | 0.3594 | 4.875 | | 3.500 | | C11648 |
| | U | | 0.3680 | 5.000 | | 3.625 | | C11620 |
| | | 9.50 | 0.3740 | | 125.00 | | 81.00 | C11649 |
| 3/8 | | | 0.3750 | 5.000 | | 3.625 | | C11885 |
| | V | | 0.3770 | 5.000 | | 3.625 | | C11621 |
| | W | | 0.3860 | 5.125 | | 3.750 | | C11650 |
| 25/64 | | | 0.3906 | 5.125 | | 3.750 | | C11651 |
| | | 10.00 | 0.3937 | | 133.00 | | 87.00 | C11622 |
| | X | | 0.3970 | 5.125 | | 3.750 | | C11890 |
| | Y | | 0.4040 | 5.250 | | 3.875 | | C11652 |
| 13/32 | | | 0.4062 | 5.250 | | 3.875 | | C11653 |
| | Z | | 0.4130 | 5.250 | | 3.875 | | C11623 |
| | | 10.50 | 0.4134 | | 133.00 | | 87.00 | C11654 |
| 27/64 | | | 0.4219 | 5.375 | | 3.938 | | C11895 |
| | | 11.00 | 0.4331 | | 142.00 | | 94.00 | C11624 |
| 7/16 | | | 0.4375 | 5.500 | | 4.063 | | C11900 |
| | | 11.50 | 0.4528 | | 142.00 | | 94.00 | C11625 |
| 29/64 | | | 0.4531 | 5.625 | | 4.188 | | C11905 |
| 15/32 | | | 0.4688 | 5.750 | | 4.313 | | C11626 |
| | | 12.00 | 0.4724 | | 151.00 | | 101.00 | C11627 |
| 31/64 | | | 0.4844 | 5.875 | | 4.375 | | C11910 |
| | | 12.50 | 0.4921 | | 151.00 | | 101.00 | C11628 |
| 1/2 | | | 0.5000 | 6.000 | | 4.500 | | C11915 |
| | | 13.00 | 0.5118 | | 151.00 | | 101.00 | C11629 |
| | | | | | | | | C11920 |

Aircraft NAS 907, Type B
Heavy Duty

SET

Style: **2222**

| no. of pieces | drill style | surface treatment | size range | order number |
|---------------|-------------|-------------------|----------------------------|-----------------------|
| 29 | 2222 | bright | 1/16" through 1/2" x 1/64" | 2222 C70371 |



| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | ◆ | | | ◆ | ◆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable

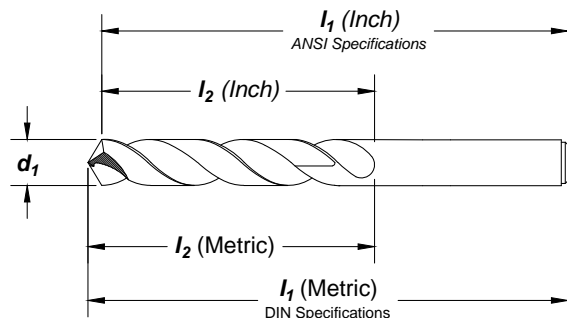


Style: Style: **2213**

Note
Operating parameters:
See Technical section



Surface Treatment



Jobber Length

Cobalt

Feature:
Highly heat resistant cobalt substrate for tough to machine materials.

| drill diameter | | | overall length | | | flute length | | | order number |
|----------------|-------------|------|--------------------|-------|-------|--------------|-------|-----------------------|--------------|
| fraction | wire/letter | mm | decimal equivalent | in | mm | in | mm | | |
| | *80 | | .0135 | .750 | | .125 | | 2213 C70213 | |
| | *79 | | .0145 | .750 | | .125 | | C70212 | |
| *1/64 | | | .0156 | .750 | | .188 | | C70000 | |
| | *78 | | .0160 | .875 | | .188 | | C70211 | |
| | *77 | | .0180 | .875 | | .188 | | C70210 | |
| | *76 | | .0200 | .875 | | .188 | | C70209 | |
| | *75 | | .0210 | 1.000 | | .250 | | C70208 | |
| | *74 | | .0225 | 1.000 | | .250 | | C70207 | |
| | *73 | | .0240 | 1.125 | | .313 | | C70206 | |
| | *72 | | .0250 | 1.125 | | .313 | | C70205 | |
| | *71 | | .0260 | 1.250 | | .375 | | C70204 | |
| | *70 | | .0280 | 1.250 | | .375 | | C70203 | |
| | *69 | | .0292 | 1.375 | | .500 | | C70202 | |
| | *68 | | .0310 | 1.375 | | .500 | | C70201 | |
| *1/32 | | | .0312 | 1.375 | | .500 | | C70001 | |
| | *67 | | .0320 | 1.375 | | .500 | | C70200 | |
| | *66 | | .0330 | 1.375 | | .500 | | C70199 | |
| | *65 | | .0350 | 1.500 | | .625 | | C70198 | |
| | *64 | | .0360 | 1.500 | | .625 | | C70197 | |
| | *63 | | .0370 | 1.500 | | .625 | | C70196 | |
| | *62 | | .0380 | 1.500 | | .625 | | C70195 | |
| | *61 | | .0390 | 1.625 | | .688 | | C70194 | |
| | | *1.0 | .0394 | | 34.00 | | 12.00 | C70057 | |
| | *60 | | .0400 | 1.625 | | .688 | | C70193 | |
| | *59 | | .0410 | 1.625 | | .688 | | C70192 | |
| | *58 | | .0420 | 1.625 | | .688 | | C70191 | |
| | *57 | | .0430 | 1.750 | | .750 | | C70190 | |
| | | *1.1 | .0433 | | 36.00 | | 14.00 | C70058 | |
| | *56 | | .0465 | 1.750 | | .750 | | C70189 | |
| *3/64 | | | .0469 | 1.750 | | .750 | | C70002 | |

*Not split point.

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Straw | ☆ | | ☆ | | ☆ | ☆ | ◆ | ◆ | ◆ | ☆ | ◆ | ◆ | |

☆ = Best Performance ◆ = Acceptable



Jobber Length

Cobalt

| drill diameter | | overall length | | | flute length | | order number | |
|----------------|-------------------------------|----------------|--------------------|-------|----------------------|----------------------|--------------|--------|
| fraction | d ₁ wire/letter | mm | decimal equivalent | in | l ₁ mm | l ₂ in | mm | |
| | | *1.2 | .0472 | | 38.00 | | 16.00 | C70059 |
| | | *1.3 | .0512 | | 38.00 | | 16.00 | C70060 |
| | *55 | | .0520 | 1.875 | | .875 | | C70188 |
| | *54 | | .0550 | 1.875 | | .875 | | C70187 |
| | | *1.4 | .0551 | | 40.00 | | 18.00 | C70061 |
| | | *1.5 | .0591 | | 40.00 | | 18.00 | C70062 |
| | *53 | | .0595 | 1.875 | | .875 | | C70186 |
| 1/16 | | | .0625 | 1.875 | | .875 | | C70003 |
| | | 1.6 | .0630 | | 43.00 | | 20.00 | C70063 |
| | 52 | | .0635 | 1.875 | | .875 | | C70185 |
| | | 1.7 | .0669 | | 43.00 | | 20.00 | C70064 |
| | 51 | | .0670 | 2.000 | | 1.000 | | C70184 |
| | 50 | | .0700 | 2.000 | | 1.000 | | C70183 |
| | | 1.8 | .0709 | | 46.00 | | 22.00 | C70065 |
| | 49 | | .0730 | 2.000 | | 1.000 | | C70182 |
| | | 1.9 | .0748 | | 46.00 | | 22.00 | C70220 |
| | 48 | | .0760 | 2.000 | | 1.000 | | C70181 |
| 5/64 | | | .0781 | 2.000 | | 1.000 | | C70004 |
| | 47 | | .0785 | 2.000 | | 1.000 | | C70180 |
| | | 2.0 | .0787 | | 49.00 | | 24.00 | C70067 |
| | 46 | | .0810 | 2.125 | | 1.125 | | C70179 |
| | 45 | | .0820 | 2.125 | | 1.125 | | C70178 |
| | | 2.1 | .0827 | | 49.00 | | 24.00 | C70068 |
| | 44 | | .0860 | 2.125 | | 1.125 | | C70177 |
| | | 2.2 | .0866 | | 53.00 | | 27.00 | C70221 |
| | 43 | | .0890 | 2.250 | | 1.250 | | C70176 |
| | | 2.3 | .0906 | | 53.00 | | 27.00 | C70070 |
| | 42 | | .0935 | 2.250 | | 1.250 | | C70175 |
| 3/32 | | | .0938 | 2.250 | | 1.250 | | C70005 |
| | | 2.4 | .0945 | | 57.00 | | 30.00 | C70071 |
| | 41 | | .0960 | 2.375 | | 1.375 | | C70174 |
| | 40 | | .0980 | 2.375 | | 1.375 | | C70173 |
| | | 2.5 | .0984 | | 57.00 | | 30.00 | C70072 |
| | 39 | | .0995 | 2.375 | | 1.375 | | C70172 |
| | 38 | | .1015 | 2.500 | | 1.438 | | C70171 |
| | | 2.6 | .1024 | | 57.00 | | 30.00 | C70073 |
| | 37 | | .1040 | 2.500 | | 1.438 | | C70170 |
| | | 2.7 | .1063 | | 61.00 | | 33.00 | C70074 |
| | 36 | | .1065 | 2.500 | | 1.438 | | C70169 |
| 7/64 | | | .1094 | 2.625 | | 1.500 | | C70006 |
| | 35 | | .1100 | 2.625 | | 1.500 | | C70168 |
| | | 2.8 | .1102 | | 61.00 | | 33.00 | C70222 |
| | 34 | | .1110 | 2.625 | | 1.500 | | C70167 |
| | 33 | | .1130 | 2.625 | | 1.500 | | C70166 |
| | | 2.9 | .1142 | | 61.00 | | 33.00 | C70076 |
| | 32 | | .1160 | 2.750 | | 1.625 | | C70165 |
| | | 3.0 | .1181 | | 61.00 | | 33.00 | C70077 |
| | 31 | | .1200 | 2.750 | | 1.625 | | C70164 |
| | | 3.1 | .1220 | | 65.00 | | 36.00 | C70078 |
| 1/8 | 1/8 | | .1250 | 2.750 | | 1.625 | | C70007 |
| | | 3.2 | .1260 | | 65.00 | | 36.00 | C70079 |
| | 30 | | .1285 | 2.750 | | 1.625 | | C70163 |
| | | 3.3 | .1299 | | 65.00 | | 36.00 | C70080 |
| | | 3.4 | .1339 | | 70.00 | | 39.00 | C70081 |
| | 29 | | .1360 | 2.875 | | 1.750 | | C70162 |
| | | 3.5 | .1378 | | 70.00 | | 39.00 | C70082 |

*Not split point.

continued on next page



Style: 2213 (continued)

| drill diameter | | | overall length | | | flute length | | order number |
|----------------|-------------|-----|--------------------|-------|-------|--------------|-------|--------------|
| fraction | wire/letter | mm | decimal equivalent | in | mm | in | mm | |
| | 28 | | .1405 | 2.875 | | 1.750 | | C70161 |
| 9/64 | | | .1406 | 2.875 | | 1.750 | | C70008 |
| | | 3.6 | .1417 | | 70.00 | | 39.00 | C70083 |
| | 27 | | .1440 | 3.000 | | 1.875 | | C70160 |
| | | 3.7 | .1457 | | 70.00 | | 39.00 | C70223 |
| | 26 | | .1470 | 3.000 | | 1.875 | | C70159 |
| | 25 | | .1495 | 3.000 | | 1.875 | | C70158 |
| | | 3.8 | .1496 | | 75.00 | | 43.00 | C70085 |
| | 24 | | .1520 | 3.125 | | 2.000 | | C70157 |
| | | 3.9 | .1535 | | 75.00 | | 43.00 | C70086 |
| | 23 | | .1540 | 3.125 | | 2.000 | | C70156 |
| 5/32 | | | .1562 | 3.125 | | 2.000 | | C70009 |
| | 22 | | .1570 | 3.125 | | 2.000 | | C70155 |
| | | 4.0 | .1575 | | 75.00 | | 43.00 | C70087 |
| | 21 | | .1590 | 3.250 | | 2.125 | | C70154 |
| | 20 | | .1610 | 3.250 | | 2.125 | | C70153 |
| | | 4.1 | .1614 | | 75.00 | | 43.00 | C70088 |
| | | 4.2 | .1654 | | 75.00 | | 43.00 | C70089 |
| | 19 | | .1660 | 3.250 | | 2.125 | | C70152 |
| | | 4.3 | .1693 | | 80.00 | | 47.00 | C70090 |
| | 18 | | .1695 | 3.250 | | 2.125 | | C70151 |
| 11/64 | | | .1719 | | 82.55 | | 53.98 | C70010 |
| | 17 | | .1730 | 3.375 | | 2.188 | | C70150 |
| | | 4.4 | .1732 | | 80.00 | | 47.00 | C70091 |
| | 16 | | .1770 | 3.375 | | 2.188 | | C70149 |
| | | 4.5 | .1772 | | 80.00 | | 47.00 | C70092 |
| | 15 | | .1800 | 3.375 | | 2.188 | | C70148 |
| | | 4.6 | .1811 | | 80.00 | | 47.00 | C70224 |
| | 14 | | .1820 | 3.375 | | 2.188 | | C70147 |
| | 13 | | .1850 | 3.500 | | 2.313 | | C70146 |
| | | 4.7 | .1850 | | 80.00 | | 47.00 | C70094 |
| 3/16 | | | .1875 | 3.500 | | 2.313 | | C70011 |
| | 12 | | .1890 | 3.500 | | 2.313 | | C70145 |
| | | 4.8 | .1890 | | 86.00 | | 52.00 | C70095 |
| | 11 | | .1910 | 3.500 | | 2.313 | | C70144 |
| | | 4.9 | .1929 | | 86.00 | | 52.00 | C70096 |
| | 10 | | .1935 | 3.625 | | 2.438 | | C70143 |
| | 9 | | .1960 | 3.625 | | 2.438 | | C70142 |
| | | 5.0 | .1968 | | 86.00 | | 52.00 | C70097 |
| | 8 | | .1990 | 3.625 | | 2.438 | | C70141 |
| | | 5.1 | .2008 | | 86.00 | | 52.00 | C70098 |
| | 7 | | .2010 | 3.625 | | 2.438 | | C70140 |
| 13/64 | | | .2031 | 3.625 | | 2.438 | | C70012 |
| | 6 | | .2040 | 3.750 | | 2.500 | | C70139 |
| | | 5.2 | .2047 | | 86.00 | | 52.00 | C70099 |
| | 5 | | .2055 | 3.750 | | 2.500 | | C70138 |
| | | 5.3 | .2087 | | 86.00 | | 52.00 | C70100 |
| | 4 | | .2090 | 3.750 | | 2.500 | | C70137 |

Jobber Length
Cobalt

continued on next page

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Straw | ☆ | | ☆ | | ☆ | ☆ | ◆ | ◆ | ◆ | ☆ | ◆ | ◆ | |

☆ = Best Performance ◆ = Acceptable



Jobber Length

Cobalt

| drill diameter | | overall length | | | flute length | | order number | |
|----------------|-------------------------------|----------------|-----------------------|-------|----------------------|-------|----------------------|--------|
| fraction | d ₁ wire/letter | mm | decimal equivalent | in | l ₁ mm | in | l ₂ mm | 2213 |
| | | 5.4 | .2126 | | 93.00 | | 57.00 | C70101 |
| | 3 | | .2130 | 3.750 | | 2.500 | | C70136 |
| | | 5.5 | .2165 | | 93.00 | | 57.00 | C70102 |
| 7/32 | | | .2188 | 3.750 | | 2.500 | | C70013 |
| | | 5.6 | .2205 | | 93.00 | | 57.00 | C70225 |
| | 2 | | .2210 | 3.875 | | 2.625 | | C70135 |
| | | 5.7 | .2244 | | 93.00 | | 57.00 | C70104 |
| | 1 | | .2280 | 3.875 | | 2.625 | | C70134 |
| | | 5.8 | .2283 | | 93.00 | | 57.00 | C70226 |
| | A | | .2340 | 3.875 | | 2.625 | | C70032 |
| 15/64 | | | .2344 | 3.875 | | 2.625 | | C70014 |
| | | 6.0 | .2362 | | 93.00 | | 57.00 | C70106 |
| | B | | .2380 | 4.000 | | 2.750 | | C70033 |
| | | 6.1 | .2402 | | 101.00 | | 63.00 | C70107 |
| | C | | .2420 | 4.000 | | 2.750 | | C70034 |
| | | 6.2 | .2441 | | 101.00 | | 63.00 | C70108 |
| | D | | .2460 | 4.000 | | 2.750 | | C70035 |
| | | 6.3 | .2480 | | 101.00 | | 63.00 | C70109 |
| 1/4 | E | | .2500 | 4.000 | | 2.750 | | C70015 |
| | | | .2500 | 4.000 | | 2.750 | | C70015 |
| | | 6.4 | .2520 | | 101.00 | | 63.00 | C70110 |
| | | 6.5 | .2559 | | 101.00 | | 63.00 | C70111 |
| | F | | .2570 | 4.125 | | 2.875 | | C70036 |
| | | 6.6 | .2598 | | 101.00 | | 63.00 | C70112 |
| | G | | .2610 | 4.125 | | 2.875 | | C70037 |
| | | 6.7 | .2638 | | 101.00 | | 63.00 | C70113 |
| 17/64 | | | .2656 | 4.125 | | 2.875 | | C70016 |
| | H | | .2660 | 4.125 | | 2.875 | | C70038 |
| | | 6.8 | .2677 | | 109.00 | | 69.00 | C70114 |
| | I | | .2720 | 4.125 | | 2.875 | | C70039 |
| | | 7.0 | .2756 | | 109.00 | | 69.00 | C70115 |
| | J | | .2770 | 4.125 | | 2.875 | | C70040 |
| 9/32 | | | .2812 | 4.250 | | 2.938 | | C70017 |
| | K | | .2812 | 4.250 | | 2.938 | | C70041 |
| | | 7.2 | .2835 | | 109.00 | | 69.00 | C70116 |
| | L | | .2900 | 4.250 | | 2.938 | | C70042 |
| | M | | .2950 | 4.375 | | 3.063 | | C70043 |
| | | 7.5 | .2953 | | 109.00 | | 69.00 | C70117 |
| 19/64 | | | .2969 | 4.375 | | 3.063 | | C70018 |
| | N | | .3020 | 4.375 | | 3.063 | | C70044 |
| | | 7.8 | .3071 | | 117.00 | | 75.00 | C70118 |
| 5/16 | | | .3125 | 4.500 | | 3.188 | | C70019 |
| | | 8.0 | .3150 | | 117.00 | | 75.00 | C70119 |
| | O | | .3160 | 4.500 | | 3.188 | | C70045 |
| | | 8.1 | .3189 | | 117.00 | | 75.00 | C70120 |
| | P | | .3230 | 4.625 | | 3.313 | | C70046 |
| 21/64 | | | .3281 | 4.625 | | 3.313 | | C70020 |
| | Q | | .3320 | 4.750 | | 3.438 | | C70047 |
| | | 8.5 | .3346 | | 117.00 | | 75.00 | C70122 |
| | R | | .3390 | 4.750 | | 3.438 | | C70048 |
| 11/32 | | | .3438 | 4.750 | | 3.438 | | C70021 |
| | S | | .3480 | 4.875 | | 3.500 | | C70049 |
| | | 9.0 | .3543 | | 125.00 | | 81.00 | C70124 |
| | T | | .3580 | 4.875 | | 3.500 | | C70050 |
| 23/64 | | | .3594 | 4.875 | | 3.500 | | C70022 |
| | U | | .3680 | 5.000 | | 3.625 | | C70051 |

continued on next page

Style: 2213 (continued)

| drill diameter | | | overall length | | flute length | | order number | |
|----------------|-------------|------|--------------------|----------------|--------------|----------------|--------------|--------|
| d ₁ | | mm | decimal equivalent | l ₁ | | l ₂ | | 2213 |
| fraction | wire/letter | | | in | mm | in | mm | |
| | | 9.5 | .3740 | | 125.00 | | 81.00 | C70125 |
| 3/8 | | | .3750 | 5.000 | | 3.625 | | C70023 |
| | V | | .3770 | 5.000 | | 3.625 | | C70052 |
| 25/64 | W | | .3860 | 5.125 | | 3.750 | | C70053 |
| | | | .3906 | 5.125 | | 3.750 | | C70024 |
| | X | 10.0 | .3937 | | 133.00 | | 87.00 | C70126 |
| | | | .3970 | 5.125 | | 3.720 | | C70054 |
| 13/32 | Y | 10.2 | .4016 | | 133.00 | | 87.00 | C70127 |
| | | | .4040 | 5.250 | | 3.875 | | C70055 |
| 27/64 | Z | | .4062 | 5.250 | | 3.875 | | C70025 |
| | | | .4130 | 5.250 | | 3.875 | | C70056 |
| | | 10.5 | .4134 | | 133.00 | | 87.00 | C70128 |
| 7/16 | | | .4219 | 5.375 | | 3.938 | | C70026 |
| | | 11.0 | .4331 | | 142.00 | | 94.00 | C70129 |
| 29/64 | | | .4375 | 5.500 | | 4.063 | | C70027 |
| 15/32 | | 11.5 | .4528 | | 142.00 | | 94.00 | C70130 |
| 31/64 | | | .4531 | 5.625 | | 4.188 | | C70028 |
| 1/2 | | | .4688 | 5.750 | | 4.313 | | C70029 |
| | | 12.0 | .4724 | | 151.00 | | 101.00 | C70131 |
| | | | .4844 | 5.875 | | 4.375 | | C70030 |
| | | 12.5 | .4921 | | 151.00 | | 101.00 | C70132 |
| | | | .5000 | 6.000 | | 4.500 | | C70031 |
| | | 13.0 | .5118 | | 151.00 | | 101.00 | C70133 |

Jobber Length
Cobalt

SET

Style: 2213

Aircraft NAS 907, Type J
Cobalt Heavy Duty



26-Piece Set
#C00986

| no. of pieces | surface treatment | size range | order number |
|---------------|-------------------|---|--------------|
| | | | 2213 |
| 29 | straw oxide | 1/16" through 1/2" x 1/64" | C70365 |
| 26 | straw oxide | A through Z letter | C00986 |
| 60 | straw oxide | #1 through #60 wire gauge | C70366 |
| 115 | straw oxide | 1/16" through 1/2" x 1/64", A through Z and #1 through #60 | C70367 |



115-Piece Set
#C70367

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Straw | ☆ | | ☆ | | ☆ | ☆ | ◆ | ◆ | ◆ | ☆ | ◆ | ◆ | |

☆ = Best Performance ◆ = Acceptable

Cotter Pin
Heavy Duty

Style: **2011**

Note
Operating parameters:
See Technical section

ASME
B94.11M

HSS

135° Split

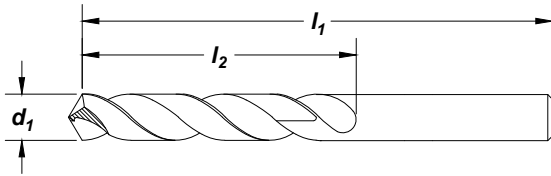
Helix
Regular
21° to 34°

Straight
Shank

Surface
Treatment

Black
Oxide

Jobber Length



Feature:

Fast penetrating split point design. Constant parallel web for easy regrinds.

High Speed Steel

| drill diameter | | decimal equivalent | overall length | | flute length | | order number |
|----------------|----------------------------|--------------------|---------------------|---------------------|---------------------|---------------------|--------------|
| fraction | d ₁ wire/letter | | l ₁ (in) | l ₂ (in) | l ₁ (in) | l ₂ (in) | |
| | | | | | | | 2011 |
| | | *80 | .0135 | .750 | .125 | | C02593 |
| | | *54 | .0550 | 1.875 | .875 | | C02646 |
| 1/16 | | | .0625 | 1.875 | .875 | | C02652 |
| | | 52 | .0635 | 1.875 | 1.000 | | C02654 |
| | | 50 | .0700 | 2.000 | 1.000 | | C02659 |
| 5/64 | | | .0781 | 2.000 | 1.000 | | C02666 |
| | | 47 | .0785 | 2.000 | 1.000 | | C02667 |
| | | 45 | .0820 | 2.125 | 1.125 | | C02671 |
| 3/32 | | | .0938 | 2.250 | 1.250 | | C02681 |
| | | 40 | .0980 | 2.375 | 1.375 | | C02685 |
| | | 37 | .1040 | 2.500 | 1.438 | | C02690 |
| 7/64 | | | .1094 | 2.625 | 1.500 | | C02694 |
| | | 32 | .1160 | 2.750 | 1.625 | | C02700 |
| | | 31 | .1200 | 2.750 | 1.625 | | C02702 |
| 1/8 | | | .1250 | 2.750 | 1.625 | | C02704 |
| | | 30 | .1285 | 2.750 | 1.625 | | C02707 |
| | | 29 | .1360 | 2.875 | 1.750 | | C02710 |
| 9/64 | | | .1406 | 2.875 | 1.750 | | C02713 |
| | | 25 | .1495 | 3.000 | 1.875 | | C02719 |
| 5/32 | | | .1562 | 3.125 | 2.000 | | C02724 |
| 11/64 | | | .1719 | 3.125 | 2.000 | | C02735 |
| 3/16 | | | .1875 | 3.500 | 2.313 | | C02746 |
| 7/32 | | | .2188 | 3.750 | 2.500 | | C02767 |
| 15/64 | | | .2344 | 3.875 | 2.625 | | C02776 |
| 1/4 | E | | .2500 | 4.000 | 2.750 | | C02785 |
| 9/32 | | | .2812 | 4.250 | 2.938 | | C02807 |
| 19/64 | | | .2969 | 4.375 | 3.063 | | C02811 |
| 5/16 | | | .3125 | 4.500 | 3.188 | | C02818 |
| 11/32 | | | .3438 | 4.750 | 3.188 | | C02833 |
| 3/8 | | | .3750 | 5.000 | 3.625 | | C02848 |
| 13/32 | | | .4062 | 5.250 | 3.875 | | C02861 |
| 7/16 | | | .4375 | 5.500 | 4.063 | | C02867 |
| 15/32 | | | .4688 | 5.750 | 4.313 | | C02872 |
| 1/2 | | | .5000 | 6.000 | 4.500 | | C02877 |

*Not split point.

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Black Oxide | ★ | | ☆ | | ★ | | | ☆ | ★ | | | | |

☆ = Best Performance ★ = Acceptable



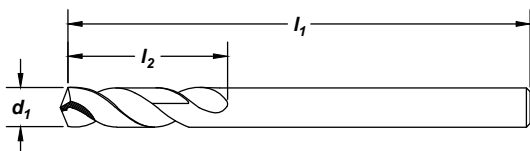
Styles: **3780**

Note
High helix for efficient chip removal.
Operating parameters: See Technical section

ASME B94.11M M42 Cobalt 135° Split High Helix 35° to 45° Straight Shank

Surface Treatment

Black Oxide



Jobber Length

Cobalt

Feature:

Preferred point for work hardening materials, with extra heavy web for superior rigidity.

| drill diameter | | decimal equivalent | overall length l ₁ (in) | flute length l ₂ (in) | order number |
|----------------|-------------------------------|--------------------|---------------------------------------|-------------------------------------|---------------------|
| fraction | d ₁ wire/letter | | | | 3780 black oxide |
| | *60 | .0400 | 1.625 | .500 | C15880 |
| | *59 | .0410 | 1.625 | .500 | C15881 |
| | *58 | .0420 | 1.625 | .500 | C15882 |
| | *57 | .0430 | 1.750 | .500 | C15883 |
| | *56 | .0465 | 1.750 | .500 | C15884 |
| *3/64 | | .0469 | 1.750 | .500 | C15885 |
| | *55 | .0520 | 1.750 | .625 | C15886 |
| | *54 | .0550 | 1.875 | .625 | C15887 |
| 1/16 | *53 | .0595 | 1.875 | .625 | C15888 |
| | | .0625 | 1.875 | .625 | C15889 |
| | 52 | .0635 | 1.875 | .688 | C15890 |
| | 51 | .0670 | 2.000 | .688 | C15891 |
| 5/64 | 50 | .0700 | 2.000 | .688 | C15892 |
| | 49 | .0730 | 2.000 | .688 | C15893 |
| | 48 | .0760 | 2.000 | .688 | C15894 |
| | | .0781 | 2.000 | .688 | C15895 |
| | 47 | .0785 | 2.000 | .688 | C15896 |
| | 46 | .0810 | 2.125 | .750 | C15897 |
| | 45 | .0820 | 2.125 | .750 | C15898 |
| | 44 | .0860 | 2.125 | .750 | C15899 |
| | 43 | .0890 | 2.250 | .750 | C15900 |
| | 42 | .0935 | 2.250 | .750 | C15901 |
| 3/32 | | .0938 | 2.250 | .750 | C15902 |
| | 41 | .0960 | 2.375 | .813 | C15903 |
| | 40 | .0980 | 2.375 | .813 | C15904 |
| | 39 | .0995 | 2.375 | .813 | C15905 |
| | 38 | .1015 | 2.500 | .813 | C15906 |
| | 37 | .1040 | 2.500 | .813 | C15907 |
| 7/64 | 36 | .1065 | 2.500 | .813 | C15908 |
| | | .1094 | 2.625 | .813 | C15909 |
| | 35 | .1100 | 2.625 | .875 | C15910 |
| | 34 | .1110 | 2.625 | .875 | C15911 |
| | 33 | .1130 | 2.625 | .875 | C15912 |
| | 32 | .1160 | 2.750 | .875 | C15913 |
| | 31 | .1200 | 2.750 | .875 | C15914 |

*Not split point.

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Black Oxide | ◆ | | ◆ | | ◆ | ◆ | | ◆ | ◆ | | ◆ | | |

◆ = Best Performance ◆ = Acceptable



Jobber Length

Cobalt

| drill diameter | | decimal equivalent | overall length l ₁ (in) | flute length l ₂ (in) | order number |
|----------------|-------------------------------|--------------------|---------------------------------------|-------------------------------------|----------------------------|
| fraction | d ₁ wire/letter | | | | 3780 black oxide |
| 1/8 | | .1250 | 2.750 | .875 | C15915 |
| | | .1285 | 2.750 | .938 | C15916 |
| | | .1360 | 2.875 | .938 | C15917 |
| | | .1405 | 2.875 | .938 | C15918 |
| 9/64 | | .1406 | 2.875 | .938 | C15919 |
| | | .1440 | 3.000 | 1.000 | C15920 |
| | | .1470 | 3.000 | 1.000 | C15921 |
| | | .1495 | 3.000 | 1.000 | C15922 |
| | | .1520 | 3.125 | 1.000 | C15923 |
| 5/32 | | .1540 | 3.125 | 1.000 | C15924 |
| | | .1562 | 3.125 | 1.000 | C15925 |
| | | .1570 | 3.125 | 1.063 | C15926 |
| | | .1590 | 3.250 | 1.063 | C15927 |
| | | .1610 | 3.250 | 1.063 | C15928 |
| | | .1660 | 3.250 | 1.063 | C15929 |
| | | .1695 | 3.250 | 1.063 | C15930 |
| 11/64 | | .1719 | 3.250 | 1.063 | C15931 |
| | | .1730 | 3.375 | 1.125 | C15932 |
| | | .1770 | 3.375 | 1.125 | C15933 |
| | | .1800 | 3.375 | 1.125 | C15934 |
| | | .1820 | 3.375 | 1.125 | C15935 |
| | | .1850 | 3.500 | 1.125 | C15936 |
| 3/16 | | .1875 | 3.500 | 1.125 | C15937 |
| | | .1890 | 3.500 | 1.188 | C15938 |
| | | .1910 | 3.500 | 1.188 | C15939 |
| | | .1935 | 3.625 | 1.188 | C15940 |
| | | .1960 | 3.625 | 1.188 | C15941 |
| | | .1990 | 3.625 | 1.188 | C15942 |
| | | .2010 | 3.625 | 1.188 | C15943 |
| | | .2031 | 3.625 | 1.188 | C15944 |
| 13/64 | | .2040 | 3.750 | 1.250 | C15945 |
| | | .2055 | 3.750 | 1.250 | C15946 |
| | | .2090 | 3.750 | 1.250 | C15947 |
| | | .2130 | 3.750 | 1.250 | C15948 |
| | | .2188 | 3.750 | 1.250 | C15949 |
| 7/32 | | .2210 | 3.875 | 1.313 | C15950 |
| | | .2280 | 3.875 | 1.313 | C15951 |
| | | .2340 | 3.875 | 1.313 | C15952 |
| | | .2344 | 3.875 | 1.313 | C15953 |
| 15/64 | | .2380 | 4.000 | 1.375 | C15954 |
| | | .2420 | 4.000 | 1.375 | C15955 |
| | | .2460 | 4.000 | 1.375 | C15956 |
| | | .2500 | 4.000 | 1.375 | C15957 |
| 1/4 | | .2570 | 4.125 | 1.438 | C15958 |
| | | .2610 | 4.125 | 1.438 | C15959 |
| 17/64 | | .2656 | 4.125 | 1.438 | C15960 |
| | | .2660 | 4.125 | 1.500 | C15961 |
| | | .2720 | 4.125 | 1.500 | C15962 |
| | | .2770 | 4.125 | 1.500 | C15963 |
| | | .2810 | 4.250 | 1.500 | C15964 |
| 9/32 | | .2812 | 4.250 | 1.500 | C15965 |
| | | .2900 | 4.250 | 1.563 | C15966 |
| | | .2950 | 4.375 | 1.563 | C15967 |
| 19/64 | | .2969 | 4.375 | 1.563 | C15968 |
| | | .3020 | 4.375 | 1.625 | C15969 |
| 5/16 | | .3125 | 4.500 | 1.625 | C15970 |
| | | .3160 | 4.500 | 1.688 | C15971 |

continued on next page



Styles: 3780 (continued)

| drill diameter | | decimal equivalent | overall length | flute length | order number |
|----------------|----------------------------|--------------------|----------------|--------------|----------------------------|
| fraction | d ₁ wire/letter | | | | |
| | P | .3230 | 4.625 | 1.688 | 3780 black oxide |
| 21/64 | | .3281 | 4.625 | 1.688 | C15973 |
| | Q | .3320 | 4.750 | 1.688 | C15974 |
| | R | .3390 | 4.750 | 1.688 | C15975 |
| 11/32 | | .3438 | 4.750 | 1.688 | C15976 |
| | S | .3480 | 4.875 | 1.750 | C15977 |
| | T | .3580 | 4.875 | 1.750 | C15978 |
| 23/64 | | .3594 | 4.875 | 1.750 | C15979 |
| | U | .3680 | 5.000 | 1.813 | C15980 |
| 3/8 | | .3750 | 5.000 | 1.813 | C15981 |
| | V | .3770 | 5.000 | 1.875 | C15982 |
| | W | .3860 | 5.125 | 1.875 | C15983 |
| 25/64 | | .3906 | 5.125 | 1.875 | C15984 |
| | X | .3970 | 5.125 | 1.938 | C15985 |
| | Y | .4040 | 5.250 | 1.938 | C15986 |
| 13/32 | | .4062 | 5.250 | 1.938 | C15987 |
| | Z | .4130 | 5.250 | 2.000 | C15988 |
| 27/64 | | .4219 | 5.375 | 2.000 | C15989 |
| 7/16 | | .4375 | 5.500 | 2.063 | C15990 |
| 29/64 | | .4531 | 5.625 | 2.125 | C15991 |
| 15/32 | | .4688 | 5.750 | 2.125 | C15992 |
| 31/64 | | .4844 | 5.875 | 2.188 | C15993 |
| 1/2 | | .5000 | 6.000 | 2.250 | C15994 |

Jobber Length

Cobalt

SET

Style: 3780

Q-AMD™ Short Flute
Aircraft Maintenance



| no. of pieces | surface treatment | size range | order number |
|---------------|-------------------|----------------------------|-----------------------|
| 29 | black oxide | 1/16" through 1/2" x 1/64" | 3780 C14499 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Black Oxide | ◆ | | ◆ | | ◆ | ◆ | | ◆ | ◆ | | ◆ | | |

☆ = Best Performance ◆ = Acceptable



Carbide Tipped

Style: **2727**

Note

Operating parameters:
See Technical section

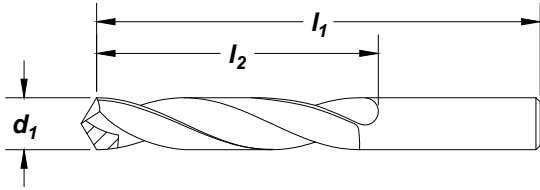


Surface Treatment



Jobber Length

Carbide



| fraction | drill diameter | | decimal equivalent | overall length | | flute length | | order number |
|----------|----------------|-------------|--------------------|---------------------|---------------------|---------------------|---------------------|--------------|
| | d ₁ | wire/letter | | l ₁ (in) | l ₂ (in) | l ₁ (in) | l ₂ (in) | |
| 1/8 | | | .1250 | 2.750 | 1.625 | | | C48655 |
| 5/32 | | | .1562 | 3.125 | 2.000 | | | C48675 |
| 3/16 | | | .1875 | 3.500 | 2.313 | | | C48697 |
| | | 7 | .2010 | 3.625 | 2.438 | | | C48707 |
| 7/32 | | | .2188 | 3.750 | 2.500 | | | C48718 |
| 1/4 | | E | .2500 | 4.000 | 2.750 | | | C48736 |
| 9/32 | | | .2812 | 4.250 | 2.938 | | | C48758 |
| 5/16 | | | .3125 | 4.500 | 3.188 | | | C48769 |
| 11/32 | | | .3438 | 4.750 | 3.438 | | | C48784 |
| 3/8 | | | .3750 | 5.000 | 3.625 | | | C48799 |
| 13/32 | | | .4062 | 5.250 | 3.875 | | | C48812 |
| 7/16 | | | .4375 | 5.500 | 4.063 | | | C48818 |
| 15/32 | | | .4688 | 5.750 | 4.313 | | | C48823 |
| 1/2 | | | .5000 | 6.000 | 4.500 | | | C48828 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | | ◆ | | ◆ | | | ☆ | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Style: **1766**

Straight Flute

Note

Tolerances for Series DM Drills:
Cutting Diameter: +.000, -.0005
Shank Diameter: +.0000, -.0005

ASME
B94.11M

Carbide

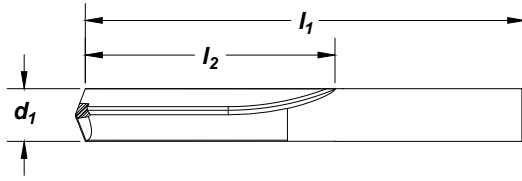
140° 4-Facet

Helix
High
35° to 45°

Straight
Shank

Surface
Treatment

Bright



| fraction | cutting diameter d₁ | wire | decimal equivalent | overall length l₁ | flute length l₂ | order number 1766 |
|----------|--|------|-----------------------|---|---|--------------------------------|
| 1/32 | | | .0313 | 1-1/2 | 1/2 | C89410 |
| | | 60 | .0400 | 1-1/2 | 1/2 | C89411 |
| | | 59 | .0410 | 1-1/2 | 1/2 | C89412 |
| | | 58 | .0420 | 1-1/2 | 1/2 | C89413 |
| | | 57 | .0430 | 1-1/2 | 1/2 | C89414 |
| | | 56 | .0465 | 1-1/2 | 1/2 | C89415 |
| 3/64 | | | .0469 | 1-1/2 | 1/2 | C89416 |
| | | 55 | .0520 | 1-1/2 | 1/2 | C89417 |
| | | 54 | .0550 | 1-1/2 | 1/2 | C89418 |
| | | 53 | .0595 | 1-1/2 | 1/2 | C89419 |
| 1/16 | | | .0625 | 1-5/8 | 5/8 | C89420 |
| | | 52 | .0635 | 1-11/16 | 11/16 | C89421 |
| | | 51 | .0670 | 1-11/16 | 11/16 | C89422 |
| | | 50 | .0700 | 1-11/16 | 11/16 | C89423 |
| | | 49 | .0730 | 1-11/16 | 11/16 | C89424 |
| | | 48 | .0760 | 1-11/16 | 11/16 | C89425 |
| 5/64 | | | .0781 | 1-11/16 | 11/16 | C89426 |
| | | 47 | .0785 | 1-3/4 | 3/4 | C89427 |
| | | 46 | .0810 | 1-3/4 | 3/4 | C89428 |
| | | 45 | .0820 | 1-3/4 | 3/4 | C89429 |
| | | 44 | .0860 | 1-3/4 | 3/4 | C89430 |
| | | 43 | .0890 | 1-3/4 | 3/4 | C89431 |
| | | 42 | .0935 | 1-3/4 | 3/4 | C89432 |
| 3/32 | | | .0938 | 1-3/4 | 3/4 | C89433 |
| | | 41 | .0960 | 1-13/16 | 13/16 | C89434 |
| | | 40 | .0980 | 1-13/16 | 13/16 | C89435 |
| | | 39 | .0995 | 1-13/16 | 13/16 | C89436 |
| | | 38 | .1015 | 1-13/16 | 13/16 | C89437 |
| | | 37 | .1040 | 1-13/16 | 13/16 | C89438 |
| | | 36 | .1065 | 1-13/16 | 13/16 | C89439 |
| 7/64 | | | .1094 | 1-13/16 | 13/16 | C89440 |
| | | 35 | .1100 | 1-7/8 | 7/8 | C89441 |
| | | 34 | .1110 | 1-7/8 | 7/8 | C89442 |
| | | 33 | .1130 | 1-7/8 | 7/8 | C89443 |
| | | 32 | .1160 | 1-7/8 | 7/8 | C89444 |
| | | 31 | .1200 | 1-7/8 | 7/8 | C89445 |
| 1/8 | | | .1250 | 1-7/8 | 7/8 | C89446 |
| | | 30 | .1285 | 1-15/16 | 15/16 | C89447 |
| | | 29 | .1360 | 1-15/16 | 15/16 | C89448 |
| | | 28 | .1405 | 1-15/16 | 15/16 | C89449 |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | ◆ | ☆ | ◆ | ◆ | | | ☆ | ☆ | ◆ | | | ◆ |

☆ = Best Performance ◆ = Acceptable



Jobber Length

Carbide

Straight Flute
Style: 1766 (continued)
Jobber Length
Carbide

| fraction | cutting diameter d ₁ | | decimal equivalent | overall length l ₁ | flute length l ₂ | order number 1766 |
|----------|------------------------------------|----|-----------------------|-------------------------------------|-----------------------------------|--------------------------------|
| | wire | | | | | |
| 9/64 | | | .1406 | 1-15/16 | 15/16 | C89450 |
| | | 27 | .1440 | 2-1/16 | 1 | C89451 |
| | | 26 | .1470 | 2-1/16 | 1 | C89452 |
| | | 25 | .1495 | 2-1/16 | 1 | C89453 |
| | | 24 | .1520 | 2-1/16 | 1 | C89454 |
| | | 23 | .1540 | 2-1/16 | 1 | C89455 |
| 5/32 | | | .1562 | 2-1/16 | 1 | C89456 |
| | | 22 | .1570 | 2-1/8 | 1-1/16 | C89457 |
| | | 21 | .1590 | 2-1/8 | 1-1/16 | C89458 |
| | | 20 | .1610 | 2-1/8 | 1-1/16 | C89459 |
| | | 19 | .1660 | 2-1/8 | 1-1/16 | C89460 |
| | | 18 | .1695 | 2-1/8 | 1-1/16 | C89461 |
| 11/64 | | | .1719 | 2-1/8 | 1-1/16 | C89462 |
| | | 17 | .1730 | 2-3/16 | 1-1/8 | C89463 |
| | | 16 | .1770 | 2-3/16 | 1-1/8 | C89464 |
| | | 15 | .1800 | 2-3/16 | 1-1/8 | C89465 |
| | | 14 | .1820 | 2-3/16 | 1-1/8 | C89466 |
| | | 13 | .1850 | 2-3/16 | 1-1/8 | C89467 |
| 3/16 | | | .1875 | 2-3/16 | 1-1/8 | C89468 |
| | | 12 | .1890 | 2-1/4 | 1-3/16 | C89469 |
| | | 11 | .1910 | 2-1/4 | 1-3/16 | C89470 |
| | | 10 | .1935 | 2-1/4 | 1-3/16 | C89471 |
| | | 9 | .1960 | 2-1/4 | 1-3/16 | C89472 |
| | | 8 | .1990 | 2-1/4 | 1-3/16 | C89473 |
| | | 7 | .2010 | 2-1/4 | 1-3/16 | C89474 |
| 13/64 | | | .2031 | 2-1/4 | 1-3/16 | C89475 |
| | | 6 | .2040 | 2-3/8 | 1-1/4 | C89476 |
| | | 5 | .2055 | 2-3/8 | 1-1/4 | C89477 |
| | | 4 | .2090 | 2-3/8 | 1-1/4 | C89478 |
| | | 3 | .2130 | 2-3/8 | 1-1/4 | C89479 |
| 7/32 | | | .2188 | 2-3/8 | 1-1/4 | C89480 |
| | | 2 | .2210 | 2-7/16 | 1-5/16 | C89481 |
| | | 1 | .2280 | 2-7/16 | 1-5/16 | C89482 |
| 15/64 | | | .2344 | 2-7/16 | 1-5/16 | C89483 |
| 1/4 | | | .2500 | 2-1/2 | 1-3/8 | C89484 |
| 17/64 | | | .2656 | 2-5/8 | 1-7/16 | C89485 |
| 9/32 | | | .2812 | 2-11/16 | 1-1/2 | C89486 |
| 19/64 | | | .2969 | 2-3/4 | 1-9/16 | C89487 |
| 5/16 | | | .3125 | 2-13/16 | 1-5/8 | C89488 |
| 21/64 | | | .3281 | 2-15/16 | 1-11/16 | C89489 |
| 11/32 | | | .3438 | 3 | 1-11/16 | C89490 |
| 23/64 | | | .3594 | 3-1/16 | 1-3/4 | C89491 |
| 3/8 | | | .3750 | 3-1/8 | 1-13/16 | C89492 |
| 25/64 | | | .3906 | 3-1/4 | 1-7/8 | C89493 |
| 13/32 | | | .4062 | 3-5/16 | 1-15/16 | C89494 |
| 27/64 | | | .4219 | 3-3/8 | 2 | C89495 |
| 7/16 | | | .4375 | 3-7/16 | 2-1/16 | C89496 |
| 29/64 | | | .4531 | 3-9/16 | 2-1/8 | C89497 |
| 15/32 | | | .4688 | 3-5/8 | 2-1/8 | C89498 |
| 31/64 | | | .4844 | 3-11/16 | 2-3/16 | C89499 |
| 1/2 | | | .5000 | 3-3/4 | 2-1/4 | C89500 |



Style: **1727**

Heavy Duty

Note
Operating parameters:
See Technical section

Carbide

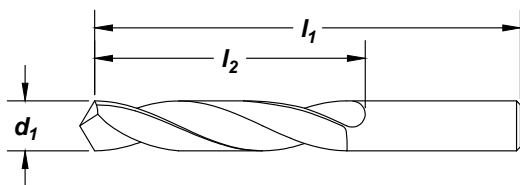
118° 4-Facet

Helix Low
10° to 20°

Straight Shank

Surface Treatment

Bright



Jobber Length

Feature:

Run at 2-3 times SFM over HSS drills.

| fraction | drill diameter | | decimal equivalent | overall length | | flute length | | order number |
|----------|----------------|--------|--------------------|----------------|-------|--------------|--------|--------------|
| | d1 wire | mm | | l1 in | mm | l2 in | mm | |
| 1/32 | | | 0.0312 | 1.250 | | 0.313 | | C89501 |
| | | 60 | 0.0400 | 1.500 | | 0.750 | | C89502 |
| | | 59 | 0.0410 | 1.500 | | 0.750 | | C89503 |
| | | 58 | 0.0420 | 1.500 | | 0.750 | | C89504 |
| | | 57 | 0.0430 | 1.500 | | 0.750 | | C89505 |
| | | 56 | 0.0465 | 1.500 | | 0.750 | | C89506 |
| 3/64 | | | 0.0469 | 1.500 | | 0.750 | | C89507 |
| | | 55 | 0.0520 | 1.500 | | 0.750 | | C89508 |
| | | 54 | 0.0550 | 1.500 | | 0.750 | | C89509 |
| | | 53 | 0.0595 | 1.500 | | 0.750 | | C47517 |
| 1/16 | | | 0.0625 | 1.500 | | 0.750 | | C47519 |
| | | 52 | 0.0635 | 1.500 | | 0.750 | | C89512 |
| | | 51 | 0.0670 | 1.500 | | 0.750 | | C89513 |
| | | 50 | 0.0700 | 1.750 | | 0.875 | | C47526 |
| | | 49 | 0.0730 | 1.750 | | 0.875 | | C89515 |
| | | 48 | 0.0760 | 1.750 | | 0.875 | | C89516 |
| 5/64 | | | 0.0781 | 1.750 | | 0.875 | | C89517 |
| | | 47 | 0.0785 | 1.750 | | 0.875 | | C89518 |
| | | 46 | 0.0810 | 1.750 | | 0.875 | | C89519 |
| | | 45 | 0.0820 | 1.750 | | 0.875 | | C89520 |
| | | 44 | 0.0860 | 2.000 | | 1.000 | | C89521 |
| | | 43 | 0.0890 | 2.000 | | 1.000 | | C89522 |
| 3/32 | | | 0.0935 | 2.000 | | 1.000 | | C89523 |
| | | | 0.0938 | 2.000 | | 1.000 | | C47548 |
| | | 41 | 0.0960 | 2.000 | | 1.000 | | C89525 |
| | | 40 | 0.0980 | 2.000 | | 1.000 | | C47552 |
| | | 39 | 0.0995 | 2.250 | | 1.250 | | C89527 |
| | | 38 | 0.1015 | 2.250 | | 1.250 | | C89528 |
| 7/64 | | | 0.1040 | 2.250 | | 1.250 | | C89529 |
| | | 36 | 0.1065 | 2.250 | | 1.250 | | C89530 |
| | | | 0.1094 | 2.250 | | 1.250 | | C47561 |
| | | 35 | 0.1100 | 2.250 | | 1.250 | | C89532 |
| | | | 0.1110 | 2.250 | | 1.250 | | C89533 |
| | 34 | 0.1110 | 2.250 | | 1.250 | | C89533 | |
| | 33 | 0.1130 | 2.250 | | 1.250 | | C89534 | |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | ◆ | | | ☆ | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Heavy Duty

Style: 1727 (continued)

Jobber Length

Carbide

| fraction | drill diameter | | decimal equivalent | overall length | | flute length | | order number |
|----------|---------------------|-----|--------------------|-------------------|----|-------------------|----|--------------|
| | d ₁ wire | mm | | l ₁ in | mm | l ₂ in | mm | |
| | 32 | | 0.1160 | 2.250 | | 1.250 | | C89535 |
| | | 3.0 | 0.1182 | | 61 | | 33 | C47239 |
| | 31 | | 0.1200 | 2.250 | | 1.250 | | C89536 |
| | | 3.1 | 0.1221 | | 65 | | 36 | C47240 |
| 1/8 | | | 0.1250 | 2.250 | | 1.250 | | C47571 |
| | | 3.2 | 0.1260 | | 65 | | 36 | C47241 |
| | 30 | | 0.1285 | 2.500 | | 1.375 | | C47574 |
| | | 3.3 | 0.1300 | | 65 | | 36 | C47242 |
| | | 3.4 | 0.1339 | | 70 | | 39 | C47243 |
| | 29 | | 0.1360 | 2.500 | | 1.375 | | C89539 |
| | | 3.5 | 0.1378 | | 70 | | 39 | C47244 |
| | 28 | | 0.1405 | 2.500 | | 1.375 | | C89540 |
| 9/64 | | | 0.1406 | 2.500 | | 1.375 | | C47580 |
| | 27 | | 0.1440 | 2.500 | | 1.375 | | C47582 |
| | 26 | | 0.1470 | 2.500 | | 1.375 | | C89543 |
| | 25 | | 0.1495 | 2.500 | | 1.375 | | C89544 |
| | 24 | | 0.1520 | 2.500 | | 1.375 | | C89545 |
| | 23 | | 0.1540 | 2.500 | | 1.375 | | C89546 |
| 5/32 | | | 0.1562 | 2.500 | | 1.375 | | C47591 |
| | 22 | | 0.1570 | 2.500 | | 1.375 | | C89548 |
| | | 4.0 | 0.1575 | | 75 | | 43 | C47245 |
| | 21 | | 0.1590 | 2.500 | | 1.375 | | C89549 |
| | 20 | | 0.1610 | 2.500 | | 1.375 | | C89550 |
| | | 4.5 | 0.1615 | | 80 | | 47 | C47246 |
| | 19 | | 0.1660 | 2.750 | | 1.625 | | C89551 |
| | 18 | | 0.1695 | 2.750 | | 1.625 | | C89552 |
| 11/64 | | | 0.1719 | 2.750 | | 1.625 | | C47602 |
| | 17 | | 0.1730 | 2.750 | | 1.625 | | C89554 |
| | 16 | | 0.1770 | 2.750 | | 1.625 | | C89555 |
| | 15 | | 0.1800 | 2.750 | | 1.625 | | C89556 |
| | 14 | | 0.1820 | 2.750 | | 1.625 | | C89557 |
| | 13 | | 0.1850 | 2.750 | | 1.625 | | C89558 |
| 3/16 | | | 0.1875 | 2.750 | | 1.625 | | C47613 |
| | 12 | | 0.1890 | 2.750 | | 1.625 | | C89560 |
| | 11 | | 0.1910 | 2.750 | | 1.625 | | C89561 |
| | 10 | | 0.1935 | 2.750 | | 1.625 | | C47618 |
| | 9 | | 0.1960 | 3.000 | | 1.750 | | C89563 |
| | | 5.0 | 0.1969 | | 86 | | 52 | C47247 |
| | 8 | | 0.1990 | 3.000 | | 1.750 | | C89564 |
| | 7 | | 0.2010 | 3.000 | | 1.750 | | C47623 |
| 13/64 | | | 0.2031 | 3.000 | | 1.750 | | C89566 |
| | 6 | | 0.2040 | 3.000 | | 1.750 | | C47625 |
| | 5 | | 0.2055 | 3.000 | | 1.750 | | C89568 |
| | 4 | | 0.2090 | 3.000 | | 1.750 | | C89569 |
| | 3 | | 0.2130 | 3.000 | | 1.750 | | C89570 |
| | | 5.5 | 0.2166 | | 93 | | 57 | C47248 |
| 7/32 | | | 0.2188 | 3.000 | | 1.750 | | C47634 |
| | 2 | | 0.2210 | 3.000 | | 1.750 | | C89572 |
| | 1 | | 0.2280 | 3.000 | | 1.750 | | C89573 |
| | A | | 0.2340 | 3.250 | | 2.000 | | C89574 |
| 15/64 | | | 0.2344 | 3.250 | | 2.000 | | C89575 |
| | | 6.0 | 0.2363 | | 93 | | 57 | C47249 |
| | B | | 0.2380 | 3.250 | | 2.000 | | C89576 |
| | C | | 0.2420 | 3.250 | | 2.000 | | C89577 |
| | D | | 0.2460 | 3.250 | | 2.000 | | C89578 |
| 1/4 | E | | 0.2500 | 3.250 | | 2.000 | | C47648 |

continued on next page



Style: 1727 (continued)

Heavy Duty

Jobber Length
Carbide

| fraction | drill diameter | | decimal equivalent | overall length | | flute length | | order number |
|----------|---------------------|------|--------------------|----------------|-----|--------------|-----|-----------------------|
| | d ₁ wire | mm | | in | mm | in | mm | |
| | | 6.5 | 0.2560 | | 101 | | 63 | 1727 C47250 |
| | F | | 0.2570 | 3.250 | | 2.000 | | C89580 |
| | G | | 0.2610 | 3.500 | | 2.125 | | C89581 |
| 17/64 | | | 0.2656 | 3.500 | | 2.125 | | C89582 |
| | H | | 0.2660 | 3.500 | | 2.125 | | C89583 |
| | I | | 0.2720 | 3.500 | | 2.125 | | C89584 |
| | | 7.0 | 0.2756 | | 109 | | 69 | C47251 |
| | J | | 0.2770 | 3.500 | | 2.125 | | C89585 |
| | K | | 0.2810 | 3.500 | | 2.125 | | C89586 |
| 9/32 | | | 0.2812 | 3.500 | | 2.125 | | C89587 |
| | L | | 0.2900 | 3.500 | | 2.125 | | C89588 |
| | M | | 0.2950 | 4.000 | | 2.375 | | C89589 |
| | | 7.5 | 0.2953 | | 109 | | 69 | C47252 |
| 19/64 | | | 0.2969 | 4.000 | | 2.375 | | C89590 |
| | N | | 0.3020 | 4.000 | | 2.375 | | C89591 |
| 5/16 | | | 0.3125 | 4.000 | | 2.375 | | C47671 |
| | | 8.0 | 0.3150 | | 117 | | 75 | C47253 |
| | O | | 0.3160 | 4.000 | | 2.375 | | C89593 |
| | P | | 0.3230 | 4.000 | | 2.375 | | C89594 |
| 21/64 | | | 0.3281 | 4.000 | | 2.500 | | C89595 |
| | Q | | 0.3320 | 4.000 | | 2.500 | | C89596 |
| | | 8.5 | 0.3347 | | 117 | | 75 | C47254 |
| | R | | 0.3390 | 4.000 | | 2.500 | | C89615 |
| 11/32 | | | 0.3438 | 4.000 | | 2.500 | | C89597 |
| | S | | 0.3480 | 4.000 | | 2.500 | | C89598 |
| | | 9.0 | 0.3544 | | 125 | | 81 | C47255 |
| | T | | 0.3580 | 4.000 | | 2.500 | | C89599 |
| 23/64 | | | 0.3594 | 4.250 | | 2.750 | | C89600 |
| | U | | 0.3680 | 4.250 | | 2.750 | | C89601 |
| | | 9.5 | 0.3741 | | 125 | | 81 | C47256 |
| 3/8 | | | 0.3750 | 4.250 | | 2.750 | | C47694 |
| | V | | 0.3770 | 4.250 | | 2.750 | | C89603 |
| | W | | 0.3860 | 4.500 | | 2.875 | | C89604 |
| 25/64 | | | 0.3906 | 4.500 | | 2.875 | | C89605 |
| | | 10.0 | 0.3938 | | 133 | | 87 | C47257 |
| | X | | 0.3970 | 4.500 | | 2.875 | | C89606 |
| | Y | | 0.4040 | 4.500 | | 2.875 | | C89607 |
| 13/32 | | | 0.4062 | 4.500 | | 2.875 | | C89608 |
| | Z | | 0.4130 | 4.500 | | 2.875 | | C89609 |
| | | 10.5 | 0.4134 | | 133 | | 87 | C47258 |
| 27/64 | | | 0.4219 | 4.500 | | 2.875 | | C89610 |
| | | 11.0 | 0.4331 | | 142 | | 94 | C47259 |
| 7/16 | | | 0.4375 | 4.500 | | 2.875 | | C47708 |
| | | 11.5 | 0.4528 | | 142 | | 94 | C47260 |
| 29/64 | | | 0.4531 | 4.750 | | 3.000 | | C89612 |
| 15/32 | | | 0.4688 | 4.750 | | 3.000 | | C89613 |
| | | 12.0 | 0.4725 | | 151 | | 101 | C47261 |
| 31/64 | | | 0.4844 | 4.750 | | 3.000 | | C89614 |
| 1/2 | | | 0.5000 | 4.750 | | 3.000 | | C47718 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | ◆ | | | ☆ | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Carbide
 Common Shank 3xD

 Style: **6100**
External Coolant - Single Margin

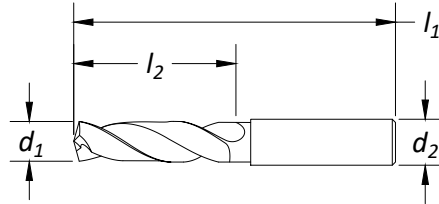
Surface Treatment



Common Shank

Note

- Made From Ultra Fine Grain Carbide
- Polished Flutes
- Defined Edge Geometry (Pre-Coat)
- 140° Self Starting Point
- Coating - Advanced AITIN
- 0.02mm (0.0008") Maximum Concentricity Shank to Din 6535 HA (h6 tolerance)
- Drill diameter tolerance = h7
- See Technical section for Drilling Method & Speeds & Feeds



| drill diameter | | shank diameter | | overall length | flute length | order number | |
|----------------|--------|----------------|-------|---------------------|---------------------|--------------|--------|
| d ₁ | | d ₂ | | l ₁ (in) | l ₂ (in) | 6100 | |
| in | metric | decimal equiv. | dia Ø | dec. equiv. | | | |
| | 3.00 | 0.1181 | 6.00 | 0.2362 | 2.441 | 0.787 | C92500 |
| 1/8 | 3.18 | 0.1250 | 6.00 | 0.2362 | 2.441 | 0.787 | C92501 |
| | 3.30 | 0.1299 | 6.00 | 0.2362 | 2.441 | 0.787 | C92502 |
| | 3.80 | 0.1496 | 6.00 | 0.2362 | 2.598 | 0.945 | C92503 |
| 5/32 | 3.97 | 0.1563 | 6.00 | 0.2362 | 2.598 | 0.945 | C92504 |
| | 4.20 | 0.1654 | 6.00 | 0.2362 | 2.598 | 0.945 | C92505 |
| 3/16 | 4.76 | 0.1875 | 6.00 | 0.2362 | 2.598 | 0.945 | C92506 |
| | 5.00 | 0.1969 | 6.00 | 0.2362 | 2.598 | 1.102 | C92507 |
| | 5.10 | 0.2008 | 6.00 | 0.2362 | 2.598 | 1.102 | C92508 |
| 7/32 | 5.56 | 0.2188 | 6.00 | 0.2362 | 2.598 | 1.102 | C92509 |
| | 5.50 | 0.2165 | 6.00 | 0.2362 | 2.598 | 1.102 | C92510 |
| | 5.80 | 0.2283 | 6.00 | 0.2362 | 2.598 | 1.102 | C92511 |
| | 6.00 | 0.2362 | 6.00 | 0.2362 | 2.598 | 1.102 | C92512 |
| 1/4 | 6.35 | 0.2500 | 8.00 | 0.3150 | 3.110 | 1.339 | C92513 |
| | 6.50 | 0.2559 | 8.00 | 0.3150 | 3.110 | 1.339 | C92514 |
| | 6.70 | 0.2638 | 8.00 | 0.3150 | 3.110 | 1.339 | C92515 |
| | 6.80 | 0.2677 | 8.00 | 0.3150 | 3.110 | 1.339 | C92516 |
| | 7.00 | 0.2743 | 8.00 | 0.3150 | 3.110 | 1.339 | C92517 |
| 9/32 | 7.15 | 0.2812 | 8.00 | 0.3150 | 3.110 | 1.339 | C92518 |
| | 7.20 | 0.2831 | 8.00 | 0.3150 | 3.110 | 1.339 | C92519 |
| 5/16 | 7.75 | 0.3050 | 8.00 | 0.3150 | 3.110 | 1.339 | C92520 |
| | 8.00 | 0.3150 | 8.00 | 0.3150 | 3.110 | 1.339 | C92521 |
| | 8.50 | 0.3346 | 10.00 | 0.3937 | 3.504 | 1.850 | C92522 |
| 11/32 | 8.75 | 0.3438 | 10.00 | 0.3937 | 3.504 | 1.850 | C92523 |
| | 9.00 | 0.3543 | 10.00 | 0.3937 | 3.504 | 1.850 | C92524 |
| 3/8 | 9.53 | 0.3750 | 10.00 | 0.3937 | 3.504 | 1.850 | C92525 |
| | 10.00 | 0.3937 | 10.00 | 0.3937 | 3.504 | 1.850 | C92526 |
| | 10.20 | 0.4016 | 12.00 | 0.4724 | 4.016 | 2.165 | C92527 |
| 13/32 | 10.32 | 0.4063 | 12.00 | 0.4724 | 4.016 | 2.165 | C92528 |
| | 10.50 | 0.4134 | 12.00 | 0.4724 | 4.016 | 2.165 | C92529 |
| | 11.00 | 0.4331 | 12.00 | 0.4724 | 4.016 | 2.165 | C92530 |
| 7/16 | 11.11 | 0.4375 | 12.00 | 0.4724 | 4.016 | 2.165 | C92531 |
| | 12.00 | 0.4724 | 12.00 | 0.4724 | 4.016 | 2.165 | C92532 |
| | 12.50 | 0.4921 | 14.00 | 0.5512 | 4.213 | 2.362 | C92533 |
| 1/2 | 12.70 | 0.5000 | 14.00 | 0.5512 | 4.213 | 2.362 | C92534 |
| | 13.00 | 0.5118 | 14.00 | 0.5512 | 4.213 | 2.362 | C92535 |
| | 13.50 | 0.5315 | 14.00 | 0.5512 | 4.213 | 2.362 | C92536 |
| | 14.00 | 0.5512 | 14.00 | 0.5512 | 4.213 | 2.362 | C92537 |

OBSOLETE

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| AITIN | | | | | | | | | | | | | |

☆ = Best Performance ◆ = Acceptable



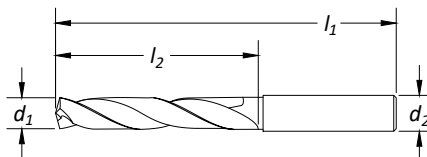
Style: **6200**

Internal Coolant - Single Margin

Note

- Made From Ultra Fine Grain Carbide
- Polished Flutes
- Defined Edge Geometry (Pre-Coat)
- 140° Self Starting Point
- Coating - Advanced AITIN
- 0.02mm (0.0008") Maximum Concentricity
- Shank to Din 6535 HA (h6 tolerance)
- Drill diameter tolerance = h7
- See Technical section for Drilling Method & Speeds & Feeds

Surface Treatment



Common Shank

Carbide

| drill diameter | | shank diameter | | overall length | flute length | order number | | |
|----------------|--------|----------------|-------|----------------|--------------|--------------|--------|--------|
| d1 | | d2 | | l1 (in) | l2 (in) | 6200 | | |
| in | metric | decimal equiv. | dia Ø | dec. equiv. | | | | |
| | 3.00 | 0.1181 | 6.00 | 0.2362 | 2.598 | 1.102 | C92537 | |
| 1/8 | 3.18 | 0.1250 | 6.00 | 0.2362 | 2.598 | 1.102 | C92538 | |
| | 3.30 | 0.1299 | 6.00 | 0.2362 | 2.598 | 1.102 | C92539 | |
| | 4.00 | 0.1575 | 6.00 | 0.2362 | 2.913 | 1.417 | C92540 | |
| | 4.20 | 0.1654 | 6.00 | 0.2362 | 2.913 | 1.417 | C92541 | |
| 3/16 | 4.50 | 0.1772 | 6.00 | 0.2362 | 2.913 | 1.417 | C92542 | |
| | 4.76 | 0.1875 | 6.00 | 0.2362 | 3.228 | 1.732 | C92543 | |
| | 5.00 | 0.1969 | 6.00 | 0.2362 | 3.228 | 1.732 | C92544 | |
| | 5.10 | 0.2008 | 6.00 | 0.2362 | 3.228 | 1.732 | C92545 | |
| 1/4 | 5.50 | 0.2165 | 6.00 | 0.2362 | 3.228 | 1.732 | C92546 | |
| | 6.00 | 0.2362 | 6.00 | 0.2362 | 3.228 | 1.732 | C92547 | |
| | 6.35 | 0.2500 | 8.00 | 0.3150 | 3.583 | 2.087 | C92548 | |
| | 6.50 | 0.2559 | 8.00 | 0.3150 | 3.583 | 2.087 | C92549 | |
| | 6.80 | 0.2677 | 8.00 | 0.3150 | 3.583 | 2.087 | C92550 | |
| | 7.00 | 0.2756 | 8.00 | 0.3150 | 3.583 | 2.087 | C92551 | |
| 9/32 | 7.15 | 0.2812 | 8.00 | 0.3150 | 3.583 | 2.087 | C92552 | |
| | 7.50 | 0.2953 | 8.00 | 0.3150 | 3.583 | 2.087 | C92553 | |
| | 7.94 | 0.3125 | 8.00 | 0.3150 | 3.583 | 2.087 | C92554 | |
| 5/16 | 8.00 | 0.3150 | 8.00 | 0.3150 | 3.583 | 2.087 | C92555 | |
| | 8.33 | 0.3281 | 10.00 | 0.3937 | 4.055 | 2.402 | C92556 | |
| | 8.50 | 0.3346 | 10.00 | 0.3937 | 4.055 | 2.402 | C92557 | |
| | 9.00 | 0.3543 | 10.00 | 0.3937 | 4.055 | 2.402 | C92558 | |
| 3/8 | 9.50 | 0.3750 | 10.00 | 0.3937 | 4.055 | 2.402 | C92559 | |
| | 10.00 | 0.3937 | 10.00 | 0.3937 | 4.055 | 2.402 | C92560 | |
| | 10.50 | 0.4063 | 12.00 | 0.4724 | 4.646 | 2.795 | C92561 | |
| | 10.52 | 0.4063 | 12.00 | 0.4724 | 4.646 | 2.795 | C92562 | |
| | 10.50 | 0.4134 | 12.00 | 0.4724 | 4.646 | 2.795 | C92563 | |
| | 10.70 | 0.4213 | 12.00 | 0.4724 | 4.646 | 2.795 | C92564 | |
| 7/16 | 11.00 | 0.4331 | 12.00 | 0.4724 | 4.646 | 2.795 | C92565 | |
| | 11.11 | 0.4375 | 12.00 | 0.4724 | 4.646 | 2.795 | C92566 | |
| | 11.60 | 0.4567 | 12.00 | 0.4724 | 4.646 | 2.795 | C92567 | |
| | 12.00 | 0.4724 | 12.00 | 0.4724 | 4.646 | 2.795 | C92568 | |
| | 12.30 | 0.4844 | 14.00 | 0.5512 | 4.882 | 3.031 | C92569 | |
| | 12.50 | 0.4921 | 14.00 | 0.5512 | 4.882 | 3.031 | C92570 | |
| 1/2 | 12.70 | 0.5000 | 14.00 | 0.5512 | 4.882 | 3.031 | C92571 | |
| | 13.00 | 0.5118 | 14.00 | 0.5512 | 4.882 | 3.031 | C92572 | |
| | 13.50 | 0.5315 | 14.00 | 0.5512 | 4.882 | 3.031 | C92573 | |
| | 14.00 | 0.5512 | 14.00 | 0.5512 | 4.882 | 3.031 | C92574 | |
| | 14.50 | 0.5709 | 16.00 | 0.6299 | 5.236 | 3.268 | C92575 | |
| | 14.70 | 0.5787 | 16.00 | 0.6299 | 5.236 | 3.268 | C92576 | |
| 5/8 | 15.00 | 0.5906 | 16.00 | 0.6299 | 5.236 | 3.268 | C92577 | |
| | 15.50 | 0.6102 | 16.00 | 0.6299 | 5.236 | 3.268 | C92578 | |
| | 15.80 | 0.6220 | 16.00 | 0.6299 | 5.236 | 3.268 | C92579 | |
| | 15.88 | 0.6250 | 16.00 | 0.6299 | 5.236 | 3.268 | C92580 | |
| | | | | | | | | C92581 |

OBSOLETE

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------|-----------------|------------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | |
| AITIN | | | | | | | | | | | |

☆ = Best Performance ◆ = Acceptable



Carbide
 Common Shank 8xD

 Style: **6300**
Internal Coolant - Double Margin

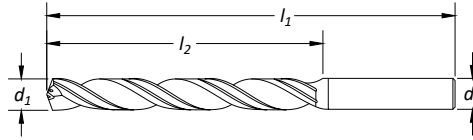
Surface Treatment



Common Shank

Note

- Made From Ultra Fine Grain Carbide
- Polished Flutes
- Defined Edge Geometry (Pre-Coat)
- 140° Self Starting Point
- Coating - Advanced AITiN
- 0.02mm (0.0008") Maximum Concentricity Shank to Din 6535 HA (h6 tolerance)
- Drill diameter tolerance = h7
- See Technical section for Drilling Method & Speeds & Feeds



| drill diameter | | shank diameter | | overall length | flute length | order number | |
|----------------|--------|----------------|-------|----------------|--------------|--------------|--------|
| d1 | | d2 | | l1 (in) | l2 (in) | 6300 | |
| in | metric | decimal equiv. | dia Ø | dec. equiv. | | | |
| | 4.00 | 0.1575 | 6.00 | 0.2362 | 3.150 | 1.654 | C92582 |
| | 4.50 | 0.1772 | 6.00 | 0.2362 | 3.150 | 1.654 | C92583 |
| 3/16 | 4.76 | 0.1875 | 6.00 | 0.2362 | 3.622 | 2.126 | C92584 |
| | 5.00 | 0.1969 | 6.00 | 0.2362 | 3.622 | 2.126 | C92585 |
| | 5.50 | 0.2165 | 6.00 | 0.2362 | 3.622 | 2.126 | C92586 |
| | 6.00 | 0.2362 | 6.00 | 0.2362 | 3.622 | 2.126 | C92587 |
| 1/4 | 6.35 | 0.2500 | 8.00 | 0.3150 | 3.937 | 2.441 | C92588 |
| | 6.50 | 0.2559 | 8.00 | 0.3150 | 3.937 | 2.441 | C92589 |
| | 6.80 | 0.2677 | 8.00 | 0.3150 | 3.937 | 2.441 | C92590 |
| | 7.00 | 0.2756 | 8.00 | 0.3150 | 4.252 | 2.756 | C92591 |
| 9/32 | 7.15 | 0.2812 | 8.00 | 0.3150 | 4.252 | 2.756 | C92592 |
| | 7.50 | 0.2953 | 8.00 | 0.3150 | 4.252 | 2.756 | C92593 |
| 5/16 | 7.94 | 0.3125 | 8.00 | 0.3150 | 4.252 | 2.756 | C92594 |
| | 8.00 | 0.3150 | 8.00 | 0.3150 | 4.252 | 2.756 | C92595 |
| | 8.50 | 0.3346 | 10.00 | 0.3937 | 4.803 | 3.150 | C92596 |
| | 9.00 | 0.3543 | 10.00 | 0.3937 | 4.803 | 3.150 | C92597 |
| | 9.50 | 0.3750 | 10.00 | 0.3937 | 5.118 | 3.465 | C92598 |
| 3/8 | 9.53 | 0.3750 | 10.00 | 0.3937 | 5.118 | 3.465 | C92599 |
| | 10.00 | 0.3937 | 10.00 | 0.3937 | 5.118 | 3.465 | C92600 |
| | 10.50 | 0.4016 | 12.00 | 0.4724 | 5.984 | 4.134 | C92601 |
| | 10.50 | 0.4134 | 12.00 | 0.4724 | 5.984 | 4.134 | C92602 |
| | 11.00 | 0.4331 | 12.00 | 0.4724 | 5.984 | 4.134 | C92603 |
| 7/16 | 11.11 | 0.4375 | 12.00 | 0.4724 | 5.984 | 4.134 | C92604 |
| | 11.80 | 0.4646 | 12.00 | 0.4724 | 5.984 | 4.134 | C92605 |
| | 12.00 | 0.4724 | 12.00 | 0.4724 | 5.984 | 4.134 | C92606 |
| | 12.50 | 0.4921 | 14.00 | 0.5512 | 6.693 | 4.843 | C92607 |
| 1/2 | 12.70 | 0.5000 | 14.00 | 0.5512 | 6.693 | 4.843 | C92608 |
| | 13.00 | 0.5118 | 14.00 | 0.5512 | 6.693 | 4.843 | C92609 |
| | 13.50 | 0.5315 | 14.00 | 0.5512 | 6.693 | 4.843 | C92610 |
| | 14.00 | 0.5512 | 14.00 | 0.5512 | 6.693 | 4.843 | C92611 |

OBSOLETE

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| AITiN | | | | | | | | | | | | | |

☆ = Best Performance ◆ = Acceptable

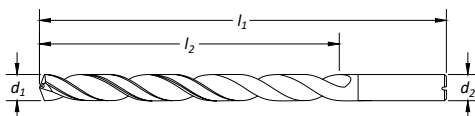


Style: **6400**

Internal Coolant - Double Margin

- Note**
- Made From Ultra Fine Grain Carbide
- Polished Flutes
- Defined Edge Geometry (Pre-Coat)
- 140° Self Starting Point
- Coating - Advanced AITiN
- 0.02mm (0.0008") Maximum Concentricity
- Shank to Din 6535 HA (h6 tolerance)
- Drill diameter tolerance = h7
- See Technical section for Drilling Method & Speeds & Feeds

Surface Treatment



A starter drill must be used.
See style: 6100 (3xD) as a starter for this item.

Common Shank

Carbide

| drill diameter | | decimal equiv. | shank diameter | | overall length | flute length | order number |
|----------------|--------|----------------|----------------|-------------|---------------------|---------------------|--------------|
| in | metric | | dia Ø | dec. equiv. | l ₁ (in) | l ₂ (in) | 6400 |
| | 4.00 | 0.1575 | 6.00 | 0.2362 | 4.016 | 2.520 | C92612 |
| | 4.50 | 0.1772 | 6.00 | 0.2362 | 4.016 | 2.520 | C92613 |
| 3/16 | 4.76 | 0.1875 | 6.00 | 0.2362 | 4.567 | 3.071 | C92614 |
| | 5.00 | 0.1969 | 6.00 | 0.2362 | 4.567 | 3.071 | C92615 |
| | 5.50 | 0.2165 | 6.00 | 0.2362 | 4.567 | 3.071 | C92616 |
| | 6.00 | 0.2362 | 6.00 | 0.2362 | 4.567 | 3.071 | C92617 |
| 1/4 | 6.35 | 0.2500 | 8.00 | 0.3150 | 5.748 | 4.252 | C92618 |
| | 6.50 | 0.2559 | 8.00 | 0.3150 | 5.748 | 4.252 | C92619 |
| | 6.80 | 0.2677 | 8.00 | 0.3150 | 5.748 | 4.252 | C92620 |
| | 7.00 | 0.2756 | 8.00 | 0.3150 | 5.748 | 4.252 | C92621 |
| 9/32 | 7.14 | 0.2812 | 8.00 | 0.3150 | 5.748 | 4.252 | C92622 |
| | 7.50 | 0.2953 | 8.00 | 0.3150 | 5.748 | 4.252 | C92623 |
| 5/16 | 7.94 | 0.3125 | 8.00 | 0.3150 | 5.748 | 4.252 | C92624 |
| | 8.00 | 0.3150 | 8.00 | 0.3150 | 5.748 | 4.252 | C92625 |
| | 8.50 | 0.3346 | 10.00 | 0.3937 | 6.378 | 4.724 | C92626 |
| | 9.00 | 0.3543 | 10.00 | 0.3937 | 6.378 | 4.724 | C92627 |
| | 9.50 | 0.3740 | 10.00 | 0.3937 | 6.378 | 4.724 | C92628 |
| 3/8 | 9.53 | 0.3750 | 10.00 | 0.3937 | 6.378 | 4.724 | C92629 |
| | 10.00 | 0.3937 | 10.00 | 0.3937 | 6.378 | 4.724 | C92630 |
| | 10.00 | 0.4016 | 12.00 | 0.4724 | 8.031 | 6.142 | C92631 |
| | 10.00 | 0.4134 | 12.00 | 0.4724 | 8.031 | 6.142 | C92632 |
| | 11.00 | 0.4331 | 12.00 | 0.4724 | 8.031 | 6.142 | C92633 |
| 7/16 | 11.11 | 0.4375 | 12.00 | 0.4724 | 8.031 | 6.142 | C92634 |
| | 11.80 | 0.4646 | 12.00 | 0.4724 | 8.031 | 6.142 | C92635 |
| | 12.00 | 0.4724 | 12.00 | 0.4724 | 8.031 | 6.142 | C92636 |
| | 12.50 | 0.4921 | 14.00 | 0.5512 | 9.055 | 7.165 | C92637 |
| 1/2 | 12.70 | 0.5000 | 14.00 | 0.5512 | 9.055 | 7.165 | C92638 |
| | 13.00 | 0.5118 | 14.00 | 0.5512 | 9.055 | 7.165 | C92639 |
| | 13.50 | 0.5315 | 14.00 | 0.5512 | 9.055 | 7.165 | C92640 |
| | 14.00 | 0.5512 | 14.00 | 0.5512 | 9.055 | 7.165 | C92641 |

OBSOLETE

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|------------|-------------|-----------------|------------|---------|------------------------------|----------|--------------------------|---------------|--|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | Ni, Co, Fe Based Super Alloy | Titanium | | | | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| AITiN | | | | | | | | | | | | | |

☆ = Best Performance ◆ = Acceptable

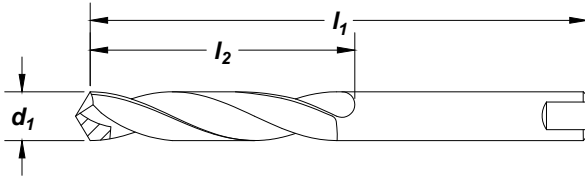
Carbide-Tipped Heavy Duty, Tanged

Style: **2745**

Note
Operating parameters: See Technical section

Surface Treatment

Taper Length

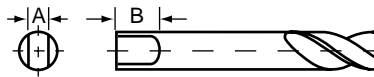


Carbide

Feature: Run at carbide speeds with the flexibility of a HSS body and shank.

| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | order number 2745 |
|--|-------------------|---|---|-----------------------------|
| 1/8 | .1250 | 5.125 | 2.750 | C49017 |
| 5/32 | .1562 | 5.375 | 3.000 | C49029 |
| 3/16 | .1875 | 5.750 | 3.375 | C49041 |
| 7/32 | .2188 | 6.000 | 3.625 | C49052 |
| 1/4 | .2500 | 6.125 | 3.750 | C49064 |
| 9/32 | .2812 | 6.250 | 3.875 | C49078 |
| 5/16 | .3125 | 6.375 | 4.000 | C49087 |
| 11/32 | .3438 | 6.500 | 4.125 | C49098 |
| 3/8 | .3750 | 6.750 | 4.250 | C49110 |
| 13/32 | .4062 | 7.000 | 4.375 | C49119 |
| 27/64 | .4219 | 7.250 | 4.625 | C49121 |
| 7/16 | .4375 | 7.250 | 4.625 | C49124 |
| 15/32 | .4688 | 7.500 | 4.750 | C49129 |
| 1/2 | .5000 | 7.750 | 4.750 | C49134 |
| 17/32 | .5312 | 8.000 | 4.750 | C49139 |
| 9/16 | .5625 | 8.250 | 4.875 | C49145 |
| 5/8 | .6250 | 8.750 | 4.875 | C49155 |

Tang Specifications



| shank diameter (inches) | | tang dimensions (inches) | |
|-------------------------|--------|--------------------------|----------------|
| from | to | width A | width B |
| 1/8 | 3/16 | .092 | .281 |
| over 3/16 | 1/4 | .120 | .312 |
| over 1/4 | 5/16 | .160 | .344 |
| over 5/16 | 3/8 | .201 | .375 |
| over 3/8 | 15/32 | .241 | .438 |
| over 15/32 | 9/16 | .300 | .500 |
| over 9/16 | 21/32 | .370 | .563 |
| over 21/32 | 3/4 | .440 | .625 |
| over 3/4 | 7/8 | .511 | .688 |
| over 7/8 | 1 | .605 | .750 |
| over 1 | 1-3/16 | .696 | .813 |
| over 1-3/16 | 1-3/8 | .813 | .875 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | ◆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Style: **2510**

General Purpose

Note

Operating parameters: See Technical section

ASME
B94.11M

DIN
340

HSS

118°

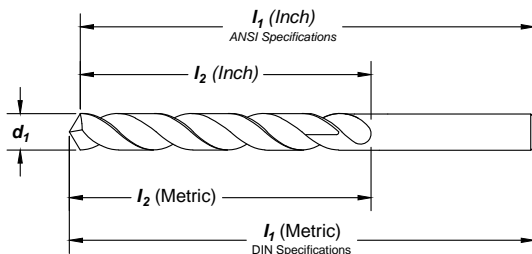
Helix
Regular
21° to 34°

Straight
Shank

Surface
Treatment

Black
Oxide

****Items are being OBSOLETED, only available until inventory is depleted.**



Feature:

General purpose with longer length for added reach.

| drill diameter | | | overall length | | flute length | | order number |
|----------------|------------------------|---------|----------------|-------|----------------|-------|---------------------|
| fraction | d ₁ wire | decimal | I ₁ | | I ₂ | | 2510 black oxide |
| | mm | equiv. | in | mm | in | mm | |
| | 1.0 | .0394 | | 56.00 | | 33.00 | **C08592 |
| | 60 | .0400 | 2.250 | | 1.125 | | C08593 |
| | 59 | .0410 | 2.250 | | 1.125 | | C08594 |
| | 58 | .0420 | 2.250 | | 1.125 | | C08596 |
| | 57 | .0430 | 2.250 | | 1.125 | | C08597 |
| | 56 | .0465 | 2.250 | | 1.125 | | C08600 |
| 3/64 | | .0469 | 2.250 | | 1.125 | | C08601 |
| | 1.25 | .0492 | | 65.00 | | 41.00 | **C08603 |
| | 55 | .0520 | 3.000 | | 1.750 | | C08605 |
| | 54 | .0550 | 3.000 | | 1.750 | | C08607 |
| | 53 | .0595 | 3.000 | | 1.750 | | C08611 |
| | 1.55 | .0610 | | 70.00 | | 45.00 | **C08612 |
| 1/16 | | .0625 | 3.000 | | 1.750 | | C08613 |
| | 52 | .0635 | 3.750 | | 2.000 | | C08615 |
| | 51 | .0670 | 3.750 | | 2.000 | | C08618 |
| | 50 | .0700 | 3.750 | | 2.000 | | C08620 |
| | 49 | .0730 | 3.750 | | 2.000 | | C08623 |
| | 48 | .0760 | 3.750 | | 2.000 | | C08625 |
| 5/64 | | .0781 | 3.750 | | 2.000 | | C08627 |
| | 47 | .0785 | 4.250 | | 2.250 | | C08628 |
| | 46 | .0810 | 4.250 | | 2.250 | | C08631 |
| | 45 | .0820 | 4.250 | | 2.250 | | C08632 |
| | 44 | .0860 | 4.250 | | 2.250 | | C08635 |
| | 43 | .0890 | 4.250 | | 2.250 | | C08638 |
| | 2.35 | .0925 | | 90.00 | | 59.00 | **C08640 |
| | 42 | .0935 | 4.250 | | 2.250 | | C08641 |
| 3/32 | | .0938 | 4.250 | | 2.250 | | C08642 |
| | 2.4 | .0945 | | 95.00 | | 62.00 | **C08643 |
| | 41 | .0960 | 4.625 | | 2.500 | | C08644 |
| | 40 | .0980 | 4.625 | | 2.500 | | C08646 |
| | 39 | .0995 | 4.625 | | 2.500 | | C08648 |
| | 38 | .1015 | 4.625 | | 2.500 | | C08649 |
| | 37 | .1040 | 4.625 | | 2.500 | | C08651 |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|--|-------|--|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | | | | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Bright | ☆ | | ☆ | | | | | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable



Taper Length

High Speed Steel

General Purpose

Style: 2510 (continued)

****Items are being OBSOLETEd, only available until inventory is depleted.**

Taper Length

High Speed Steel

| drill diameter | | overall length | | flute length | | order number |
|----------------|------|----------------|--------|--------------|-------|--------------|
| fraction | wire | decimal | in | in | mm | 2510 |
| | mm | equiv. | mm | mm | | black oxide |
| | 36 | .1065 | 4.625 | 2.500 | | C08653 |
| 7/64 | | .1094 | 4.625 | 2.500 | | C08655 |
| | 35 | .1100 | 5.125 | 2.750 | | C08656 |
| | 2.8 | .1102 | 100.00 | | 66.00 | **C08578 |
| | 34 | .1110 | 5.125 | 2.750 | | C08658 |
| | 33 | .1130 | 5.125 | 2.750 | | C08659 |
| | 32 | .1160 | 5.125 | 2.750 | | C08661 |
| | 31 | .1200 | 5.125 | 2.750 | | C08663 |
| 1/8 | | .1250 | 5.125 | 2.750 | | C08665 |
| | 3.2 | .1260 | 106.00 | | 69.00 | **C08666 |
| | 30 | .1285 | 5.375 | 3.000 | | C08668 |
| | 29 | .1360 | 5.375 | 3.000 | | C08671 |
| | 3.5 | .1378 | 112.00 | | 73.00 | **C08582 |
| | 28 | .1405 | 5.375 | 3.000 | | C08673 |
| 9/64 | | .1406 | 5.375 | 3.000 | | C08674 |
| | 27 | .1440 | 5.375 | 3.000 | | C08676 |
| | 26 | .1470 | 5.375 | 3.000 | | C08678 |
| | 25 | .1495 | 5.375 | 3.000 | | C08680 |
| | 24 | .1520 | 5.375 | 3.000 | | C08682 |
| | 23 | .1540 | 5.375 | 3.000 | | C08684 |
| 5/32 | | .1562 | 5.375 | 3.000 | | C08685 |
| | 22 | .1570 | 5.750 | 3.375 | | C08686 |
| | 21 | .1590 | 5.750 | 3.375 | | C08688 |
| | 20 | .1610 | 5.750 | 3.375 | | C08689 |
| | 19 | .1660 | 5.750 | 3.375 | | C08692 |
| | 18 | .1695 | 5.750 | 3.375 | | C08695 |
| 11/64 | | .1719 | 5.750 | 3.375 | | C08696 |
| | 17 | .1730 | 5.750 | 3.375 | | C08697 |
| | 16 | .1770 | 5.750 | 3.375 | | C08699 |
| | 15 | .1800 | 5.750 | 3.375 | | C08701 |
| | 14 | .1820 | 5.750 | 3.375 | | C08703 |
| | 13 | .1850 | 5.750 | 3.375 | | C08704 |
| 3/16 | | .1875 | 5.750 | 3.375 | | C08707 |
| | 12 | .1890 | 6.000 | 3.625 | | C08708 |
| | 11 | .1910 | 6.000 | 3.625 | | C08710 |
| | 10 | .1935 | 6.000 | 3.625 | | C08712 |
| | 9 | .1960 | 6.000 | 3.625 | | C08713 |
| | 5.0 | .1969 | 132.00 | | 87.00 | **C08714 |
| | 8 | .1990 | 6.000 | 3.625 | | C08715 |
| | 7 | .2010 | 6.000 | 3.625 | | C08717 |
| 13/64 | | .2031 | 6.000 | 3.625 | | C08718 |
| | 6 | .2040 | 6.000 | 3.625 | | C08719 |
| | 5 | .2055 | 6.000 | 3.625 | | C08721 |
| | 4 | .2090 | 6.000 | 3.625 | | C08724 |
| | 3 | .2130 | 6.000 | 3.625 | | C08726 |
| 7/32 | | .2188 | 6.000 | 3.625 | | C08728 |
| | 2 | .2210 | 6.125 | 3.750 | | C08730 |
| | 1 | .2280 | 6.125 | 3.750 | | C08733 |
| | 5.8 | .2283 | 139.00 | | 91.00 | **C08608 |
| 15/64 | | .2344 | 6.125 | 3.750 | | C08737 |
| | D | .2460 | 6.125 | 3.750 | | C08743 |
| | 6.3 | .2480 | 148.00 | | 97.00 | **C08745 |
| 1/4 | E | .2500 | 6.125 | 3.750 | | C08746 |
| | 6.5 | .2559 | 148.00 | | 97.00 | **C08749 |

continued on next page



Style: **2510** (continued)

General Purpose

****Items are being OBSOLETEd, only available until inventory is depleted.**

| fraction | drill diameter | | decimal equiv. | overall length | | flute length | | order number 2510 black oxide |
|----------|------------------------|------|----------------|----------------------|--------|----------------------|--------|--|
| | d ₁ wire | mm | | l ₁ in | mm | l ₂ in | mm | |
| | F | | .2570 | 6.250 | | 3.875 | | C08750 |
| 17/64 | | | .2656 | 6.250 | | 3.875 | | C08752 |
| | I | | .2720 | 6.250 | | 3.875 | | C08757 |
| | | 7.0 | .2756 | | 156.00 | | 102.00 | **C08758 |
| | J | | .2770 | 6.250 | | 3.875 | | C08759 |
| 9/32 | | | .2812 | 6.250 | | 3.875 | | C08766 |
| 19/64 | | | .2969 | 6.375 | | 4.000 | | C08770 |
| | N | | .3020 | 6.375 | | 4.000 | | C08772 |
| 5/16 | | | .3125 | 6.375 | | 4.000 | | C08777 |
| | | 8.0 | .3150 | | 165.00 | | 109.00 | **C08778 |
| | O | | .3160 | 6.500 | | 4.125 | | C08779 |
| | P | | .3230 | 6.500 | | 4.125 | | C08782 |
| 21/64 | | | .3281 | 6.500 | | 4.125 | | C08785 |
| | Q | | .3320 | 6.500 | | 4.125 | | C08787 |
| | R | | .3390 | 6.500 | | 4.125 | | C08790 |
| 11/32 | | | .3438 | 6.500 | | 4.125 | | C08792 |
| 23/64 | | | .3594 | 6.750 | | 4.250 | | C08800 |
| 3/8 | | | .3750 | 6.750 | | 4.250 | | C08807 |
| | V | | .3770 | 7.000 | | 4.375 | | C08808 |
| 25/64 | | | .3906 | 7.000 | | 4.375 | | C08815 |
| | | 10.2 | .4016 | | 184.00 | | 121.00 | **C08818 |
| 13/32 | | | .4062 | 7.000 | | 4.375 | | C08821 |
| 27/64 | | | .4219 | 7.250 | | 4.625 | | C08824 |
| 7/16 | | | .4375 | 7.250 | | 4.625 | | C08827 |
| | | 11.2 | .4409 | | 195.00 | | 128.00 | **C08828 |
| 29/64 | | | .4531 | 7.500 | | 4.750 | | C08830 |
| 15/32 | | | .4688 | 7.500 | | 4.750 | | C08832 |
| 31/64 | | | .4844 | 7.750 | | 4.750 | | C08835 |
| 1/2 | | | .5000 | 7.750 | | 4.750 | | C08837 |
| 33/64 | | | .5156 | 8.000 | | 4.750 | | C08840 |
| 17/32 | | | .5312 | 8.000 | | 4.750 | | C08842 |
| 35/64 | | | .5469 | 8.250 | | 4.875 | | C08845 |
| 9/16 | | | .5625 | 8.250 | | 4.875 | | C08848 |
| 37/64 | | | .5781 | 8.750 | | 4.875 | | C08850 |
| | | 15.0 | .5906 | | 220.00 | | 144.00 | **C08852 |
| 19/32 | | | .5938 | 8.750 | | 4.875 | | C08853 |
| 39/64 | | | .6094 | 8.750 | | 4.875 | | C08855 |
| 5/8 | | | .6250 | 8.750 | | 4.875 | | C08858 |
| 41/64 | | | .6406 | 9.000 | | 5.125 | | C08861 |
| 21/32 | | | .6562 | 9.000 | | 5.125 | | C08863 |
| | | 17.0 | .6693 | | 235.00 | | 149.00 | **C08865 |
| 43/64 | | | .6719 | 9.250 | | 5.375 | | C08866 |
| 11/16 | | | .6875 | 9.250 | | 5.375 | | C08868 |
| 45/64 | | | .7031 | 9.500 | | 5.625 | | C08870 |
| 23/32 | | | .7188 | 9.500 | | 5.625 | | C08872 |
| 47/64 | | | .7344 | 9.750 | | 5.875 | | C08874 |

Taper Length

High Speed Steel

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable



General Purpose
Style: 2510 (continued)
****Items are being OBSOLETEED, only available until inventory is depleted.**
Taper Length
High Speed Steel

| drill diameter | | overall length | | | | flute length | | order number |
|----------------|------------------------|----------------|----------------|----------------|----|----------------|----|---------------------|
| fraction | d ₁ wire | mm | decimal equiv. | l ₁ | | l ₂ | | 2510 black oxide |
| | | | | in | mm | in | mm | |
| 3/4 | | | .7500 | 9.750 | | 5.875 | | C08876 |
| 49/64 | | | .7656 | 9.875 | | 6.000 | | C08877 |
| 25/32 | | | .7812 | 9.875 | | 6.000 | | C08879 |
| 51/64 | | | .7969 | 10.000 | | 6.125 | | C08881 |
| 13/16 | | | .8125 | 10.000 | | 6.125 | | C08883 |
| 53/64 | | | .8281 | 10.000 | | 6.125 | | C08885 |
| 27/32 | | | .8438 | 10.000 | | 6.125 | | C08886 |
| 55/64 | | | .8594 | 10.000 | | 6.125 | | C08888 |
| 7/8 | | | .8750 | 10.000 | | 6.125 | | C08890 |
| 57/64 | | | .8906 | 10.000 | | 6.125 | | C08892 |
| 29/32 | | | .9062 | 10.000 | | 6.125 | | C08894 |
| 59/64 | | | .9219 | 10.750 | | 6.125 | | C08895 |
| 15/16 | | | .9375 | 10.750 | | 6.125 | | C08897 |
| 61/64 | | | .9531 | 11.000 | | 6.375 | | C08899 |
| 31/32 | | | .9688 | 11.000 | | 6.375 | | C08901 |
| 63/64 | | | .9844 | 11.000 | | 6.375 | | C08903 |
| 1 | | | 1.0000 | 11.000 | | 6.375 | | C08904 |

General Purpose
SET
Style: 2510

| no. of pieces | surface treatment | size range | order number |
|---------------|-------------------|----------------------------|----------------|
| 29 | black oxide | 1/16" through 1/2" x 1/64" | 2510 C00962 |



| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable



Style: **2550**

High Helix

Note
Operating parameters: See Technical section

ASME
B94.11M

HSS

118°

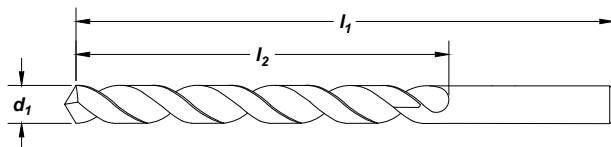
Helix
High
35° to 45°

Straight
Shank

Surface
Treatment

Bright

****Items are being OBSOLETED, only available until inventory is depleted.**



Taper Length

High Speed Steel

Feature:

Fast spiral aids chip removal in softer materials.

| drill diameter | | wire | decimal equiv. | overall length l ₁ (in) | flute length l ₂ (in) | order number 2550 |
|----------------|----------------|------|----------------|---------------------------------------|-------------------------------------|-----------------------------|
| fraction | d ₁ | | | | | |
| 1/32 | | | .0312 | 1.625 | .750 | **C09060 |
| 3/64 | | | .0469 | 2.250 | 1.125 | **C09070 |
| | | 55 | .0520 | 3.000 | 1.750 | **C09074 |
| | | 54 | .0550 | 3.000 | 1.750 | **C09076 |
| | | 53 | .0595 | 3.000 | 1.750 | **C09080 |
| | | 51 | .0670 | 3.750 | 2.000 | **C09087 |
| | | 49 | .0730 | 3.750 | 2.000 | **C09092 |
| | | 48 | .0760 | 3.750 | 2.000 | **C09094 |
| 5/64 | | | .0781 | 3.750 | 2.000 | **C09096 |
| | | 47 | .0785 | 4.250 | 2.250 | **C09097 |
| | | 46 | .0810 | 4.250 | 2.250 | **C09100 |
| | | 45 | .0820 | 4.250 | 2.250 | **C09101 |
| | | 44 | .0860 | 4.250 | 2.250 | **C09104 |
| | | 43 | .0890 | 4.250 | 2.250 | **C09107 |
| | | 42 | .0935 | 4.250 | 2.250 | **C09110 |
| 3/32 | | | .0938 | 4.250 | 2.250 | **C09111 |
| | | 41 | .0960 | 4.625 | 2.500 | **C09113 |
| | | 40 | .0980 | 4.625 | 2.500 | **C09115 |
| | | 39 | .0995 | 4.625 | 2.500 | **C09117 |
| | | 38 | .1015 | 4.625 | 2.500 | **C09118 |
| | | 37 | .1040 | 4.625 | 2.500 | **C09120 |
| | | 36 | .1065 | 4.625 | 2.500 | **C09122 |
| | | 33 | .1130 | 5.125 | 2.750 | **C09128 |
| | | 32 | .1160 | 5.125 | 2.750 | **C09130 |
| | | 29 | .1360 | 5.375 | 3.000 | **C09140 |
| 9/64 | | | .1406 | 5.375 | 3.000 | **C09143 |
| | | 27 | .1440 | 5.375 | 3.000 | **C09145 |
| 11/64 | | | .1719 | 5.750 | 3.375 | **C09165 |
| | | 16 | .1770 | 5.750 | 3.375 | **C09168 |
| | | 15 | .1800 | 5.750 | 3.375 | **C09170 |
| 3/16 | | | .1875 | 5.750 | 3.375 | **C09176 |
| | | 11 | .1910 | 6.000 | 3.625 | **C09179 |
| | | 10 | .1935 | 6.000 | 3.625 | **C09181 |
| | | 8 | .1990 | 6.000 | 3.625 | **C09184 |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ◆ | | ☆ | | | | | | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



High Helix

Style: **2550** (continued)

****Items are being OBSOLETEED, only available until inventory is depleted.**

Taper Length

High Speed Steel

| drill diameter | | decimal equiv. | overall length l ₁ (in) | flute length l ₂ (in) | order number 2550 |
|----------------|------------------------|----------------|---------------------------------------|-------------------------------------|-----------------------------|
| fraction | d ₁ wire | | | | |
| | 7 | .2010 | 6.000 | 3.625 | **C09186 |
| 13/64 | | .2031 | 6.000 | 3.625 | **C09187 |
| 7/32 | | .2188 | 6.000 | 3.625 | **C09197 |
| | 1 | .2280 | 6.125 | 3.750 | **C09202 |
| 15/64 | | .2344 | 6.125 | 3.750 | **C09205 |
| 1/4 | | .2500 | 6.125 | 3.750 | **C09211 |
| 5/16 | | .3125 | 6.375 | 4.000 | **C09234 |
| 3/8 | | .3750 | 6.750 | 4.250 | **C09257 |
| 7/16 | | .4375 | 7.250 | 4.625 | **C09271 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ◆ | | ☆ | | | | | | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Style: **2513**

Note
Operating parameters: See Technical section

ASME
B94.11M

M42
Cobalt

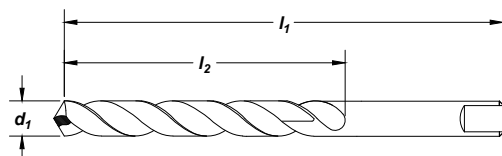
118° K-Notch

Helix
Regular
21° to 34°

Straight
Shank Tang

Surface
Treatment

Straw
Oxide



Taper Length

Cobalt

Feature:

Highly heat resistant substrate for tough to machine materials.

| drill diameter | decimal | overall length | flute length | order number |
|----------------------|---------|---------------------------|---------------------------|--------------|
| d₁ | equiv. | l₁ (in) | l₂ (in) | 2513 |
| 1/16 | .0625 | 3.000 | 1.750 | C83000 |
| 5/64 | .0781 | 3.750 | 2.000 | C83001 |
| 3/32 | .0938 | 4.625 | 2.500 | C83002 |
| 40 | .0980 | 4.625 | 2.500 | C83026 |
| 38 | .1015 | 4.625 | 2.500 | C83025 |
| 37 | .1040 | 4.625 | 2.500 | C83024 |
| 36 | .1065 | 4.625 | 2.500 | C83023 |
| 7/64 | .1094 | 4.250 | 2.250 | C83003 |
| 33 | .1130 | 5.125 | 2.750 | C83022 |
| 1/8 | .1250 | 5.125 | 3.375 | C14873 |
| 30 | .1285 | 5.375 | 3.000 | C83021 |
| 29 | .1360 | 5.375 | 3.000 | C83020 |
| 9/64 | .1406 | 5.375 | 3.625 | C14882 |
| 27 | .1440 | 5.375 | 3.000 | C83019 |
| 26 | .1470 | 5.375 | 3.000 | C83018 |
| 5/32 | .1562 | 5.375 | 3.750 | C14893 |
| 21 | .1590 | 5.750 | 3.375 | C83017 |
| 20 | .1610 | 5.750 | 3.375 | C83016 |
| 11/64 | .1719 | 5.750 | 3.375 | C83004 |
| 16 | .1770 | 5.750 | 3.375 | C83015 |
| 15 | .1800 | 5.750 | 3.375 | C83014 |
| 3/16 | .1875 | 5.750 | 4.125 | C14915 |
| 7 | .2010 | 6.000 | 3.625 | C83013 |
| 13/64 | .2031 | 6.000 | 3.625 | C83005 |
| 3 | .2130 | 6.000 | 3.625 | C83012 |
| 7/32 | .2188 | 6.000 | 4.375 | C14935 |
| 1 | .2280 | 6.125 | 3.750 | C83011 |
| 15/64 | .2344 | 6.125 | 3.750 | C83006 |
| 1/4 | .2500 | 6.125 | 4.813 | C14954 |
| 17/64 | .2656 | 6.250 | 3.875 | C83007 |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Straw | ◆ | | ☆ | | ◆ | ☆ | | ◆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable



Heavy Duty
Tanged
Style: 2513 (continued)

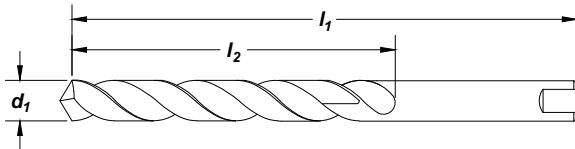
Taper Length
High Speed Steel

| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | order number 2513 |
|--|-------------------|---|---|-----------------------------|
| 9/32 | .2812 | 6.250 | 5.000 | C14973 |
| 19/64 | .2969 | 6.375 | 4.000 | C83008 |
| 5/16 | .3125 | 6.375 | 5.125 | C14984 |
| 21/64 | .3281 | 6.500 | 4.125 | C83009 |
| 11/32 | .3438 | 6.500 | 5.250 | C14999 |
| 23/64 | .3594 | 6.750 | 5.375 | C15007 |
| 3/8 | .3750 | 6.750 | 5.375 | C15014 |
| 25/64 | .3906 | 7.000 | 4.375 | C83010 |
| 13/32 | .4062 | 7.000 | 5.625 | C15028 |
| 27/64 | .4219 | 7.250 | 5.688 | C15031 |
| 7/16 | .4375 | 7.250 | 5.688 | C15034 |
| 29/64 | .4531 | 7.500 | 5.750 | C15037 |
| 15/32 | .4688 | 7.500 | 5.750 | C15039 |
| 31/64 | .4844 | 7.750 | 5.750 | C15042 |
| 1/2 | .5000 | 7.750 | 5.750 | C15044 |

Automotive, Tanged Shank
Heavy Duty
Style: 2540

Note
 Operating parameters: See Technical section

| | | | | | | |
|--------------|-----|--------------|--------------------------|-----------------------|-------------------|-------------|
| ASME B94.11M | HSS | 118° K-Notch | Helix Regular 21° to 34° | Straight Shank Tanged | Surface Treatment | Black Oxide |
|--------------|-----|--------------|--------------------------|-----------------------|-------------------|-------------|


****Items are being OBSOLETED, only available until inventory is depleted.**

Feature:
 Heavy duty design with long length for extended reach application.

| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | order number 2540 |
|--|-------------------|---|---|-----------------------------|
| 1/8 | .1250 | 5.125 | 3.375 | **C09443 |
| 5/32 | .1562 | 5.375 | 3.750 | **C09455 |
| 3/16 | .1875 | 5.750 | 4.125 | **C09467 |
| 7/32 | .2188 | 6.000 | 4.375 | **C09478 |
| 1/4 | .2500 | 6.125 | 4.813 | **C09490 |
| 5/16 | .3125 | 6.375 | 5.125 | **C09513 |
| 11/32 | .3438 | 6.500 | 5.250 | **C09524 |
| 13/32 | .4062 | 7.000 | 5.625 | **C09545 |
| 7/16 | .4375 | 7.250 | 5.688 | **C09550 |
| 29/64 | .4531 | 7.500 | 5.750 | **C09553 |
| 15/32 | .4688 | 7.500 | 5.750 | **C09555 |
| 1/2 | .5000 | 7.750 | 5.750 | **C09560 |
| 33/64 | .5156 | 8.000 | 6.000 | **C09563 |
| 17/32 | .5312 | 8.000 | 6.000 | **C09565 |
| 9/16 | .5625 | 8.250 | 6.250 | **C09571 |
| 19/32 | .5938 | 8.750 | 6.500 | **C09576 |
| 5/8 | .6250 | 8.750 | 6.500 | **C09581 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Black Oxide | ★ | | ☆ | | ☆ | | | ★ | ☆ | | | | |

☆ = Best Performance ★ = Acceptable



Styles: **2565, 2565-TN**

Parabolic

Note

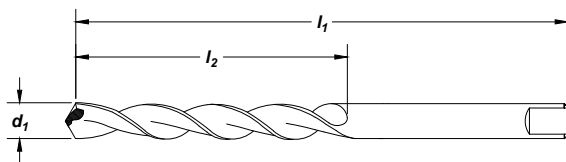
Operating parameters: See Technical section
Adjust the parameters as follows:
double the given feed rate.



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



Taper Length

High Speed Steel

Feature:

Excels in deep hole drilling without pecking in softer, free machining materials. Drill up to 10x diameter without pecking. Taper length for extended reach. Standard with automotive tang.

| drill diameter | | | | | order number | |
|----------------|-------------------------|----------------|------------------------------------|----------------------------------|--------------|-------------|
| fraction | d ₁ wire/let | decimal equiv. | overall length l ₁ (in) | flute length l ₂ (in) | 2565 bright | 2565-TN TiN |
| 1/16 | | .0625 | 3.000 | 1.750 | C16058 | C05105 |
| | 50 | .0700 | 3.750 | 2.000 | **C16269 | - |
| 5/64 | | .0781 | 3.750 | 2.000 | C16059 | C05111 |
| | 47 | .0785 | 4.250 | 2.250 | **C16266 | - |
| | 43 | .0890 | 4.250 | 2.250 | **C16262 | - |
| | 42 | .0935 | 4.250 | 2.250 | **C16261 | - |
| 3/32 | | .0938 | 4.250 | 2.250 | C16060 | C05118 |
| | 37 | .1040 | 4.625 | 2.500 | **C16256 | **C05123 |
| | 36 | .1065 | 4.625 | 2.500 | **C16255 | - |
| 7/64 | | .1094 | 4.625 | 2.500 | C16061 | C05125 |
| | 33 | .1130 | 5.125 | 2.750 | **C16252 | - |
| 1/8 | | .1250 | 5.125 | 2.750 | C16062 | C05131 |
| | 30 | .1285 | 5.375 | 3.000 | C16249 | - |
| | 29 | .1360 | 5.375 | 3.000 | C16248 | - |
| 9/64 | | .1406 | 5.375 | 3.000 | C16063 | C05135 |
| | 26 | .1470 | 5.375 | 3.000 | C16245 | - |
| | 25 | .1495 | 5.375 | 3.000 | C16244 | - |
| 5/32 | | .1562 | 5.375 | 3.000 | C16064 | C05141 |
| | 21 | .1590 | 5.750 | 3.375 | C16240 | - |
| | 20 | .1610 | 5.750 | 3.375 | C16239 | - |
| 11/64 | | .1719 | 5.750 | 3.375 | C16065 | C05147 |
| | 16 | .1730 | 5.750 | 3.375 | **C16235 | - |
| | 15 | .1770 | 5.750 | 3.375 | **C16234 | - |
| 3/16 | | .1875 | 5.750 | 3.375 | C16066 | C05153 |
| | 10 | .1935 | 6.000 | 3.625 | **C16229 | - |
| | 9 | .1960 | 6.000 | 3.625 | C16228 | - |
| | 7 | .2010 | 6.000 | 3.625 | **C16226 | - |
| 13/64 | | .2031 | 6.000 | 3.625 | C16067 | C05160 |
| | 3 | .2130 | 6.000 | 3.625 | **C16222 | - |
| 7/32 | | .2188 | 6.000 | 3.625 | C16068 | C05165 |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ★ | | ★ | | ★ | | | | | ★ | | | |
| TiN | ★ | | ★ | | ★ | | | | | | | | |

★ = Best Performance ★ = Acceptable



****Items are being OBSOLETED, only available until inventory is depleted.**

Taper Length

High Speed Steel

| drill diameter | | decimal equiv. | overall length l ₁ (in) | flute length l ₂ (in) | order number | |
|----------------|-------------------------|----------------|---------------------------------------|-------------------------------------|--------------|-------------|
| fraction | d ₁ wire/let | | | | 2565 bright | 2565-TN TiN |
| 15/64 | | .2344 | 6.125 | 3.750 | C16069 | C05169 |
| 1/4 | E | .2500 | 6.125 | 3.750 | C16070 | C05173 |
| 17/64 | | .2656 | 6.250 | 3.875 | C16071 | C05176 |
| 9/32 | | .2812 | 6.250 | 3.875 | C16072 | C05181 |
| 19/64 | | .2969 | 6.375 | 4.000 | C16073 | C05184 |
| 5/16 | | .3125 | 6.375 | 4.000 | C16074 | C05185 |
| 21/64 | | .3281 | 6.500 | 4.125 | C16075 | C05187 |
| 11/32 | | .3438 | 6.500 | 4.125 | C16076 | C05190 |
| 23/64 | | .3594 | 6.750 | 4.250 | C16077 | C05193 |
| 3/8 | | .3750 | 6.750 | 4.250 | C16078 | C05195 |
| 25/64 | | .3906 | 7.000 | 4.375 | C16079 | C05198 |
| 13/32 | | .4062 | 7.000 | 4.375 | C16080 | C05201 |
| 27/64 | | .4219 | 7.250 | 4.625 | C16081 | C05203 |
| 7/16 | | .4375 | 7.250 | 4.625 | C16082 | C05204 |
| 29/64 | | .4531 | 7.500 | 4.750 | C16083 | C05205 |
| 15/32 | | .4688 | 7.500 | 4.750 | C16084 | C05206 |
| 31/64 | | .4844 | 7.750 | 4.750 | C16085 | C05207 |
| 1/2 | | .5000 | 7.750 | 4.750 | C16086 | C05208 |
| 33/64 | | .5156 | 8.000 | 6.000 | C13000 | C13019 |
| 17/32 | | .5312 | 8.000 | 6.000 | C13001 | C13020 |
| 35/64 | | .5469 | 8.250 | 6.250 | C13002 | C13022 |
| 9/16 | | .5625 | 8.250 | 6.250 | C13004 | C13023 |
| 37/64 | | .5781 | 8.750 | 6.500 | C13005 | C13024 |
| 19/32 | | .5938 | 8.750 | 6.500 | C13006 | C13026 |
| 5/8 | | .6250 | 8.750 | 6.500 | C13008 | C13028 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Bright | ◆ | | ◆ | | ◆ | | | | | ☆ | | | |
| TiN | ☆ | | ☆ | | ☆ | | | | | | | | |

☆ = Best Performance ◆ = Acceptable



Styles: **2575, 2575-TN, 2575-TA**

Note
Operating parameters: See Technical section

ASME
B94.11M

DIN
340

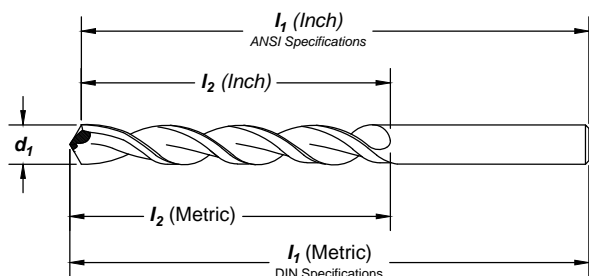
M42
Cobalt



Surface
Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



Taper Length

Cobalt

Feature:

Effective deep hole drilling in a wide array of materials. Available coating for extended tool life and productivity. Longer design for deeper holes and extended reach.

| drill diameter | | overall length | | flute length | | order number | |
|----------------|----------------------|-------------------|----------------|----------------|---------------------|----------------|----------|
| fraction | d1 wire/let mm | decimal equiv. | I1 in mm | I2 in mm | 2575 straw oxide | 2575-TN TiN | |
| | *1.50 | .0591 | 76.00 | | 44.00 | C16805 | C16914 |
| 1/16 | | .0625 | 3.000 | 1.750 | | C16776 | C16885 |
| | 52 | .0635 | 3.750 | 2.000 | | **C16775 | — |
| | 51 | .0670 | 3.750 | 2.000 | | **C16774 | **C16883 |
| | 50 | .0700 | 3.750 | 2.000 | | **C16773 | **C16882 |
| | 49 | .0730 | 3.750 | 2.000 | | **C16772 | **C16881 |
| | 48 | .0760 | 3.750 | 2.000 | | **C16771 | — |
| 5/64 | | .0781 | 3.750 | 2.000 | | C16777 | C16886 |
| | 47 | .0785 | 4.250 | 2.250 | | **C16770 | **C16879 |
| | 2.00 | .0787 | 108.00 | | 57.00 | **C16806 | **C16915 |
| | 46 | .0810 | 4.250 | 2.250 | | **C16769 | — |
| | 44 | .0860 | 4.250 | 2.250 | | **C16767 | **C16876 |
| | 43 | .0890 | 4.250 | 2.250 | | **C16766 | **C16875 |
| | 42 | .0935 | 4.250 | 2.250 | | **C16765 | — |
| 3/32 | | .0938 | 4.250 | 2.250 | | C16778 | C16887 |
| | 41 | .0960 | 4.625 | 2.500 | | **C16764 | **C16873 |
| | 40 | .0980 | 4.625 | 2.500 | | **C16763 | — |
| | 2.50 | .0984 | 117.00 | | 64.00 | **C16807 | **C16916 |
| | 39 | .0995 | 4.625 | 2.500 | | **C16762 | **C16871 |
| | 38 | .1015 | 4.625 | 2.500 | | **C16761 | **C16870 |
| | 37 | .1040 | 4.625 | 2.500 | | **C16760 | **C16869 |
| | 36 | .1065 | 4.625 | 2.500 | | **C16759 | — |
| 7/64 | | .1094 | 4.625 | 2.500 | | C16779 | C16888 |
| | 35 | .1100 | 5.125 | 2.750 | | **C16758 | — |
| | 34 | .1110 | 5.125 | 2.750 | | **C16757 | — |
| | 33 | .1130 | 5.125 | 2.750 | | **C16756 | **C16865 |
| | 32 | .1160 | 5.125 | 2.750 | | **C16755 | **C16864 |
| | 3.00 | .1181 | 130.00 | | 70.00 | **C16808 | **C16917 |
| | 31 | .1200 | 5.125 | 2.750 | | **C16754 | **C16863 |

*Not split point.

continued on next page

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) | |
|--------------------|-------------|-------|-----------------|-------------|------|-----------------|------------|--------------------------|------------------------------|----------|----------------------|-----|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | >45 |
| Straw | | | | | | | | | | ☆ | | |
| TiN | ◆ | | ◆ | | ◆ | ◆ | | ◆ | ◆ | | | |

☆ = Best Performance ◆ = Acceptable



****Items are being OBSOLETED, only available until inventory is depleted.**

Taper Length

Cobalt

| fraction | drill diameter | | decimal equiv. | overall length | | flute length | | order number | |
|----------|----------------|------|----------------|----------------|--------|----------------|--------|--------------|----------|
| | d ₁ | | | l ₁ | | l ₂ | | 2575 | 2575-TN |
| | wire/let | mm | | in | mm | in | mm | straw oxide | TiN |
| 1/8 | | | .1250 | 5.125 | | 2.750 | | C16780 | C16889 |
| | 30 | | .1285 | 5.375 | | 3.000 | | **C16753 | **C16862 |
| | 29 | | .1360 | 5.375 | | 3.000 | | **C16752 | **C16861 |
| | | 3.50 | .1378 | | 137.00 | | 76.00 | **C16809 | — |
| | 28 | | .1405 | 5.375 | | 3.000 | | **C16751 | **C16860 |
| 9/64 | | | .1406 | 5.375 | | 3.000 | | C16781 | C16890 |
| | 26 | | .1470 | 5.375 | | 3.000 | | **C16749 | **C16858 |
| | 25 | | .1495 | 5.375 | | 3.000 | | **C16748 | — |
| | 24 | | .1520 | 5.375 | | 3.000 | | **C16747 | **C16856 |
| | 23 | | .1540 | 5.375 | | 3.000 | | **C16746 | **C16855 |
| 5/32 | | | .1562 | 5.375 | | 3.000 | | C16782 | C16891 |
| | 22 | | .1570 | 5.750 | | 3.375 | | **C16745 | **C16854 |
| | | 4.00 | .1575 | | 146.00 | | 86.00 | C16810 | — |
| | 21 | | .1590 | 5.750 | | 3.375 | | **C16744 | **C16853 |
| | 20 | | .1610 | 5.750 | | 3.375 | | **C16743 | **C16852 |
| | 19 | | .1660 | 5.750 | | 3.375 | | **C16742 | **C16851 |
| | 18 | | .1695 | 5.750 | | 3.375 | | **C16741 | — |
| 11/64 | | | .1719 | 5.750 | | 3.375 | | C16783 | C16892 |
| | 17 | | .1730 | 5.750 | | 3.375 | | **C16740 | **C16849 |
| | 16 | | .1770 | 5.750 | | 3.375 | | **C16739 | **C16848 |
| | | 4.50 | .1772 | | 126.00 | | 82.00 | **C16811 | — |
| | 15 | | .1800 | 5.750 | | 3.375 | | **C16738 | **C16847 |
| | 14 | | .1820 | 5.750 | | 3.375 | | **C16737 | **C16846 |
| | 13 | | .1850 | 5.750 | | 3.375 | | **C16736 | — |
| 3/16 | | | .1875 | 5.750 | | 3.375 | | C16784 | C16893 |
| | 12 | | .1890 | 6.000 | | 3.625 | | **C16735 | — |
| | 11 | | .1910 | 6.000 | | 3.625 | | **C16734 | **C16843 |
| | 10 | | .1935 | 6.000 | | 3.625 | | **C16733 | — |
| | 9 | | .1960 | 6.000 | | 3.625 | | **C16732 | **C16841 |
| | | 5.00 | .1969 | | 152.00 | | 92.00 | C16812 | C16921 |
| | 8 | | .1990 | 6.000 | | 3.625 | | **C16731 | — |
| | 7 | | .2010 | 6.000 | | 3.625 | | **C16730 | **C16839 |
| 13/64 | | | .2031 | 6.000 | | 3.625 | | C16785 | C16894 |
| | 6 | | .2040 | 6.000 | | 3.625 | | **C16729 | — |
| | | 5.20 | .2047 | | 152.00 | | 92.00 | **C16813 | — |
| | 5 | | .2055 | 6.000 | | 3.625 | | **C16728 | **C16837 |
| | 4 | | .2090 | 6.000 | | 3.625 | | **C16727 | **C16836 |
| | 3 | | .2130 | 6.000 | | 3.625 | | — | **C16835 |
| | | 5.50 | .2165 | | 152.00 | | 92.00 | **C16814 | **C16923 |
| 7/32 | | | .2188 | 6.000 | | 3.625 | | C16786 | C16895 |
| | | 5.60 | .2205 | | 156.00 | | 95.00 | **C16815 | **C16924 |
| | 2 | | .2210 | 6.125 | | 3.750 | | **C16725 | — |
| | 1 | | .2280 | 6.125 | | 3.750 | | **C16724 | **C16833 |
| 15/64 | | | .2344 | 6.125 | | 3.750 | | C16787 | C16896 |
| | | 6.00 | .2362 | | 156.00 | | 95.00 | C16816 | C16925 |
| 1/4 | | | .2500 | 6.125 | | 3.750 | | C16788 | C16897 |
| | | 6.50 | .2559 | | 159.00 | | 98.00 | **C16817 | — |
| 17/64 | | | .2656 | 6.250 | | 3.875 | | C16789 | C16898 |
| | | 6.80 | .2677 | | 159.00 | | 98.00 | **C16818 | — |
| | | 7.00 | .2756 | | 159.00 | | 98.00 | **C16819 | — |
| 9/32 | | | .2812 | 6.250 | | 3.875 | | C16790 | C16899 |
| | | 7.50 | .2953 | | 162.00 | | 102.00 | **C16820 | **C16929 |
| 19/64 | | | .2969 | 6.375 | | 4.000 | | C16791 | C16900 |

continued on next page



Styles: 2575, 2575-TN, 2575-TA (continued)

****Items are being OBSOLETED, only available until inventory is depleted.**

| drill diameter | | decimal | | overall length | | flute length | | order number | |
|----------------|-------------------------|---------|--------|----------------|--------|--------------|--------|------------------|-------------|
| fraction | d ₁ wire/let | mm | equiv. | in | mm | in | mm | 2575 straw oxide | 2575-TN TiN |
| 5/16 | | | .3125 | 6.375 | | 4.000 | | C16792 | C16901 |
| | | 8.00 | .3150 | | 165.00 | | 105.00 | **C16821 | **C16930 |
| | | 8.20 | .3228 | | 165.00 | | 105.00 | **C16822 | **C16931 |
| 21/64 | | | .3281 | 6.500 | | 4.125 | | C16793 | C16902 |
| | | 8.60 | .3386 | | 165.00 | | 105.00 | **C16824 | **C16933 |
| 11/32 | | | .3438 | 6.500 | | 4.125 | | C16794 | C16903 |
| | | 9.00 | .3543 | | 171.00 | | 108.00 | **C16825 | — |
| 23/64 | | | .3594 | 6.750 | | 4.250 | | C16795 | C16904 |
| | | 9.50 | .3740 | | 171.00 | | 108.00 | **C16826 | **C16935 |
| 3/8 | | | .3750 | 6.750 | | 4.250 | | C16796 | C16905 |
| 25/64 | | | .3906 | 7.000 | | 4.375 | | C16797 | C16906 |
| | | 10.00 | .3937 | | 178.00 | | 111.00 | **C16827 | **C16936 |
| 13/32 | | | .4062 | 7.000 | | 4.375 | | C16798 | C16907 |
| | | 10.50 | .4134 | | 184.00 | | 117.00 | **C16828 | — |
| 27/64 | | | .4219 | 7.250 | | 4.625 | | C16799 | C16908 |
| | | 11.00 | .4331 | | 184.00 | | 117.00 | **C16829 | **C16938 |
| 7/16 | | | .4375 | 7.250 | | 4.625 | | C16800 | C16909 |
| | | 11.50 | .4528 | | 190.00 | | 121.00 | **C16830 | — |
| 29/64 | | | .4531 | 7.500 | | 4.750 | | C16801 | C16910 |
| 15/32 | | | .4688 | 7.500 | | 4.750 | | C16802 | C16911 |
| | | 12.00 | .4724 | | 190.00 | | 121.00 | **C16831 | **C16940 |
| 31/64 | | | .4844 | 7.750 | | 4.750 | | C16803 | C16912 |
| | | 12.50 | .4921 | | 190.00 | | 121.00 | **C16832 | — |
| 1/2 | | | .5000 | 7.750 | | 4.750 | | C16804 | C16913 |

Taper Length

Cobalt

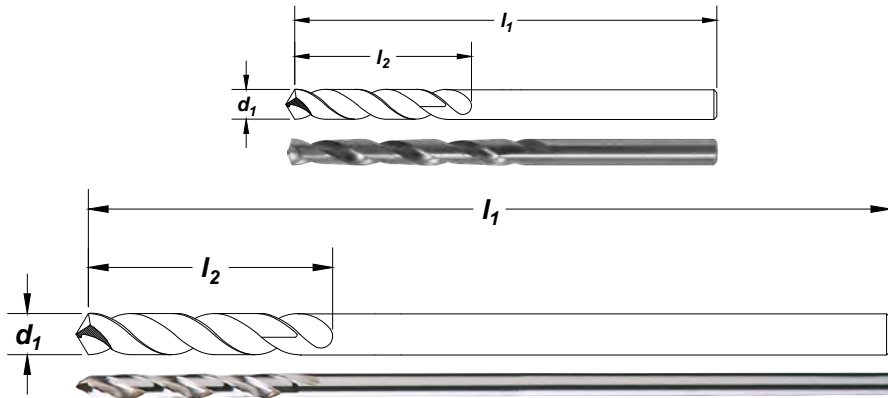
| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Straw | | | | | | | | | | ☆ | | | |
| TiN | ◆ | | ◆ | | ◆ | ◆ | | ◆ | ◆ | | | | |

☆ = Best Performance ◆ = Acceptable



Aircraft NAS 907, Type B
 6" & 12" Extension

Styles: 3957-6, 3957-12
Note
 Operating parameters: See Technical section

Aircraft Extension
High Speed Steel

Feature:
 Ideal for long reach drilling applications.

| drill diameter | | | order number | | |
|----------------|----------------------|-------------------|--------------------------|----------------------------|----------------------------|
| fraction | d_1 wire/letter | decimal equiv. | 3957-6 l_1 (6.0 in) | 3957-12 l_1 (12.0 in) | flute length l_2 (in) |
| *3/64 | | .0469 | C13100 | - | .750 |
| 1/16 | | .0625 | C13101 | C13176 | .875 |
| | 52 | .0635 | C13174 | - | .875 |
| | 51 | .0670 | C13173 | - | 1.000 |
| | 50 | .0700 | C13172 | - | 1.000 |
| | 49 | .0730 | C13171 | - | 1.000 |
| | 48 | .0760 | C13170 | - | 1.000 |
| 5/64 | | .0781 | C13102 | C13177 | 1.000 |
| | 47 | .0785 | C13169 | - | 1.125 |
| | 46 | .0810 | C13168 | - | 1.125 |
| | 45 | .0820 | C13167 | - | 1.125 |
| | 44 | .0860 | C13166 | - | 1.250 |
| | 43 | .0890 | C13165 | - | 1.250 |
| | 42 | .0935 | C13164 | - | 1.250 |
| 3/32 | | .0938 | C13103 | C13178 | 1.250 |
| | 41 | .0960 | C13163 | - | 1.375 |
| | 40 | .0980 | C13162 | C13244 | 1.375 |
| | 39 | .0995 | C13161 | C13243 | 1.375 |
| | 38 | .1015 | C13160 | - | 1.438 |
| | 37 | .1040 | C13159 | - | 1.438 |
| | 36 | .1065 | C13158 | - | 1.438 |
| 7/64 | | .1094 | C13104 | C13179 | 1.500 |
| | 35 | .1100 | C13157 | - | 1.500 |
| | 34 | .1110 | C13156 | - | 1.500 |
| | 33 | .1130 | C13155 | - | 1.500 |
| | 32 | .1160 | C13154 | - | 1.625 |
| | 31 | .1200 | C13153 | C13242 | 1.625 |
| 1/8 | | .1250 | C13105 | C13180 | 1.625 |
| | 30 | .1285 | C13152 | C13241 | 1.625 |
| | 29 | .1360 | C13151 | C13240 | 1.750 |
| | 28 | .1405 | C13150 | C13239 | 1.750 |
| 9/64 | | .1406 | C13106 | C13181 | 1.750 |
| | 27 | .1440 | C13149 | C13238 | 1.875 |
| | 26 | .1470 | C13148 | C13237 | 1.875 |
| | 25 | .1495 | C13147 | C13236 | 1.875 |
| | 24 | .1520 | C13146 | C13235 | 2.000 |
| | 23 | .1540 | C13145 | - | 2.000 |
| 5/32 | | .1562 | C13107 | C13182 | 2.000 |
| | 22 | .1570 | C13144 | - | 2.000 |
| | 21 | .1590 | C13143 | C13234 | 2.125 |

*Not split point.

continued on next page



Styles: **3957-6, 3957-12** (continued)

| drill diameter | | | order number | | |
|----------------|-------------------------------|-------------------|-----------------------------------|-------------------------------------|-------------------------------------|
| fraction | d ₁ wire/letter | decimal equiv. | overall length | | flute length l ₂ (in) |
| | | | 3957-6 l ₁ (6.0 in) | 3957-12 l ₁ (12.0 in) | |
| | 20 | .1610 | C13142 | C13233 | 2.125 |
| | 19 | .1660 | C13141 | C13232 | 2.125 |
| | 18 | .1695 | C13140 | - | 2.125 |
| 11/64 | | .1719 | C13108 | C13183 | 2.125 |
| | 17 | .1730 | C13139 | - | 2.188 |
| | 16 | .1770 | C13138 | C13231 | 2.188 |
| | 15 | .1800 | C13137 | C13230 | 2.188 |
| | 14 | .1820 | C13136 | - | 2.188 |
| | 13 | .1850 | C13135 | C13229 | 2.313 |
| 3/16 | | .1875 | C13109 | C13184 | 2.313 |
| | 12 | .1890 | C13134 | C13228 | 2.313 |
| | 11 | .1910 | C13133 | C13227 | 2.313 |
| | 10 | .1935 | C13132 | C13226 | 2.438 |
| | 9 | .1960 | C13131 | C13225 | 2.438 |
| | 8 | .1990 | C13130 | C13224 | 2.438 |
| | 7 | .2010 | C13129 | C13223 | 2.438 |
| 13/64 | | .2031 | C13110 | C13185 | 2.438 |
| | 6 | .2040 | C13128 | C13222 | 2.500 |
| | 5 | .2055 | C13127 | C13221 | 2.500 |
| | 4 | .2090 | C13126 | - | 2.500 |
| | 3 | .2130 | C13125 | C13220 | 2.500 |
| 7/32 | | .2188 | C13111 | C13186 | 2.500 |
| | 2 | .2210 | C13124 | C13219 | 2.625 |
| | 1 | .2280 | C13123 | C13218 | 2.625 |
| 15/64 | | .2344 | C13112 | C13187 | 2.625 |
| 1/4 | E | .2500 | C13113 | C13188 | 2.750 |
| | F | .2570 | C13122 | - | 2.875 |
| 17/64 | | .2656 | - | C13189 | 2.625 |
| 17/64 | | .2656 | C13245 | - | 2.875 |
| 9/32 | | .2812 | C13114 | C13190 | 3.063 |
| 19/64 | | .2969 | - | C13191 | 3.063 |
| 5/16 | | .3125 | C13115 | C13192 | 3.188 |
| | O | .3160 | - | C13211 | 3.438 |
| 21/64 | | .3281 | - | C13193 | 3.438 |
| 11/32 | | .3438 | C13116 | C13194 | 3.438 |
| 23/64 | | .3594 | - | C13195 | 3.500 |
| 3/8 | | .3750 | C13117 | C13196 | 3.625 |
| 25/64 | | .3906 | - | C13197 | 3.750 |
| 13/32 | | .4062 | C13118 | C13198 | 3.750 |
| 27/64 | | .4219 | C13246 | C13199 | 3.938 |
| 7/16 | | .4375 | C13119 | C13200 | 4.063 |
| 29/64 | | .4531 | - | C13201 | 4.188 |
| 15/32 | | .4688 | C13120 | C13202 | 4.313 |
| 31/64 | | .4844 | - | C13203 | 4.375 |
| 1/2 | | .5000 | C13121 | C13204 | 4.500 |

Aircraft Extension
High Speed Steel

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | ◆ | | | ◆ | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Note
Operating parameters: See Technical section

M42
Cobalt

NAS 907
TYPE J

135° Split

Helix
Regular
21° to 34°

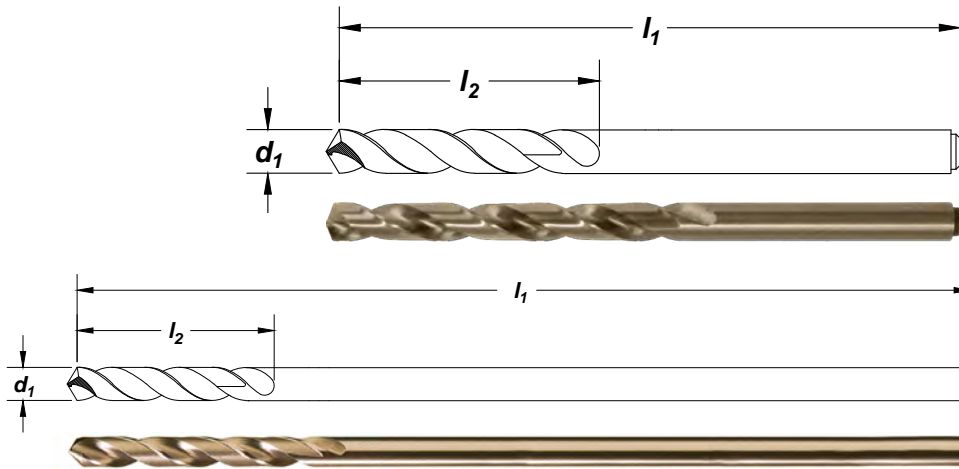
Straight
Shank

Surface
Treatment

Straw
Oxide

Aircraft Extension

Cobalt



Feature:

Highly heat resistant substrate for tough to machine materials. Extended length for long reach applications.

| drill diameter | | | order number | | |
|----------------|-------------|----------------|----------------|-----------------|--------------|
| fraction | wire/letter | decimal equiv. | 3722-6 | 3722-12 | flute length |
| | | | overall length | | |
| | | | l_1 (6.0 in) | l_1 (12.0 in) | l_2 (in) |
| 3/32 | 42 | 0.0935 | C08100 | — | 1.250 |
| | 41 | 0.0938 | C08101 | C08188 | 1.250 |
| | 40 | 0.0960 | C08102 | — | 1.375 |
| | 39 | 0.0980 | C08144 | C08167 | 1.375 |
| | 38 | 0.0995 | C08103 | — | 1.375 |
| | 37 | 0.1015 | C08104 | — | 1.438 |
| | 36 | 0.1040 | C08105 | — | 1.438 |
| 7/64 | 36 | 0.1065 | C08106 | — | 1.438 |
| | 35 | 0.1094 | C08107 | C08168 | 1.500 |
| | 34 | 0.1100 | C08108 | — | 1.500 |
| | 34 | 0.1110 | C08109 | — | 1.500 |
| | 32 | 0.1160 | C08110 | — | 1.625 |
| | 31 | 0.1200 | C08111 | — | 1.625 |
| | 30 | 0.1250 | C08115 | C08169 | 1.625 |
| 1/8 | 30 | 0.1285 | C08142 | C08170 | 1.625 |
| | 29 | 0.1360 | C08112 | C08171 | 1.750 |
| | 28 | 0.1405 | C08113 | — | 1.750 |
| | 28 | 0.1406 | C08114 | C08172 | 1.750 |
| | 27 | 0.1440 | C08140 | C08173 | 1.875 |
| | 26 | 0.1470 | C08145 | — | 1.875 |
| | 25 | 0.1495 | C08146 | — | 1.875 |
| 9/64 | 24 | 0.1520 | C08147 | — | 2.000 |
| | 23 | 0.1540 | C08148 | — | 2.000 |
| | 22 | 0.1562 | C08117 | C08174 | 2.000 |
| | 22 | 0.1570 | C08149 | — | 2.000 |
| | 21 | 0.1590 | C08138 | C08175 | 2.125 |
| | 20 | 0.1610 | C08137 | C08176 | 2.125 |
| | 19 | 0.1660 | C08150 | C08177 | 2.125 |
| 5/32 | 18 | 0.1695 | C08151 | — | 2.125 |
| | 18 | 0.1719 | C08152 | C08178 | 2.125 |
| | 17 | 0.1730 | C08153 | — | 2.188 |
| | 17 | 0.1730 | C08153 | — | 2.188 |

continued on next page



Style: **3722-6, 3722-12** (continued)

| drill diameter | | decimal equiv. | order number | | flute length |
|----------------|-------------|----------------|----------------|-----------------|--------------|
| d_1 | fraction | | 3722-6 | 3722-12 | |
| fraction | wire/letter | | l_1 (6.0 in) | l_1 (12.0 in) | l_2 (in) |
| | 16 | 0.1770 | C08135 | C08179 | 2.188 |
| | 15 | 0.1800 | C08154 | — | 2.188 |
| | 14 | 0.1820 | C08155 | — | 2.188 |
| | 13 | 0.1850 | C08134 | — | 2.313 |
| 3/16 | | 0.1875 | C08119 | C08180 | 2.313 |
| | 12 | 0.1890 | C08156 | — | 2.313 |
| | 11 | 0.1910 | C08133 | C08181 | 2.313 |
| | 10 | 0.1935 | C08132 | C08182 | 2.438 |
| | 9 | 0.1960 | C08157 | — | 2.438 |
| | 8 | 0.1990 | C08130 | — | 2.438 |
| | 7 | 0.2010 | C08158 | — | 2.438 |
| 13/64 | | 0.2031 | C08159 | C08183 | 2.438 |
| | 6 | 0.2040 | C08160 | — | 2.500 |
| | 5 | 0.2055 | C08161 | — | 2.500 |
| | 4 | 0.2090 | C08162 | — | 2.500 |
| | 3 | 0.2130 | C08163 | — | 2.500 |
| 7/32 | | 0.2188 | C08121 | C08184 | 2.500 |
| | 2 | 0.2210 | C08164 | C08185 | 2.625 |
| | 1 | 0.2280 | C08165 | — | 2.625 |
| 15/64 | | 0.2344 | C08166 | C08186 | 2.625 |
| 1/4 | | 0.2500 | C08123 | C08187 | 2.750 |

Aircraft Extension

Cobalt

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Straw | ☆ | | ☆ | | ☆ | ☆ | ◆ | ◆ | ◆ | ☆ | ◆ | ◆ | |

☆ = Best Performance ◆ = Acceptable



Extra Length
General Purpose

Style: **950E**

Note

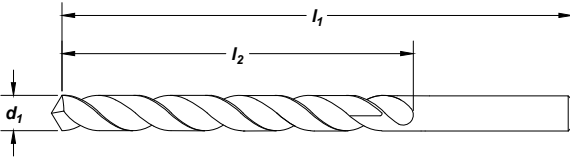
Operating parameters: See Technical section



Surface Treatment



Extra Length



Feature:

Extra length for long reach and deeper drilling depth.

High Speed Steel

| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | order number 950E |
|--|-------------------|---|---|-----------------------------|
| 3/32 | .0938 | 8.000 | 5.500 | C09655 |
| 7/64 | .1094 | 8.000 | 5.500 | C09656 |
| 1/8 | .1250 | 8.000 | 5.500 | C09657 |
| 1/8 | .1250 | 10.000 | 7.500 | C09707 |
| 1/8 | .1250 | 12.000 | 9.000 | C09736 |
| 9/64 | .1406 | 8.000 | 5.500 | C09658 |
| 5/32 | .1562 | 8.000 | 5.500 | C09659 |
| 5/32 | .1562 | 10.000 | 7.500 | C09709 |
| 5/32 | .1562 | 12.000 | 9.000 | C09738 |
| 11/64 | .1719 | 8.000 | 5.500 | C09660 |
| 3/16 | .1875 | 8.000 | 5.500 | C09661 |
| 3/16 | .1875 | 10.000 | 7.500 | C09711 |
| 3/16 | .1875 | 12.000 | 9.000 | C09740 |
| 13/64 | .2031 | 8.000 | 5.500 | C09662 |
| 7/32 | .2188 | 8.000 | 5.500 | C09663 |
| 7/32 | .2188 | 10.000 | 7.500 | C09713 |
| 7/32 | .2188 | 12.000 | 9.000 | C09742 |
| 15/64 | .2344 | 8.000 | 5.500 | C09664 |
| 15/64 | .2344 | 10.000 | 7.500 | C09714 |
| 1/4 | .2500 | 8.000 | 5.500 | C09665 |
| 1/4 | .2500 | 10.000 | 7.500 | C09715 |
| 1/4 | .2500 | 12.000 | 9.000 | C09744 |
| 17/64 | .2656 | 8.000 | 5.500 | C09666 |
| 9/32 | .2812 | 8.000 | 5.500 | C09667 |
| 9/32 | .2812 | 10.000 | 7.500 | C09717 |
| 9/32 | .2812 | 12.000 | 9.000 | C09746 |
| 19/64 | .2969 | 8.000 | 5.500 | C09668 |
| 5/16 | .3125 | 8.000 | 5.500 | C09669 |
| 5/16 | .3125 | 10.000 | 7.500 | C09719 |
| 5/16 | .3125 | 12.000 | 9.000 | C09748 |
| 21/64 | .3281 | 8.000 | 5.500 | C09670 |
| 11/32 | .3438 | 8.000 | 5.500 | C09671 |
| 11/32 | .3438 | 10.000 | 7.500 | C09721 |
| 11/32 | .3438 | 12.000 | 9.000 | C09750 |
| 23/64 | .3594 | 8.000 | 5.500 | C09672 |
| 3/8 | .3750 | 8.000 | 5.500 | C09673 |
| 3/8 | .3750 | 10.000 | 7.500 | C09723 |
| 3/8 | .3750 | 12.000 | 9.000 | C09752 |
| 25/64 | .3906 | 8.000 | 5.500 | C09674 |
| 13/32 | .4062 | 8.000 | 5.500 | C09675 |
| 13/32 | .4062 | 10.000 | 7.500 | C09725 |
| 13/32 | .4062 | 12.000 | 9.000 | C09754 |

continued on next page



Style: 950E (continued)

| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | order number 950E |
|--|-------------------|---|---|-----------------------------|
| 27/64 | .4219 | 8.000 | 5.500 | C09676 |
| 7/16 | .4375 | 8.000 | 5.500 | C09677 |
| 7/16 | .4375 | 10.000 | 7.500 | C09727 |
| 7/16 | .4375 | 12.000 | 9.000 | C09756 |
| 29/64 | .4531 | 8.000 | 5.500 | C09678 |
| 15/32 | .4688 | 8.000 | 5.500 | C09679 |
| 15/32 | .4688 | 10.000 | 7.500 | C09729 |
| 15/32 | .4688 | 12.000 | 9.000 | C09758 |
| 31/64 | .4844 | 8.000 | 5.500 | C09680 |
| 1/2 | .5000 | 8.000 | 5.500 | C09681 |
| 1/2 | .5000 | 10.000 | 7.500 | C09731 |
| 1/2 | .5000 | 12.000 | 9.000 | C09760 |
| 17/32 | .5312 | 10.000 | 7.500 | C09733 |
| 17/32 | .5312 | 12.000 | 9.000 | C09762 |
| 9/16 | .5625 | 10.000 | 7.500 | C09735 |
| 9/16 | .5625 | 12.000 | 9.000 | C09764 |
| 19/32 | .5938 | 12.000 | 9.000 | C09766 |
| 5/8 | .6250 | 12.000 | 9.000 | C09768 |
| 21/32 | .6562 | 12.000 | 9.000 | C09770 |
| 11/16 | .6875 | 12.000 | 9.000 | C09772 |
| 23/32 | .7188 | 12.000 | 9.000 | C09774 |
| 3/4 | .7500 | 12.000 | 9.000 | C09776 |

Extra Length

High Speed Steel

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Black Oxide | ☆ | | ☆ | | | | | ☆ | ◆ | | | | |

☆ = Best Performance ◆ = Acceptable



Taper Shank
Standard, Undersized, & Oversized

Styles: 2410, 2411, 2412

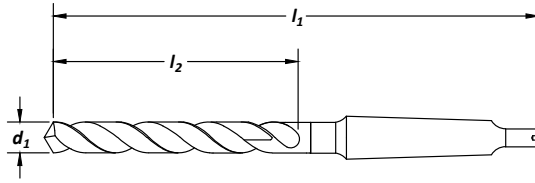
Note
Undersized and oversized shank drills available from stock in popular sizes.

Operating parameters: See Technical section
Morse Taper Shank specs: See Technical section

ASME B94.11M HSS 118° Helix Regular 21° to 34° Taper Shank Surface Treatment Black Oxide

Taper Shank

High Speed Steel



Feature:
General purpose use in steel and iron.

| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | morse taper | order number | | |
|--|----------------|---|---|-------------|-------------------------|---------------------------|--------------------------|
| | | | | | 2410 standard | 2411 undersized | 2412 oversized |
| 1/8 | .1250 | 5.125 | 1.875 | 1 | C12040 | — | — |
| 5/32 | .1562 | 5.375 | 2.125 | 1 | C12052 | — | — |
| 3/16 | .1875 | 5.750 | 2.500 | 1 | C12064 | — | — |
| 13/64 | .2031 | 6.000 | 2.750 | 1 | C12069 | — | — |
| 7/32 | .2188 | 6.000 | 2.750 | 1 | C12075 | — | — |
| 15/64 | .2344 | 6.125 | 2.875 | 1 | C12082 | — | — |
| 1/4-E | .2500 | 6.125 | 2.875 | 1 | C12091 | — | — |
| 17/64 | .2656 | 6.250 | 3.000 | 1 | C12099 | — | — |
| 9/32 | .2812 | 6.250 | 3.000 | 1 | C12113 | — | — |
| 19/64 | .2969 | 6.375 | 3.125 | 1 | C12117 | — | — |
| 5/16 | .3125 | 6.375 | 3.125 | 1 | C12124 | — | — |
| 21/64 | .3281 | 6.500 | 3.250 | 1 | C12132 | — | — |
| 11/32 | .3438 | 6.500 | 3.250 | 1 | C12139 | — | — |
| 23/64 | .3594 | 6.750 | 3.500 | 1 | C12147 | — | — |
| 3/8 | .3750 | 6.750 | 3.500 | 1 | C12154 | — | — |
| 25/64 | .3906 | 7.000 | 3.625 | 1 | C12162 | — | — |
| 13/32 | .4062 | 7.000 | 3.625 | 1 | C12167 | — | — |
| 27/64 | .4219 | 7.250 | 3.875 | 1 | C12170 | — | — |
| 7/16 | .4375 | 7.250 | 3.875 | 1 | C12173 | — | — |
| 29/64 | .4531 | 7.500 | 4.125 | 1 | C12176 | — | — |
| 15/32 | .4688 | 7.500 | 4.125 | 1 | C12178 | — | — |
| 31/64 | .4844 | 8.250 | 4.375 | 2 | C12181 | — | — |
| 1/2 | .5000 | 8.250 | 4.375 | 2 | C12183 | — | — |
| 1/2 | .5000 | 7.750 | 4.375 | 1 | — | C12483 | — |
| 33/64 | .5156 | 8.500 | 4.625 | 2 | C12186 | — | — |
| 17/32 | .5312 | 8.500 | 4.625 | 2 | C12188 | — | — |
| 35/64 | .5469 | 8.750 | 4.875 | 2 | C12191 | — | — |
| 9/16 | .5625 | 8.750 | 4.875 | 2 | C12194 | — | — |
| 37/64 | .5781 | 8.750 | 4.875 | 2 | C12196 | — | — |
| 19/32 | .5938 | 8.750 | 4.875 | 2 | C12199 | — | — |
| 39/64 | .6094 | 8.750 | 4.875 | 2 | C12201 | — | — |
| 5/8 | .6250 | 8.750 | 4.875 | 2 | C12204 | — | — |
| 41/64 | .6406 | 9.000 | 5.125 | 2 | C12207 | — | — |
| 21/32 | .6562 | 9.000 | 5.125 | 2 | C12209 | — | — |
| 43/64 | .6719 | 9.250 | 5.375 | 2 | C12212 | — | — |
| 11/16 | .6875 | 9.250 | 5.375 | 2 | C12214 | — | — |
| 11/16 | .6875 | 10.000 | 5.375 | 3 | — | — | C12670 |

continued on next page



Styles: 2410, 2411, 2412 (continued)

| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | morse taper | order number | | |
|--|-------------------|---|---|----------------|-------------------------|---------------------------|--------------------------|
| | | | | | 2410 standard | 2411 undersized | 2412 oversized |
| 45/64 | .7031 | 9.500 | 5.625 | 2 | C12216 | — | — |
| 23/32 | .7188 | 9.500 | 5.625 | 2 | C12218 | — | — |
| 47/64 | .7344 | 9.750 | 5.875 | 2 | C12220 | — | — |
| 3/4 | .7500 | 9.750 | 5.875 | 2 | C12222 | — | — |
| 3/4 | .7500 | 10.500 | 5.875 | 3 | — | — | C12678 |
| 49/64 | .7656 | 9.875 | 6.000 | 2 | C12223 | — | — |
| 25/32 | .7812 | 9.875 | 6.000 | 2 | C12225 | — | — |
| 51/64 | .7969 | 10.750 | 6.125 | 3 | C12227 | — | — |
| 13/16 | .8125 | 10.750 | 6.125 | 3 | C12229 | — | — |
| 53/64 | .8281 | 10.750 | 6.125 | 3 | C12231 | — | — |
| 27/32 | .8438 | 10.750 | 6.125 | 3 | C12232 | — | — |
| 55/64 | .8594 | 10.750 | 6.125 | 3 | C12234 | — | — |
| 7/8 | .8750 | 10.750 | 6.125 | 3 | C12236 | — | — |
| 7/8 | .8750 | 10.000 | 6.125 | 2 | — | C12505 | — |
| 57/64 | .8906 | 10.750 | 6.125 | 3 | C12238 | — | — |
| 29/32 | .9062 | 10.750 | 6.125 | 3 | C12240 | — | — |
| 59/64 | .9219 | 10.750 | 6.125 | 3 | C12241 | — | — |
| 15/16 | .9375 | 10.750 | 6.125 | 3 | C12243 | — | — |
| 31/32 | .9688 | 11.000 | 6.375 | 3 | C12247 | — | — |
| 63/64 | .9844 | 11.000 | 6.375 | 3 | C12249 | — | — |
| 1 | 1.0000 | 11.000 | 6.375 | 3 | C12250 | — | — |
| 1 | 1.0000 | 12.000 | 6.375 | 4 | — | — | C12684 |
| 1-1/64 | 1.0156 | 11.125 | 6.500 | 3 | C12252 | — | — |
| 1-1/32 | 1.0312 | 11.125 | 6.500 | 3 | C12254 | — | — |
| 1-1/16 | 1.0625 | 11.250 | 6.625 | 3 | C12257 | — | — |
| 1-1/16 | 1.0625 | 12.250 | 6.625 | 4 | — | — | C12691 |
| 1-1/8 | 1.1250 | 12.750 | 7.125 | 4 | C12265 | — | — |
| 1-1/8 | 1.1250 | 11.750 | 7.125 | 3 | — | C12518 | — |
| 1-3/16 | 1.1875 | 13.000 | 7.375 | 4 | C12272 | — | — |
| 1-1/4 | 1.2500 | 13.500 | 7.875 | 4 | C12279 | — | — |
| 1-1/4 | 1.2500 | 12.500 | 7.875 | 3 | — | C12532 | — |
| 1-5/16 | 1.3125 | 14.250 | 8.625 | 4 | C12286 | — | — |
| 1-11/32 | 1.3438 | 14.375 | 8.750 | 4 | C12290 | — | — |
| 1-3/8 | 1.3750 | 14.500 | 8.875 | 4 | C12293 | — | — |
| 1-7/16 | 1.4375 | 14.750 | 9.125 | 4 | C12301 | — | — |
| 1-15/32 | 1.4688 | 14.875 | 9.250 | 4 | C12304 | — | — |
| 1-1/2 | 1.5000 | 15.000 | 9.375 | 4 | C12308 | — | — |
| 1-17/32 | 1.5312 | 15.000 | 9.375 | 4 | — | C12541 | — |
| 1-9/16 | 1.5625 | 16.625 | 9.625 | 5 | C12315 | — | — |
| 1-5/8 | 1.6250 | 17.000 | 10.000 | 5 | C12322 | — | — |
| 1-3/4 | 1.7500 | 17.125 | 10.125 | 5 | C12336 | — | — |
| 1-3/4 | 1.7500 | 16.250 | 10.375 | 4 | — | C12566 | — |
| 1-7/8 | 1.8750 | 17.375 | 10.375 | 5 | C12351 | — | — |
| 2 | 2.0000 | 17.375 | 10.375 | 5 | C12365 | — | — |

Taper Shank

High Speed Steel

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Black Oxide | ☆ | | ☆ | | | | | ☆ | ◆ | | | | |

☆ = Best Performance ◆ = Acceptable



Cobalt
Heavy-Duty



Style: **2440**

Note
Operating parameters: See Technical section
Morse Taper Shank specs: See Technical section

ASME
B94.11M

M42
Cobalt

135° MOD

Helix
Regular
21° to 34°

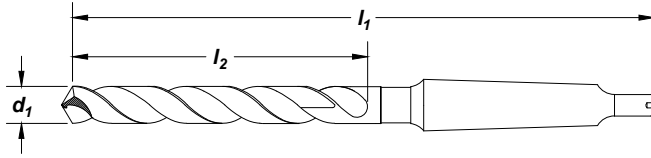
Taper
Shank

Surface
Treatment

Straw
Oxide

****Items are being OBSOLETED, only available until inventory is depleted.**

Taper Shank



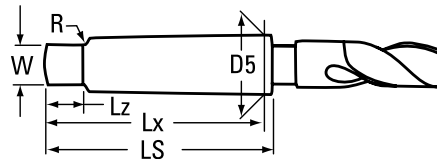
Feature:

Highly heat resistant substrate for tough to machine materials.

| drill diameter | decimal equiv. | overall length I ₁ (in) | flute length I ₂ (in) | morse taper | order number |
|----------------------|----------------|------------------------------------|----------------------------------|-------------|--------------|
| d₁ | | | | | 2440 |
| 1/4 | .2500 | 6.125 | 2.875 | 1 | **C12705 |
| 3/8 | .3750 | 7.375 | 3.500 | 2 | **C12751 |
| 1/2 | .5000 | 8.250 | 4.375 | 2 | **C12775 |
| 5/8 | .6250 | 8.750 | 4.875 | 2 | **C12796 |
| 11/16 | .6875 | 10.000 | 5.375 | 3 | **C12806 |
| 7/8 | .8750 | 10.750 | 6.125 | 3 | **C12828 |
| 15/16 | .9375 | 10.750 | 6.125 | 3 | **C12835 |

TECH TIPS

Morse Taper Shank Specifications



| morse taper shank no. | taper per foot | taper per inch | D5 max shank dia. | LS length of shank | Lx length of shank to gauge line | Lz length of tang | W thickness of tang | R radius |
|-----------------------|----------------|----------------|-------------------|--------------------|----------------------------------|-------------------|---------------------|----------|
| 1 | .5985 | .0498 | .475 | 2.56 | 2.44 | .37 | .20 | .19 |
| 2 | .5994 | .0499 | .700 | 3.12 | 2.94 | .44 | .25 | .25 |
| 3 | .6023102 | .0501 | .938 | 3.87 | 3.69 | .56 | .31 | .28 |
| 4 | .6232 | .0519 | 1.231 | 4.87 | 4.62 | .62 | .47 | .31 |
| 5 | .6315 | .0526 | 1.749 | 6.12 | 5.87 | .75 | .62 | .37 |
| 6 | .6256 | .0521 | 2.494 | 8.56 | 8.25 | 1.12 | .75 | .50 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Straw | ☆ | | ☆ | | ☆ | ☆ | ◆ | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable



Style: 940E

Note

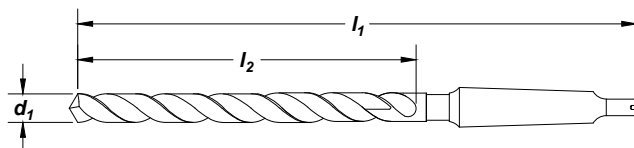
Operating parameters: See Technical section
Morse Taper Shank specs: See Technical section



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



Feature:

Extra length for long reach and deeper drilling depth.

| drill diameter d ₁ | decimal equiv. | overall length l ₁ (in) | flute length l ₂ (in) | morse taper | order number 940E |
|----------------------------------|----------------|---------------------------------------|-------------------------------------|-------------|-----------------------------|
| 31/64 | .4844 | 11.875 | 8.000 | 2 | **C13830 |
| 1/2 | .5000 | 11.875 | 8.000 | 2 | **C13831 |
| 33/64 | .5156 | 11.875 | 8.000 | 2 | **C13832 |
| 17/32 | .5312 | 11.875 | 8.000 | 2 | — |
| 35/64 | .5469 | 11.875 | 8.000 | 2 | **C13834 |
| 9/16 | .5625 | 11.875 | 8.000 | 2 | **C13835 |
| 37/64 | .5781 | 11.875 | 8.000 | 2 | **C13836 |
| 19/32 | .5938 | 11.875 | 8.000 | 2 | **C13837 |
| 5/8 | .6250 | 11.875 | 8.000 | 2 | — |
| 41/64 | .6406 | 11.875 | 8.000 | 2 | **C13840 |
| 21/32 | .6562 | 11.875 | 8.000 | 2 | **C13841 |
| 43/64 | .6719 | 11.875 | 8.000 | 2 | **C13842 |
| 11/16 | .6875 | 11.875 | 8.000 | 2 | **C13843 |
| 45/64 | .7031 | 11.875 | 8.000 | 2 | **C13844 |
| 23/32 | .7188 | 11.875 | 8.000 | 2 | **C13845 |
| 3/4 | .7500 | 11.875 | 8.000 | 2 | **C13847 |
| 49/64 | .7656 | 11.875 | 8.000 | 2 | — |
| 25/32 | .7812 | 11.875 | 8.000 | 2 | **C13849 |

Taper Shank

Cobalt

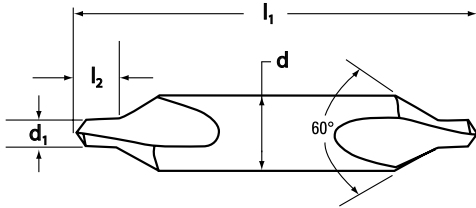
| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Black Oxide | ☆ | | ☆ | | | | | ☆ | ◆ | | | | |

☆ = Best Performance ◆ = Acceptable

Combined Drill & Countersink
Style: 1798

Note
 Operating parameters: See Technical section

ASME B94.11M Carbide Surface Treatment Bright

Countersink
Carbide


| size number | drill diameter | | body diameter | overall length | drill length | order number |
|-------------|----------------|---------|---------------|-------------------|-------------------|--------------|
| | in | decimal | d in | l ₁ in | l ₂ in | |
| #1 | 3/64 | .0469 | .125 | 1.500 | .0469 | C52772 |
| #2 | 5/64 | .0781 | .188 | 2.000 | .0781 | C52773 |
| #3 | 7/64 | .1094 | .250 | 2.000 | .1094 | C52774 |
| #4 | 1/8 | .1250 | .313 | 2.125 | .1250 | C52775 |
| #5 | 3/16 | .1875 | .438 | 2.750 | .1875 | C52776 |
| #6 | 7/32 | .2188 | .500 | 3.000 | .2188 | C52777 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | ◆ | ☆ | ◆ | ◆ | ◆ | | ☆ | ☆ | ☆ | | | |

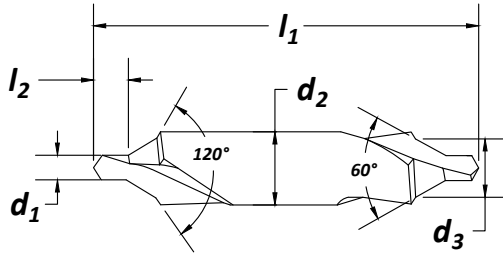
☆ = Best Performance ◆ = Acceptable



Bell Type Drill & Countersink

Style: **996**

Note
Bell-type tool forms protected centers.



ASME B94.11M

HSS

118°

Surface Treatment

Bright



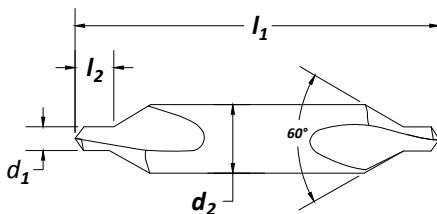
Countersink

High Speed Steel

| size number | body diameter | | drill diameter | | bell diameter | overall length | drill length | order number |
|-------------|-------------------|-------------------|------------------------|-------------------|-------------------|-------------------|--------------|--------------|
| | d ₂ in | d ₁ in | d ₁ decimal | d ₃ in | l ₁ in | l ₂ in | | |
| #11 | .125 | 3/64 | .0469 | .100 | 1.250 | .047 | C46272 | |
| #12 | .188 | 1/16 | .0625 | .150 | 1.875 | .063 | C46273 | |
| #13 | .250 | 3/32 | .0938 | .200 | 2.000 | .094 | C46274 | |
| #14 | .313 | 7/64 | .1094 | .250 | 2.125 | .109 | C46275 | |
| #15 | .438 | 5/32 | .1562 | .350 | 2.750 | .156 | C46276 | |
| #16 | .500 | 3/16 | .1875 | .400 | 3.000 | .188 | C46277 | |
| #17 | .625 | 7/32 | .2188 | .500 | 3.250 | .219 | C46278 | |
| #18 | .750 | 1/4 | .2500 | .600 | 3.500 | .250 | C46279 | |

Style: **998**

Plain Drill & Countersink



ASME B94.11M

HSS

118°

Surface Treatment

Bright



| size number | body diameter | | drill diameter | | overall length | drill length | order number |
|-------------|-------------------|-------------------|------------------------|-------------------|-------------------|--------------|--------------|
| | d ₂ in | d ₁ in | d ₁ decimal | l ₁ in | l ₂ in | | |
| #00 | .125 | .025 | .0250 | 1.250 | .030 | C46261 | |
| #0 | .125 | 1/32 | .0312 | 1.250 | .038 | C46262 | |
| #1 | .125 | 3/64 | .0469 | 1.250 | .047 | C46263 | |
| #2 | .188 | 5/64 | .0781 | 1.875 | .078 | C46264 | |
| #3 | .250 | 7/64 | .1094 | 2.000 | .109 | C46265 | |
| #4 | .313 | 1/8 | .1250 | 2.125 | .125 | C46266 | |
| #5 | .438 | 3/16 | .1875 | 2.750 | .188 | C46267 | |
| #6 | .500 | 7/32 | .2188 | 3.000 | .219 | C46268 | |
| #7 | .625 | 1/4 | .2500 | 3.250 | .250 | C46269 | |
| #8 | .750 | 5/16 | .3125 | 3.500 | .313 | C46270 | |

SET

Style: **998**

Plain Drill & Countersink

| no. of pieces | size range | order number |
|---------------|---------------|--------------|
| 5 | #1 through #5 | C00944 |



| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | ☆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable

Countersink & Deburring

Style: **3001**

M42
Cobalt

Straight
Shank

Surface
Treatment

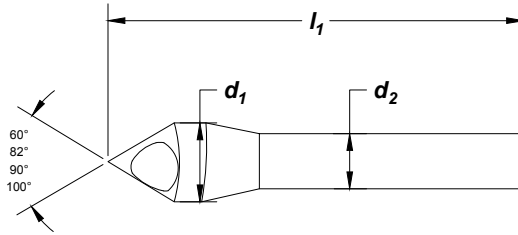
Bright

Note

All dimensions in inches.

Many tools are available with additional surface treatments. Please call for a quote.

Countersink and deburring tools are simple, all-purpose tools made of Cobalt that provide flawless countersinking and deburring. The chatter-free cutting action requires minimal power. The micro-smooth CNC precision ground construction produces clean, smooth cutting without smearing on a variety of materials. The tool especially excels in countersinking or deburring holes in aluminum, plastics and other nonmetallic.



Additional View



Countersink

Cobalt

60° Countersink Angle

| head diameter d_1 | diameter of cut | | overall length l_1 (in) | shank diameter d_2 (in) | order no. 3001 bright |
|------------------------|-----------------|--------|------------------------------|------------------------------|------------------------------------|
| | min | max | | | |
| 5/16 | 7/64 | 9/32 | 1-7/8 | 1/4 | C94560 |
| 3/8 | 5/32 | 11/32 | 1-7/8 | 1/4 | C94561 |
| 1/2 | 11/64 | 29/64 | 2 | 5/16 | C94562 |
| 5/8 | 3/16 | 37/64 | 2-1/2 | 3/8 | C94563 |
| 3/4 | 1/4 | 45/64 | 2-3/4 | 3/8 | C94564 |
| 1 | 19/64 | 27/32 | 3 | 3/8 | C94565 |
| 1-1/4 | 27/64 | 1-1/32 | 3-1/2 | 1/2 | C94566 |

82° Countersink Angle

| head diameter d_1 | diameter of cut | | overall length l_1 (in) | shank diameter d_2 (in) | order no. 3001 bright |
|------------------------|-----------------|--------|------------------------------|------------------------------|------------------------------------|
| | min | max | | | |
| 5/16 | 3/32 | 9/32 | 1-5/8 | 1/4 | C94567 |
| 3/8 | 9/64 | 11/32 | 1-3/4 | 1/4 | C94568 |
| 1/2 | 5/32 | 29/64 | 1-3/4 | 5/16 | C94569 |
| 5/8 | 11/64 | 37/64 | 2-1/8 | 3/8 | C94570 |
| 3/4 | 13/64 | 45/64 | 2-3/8 | 3/8 | C94571 |
| 1 | 19/64 | 59/64 | 2-5/8 | 3/8 | C94572 |
| 1-1/4 | 23/64 | 1-1/32 | 3-1/8 | 1/2 | C94573 |

90° Countersink Angle

| head diameter d_1 | diameter of cut | | overall length l_1 (in) | shank diameter l_2 (in) | order no. 3001 bright |
|------------------------|-----------------|--------|------------------------------|------------------------------|------------------------------------|
| | min | max | | | |
| 5/16 | 3/32 | 9/32 | 1-5/8 | 1/4 | C94574 |
| 3/8 | 9/64 | 11/32 | 1-3/4 | 1/4 | C94575 |
| 1/2 | 5/32 | 29/64 | 1-3/4 | 5/16 | C94576 |
| 5/8 | 11/64 | 37/64 | 2-1/8 | 3/8 | C94577 |
| 3/4 | 13/64 | 45/64 | 2-3/8 | 3/8 | C94578 |
| 1 | 19/64 | 59/64 | 2-5/8 | 3/8 | C94579 |
| 1-1/4 | 23/64 | 1-1/32 | 3-1/8 | 1/2 | C94580 |

100° Countersink Angle

| head diameter d_1 | diameter of cut | | overall length l_1 (in) | shank diameter l_2 (in) | order no. 3001 bright |
|------------------------|-----------------|--------|------------------------------|------------------------------|------------------------------------|
| | min | max | | | |
| 5/16 | 3/32 | 9/32 | 1-5/8 | 1/4 | C94581 |
| 3/8 | 9/64 | 11/32 | 1-3/4 | 1/4 | C94582 |
| 1/2 | 5/32 | 29/64 | 1-3/4 | 5/16 | C94583 |
| 5/8 | 11/64 | 37/64 | 2-1/8 | 3/8 | C94584 |
| 3/4 | 13/64 | 45/64 | 2-3/8 | 3/8 | C94585 |
| 1 | 19/64 | 59/64 | 2-5/8 | 3/8 | C94586 |
| 1-1/4 | 23/64 | 1-1/32 | 3-1/8 | 1/2 | C94587 |

SET

Style: **3001** 4 Pieces

| angle | sizes | order number 3001 |
|-------|--|-----------------------------|
| 60° | 5/16, 3/8, 1/2, 5/8 <i>C94560, C94561, C94562, C94563</i> | C94588 |
| 82° | 5/16, 3/8, 1/2, 5/8 <i>C94567, C94568, C94569, C94570</i> | C94589 |
| 90° | 5/16, 3/8, 1/2, 5/8 <i>C94574, C94575, C94576, C94577</i> | C94590 |
| 100° | 5/16, 3/8, 1/2, 5/8 <i>C94581, C94582, C94583, C94584</i> | C94591 |

SET

Style: **3001** 5 Pieces

| angle | sizes | order number 3001 |
|-------|---|-----------------------------|
| 60° | 5/16, 3/8, 1/2, 3/4, 1 <i>C94560, C94561, C94562, C94564, C94565</i> | C94592 |
| 82° | 5/16, 3/8, 1/2, 3/4, 1 <i>C94567, C94568, C94569, C94571, C94572</i> | C94593 |
| 90° | 5/16, 3/8, 1/2, 3/4, 1 <i>C94574, C94575, C94576, C94578, C94579</i> | C94594 |
| 100° | 5/16, 3/8, 1/2, 3/4, 1 <i>C94581, C94582, C94583, C94585, C94586</i> | C94595 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | ◆ | | | | | ☆ | | | |

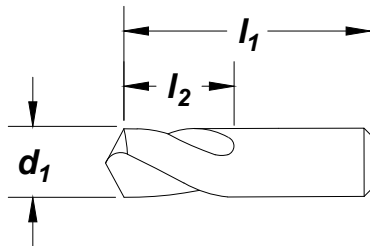
☆ = Best Performance ◆ = Acceptable



Style: **995**

Note
Operating parameters: See Technical section

ASME B94.11M HSS 118° Straight Shank Surface Treatment Bright



| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | order number |
|--|----------------|---|---|----------------------|
| 3/8 | .3750 | 2.000 | 1.000 | 995 C11739 |
| 1/2 | .5000 | 2.000 | 1.000 | C11757 |
| 5/8 | .6250 | 2.250 | 1.125 | C11771 |
| 3/4 | .7500 | 2.250 | 1.125 | C11782 |
| 1 | 1.0000 | 2.500 | 1.250 | C11796 |

Spotting / Centering / Drift High Speed Steel

TECH TIP

Using Spotting and Centering Drills

- Use these drills to get true and accurate centers.
- There is no body clearance on these drills to allow chucking close to the point. This features helps to maintain drill accuracy for centering.

TECH TIP

Point Angle: 90° versus 120°

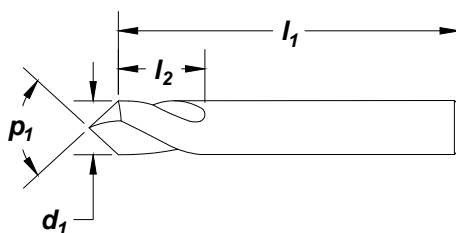
- Use the 90° point spotting drill for a 118° point following drill.
- Use the 120° point spotting drill for a 135° following drill.

Style: **1799**

Spotting & Centering Long

Note
Operating parameters: See Technical section

ASME B94.11M Carbide Straight Shank Surface Treatment AITiN



| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | order number | | |
|--|----------------|---|---|-----------------------------------|--------|--------|
| | | | | p₁ -point angle | | |
| | | | | 90° | 120° | 142° |
| 1/8 | 0.1250 | 2 | 3/8 | C46400 | C46401 | C46402 |
| 3/16 | 0.1875 | 3 | 3/4 | C46403 | C46404 | C46405 |
| 1/4 | 0.2500 | 3 | 3/4 | C46406 | C46407 | C46408 |
| 5/16 | 0.3125 | 2 1/2 | 1 | C46409 | C46410 | C46411 |
| 3/8 | 0.3750 | 3 | 1 | C46412 | C46413 | C46414 |
| 1/2 | 0.5000 | 4 | 1 | C46415 | C46416 | C46417 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| AITiN | ☆ | | ☆ | | | | | ☆ | ☆ | ◆ | | | |

☆ = Best Performance ◆ = Acceptable

NC Spotting & Centering Short

Style: **2636**

High Speed Steel Spotting / Centering / Drift

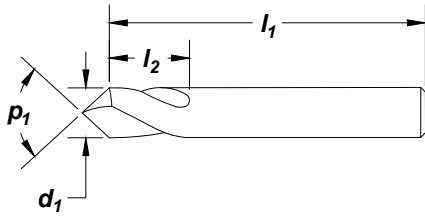
Note
Operating parameters: See Technical section

ASME
B94.11M

M42
Cobalt



Surface
Treatment



| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | order number p₁ - point angle | |
|--|-------------------|---|---|--|--------|
| | | | | 90° | 120° |
| 1/4 | .2500 | 2.500 | 1.000 | C26167 | C26174 |
| 3/8 | .3750 | 3.125 | 1.125 | C26168 | C26175 |
| 1/2 | .5000 | 3.750 | 1.500 | C26169 | C26176 |
| 5/8 | .6250 | 4.250 | 1.625 | C26170 | C26177 |
| 3/4 | .7500 | 5.000 | 1.750 | C26171 | C26178 |
| 1 | 1.0000 | 6.000 | 1.750 | C26172 | C26179 |

NC Spotting & Centering Long

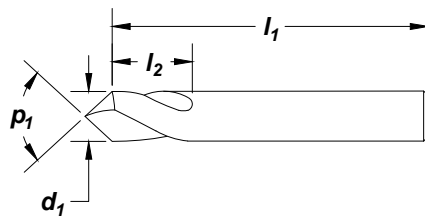
Style: **2646**

ASME
B94.11M

M42
Cobalt



Surface
Treatment



| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | order number p₁ - point angle | |
|--|-------------------|---|---|--|--------|
| | | | | 90° | 120° |
| 1/4 | .2500 | 4.000 | 1.000 | C26181 | C26188 |
| 3/8 | .3750 | 5.000 | 1.125 | C26182 | C26189 |
| 1/2 | .5000 | 6.000 | 1.500 | C26183 | C26190 |
| 5/8 | .6250 | 7.125 | 1.625 | C26184 | C26191 |
| 3/4 | .7500 | 8.000 | 1.750 | C26185 | C26192 |
| 1 | 1.0000 | 8.000 | 1.750 | C26186 | C26193 |

NC Spotting & Centering Short and Long

SET

Style: **2636, 2646**

| no. of pieces | point angle | size range | order number | |
|------------------|----------------|-----------------|--------------|-------------|
| | | | 2636 | 2646 |
| 6 | 90° | 1/4" through 1" | C26173 | C26187 |
| 6 | 120° | 1/4" through 1" | C26180 | C26194 |



| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Straw | ☆ | | ☆ | | ☆ | | | ☆ | ☆ | ☆ | ◆ | | |

☆ = Best Performance ◆ = Acceptable

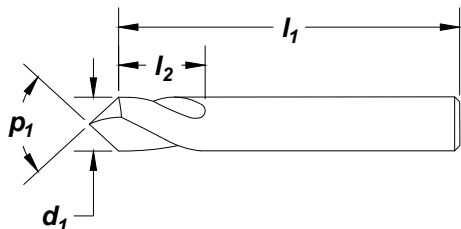


NC Spotting & Centering
Short

Style: **2635**

Note
Operating parameters: See Technical section

HSS Surface Treatment: Bright

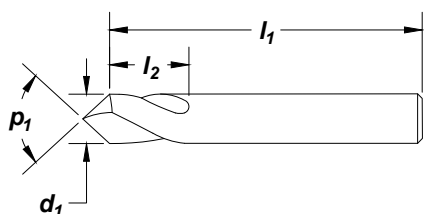


| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | order number p₁ - point angle | |
|--|-------------------|---|---|--|--------|
| | | | | 90° | 120° |
| 1/4 | .2500 | 2.500 | 1.000 | C24167 | C24174 |
| 3/8 | .3750 | 3.125 | 1.125 | C24168 | C24175 |
| 1/2 | .5000 | 3.750 | 1.500 | C24169 | C24176 |
| 5/8 | .6250 | 4.250 | 1.625 | C24170 | C24177 |
| 3/4 | .7500 | 5.000 | 1.750 | C24171 | C24178 |
| 1 | 1.0000 | 6.000 | 1.750 | C24172 | C24179 |

Spotting / Centering / Drift High Speed Steel

NC Spotting & Centering
Long

Style: **2645**



| drill diameter d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | order number p₁ - point angle | |
|--|-------------------|---|---|--|--------|
| | | | | 90° | 120° |
| 1/4 | .2500 | 4.000 | 1.000 | C24181 | C24188 |
| 3/8 | .3750 | 5.000 | 1.125 | C24182 | C24189 |
| 1/2 | .5000 | 6.000 | 1.500 | C24183 | C24190 |
| 5/8 | .6250 | 7.125 | 1.625 | C24184 | C24191 |
| 3/4 | .7500 | 8.000 | 1.750 | C24185 | C24192 |
| 1 | 1.0000 | 8.000 | 1.750 | C24186 | C24193 |

NC Spotting & Centering
Short and Long

SET Style: **2635, 2645**

| no. of pieces | point angle | size range | order number | |
|---------------|-------------|-----------------|--------------|-------------|
| | | | 2635 | 2645 |
| 6 | 90° | 1/4" through 1" | C24173 | C24187 |
| 6 | 120° | 1/4" through 1" | C24180 | C24194 |



6-Piece Set #C24187

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | ◆ | | | ☆ | ☆ | ☆ | | | |

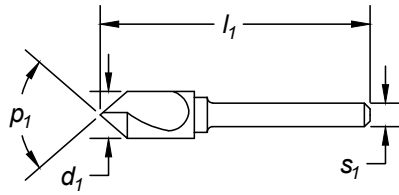
☆ = Best Performance ◆ = Acceptable

Single Flute Carbide Countersink

Style: **110C1**

Countersink

Carbide



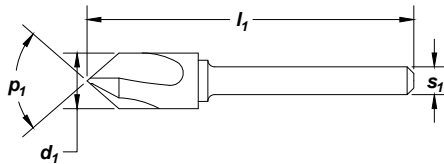
Carbide Surface Treatment Bright



| tool diameter d ₁ (in) | | shank diameter s ₁ (in) | overall length l ₁ (in) | p ₁ order number - 110C1 | | |
|--------------------------------------|---------|---------------------------------------|---------------------------------------|--|-----------|-----------|
| fraction | decimal | | | 60° angle | 82° angle | 90° angle |
| 1/8 | .1250 | 1/8 | 1-1/2 | C46320 | C46328 | C46336 |
| 3/16 | .1875 | 3/16 | 2 | C46321 | C46329 | C46337 |
| 1/4 | .2500 | 1/4 | 2 | C46322 | C46330 | C46338 |
| 3/8 | .3750 | 1/4 | 2-5/8 | C46323 | C46331 | C46339 |
| 1/2 | .5000 | 1/4 | 2-7/8 | C46324 | C46332 | C46340 |
| 5/8 | .6250 | 3/8 | 3 | C46325 | C46333 | C46341 |
| 3/4 | .7500 | 1/2 | 3 | C46326 | C46334 | C46342 |
| 1 | 1.000 | 1/2 | 2-3/4 | C46327 | C46335 | C46343 |

3 Flute Carbide Countersink

Style: **110C3**



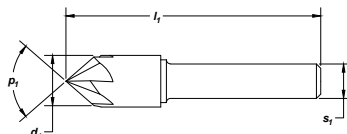
Carbide Surface Treatment Bright



| tool diameter d ₁ (in) | | shank diameter s ₁ (in) | overall length l ₁ (in) | p ₁ order number - 110C3 | | |
|--------------------------------------|---------|---------------------------------------|---------------------------------------|--|-----------|-----------|
| fraction | decimal | | | 60° angle | 82° angle | 90° angle |
| 1/8 | .1250 | 1/8 | 1-1/2 | C46344 | C46352 | C46360 |
| 3/16 | .1875 | 3/16 | 2 | C46345 | C46353 | C46361 |
| 1/4 | .2500 | 1/4 | 2 | C46346 | C46354 | C46362 |
| 3/8 | .3750 | 1/4 | 2-5/8 | C46347 | C46355 | C46363 |
| 1/2 | .5000 | 1/4 | 2-7/8 | C46348 | C46356 | C46364 |
| 5/8 | .6250 | 3/8 | 3 | C46349 | C46357 | C46365 |
| 3/4 | .7500 | 1/2 | 3 | C46350 | C46358 | C46366 |
| 1 | 1.000 | 1/2 | 2-3/4 | C46351 | C46359 | C46367 |

6 Flute Carbide Countersink

Style: **110C6**



Carbide Surface Treatment Bright



| tool diameter d ₁ (in) | | shank diameter s ₁ (in) | overall length l ₁ (in) | p ₁ order number - 110C6 | | |
|--------------------------------------|---------|---------------------------------------|---------------------------------------|--|-----------|-----------|
| fraction | decimal | | | 60° angle | 82° angle | 90° angle |
| 1/8 | .1250 | 1/8 | 1-1/2 | C46368 | C46376 | C46384 |
| 3/16 | .1875 | 3/16 | 2 | C46369 | C46377 | C46385 |
| 1/4 | .2500 | 1/4 | 2 | C46370 | C46378 | C46386 |
| 3/8 | .3750 | 1/4 | 2-5/8 | C46371 | C46379 | C46387 |
| 1/2 | .5000 | 1/4 | 2-7/8 | C46372 | C46380 | C46388 |
| 5/8 | .6250 | 3/8 | 3 | C46373 | C46381 | C46389 |
| 3/4 | .7500 | 1/2 | 3 | C46374 | C46382 | C46390 |
| 1 | 1.000 | 1/2 | 2-3/4 | C46375 | C46383 | C46391 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ☆ | | | | | ☆ | ☆ | | | | |

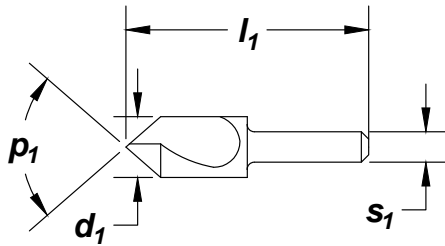
☆ = Best Performance ◆ = Acceptable



Single Flute Countersink

Style: **10001**

Note
Operating parameters:
See Technical section



HSS **Surface Treatment**



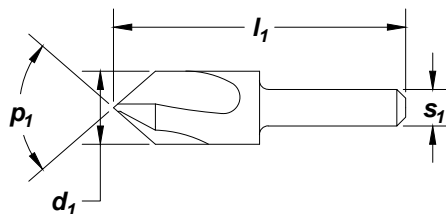
Countersink

High Speed Steel

| tool diameter d ₁ (in) | | shank diameter | | overall length | | p ₁ order number - 10001 | | | | |
|--------------------------------------|---------|---------------------|---------------------|----------------|-----------|--|------------|------------|--|--|
| fraction | decimal | s ₁ (in) | l ₁ (in) | 60° angle | 82° angle | 90° angle | 100° angle | 120° angle | | |
| 1/4 | .2500 | .188 | 1.500 | C46101 | C46102 | C46103 | C46104 | C46106 | | |
| 3/8 | .3750 | .250 | 1.750 | C46107 | C46108 | C46109 | C46110 | C46112 | | |
| 1/2 | .5000 | .250 | 2.000 | C46113 | C46114 | C46115 | C46116 | C46118 | | |
| 5/8 | .6250 | .375 | 2.250 | C46119 | C46120 | C46121 | C46122 | C46123 | | |
| 3/4 | .7500 | .500 | 2.625 | C46124 | C46125 | C46126 | C46127 | C46129 | | |
| 1 | 1.0000 | .500 | 2.750 | C46130 | C46131 | C46132 | C46133 | C46135 | | |
| 1-1/4 | 1.2500 | .500 | 2.750 | C46136 | C46137 | C46138 | - | - | | |
| 1-1/2 | 1.5000 | .750 | 2.875 | C46141 | C46139 | C46140 | - | - | | |
| 2 | 2.0000 | .750 | 3.250 | C46142 | - | C46143 | - | - | | |

Style: **10003**

3 Flute Countersink



HSS **Surface Treatment**



| tool diameter d ₁ | | shank diameter | | overall length | | p ₁ order number - 10003 | | | | |
|---------------------------------|---------|---------------------|---------------------|----------------|-----------|--|------------|------------|--|--|
| fraction | decimal | s ₁ (in) | l ₁ (in) | 60° angle | 82° angle | 90° angle | 100° angle | 120° angle | | |
| 1/4 | .2500 | .188 | 1.500 | C46150 | C46151 | C46152 | C46153 | C46155 | | |
| 3/8 | .3750 | .250 | 1.750 | C46156 | C46157 | C46158 | C46159 | C46161 | | |
| 1/2 | .5000 | .250 | 2.000 | C46162 | C46163 | C46164 | C46165 | C46167 | | |
| 5/8 | .6250 | .375 | 2.250 | C46168 | C46169 | C46170 | C46171 | C46173 | | |
| 3/4 | .7500 | .500 | 2.625 | C46174 | C46175 | C46176 | C46177 | C46179 | | |
| 1 | 1.0000 | .500 | 2.750 | C46180 | C46181 | C46182 | C46183 | C46185 | | |
| 1-1/4 | 1.2500 | .500 | 2.750 | C46186 | C46187 | C46188 | - | - | | |
| 1-1/2 | 1.5000 | .750 | 2.875 | C46189 | C46190 | C46191 | - | - | | |
| 2 | 2.0000 | .750 | 3.250 | - | - | C46192 | - | - | | |

SET

Style: **10001, 10003**

Countersink Sets
Single flute and 3 flute



| no. of pieces | angle | size range | order number | |
|---------------|-------|--------------------------|--------------|--------------|
| | | | 10001 | 10003 |
| 5 | 60° | 1/4" through 3/4" x 1/8" | C00970 | C00972 |
| 5 | 82° | 1/4" through 3/4" x 1/8" | C00971 | C00973 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Black Oxide | ☆ | | ◆ | | | | | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable

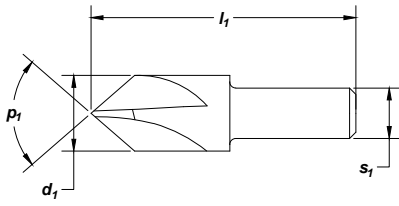
4 Flute Center Reamer / Countersink

Style: **610**

Surface Treatment



Countersink



High Speed Steel

| tool diameter d_1 (in) | | shank diameter s_1 (in) | overall length l_1 (in) | p_1 order number - 610 | | | |
|--------------------------|---------|---------------------------|---------------------------|---------------------------------|-----------|-----------|------------|
| fraction | decimal | | | 60° angle | 82° angle | 90° angle | 100° angle |
| 1/4 | .2500 | .188 | 1.500 | C46198 | C46199 | C46200 | C46201 |
| 3/8 | .3750 | .250 | 1.750 | C46204 | C46205 | C46206 | C46207 |
| 1/2 | .5000 | .375 | 2.000 | C46210 | C46211 | C46212 | C46213 |
| 5/8 | .6250 | .375 | 2.250 | C46216 | C46217 | C46218 | C46219 |
| 3/4 | .7500 | .500 | 2.625 | C46222 | C46223 | C46224 | C46225 |

4 Flute Center Reamer / Countersink

SET

Style: **610**

| no. of pieces | angle | size range | order number |
|---------------|-------|--------------------|----------------------|
| 5 | 82° | 1/4" - 3/4" x 1/8" | 610 C00969 |



Drift Drill

Style: **105**

| fits morse taper socket or sleeve | order number |
|-----------------------------------|----------------------|
| #1 | 105 C53665 |
| #2 | C53666 |
| #3 | C53667 |
| #4 | C53668 |

Surface Treatment



TECH TIPS

Using Drill Drifts

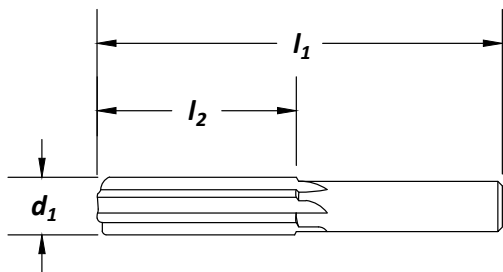
- Used to remove taper shank drills and tapered sockets from the spindle or from holders.



Styles: **1730**

Note
Operating parameters: See Technical section

ANSI SIZES Carbide Thru Holes Straight Flute Straight Shank Surface Treatment Bright



Reamers

Carbide

Feature:
High red hardness for extended wear life in high heat conditions.

| reamer dia. d₁ | decimal equiv. | shank dia. | overall length l₁ (in) | flute length l₂ (in) | number of flutes | order number 1730 |
|-------------------------------------|-------------------|------------|---|---|---------------------|-----------------------------|
| 1/16 | .0625 | .058 | 1.500 | .375 | 4 | C50103 |
| 3/32 | .0938 | .088 | 2.000 | .500 | 4 | C50121 |
| 1/8 | .1250 | .120 | 2.250 | .625 | 4 | C50133 |
| 5/32 | .1562 | .151 | 2.500 | .750 | 4 | C50145 |
| 3/16 | .1875 | .182 | 2.750 | .875 | 4 | C50157 |
| 7/32 | .2188 | .213 | 3.000 | 1.000 | 4 | C50168 |
| 1/4 | .2500 | .244 | 3.000 | 1.000 | 4 | C50180 |
| 9/32 | .2812 | .270 | 3.250 | 1.125 | 6 | C50194 |
| 5/16 | .3125 | .301 | 3.250 | 1.125 | 6 | C50203 |
| 11/32 | .3438 | .332 | 3.500 | 1.250 | 6 | C50214 |
| 3/8 | .3750 | .363 | 3.500 | 1.250 | 6 | C50226 |

TECH TIPS

How to Select the Correct Reamer Style

- Straight flute reamers, styles 4001, 4005, 1730, and 4703, are for use in through hole applications.
- Spiral flute reamers, style 4030, are for use in blind holes. They produce a smoother finish than straight flute reamers.
- Use reamer style 616, bridge reamer and style 618, car reamer, for aligning misaligned holes.
- Style 642 taper pipe reamers are used to ream a tapered hole before tapping only in soft, stringy materials.
- High spiral Taper Pin Reamers, style 650 are used to produce taper pin holes; the high spiral prevents chip packing.
- Taper pin reamers styles 657 and 659 are used to produce taper pin holes primarily by hand reaming; drill the starting hole a few thousands of an inch smaller than the desired small diameter of the finished hole.

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | | ☆ | ☆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Straight Shank and Flute Chucking

Styles: **4001**

Note

Custom reamer dimensions shown in Technical Section.

Operating parameters: See Technical section

ASME B94.2

DIN 338

HSS

Thru Holes

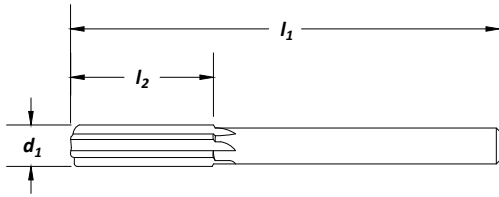
Straight Flute

Straight Shank

Surface Treatment

Bright

Reamers



High Speed Steel

| reamer dia. | | overall length | | flute length | | number of flutes | order number | | |
|----------------|------|----------------|----------------|----------------|-------|------------------|--------------|---|---------|
| d ₁ | | | l ₁ | l ₂ | | | | | |
| in | wire | metric | decimal equiv. | in | mm | in | mm | | |
| | 60 | | .0400 | 2.500 | | .500 | | 4 | C25003 |
| | 59 | | .0410 | 2.500 | | .500 | | 4 | C25005 |
| | 58 | | .0420 | 2.500 | | .500 | | 4 | C25008 |
| | 57 | | .0430 | 2.500 | | .500 | | 4 | C25010 |
| | 56 | | .0465 | 2.500 | | .500 | | 4 | C25019 |
| 3/64 | | | .0469 | 2.500 | | .500 | | 4 | C25020 |
| | 55 | | .0520 | 2.500 | | .500 | | 4 | C25034 |
| | 54 | | .0550 | 2.500 | | .500 | | 4 | C25041 |
| | | 1.5 | .0591 | | 63.50 | | 12.70 | 4 | C25059 |
| | 53 | | .0595 | 2.500 | | .500 | | 4 | C25053 |
| 1/16 | | | .0625 | 2.500 | | .500 | | 4 | C25060 |
| | 52 | | .0635 | 2.500 | | .500 | | 4 | C25063 |
| | 51 | | .0670 | 3.000 | | .750 | | 4 | C25072 |
| | 50 | | .0700 | 3.000 | | .750 | | 4 | C25079 |
| | 49 | | .0730 | 3.000 | | .750 | | 4 | C25087 |
| | 48 | | .0760 | 3.000 | | .750 | | 4 | C25094 |
| 5/64 | | | .0781 | 3.000 | | .750 | | 4 | C25100 |
| | 47 | | .0785 | 3.000 | | .750 | | 4 | C25101 |
| | | 2.0 | .0787 | | 76.20 | | 19.05 | 4 | C25095 |
| | 46 | | .0810 | 3.000 | | .750 | | 4 | C25108 |
| | 45 | | .0820 | 3.000 | | .750 | | 4 | C25110 |
| | 44 | | .0860 | 3.000 | | .750 | | 4 | C25120 |
| | 43 | | .0890 | 3.000 | | .750 | | 4 | C25128 |
| | 42 | | .0935 | 3.000 | | .750 | | 4 | C25139 |
| 3/32 | | | .0938 | 3.000 | | .750 | | 4 | C25140 |
| | 41 | | .0960 | 3.500 | | .875 | | 4 | C25146 |
| | 40 | | .0980 | 3.500 | | .875 | | 4 | C25151 |
| | 39 | | .0995 | 3.500 | | .875 | | 4 | C25155 |
| | 38 | | .1015 | 3.500 | | .875 | | 4 | C25159 |
| | 37 | | .1040 | 3.500 | | .875 | | 4 | C25165 |
| | 36 | | .1065 | 3.500 | | .875 | | 4 | C25171 |
| 7/64 | | | .1094 | 3.500 | | .875 | | 4 | C25178 |
| | 35 | | .1100 | 3.500 | | .875 | | 4 | C25180 |
| | 34 | | .1110 | 3.500 | | .875 | | 4 | C25183 |
| | 33 | | .1130 | 3.500 | | .875 | | 4 | C25187 |
| | 32 | | .1160 | 3.500 | | .875 | | 4 | C25194 |
| | | 3.0 | .1181 | | 88.90 | | 22.23 | 4 | C25185 |
| | 31 | | .1200 | 3.500 | | .875 | | 4 | C25203 |
| 1230* | | | .1230 | 3.500 | | .875 | | 4 | *C25210 |
| .1240 | | | .1240 | 3.500 | | .875 | | 4 | C25212 |
| .1247* | | | .1247 | 3.500 | | .875 | | 4 | *C25215 |
| 1/8 | | | .1250 | 3.500 | | .875 | | 4 | C25216 |
| .1260 | | | .1260 | 3.500 | | .875 | | 4 | C25220 |
| | 30 | | .1285 | 3.500 | | .875 | | 4 | C25226 |
| | 29 | | .1360 | 4.000 | | 1.000 | | 4 | C25243 |

*dowel pin reamer tolerance +.0000/- .0002

continued on next page



Styles: 4001 (continued)

| reamer dia. | | | overall length | | flute length | | number of flutes | order number |
|-------------|---------|--------|----------------|-------|--------------|-------|------------------|--------------|
| in | d1 wire | metric | decimal equiv. | l1 in | mm | l2 in | | |
| | 28 | | .1405 | 4.000 | | 1.000 | | C25253 |
| 9/64 | | | .1406 | 4.000 | | 1.000 | | C25254 |
| | 27 | | .1440 | 4.000 | | 1.000 | | C25262 |
| | 26 | | .1470 | 4.000 | | 1.000 | | C25269 |
| | 25 | | .1495 | 4.000 | | 1.000 | | C25275 |
| | 24 | | .1520 | 4.000 | | 1.000 | | C25281 |
| | 23 | | .1540 | 4.000 | | 1.000 | | C25285 |
| 5/32 | | | .1562 | 4.000 | | 1.000 | | C25290 |
| | 22 | | .1570 | 4.000 | | 1.000 | | C25292 |
| | | 4.0 | .1575 | | 101.60 | | 25.40 | C25291 |
| | 21 | | .1590 | 4.500 | | 1.125 | | C25297 |
| | 20 | | .1610 | 4.500 | | 1.125 | | C25301 |
| | 19 | | .1660 | 4.500 | | 1.125 | | C25313 |
| | 18 | | .1695 | 4.500 | | 1.125 | | C25322 |
| 11/64 | | | .1719 | 4.500 | | 1.125 | | C25327 |
| | 17 | | .1730 | 4.500 | | 1.125 | | C25330 |
| | 16 | | .1770 | 4.500 | | 1.125 | | C25339 |
| | 15 | | .1800 | 4.500 | | 1.125 | | C25346 |
| | 14 | | .1820 | 4.500 | | 1.125 | | C25351 |
| | 13 | | .1850 | 4.500 | | 1.125 | | C25357 |
| 1855* | | | .1855 | 4.500 | | 1.125 | | *C25360 |
| .1865 | | | .1865 | 4.500 | | 1.125 | | C25362 |
| .1870* | | | .1870 | 4.500 | | 1.125 | | *C25365 |
| 3/16 | | | .1875 | 4.500 | | 1.125 | | C25366 |
| .1885 | | | .1885 | 4.500 | | 1.125 | | C25368 |
| | 12 | | .1890 | 4.500 | | 1.125 | | C25369 |
| | 11 | | .1910 | 5.000 | | 1.250 | | C25374 |
| | 10 | | .1935 | 5.000 | | 1.250 | | C25380 |
| | 9 | | .1960 | 5.000 | | 1.250 | | C25385 |
| | | 5.0 | .1969 | | 127.00 | | 31.75 | C25314 |
| | 8 | | .1990 | 5.000 | | 1.250 | | C25392 |
| | 7 | | .2010 | 5.000 | | 1.250 | | C25397 |
| 13/64 | | | .2031 | 5.000 | | 1.250 | | C25402 |
| | 6 | | .2040 | 5.000 | | 1.250 | | C25404 |
| | 5 | | .2055 | 5.000 | | 1.250 | | C25408 |
| | 4 | | .2090 | 5.000 | | 1.250 | | C25417 |
| | 3 | | .2130 | 5.000 | | 1.250 | | C25426 |
| 7/32 | | | .2188 | 5.000 | | 1.250 | | C25438 |
| | 2 | | .2210 | 6.000 | | 1.500 | | C25443 |
| | 1 | | .2280 | 6.000 | | 1.500 | | C25459 |
| | A | | .2340 | 6.000 | | 1.500 | | C25473 |
| 15/64 | | | .2344 | 6.000 | | 1.500 | | C25474 |
| | | 6.0 | .2362 | | 152.40 | | 38.10 | C25475 |
| | B | | .2380 | 6.000 | | 1.500 | | C25483 |
| | C | | .2420 | 6.000 | | 1.500 | | C25492 |
| | D | | .2460 | 6.000 | | 1.500 | | C25501 |
| 2480* | | | .2480 | 6.000 | | 1.500 | | *C25508 |
| .2490 | | | .2490 | 6.000 | | 1.500 | | C25510 |
| .2495* | | | .2495 | 6.000 | | 1.500 | | *C25512 |

*dowel pin reamer tolerance +.0000/- .0002

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | ☆ | | | ☆ | ◆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Reamers

High Speed Steel

**Straight Shank and Flute
Chucking**

Styles: 4001 (continued)

Reamers

High Speed Steel

| reamer dia. | | decimal | | overall length | | flute length | | number of flutes | order number |
|-------------|----------------------------|---------|-------|-------------------|-------|-------------------|--------|------------------|--------------|
| in | d ₁ wire metric | equiv. | in | l ₁ mm | in | l ₂ mm | | | |
| 1/4 | E | .2500 | 6.000 | 1.500 | 6 | C25513 | | | |
| .2510 | | .2510 | 6.000 | 1.500 | 6 | C25516 | | | |
| | F | .2570 | 6.000 | 1.500 | 6 | C25530 | | | |
| | G | .2610 | 6.000 | 1.500 | 6 | C25539 | | | |
| 17/64 | | .2656 | 6.000 | 1.500 | 6 | C25550 | | | |
| | H | .2660 | 6.000 | 1.500 | 6 | C25552 | | | |
| | I | .2720 | 6.000 | 1.500 | 6 | C25566 | | | |
| | | 7.0 | .2756 | 152.40 | 38.10 | 6 | C25567 | | |
| | J | .2770 | 6.000 | 1.500 | 6 | C25577 | | | |
| | K | .2810 | 6.000 | 1.500 | 6 | C25585 | | | |
| 9/32 | | .2812 | 6.000 | 1.500 | 6 | C25608 | | | |
| | L | .2900 | 6.000 | 1.500 | 6 | C25605 | | | |
| | M | .2950 | 6.000 | 1.500 | 6 | C25617 | | | |
| 19/64 | | .2969 | 6.000 | 1.500 | 6 | C25622 | | | |
| | N | .3020 | 6.000 | 1.500 | 6 | C25634 | | | |
| .3105* | | .3105 | 6.000 | 1.500 | 6 | *C25655 | | | |
| .3115 | | .3115 | 6.000 | 1.500 | 6 | C25658 | | | |
| .3120* | | .3120 | 6.000 | 1.500 | 6 | *C25660 | | | |
| 5/16 | | .3125 | 6.000 | 1.500 | 6 | C25661 | | | |
| .3135 | | .3135 | 6.000 | 1.500 | 6 | C25663 | | | |
| | | 8.0 | .3150 | 152.40 | 38.10 | 6 | C25668 | | |
| | O | .3160 | 6.000 | 1.500 | 6 | C25669 | | | |
| | P | .3230 | 6.000 | 1.500 | 6 | C25685 | | | |
| 21/64 | | .3281 | 6.000 | 1.500 | 6 | C25698 | | | |
| | Q | .3320 | 6.000 | 1.500 | 6 | C25707 | | | |
| | R | .3390 | 6.000 | 1.500 | 6 | C25723 | | | |
| 11/32 | | .3438 | 6.000 | 1.500 | 6 | C25733 | | | |
| | S | .3480 | 7.000 | 1.750 | 6 | C25742 | | | |
| | | 9.0 | .3543 | 177.80 | 44.45 | 6 | C25743 | | |
| | T | .3580 | 7.000 | 1.750 | 6 | C25764 | | | |
| 23/64 | | .3594 | 7.000 | 1.750 | 6 | C25768 | | | |
| | U | .3680 | 7.000 | 1.750 | 6 | C25789 | | | |
| .3730* | | .3730 | 7.000 | 1.750 | 6 | *C25801 | | | |
| .3740 | | .3740 | 7.000 | 1.750 | 6 | C25804 | | | |
| .3745* | | .3745 | 7.000 | 1.750 | 6 | *C25806 | | | |
| 3/8 | | .3750 | 7.000 | 1.750 | 6 | C25807 | | | |
| .3760 | | .3760 | 7.000 | 1.750 | 6 | C25809 | | | |
| | V | .3770 | 7.000 | 1.750 | 6 | C25811 | | | |
| | W | .3860 | 7.000 | 1.750 | 6 | C25833 | | | |
| 25/64 | | .3906 | 7.000 | 1.750 | 6 | C25844 | | | |
| | | 10.0 | .3937 | 177.80 | 44.45 | 6 | C25845 | | |
| | X | .3970 | 7.000 | 1.750 | 6 | C25858 | | | |
| | Y | .4040 | 7.000 | 1.750 | 6 | C25873 | | | |
| 13/32 | | .4062 | 7.000 | 1.750 | 6 | C25878 | | | |
| | Z | .4130 | 7.000 | 1.750 | 6 | C25892 | | | |
| 27/64 | | .4219 | 7.000 | 1.750 | 6 | C25911 | | | |
| | | 11.0 | .4331 | 177.80 | 44.45 | 6 | C25912 | | |
| .4355* | | .4355 | 7.000 | 1.750 | 6 | *C25942 | | | |
| .4365 | | .4365 | 7.000 | 1.750 | 6 | C25944 | | | |
| .4370* | | .4370 | 7.000 | 1.750 | 6 | *C25946 | | | |
| 7/16 | | .4375 | 7.000 | 1.750 | 6 | C25947 | | | |
| .4385 | | .4385 | 7.000 | 1.750 | 6 | C25949 | | | |
| 29/64 | | .4531 | 7.000 | 1.750 | 6 | C25981 | | | |
| 15/32 | | .4688 | 7.000 | 1.750 | 6 | C26014 | | | |
| | | 12.0 | .4724 | 203.20 | 50.80 | 6 | C26015 | | |
| 31/64 | | .4844 | 8.000 | 2.000 | 6 | C26048 | | | |
| .4990* | | .4990 | 8.000 | 2.000 | 6 | *C26080 | | | |

*dowel pin reamer tolerance +.0000/-0.0002

continued on next page



Styles: 4001 (continued)

| reamer dia. | | | overall length | | flute length | | number of flutes | order number | |
|-------------|---------------------|--------|----------------|-------------------|-------------------|-------------------|------------------|--------------|-------------------|
| in | d ₁ wire | metric | decimal equiv. | l ₁ in | l ₁ mm | l ₂ in | | | l ₂ mm |
| 1/2 | | | .5000 | 8.000 | | 2.000 | | 6 | C26083 |
| .5010* | | | .5010 | 8.000 | | 2.000 | | 8 | *C26085 |
| | | 13.0 | .5118 | | 203.20 | | 50.80 | 8 | C26086 |
| 17/32 | | | .5312 | 8.000 | | 2.000 | | 8 | C26150 |
| | | 14.0 | .5512 | | 203.20 | | 50.80 | 8 | C26151 |
| 9/16 | | | .5625 | 8.000 | | 2.000 | | 8 | C26217 |
| | | 15.0 | .5906 | | 203.20 | | 50.80 | 8 | C26218 |
| 19/32 | | | .5938 | 8.000 | | 2.000 | | 8 | C26284 |
| 5/8 | | | .6250 | 9.000 | | 2.250 | | 8 | C26351 |
| | | 16.0 | .6299 | | 228.60 | | 57.15 | 8 | C26352 |
| 21/32 | | | .6562 | 9.000 | | 2.250 | | 8 | C26418 |
| 11/16 | | | .6875 | 9.000 | | 2.250 | | 8 | C26485 |
| 23/32 | | | .7188 | 9.000 | | 2.250 | | 8 | C26550 |
| 3/4 | | | .7500 | 9.500 | | 2.500 | | 8 | C26615 |
| 25/32 | | | .7812 | 9.500 | | 2.500 | | 8 | C26680 |
| 13/16 | | | .8125 | 9.500 | | 2.500 | | 8 | C26746 |
| 27/32 | | | .8438 | 9.500 | | 2.500 | | 8 | C26811 |
| 7/8 | | | .8750 | 10.000 | | 2.625 | | 8 | C26876 |
| 29/32 | | | .9062 | 10.000 | | 2.625 | | 8 | C26941 |
| 15/16 | | | .9375 | 10.000 | | 2.625 | | 8 | C27006 |
| 31/32 | | | .9688 | 10.000 | | 2.625 | | 8 | C27072 |
| 1 | | | 1.0000 | 10.500 | | 2.750 | | 8 | C27137 |
| 1-1/16 | | | 1.0625 | 10.500 | | 2.750 | | 10 | C27144 |
| 1-1/8 | | | 1.1250 | 11.000 | | 2.875 | | 10 | C27152 |
| 1-3/16 | | | 1.1875 | 11.000 | | 2.875 | | 10 | C27159 |
| 1-1/4 | | | 1.2500 | 11.500 | | 3.000 | | 10 | C27166 |
| 1-3/8 | | | 1.3750 | 12.000 | | 3.250 | | 10 | C27180 |
| 1-1/2 | | | 1.5000 | 12.500 | | 3.500 | | 12 | C27195 |

*dowel pin reamer tolerance +.0000/- .0002

Reamers

High Speed Steel

SET

Style: 4001

Straight Shank and Flute
Chucking

| no. of pieces | surface treatment | size range | order number |
|---------------|-------------------|----------------------------|--------------|
| 29 | bright | 1/16" through 1/2" x 1/64" | C00964 |



| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | ☆ | | | ☆ | ◆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable

Straight Shank, Spiral Flute Chucking

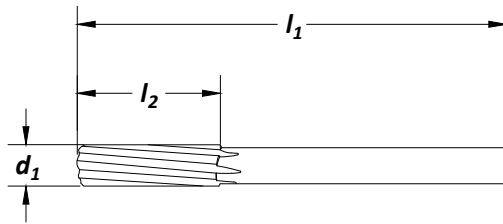
Styles: **4030**

Note

Custom reamer dimensions shown in Technical Section.

Operating parameters:
See Technical section

ASME B94.2 HSS Blind Holes Thru Holes RH Spiral Flute Straight Shank Surface Treatment Bright



Reamers

High Speed Steel

| reamer dia. d₁ | decimal equiv. | overall length l₁ (in) | flute length l₂ (in) | number of flutes | order number 4030 |
|-------------------------------------|-------------------|---|---|---------------------|-----------------------------|
| 1/16 | .0625 | 2.500 | .500 | 4 | C29273 |
| 5/64 | .0781 | 3.000 | .750 | 4 | C29311 |
| 3/32 | .0938 | 3.000 | .750 | 4 | C29350 |
| 7/64 | .1094 | 3.500 | .875 | 4 | C29386 |
| 1/8 | .1250 | 3.500 | .875 | 6 | C29421 |
| 9/64 | .1406 | 4.000 | 1.000 | 6 | C29457 |
| 5/32 | .1562 | 4.000 | 1.000 | 6 | C29493 |
| 3/16 | .1875 | 4.500 | 1.125 | 6 | C29565 |
| 13/64 | .2031 | 5.000 | 1.250 | 6 | C29601 |
| 7/32 | .2188 | 5.000 | 1.250 | 6 | C29637 |
| 1/4 | .2500 | 6.000 | 1.500 | 6 | C29709 |
| 17/64 | .2656 | 6.000 | 1.500 | 6 | C29745 |
| 9/32 | .2812 | 6.000 | 1.500 | 6 | C29803 |
| 5/16 | .3125 | 6.000 | 1.500 | 6 | C29853 |
| 21/64 | .3281 | 6.000 | 1.500 | 6 | C29890 |
| 11/32 | .3438 | 6.000 | 1.500 | 6 | C29925 |
| 23/64 | .3594 | 7.000 | 1.750 | 6 | C29960 |
| 3/8 | .3750 | 7.000 | 1.750 | 6 | C29997 |
| 25/64 | .3906 | 7.000 | 1.750 | 6 | C30033 |
| 13/32 | .4062 | 7.000 | 1.750 | 6 | C30067 |
| 7/16 | .4375 | 7.000 | 1.750 | 6 | C30134 |
| 29/64 | .4531 | 7.000 | 1.750 | 6 | C30168 |
| 15/32 | .4688 | 7.000 | 1.750 | 6 | C30201 |
| 31/64 | .4844 | 8.000 | 2.000 | 6 | C30235 |
| 1/2 | .5000 | 8.000 | 2.000 | 6 | C30268 |
| 17/32 | .5312 | 8.000 | 2.000 | 8 | C30335 |
| 9/16 | .5625 | 8.000 | 2.000 | 8 | C30402 |
| 19/32 | .5938 | 8.000 | 2.000 | 8 | C30469 |
| 5/8 | .6250 | 9.000 | 2.250 | 8 | C30536 |
| 21/32 | .6562 | 9.000 | 2.250 | 8 | C30603 |
| 11/16 | .6875 | 9.000 | 2.250 | 8 | C30670 |
| 23/32 | .7188 | 9.000 | 2.250 | 8 | C30735 |
| 3/4 | .7500 | 9.500 | 2.500 | 8 | C30800 |
| 25/32 | .7812 | 9.500 | 2.500 | 8 | C30865 |
| 13/16 | .8125 | 9.500 | 2.500 | 8 | C30931 |
| 7/8 | .8750 | 10.000 | 2.625 | 8 | C31061 |
| 15/16 | .9375 | 10.000 | 2.625 | 8 | C31191 |
| 1 | 1.0000 | 10.500 | 2.750 | 8 | C31322 |
| 1-1/8 | 1.1250 | 11.000 | 2.875 | 10 | C31337 |
| 1-1/4 | 1.2500 | 11.500 | 3.000 | 10 | C31351 |
| 1-3/8 | 1.3750 | 12.000 | 3.250 | 10 | C31365 |
| 1-1/2 | 1.5000 | 12.500 | 3.500 | 12 | C31380 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | | ☆ | | ☆ | | | ☆ | ◆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable

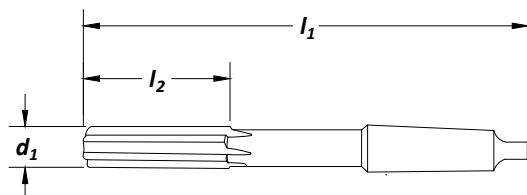


Styles: 4005

Note
Custom reamer dimensions shown in Technical Section.

Operating parameters:
See Technical section

ANSI SIZES HSS Thru Holes Straight Flute Taper Shank Surface Treatment Bright



| reamer dia. | decimal | overall length | flute length | morse | number | order number |
|----------------------|---------|---------------------------|---------------------------|-------|-----------|--------------|
| d₁ | equiv. | I₁ (in) | I₂ (in) | taper | of flutes | 4005 |
| 1/4 | .2500 | 6.000 | 1.500 | 1 | 6 | C33842 |
| 5/16 | .3125 | 6.000 | 1.500 | 1 | 6 | C33986 |
| 3/8 | .3750 | 7.000 | 1.750 | 1 | 6 | C34129 |
| 7/16 | .4375 | 7.000 | 1.750 | 1 | 6 | C34266 |
| 1/2 | .5000 | 8.000 | 2.000 | 1 | 6 | C34400 |
| 17/32 | .5312 | 8.000 | 2.000 | 1 | 6 | C34467 |
| 9/16 | .5625 | 8.000 | 2.000 | 1 | 8 | C34534 |
| 19/32 | .5938 | 8.000 | 2.000 | 1 | 8 | C34601 |
| 5/8 | .6250 | 9.000 | 2.250 | 2 | 8 | C34668 |
| 21/32 | .6562 | 9.000 | 2.250 | 2 | 8 | C34735 |
| 11/16 | .6875 | 9.000 | 2.250 | 2 | 8 | C34802 |
| 23/32 | .7188 | 9.000 | 2.250 | 2 | 8 | C34867 |
| 3/4 | .7500 | 9.500 | 2.500 | 2 | 8 | C34932 |
| 25/32 | .7812 | 9.500 | 2.500 | 2 | 8 | C34997 |
| 13/16 | .8125 | 9.500 | 2.500 | 2 | 8 | C35063 |
| 27/32 | .8438 | 9.500 | 2.500 | 2 | 8 | C35128 |
| 7/8 | .8750 | 10.000 | 2.625 | 2 | 8 | C35193 |
| 29/32 | .9062 | 10.000 | 2.625 | 2 | 8 | C35258 |
| 15/16 | .9375 | 10.000 | 2.625 | 3 | 8 | C35323 |
| 31/32 | .9688 | 10.000 | 2.625 | 3 | 8 | C35389 |
| 1" | 1.0000 | 10.500 | 2.750 | 3 | 8 | C35454 |
| 1-1/16 | 1.0625 | 10.500 | 2.750 | 3 | 10 | C35461 |
| 1-1/8 | 1.1250 | 11.000 | 2.875 | 3 | 10 | C35469 |
| 1-3/16 | 1.1875 | 11.000 | 2.875 | 3 | 10 | C35476 |
| 1-1/4 | 1.2500 | 11.500 | 3.000 | 4 | 10 | C35483 |
| 1-5/16 | 1.3125 | 11.500 | 3.000 | 4 | 10 | C35490 |
| 1-3/8 | 1.3750 | 12.000 | 3.250 | 4 | 10 | C35497 |
| 1-7/16 | 1.4375 | 12.000 | 3.250 | 4 | 10 | C35505 |
| 1-1/2 | 1.5000 | 12.500 | 3.500 | 4 | 12 | C35512 |

Reamers

High Speed Steel

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | | ☆ | | ☆ | | | ☆ | ◆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Straight Shank and Flute Chucking - Carbide-Tipped

Styles: **4703**



Note

Run at carbide speeds.

HSS shank and body for extra strength.

Operating parameters: See Technical section

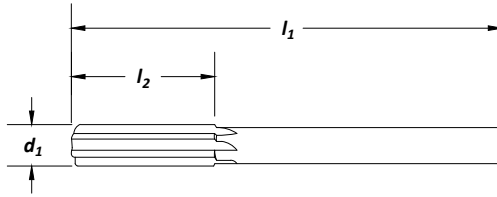


Surface Treatment



Reamers

High Speed Steel



| reamer dia. | decimal | | overall length | flute length | number | order number |
|----------------------|---------|------------|---------------------------|---------------------------|-----------|--------------|
| d₁ | equiv. | shank dia. | l₁ (in) | l₂ (in) | of flutes | 4703 |
| 1/4 | .2500 | .2405 | 6.000 | 1.500 | 4 | C50368 |
| 9/32 | .2812 | .2485 | 6.000 | 1.500 | 4 | C50382 |
| 5/16 | .3125 | .2792 | 6.000 | 1.500 | 4 | C50391 |
| 11/32 | .3438 | .2792 | 6.000 | 1.500 | 4 | C50402 |
| 3/8 | .3750 | .3105 | 7.000 | 1.750 | 4 | C50414 |
| 13/32 | .4062 | .3105 | 7.000 | 1.750 | 4 | C50423 |
| 7/16 | .4375 | .3730 | 7.000 | 1.750 | 6 | C50428 |
| 15/32 | .4688 | .3730 | 7.000 | 1.750 | 6 | C50433 |
| 1/2 | .5000 | .4355 | 8.000 | 2.000 | 6 | C50438 |
| 17/32 | .5312 | .4355 | 8.000 | 2.000 | 6 | C50443 |
| 9/16 | .5625 | .4355 | 8.000 | 2.000 | 6 | C50449 |
| 5/8 | .6250 | .5620 | 9.000 | 2.250 | 6 | C50459 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | ◆ | ☆ | ◆ | ☆ | ◆ | ◆ | ☆ | ◆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable

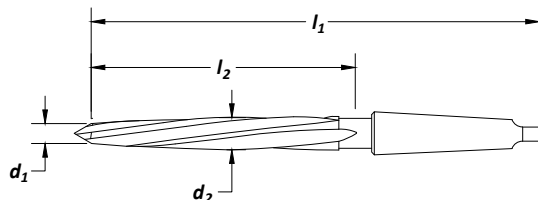


**Taper Shank
Bridge Reamer**

Style: **616**

Note
Operating parameters:
See Technical section

ANSI SIZES HSS LHS/RHC Taper Shank Surface Treatment Black Oxide



| reamer dia. d₂ | decimal equiv. | small end dia. d₁ (in) | overall length l₁ (in) | flute length l₂ (in) | morse taper | number of flutes | order number |
|-------------------------------------|-------------------|---|---|---|----------------|---------------------|----------------------|
| 7/16 | .4375 | .266 | 8.250 | 4.375 | 2 | 4 | 616 C23812 |
| 1/2 | .5000 | .313 | 9.000 | 5.125 | 2 | 4 | C23813 |
| 9/16 | .5625 | .375 | 9.000 | 5.125 | 2 | 4 | C23814 |
| 5/8 | .6250 | .391 | 10.000 | 6.125 | 2 | 4 | C23815 |
| 11/16 | .6875 | .406 | 11.750 | 7.125 | 3 | 4 | C23816 |
| 3/4 | .7500 | .469 | 12.000 | 7.375 | 3 | 4 | C23817 |
| 13/16 | .8125 | .547 | 12.000 | 7.375 | 3 | 4 | C23818 |
| 7/8 | .8750 | .609 | 12.000 | 7.375 | 3 | 4 | C23819 |
| 15/16 | .9375 | .672 | 12.000 | 7.375 | 3 | 4 | C23820 |
| 1 | 1.0000 | .734 | 12.000 | 7.375 | 3 | 4 | C23821 |
| 1-1/16 | 1.0625 | .813 | 12.000 | 7.375 | 3 | 4 | C23822 |
| 1-1/8 | 1.1250 | .859 | 12.000 | 7.375 | 3 | 4 | C23823 |
| 1-3/16 | 1.1875 | .922 | 12.000 | 7.375 | 3 | 4 | C23824 |

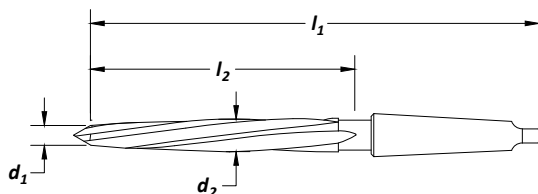
Reamers
High Speed Steel

Style: **618**

**Taper Shank
Car Reamer**

Note
Operating parameters:
See Technical section

ANSI SIZES HSS LHS/RHC Taper Shank Surface Treatment Black Oxide



| reamer dia. d₂ | decimal equiv. | small end dia. d₁ (in) | overall length l₁ (in) | flute length l₂ (in) | morse taper | number of flutes | order number |
|-------------------------------------|-------------------|---|---|---|----------------|---------------------|----------------------|
| 9/16 | .5625 | 0.313 | 7.563 | 3.938 | 2 | 5 | 618 C23957 |
| 5/8 | .6250 | 0.328 | 8.063 | 4.438 | 2 | 5 | C23958 |
| 11/16 | .6875 | 0.359 | 8.813 | 4.438 | 3 | 5 | C23959 |
| 3/4 | .7500 | 0.422 | 9.500 | 5.000 | 3 | 5 | C23960 |
| 13/16 | .8125 | 0.469 | 9.500 | 5.000 | 3 | 5 | C23961 |
| 15/16 | .9375 | 0.563 | 9.500 | 5.000 | 3 | 5 | C23962 |

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-----------------|-------|-----------------|-------------|------|-----------------|------------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | |
| Bright | ☆ | | ☆ | | | | | ☆ | ☆ | | |

☆ = Best Performance ◆ = Acceptable



Taper Pipe

Style: **642**

Note

Operating parameters:
See Technical section

ANSI SIZES

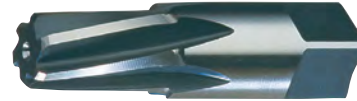
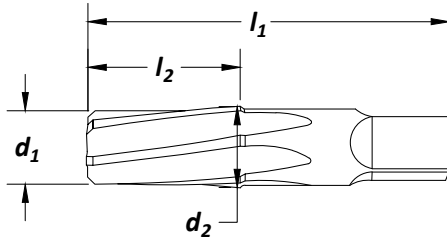
HSS

LHS / RHC

Square Shank

Surface Treatment

Bright



Reamers

High Speed Steel

| nominal pipe diameter | small end dia. d_1 (in) | large end dia. d_2 (in) | overall length l_1 (in) | flute length l_2 (in) | no. of flutes | order number |
|-----------------------|---------------------------|---------------------------|---------------------------|-------------------------|---------------|--------------|
| 1/8 | .316 | .362 | 2.125 | .750 | 6 | C24982 |
| 1/4 | .406 | .472 | 2.438 | 1.063 | 6 | C24983 |
| 3/8 | .540 | .606 | 2.563 | 1.063 | 6 | C24984 |
| 1/2 | .665 | .751 | 3.125 | 1.375 | 6 | C24985 |
| 3/4 | .876 | .962 | 3.750 | 1.375 | 8 | C24986 |
| 1 | 1.103 | 1.212 | 3.750 | 1.750 | 8 | C24987 |
| 1-1/4 | 1.444 | 1.553 | 4.000 | 1.750 | 10 | C24988 |
| 1-1/2 | 1.684 | 1.793 | 4.250 | 1.750 | 10 | C24989 |

High Spiral Spirex

Taper Pin

Style: **650**

Note

Operating parameters:
See Technical section

ANSI SIZES

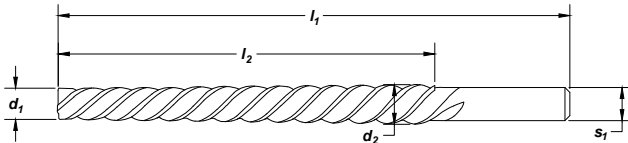
HSS

1/4" / 12"

LH Spiral Flute

Surface Treatment

Bright



| pin size | small end dia. d_1 (in) | large end dia. d_2 (in) | overall length l_1 (in) | flute length l_2 (in) | shank dia. s_1 (in) | order number |
|----------|---------------------------|---------------------------|---------------------------|-------------------------|-----------------------|--------------|
| #7/0 | .0497 | .0666 | 1.813 | .813 | .0781 | C24229 |
| #6/0 | .0611 | .0806 | 1.938 | .938 | .0938 | C24230 |
| #5/0 | .0719 | .0966 | 2.188 | 1.188 | .1094 | C24231 |
| #4/0 | .0869 | .1142 | 2.313 | 1.313 | .1250 | C24232 |
| #3/0 | .1029 | .1302 | 2.313 | 1.313 | .1406 | C24233 |
| #2/0 | .1137 | .1462 | 2.563 | 1.563 | .1562 | C24234 |
| #0 | .1287 | .1638 | 2.938 | 1.688 | .1719 | C24235 |
| #1 | .1447 | .1798 | 2.938 | 1.688 | .1875 | C24236 |
| #2 | .1605 | .2008 | 3.188 | 1.938 | .2031 | C24237 |
| #3 | .1813 | .2294 | 3.688 | 2.313 | .2344 | C24238 |
| #4 | .2071 | .2604 | 4.063 | 2.563 | .2656 | C24239 |
| #5 | .2409 | .2994 | 4.313 | 2.813 | .3125 | C24240 |
| #6 | .2773 | .3540 | 5.438 | 3.688 | .3594 | C24241 |
| #7 | .3297 | .4220 | 6.313 | 4.438 | .4062 | C24242 |
| #8 | .3971 | .5050 | 7.188 | 5.188 | .4375 | C24243 |
| #9 | .4805 | .6066 | 8.313 | 6.063 | .5625 | C24244 |
| #10 | .5799 | .7216 | 9.313 | 6.813 | .6250 | C24245 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | | | | | | | ☆ | | |

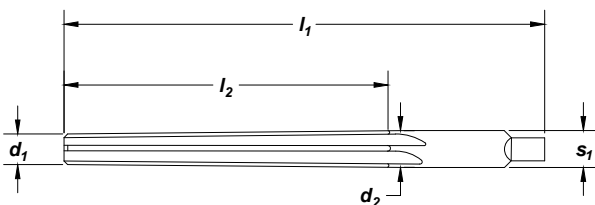
☆ = Best Performance ◆ = Acceptable



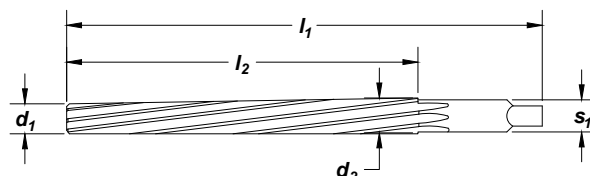
Styles: **657, 659**

Note
Operating parameters:
See Technical section

ANSI SIZES HSS 1/4" / 12" LHS / RHC Straight Flute Square Shank Surface Treatment Bright



Style 657 - Straight Flute



Style 659 - LHH/RHC

Reamers

High Speed Steel

| pin size | small end dia. d ₁ (in) | large end dia. d ₂ (in) | overall length l ₁ (in) | flute length l ₂ (in) | shank dia. s ₁ (in) | no. of flutes | order number | |
|----------|------------------------------------|------------------------------------|------------------------------------|----------------------------------|--------------------------------|---------------|--------------------|-------------------|
| | | | | | | | 657 straight flute | 659 helical flute |
| #6/0 | .0611 | .0806 | 1.938 | .938 | .0938 | 4 | C24250 | C24271 |
| #5/0 | .0719 | .0966 | 2.188 | 1.188 | .1094 | 4 | C24251 | C24272 |
| #4/0 | .0869 | .1142 | 2.313 | 1.313 | .1250 | 4 | C24252 | C24273 |
| #3/0 | .1029 | .1302 | 2.313 | 1.313 | .1406 | 4 | C24253 | C24274 |
| #2/0 | .1137 | .1462 | 2.563 | 1.563 | .1562 | 4 | C24254 | C24275 |
| #0 | .1287 | .1638 | 2.938 | 1.688 | .1719 | 4 | C24255 | C24276 |
| #1 | .1447 | .1798 | 2.938 | 1.688 | .1875 | 6 | C24256 | C24277 |
| #2 | .1605 | .2008 | 3.188 | 1.938 | .2031 | 6 | C24257 | C24278 |
| #3 | .1813 | .2294 | 3.688 | 2.313 | .2344 | 6 | C24258 | C24279 |
| #4 | .2071 | .2604 | 4.063 | 2.563 | .2656 | 6 | C24259 | C24280 |
| #5 | .2409 | .2994 | 4.313 | 2.813 | .3125 | 6 | C24260 | C24281 |
| #6 | .2773 | .3540 | 5.438 | 3.688 | .3594 | 6 | C24261 | C24282 |
| #7 | .3297 | .4220 | 6.313 | 4.438 | .4062 | 6 | C24262 | C24283 |
| #8 | .3971 | .5050 | 7.188 | 5.188 | .4375 | 6 | C24263 | C24284 |
| #9 | .4805 | .6066 | 8.313 | 6.063 | .5625 | 6 | C24264 | C24285 |
| #10 | .5799 | .7216 | 9.313 | 6.813 | .6250 | 6 | C24265 | C24286 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | ☆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable

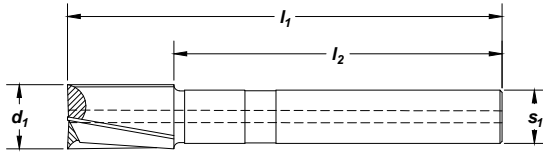


Note
Pilots listed on page 114.

ANSI SIZES HSS RH Spiral Flute Straight Shank Surface Treatment Bright

Counterbore

High Speed Steel



| counterbore diameter | | pilot shank sizes | | shank length | overall length | shank diameter | pilot size range | no. of flutes | order no. |
|----------------------|--------|-------------------|-------|---------------------|---------------------|---------------------|------------------|---------------|-----------|
| d ₁ | | | | I ₂ (in) | I ₁ (in) | S ₁ (in) | | | 879 |
| fraction | in | fraction | in | | | | | | |
| 3/16 | .1875 | 3/32 | .0938 | 2.125 | 3.000 | .234 | 1/8 - 3/16 | 3 | C46421 |
| 7/32 | .2188 | 3/32 | .0938 | 2.125 | 3.000 | .234 | 1/8 - 7/32 | 3 | C46422 |
| 1/4 | .2500 | 3/32 | .0938 | 3.063 | 3.813 | .234 | 1/8 - 3/16 | 3 | C46423 |
| 9/32 | .2812 | 3/32 | .0938 | 3.063 | 3.813 | .266 | 1/8 - 7/32 | 3 | C46424 |
| 5/16 | .3125 | 3/32 | .0938 | 3.063 | 3.813 | .297 | 1/8 - 1/4 | 3 | C46425 |
| 11/32 | .3438 | 3/32 | .0938 | 3.063 | 3.813 | .313 | 1/8 - 9/32 | 3 | C46426 |
| 3/8 | .3750 | 5/32 | .1562 | 3.063 | 4.063 | .313 | 3/16 - 5/16 | 3 | C46427 |
| 13/32 | .4062 | 5/32 | .1562 | 3.063 | 4.063 | .375 | 3/16 - 11/32 | 3 | C46428 |
| 7/16 | .4375 | 5/32 | .1562 | 3.063 | 4.063 | .375 | 3/16 - 3/8 | 3 | C46429 |
| 15/32 | .4688 | 3/16 | .1875 | 3.063 | 4.313 | .438 | 1/4 - 13/32 | 3 | C46430 |
| 1/2 | .5000 | 3/16 | .1875 | 3.063 | 4.313 | .438 | 1/4 - 7/16 | 3 | C46431 |
| 17/32 | .5312 | 3/16 | .1875 | 3.063 | 4.313 | .500 | 1/4 - 15/32 | 3 | C46432 |
| 9/16 | .5625 | 3/16 | .1875 | 3.063 | 4.313 | .500 | 1/4 - 1/2 | 3 | C46433 |
| 19/32 | .5938 | 3/16 | .1875 | 3.875 | 5.125 | .500 | 1/4 - 17/32 | 3 | C46434 |
| 5/8 | .6250 | 3/16 | .1875 | 3.875 | 5.125 | .500 | 1/4 - 9/16 | 3 | C46435 |
| 21/32 | .6562 | 3/16 | .1875 | 3.875 | 5.125 | .500 | 1/4 - 19/32 | 3 | C46436 |
| 11/16 | .6875 | 3/16 | .1875 | 3.875 | 5.125 | .500 | 1/4 - 5/8 | 3 | C46437 |
| 23/32 | .7188 | 1/4 | .2500 | 3.875 | 5.375 | .500 | 5/16 - 21/32 | 3 | C46438 |
| 3/4 | .7500 | 1/4 | .2500 | 3.875 | 5.375 | .500 | 5/16 - 11/16 | 3 | C46439 |
| 25/32 | .7812 | 1/4 | .2500 | 3.875 | 5.375 | .625 | 5/16 - 23/32 | 3 | C46440 |
| 13/16 | .8125 | 1/4 | .2500 | 3.875 | 5.375 | .625 | 5/16 - 3/4 | 3 | C46441 |
| 7/8 | .8750 | 1/4 | .2500 | 3.875 | 5.375 | .750 | 5/16 - 13/16 | 3 | C46443 |
| 15/16 | .9375 | 1/4 | .2500 | 4.625 | 6.125 | .750 | 5/16 - 7/8 | 3 | C46445 |
| 1 | 1.0000 | 5/16 | .3125 | 4.625 | 6.375 | .750 | 3/8 - 15/16 | 3 | C46447 |
| 1-1/16 | 1.0625 | 5/16 | .3125 | 4.625 | 6.375 | .750 | 3/8 - 1 | 3 | C46448 |
| 1-1/8 | 1.1250 | 5/16 | .3125 | 4.625 | 6.375 | 1.000 | 3/8 - 1-1/16 | 3 | C46449 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | ☆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable

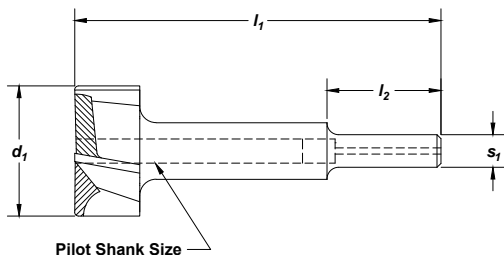


Style: **884**

Note

Pilots listed on page 125.

ANSI SIZES HSS Straight Shank Surface Treatment Bright



Counterbore

High Speed Steel

| counterbore diameter d₁ | | pilot shank sizes | | shank length l₂ (in) | overall length l₁ (in) | shank diameter s₁ (in) | pilot size range | no. of flutes | order no. |
|--|--------|-------------------|-------|---|---|---|------------------|---------------|------------|
| fraction | in | fraction | in | | | | | | 884 |
| 1/4 | .2500 | 3/32 | .0938 | 1.125 | 2.375 | .250 | 1/8 - 3/16 | 4 | C46886 |
| 5/16 | .3125 | 3/32 | .0938 | .875 | 2.375 | .250 | 1/8 - 1/4 | 4 | C46888 |
| 3/8 | .3750 | 3/32 | .0938 | .875 | 2.375 | .250 | 3/16 - 5/16 | 4 | C46890 |
| 13/32 | .4062 | 1/8 | .1250 | .875 | 2.813 | .250 | 3/16 - 11/32 | 4 | C46891 |
| 7/16 | .4375 | 1/8 | .1250 | .875 | 2.813 | .250 | 3/16 - 3/8 | 4 | C46892 |
| 15/32 | .4688 | 1/8 | .1250 | .875 | 2.813 | .250 | 1/4 - 13/32 | 4 | C46893 |
| 1/2 | .5000 | 1/8 | .1250 | .875 | 2.813 | .250 | 1/4 - 7/16 | 4 | C46894 |
| 9/16 | .5625 | 1/8 | .1250 | .875 | 2.813 | .250 | 1/4 - 1/2 | 4 | C46896 |
| 5/8 | .6250 | 1/8 | .1250 | .875 | 2.813 | .250 | 1/4 - 9/16 | 4 | C46898 |
| 11/16 | .6875 | 3/16 | .1875 | .875 | 2.813 | .250 | 1/4 - 5/8 | 4 | C46900 |
| 3/4 | .7500 | 3/16 | .1875 | .875 | 2.813 | .250 | 5/16 - 11/16 | 4 | C46902 |
| 13/16 | .8125 | 3/16 | .1875 | .875 | 2.813 | .250 | 5/16 - 3/4 | 4 | C46904 |
| 7/8 | .8750 | 3/16 | .1875 | .875 | 2.813 | .250 | 5/16 - 13/16 | 4 | C46906 |
| 15/16 | .9375 | 3/16 | .1875 | .875 | 2.813 | .250 | 5/16 - 7/8 | 4 | C46908 |
| 1 | 1.0000 | 3/16 | .1875 | .875 | 2.813 | .250 | 3/8 - 15/16 | 4 | C46910 |

TECH TIPS

Aircraft Type Counterbores

- Designed for aircraft fabricating use with portable pneumatic and electric drills.
- Smaller pilot holes than standard counterbores.
- Corner radius of 1/32" is standard.

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | ☆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Interchangeable Pilot
 for Counterbore & Spot Facer

 Style: **879P**

Counterbore
High Speed Steel
Note

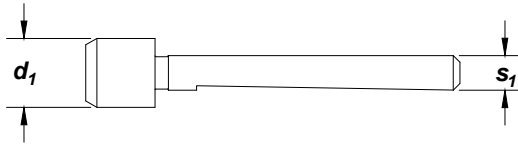
 For pilot diameter, match pilot shank size, from style #884 or #879, to pilot shank size **S₁** in these columns.

ANSI SIZES

HSS

Surface Treatment

Bright



| pilot diameter d₁ | decimal equiv. | S₁ | | | | | | | |
|--|----------------|----------------------|--------|--------|--------|--------|--------|--------|--------|
| | | 3/32" | 1/8" | 5/32" | 3/16" | 1/4" | 5/16" | 3/8" | 7/16" |
| 3/32 | .0938 | C46520 | - | - | - | - | - | - | - |
| .127 | .1250 | C46525 | - | - | - | - | - | - | - |
| 1/8 | .1250 | C46523 | C46522 | - | - | - | - | - | - |
| 5/32 | .1562 | C46528 | C46527 | C46529 | - | - | - | - | - |
| .157 | .1570 | C46531 | - | - | - | - | - | - | - |
| .159 | .1590 | C46533 | - | - | - | - | - | - | - |
| 3/16 | .1875 | C46538 | C46537 | C46539 | C46540 | - | - | - | - |
| .191 | .1910 | C46545 | C46544 | - | C46546 | - | - | - | - |
| 13/64 | .2031 | - | C46547 | - | - | - | - | - | - |
| 7/32 | .2188 | C46549 | C46548 | C46550 | C46551 | - | - | - | - |
| 1/4 | .2500 | C46554 | C46553 | C46555 | C46556 | C46557 | - | - | - |
| .255 | .2550 | - | C46558 | - | C46560 | - | - | - | - |
| 9/32 | .2812 | - | - | C46565 | C46566 | - | - | - | - |
| 5/16 | .3125 | C46570 | C46569 | C46571 | C46572 | C46573 | - | - | - |
| 11/32 | .3438 | - | C46576 | C46578 | C46579 | C46580 | - | - | - |
| 3/8 | .3750 | C46314 | C46583 | C46584 | C46585 | C46586 | C46587 | - | - |
| 13/32 | .4062 | - | - | - | C46592 | C46593 | C46594 | - | - |
| 7/16 | .4375 | - | - | C46597 | C46598 | C46599 | C46600 | - | - |
| 15/32 | .4688 | - | - | - | C46605 | - | - | - | - |
| 1/2 | .5000 | - | - | - | C46612 | C46613 | C46614 | - | - |
| 17/32 | .5312 | - | - | - | C46620 | C46621 | C46622 | - | - |
| 9/16 | .5625 | - | - | - | - | C46629 | C46630 | - | - |
| 19/32 | .5938 | - | - | - | - | - | - | C46639 | - |
| 5/8 | .6250 | - | - | - | - | C46645 | - | C46647 | - |
| 11/16 | .6875 | - | - | - | - | C46657 | C46658 | C46659 | - |
| 3/4 | .7500 | - | - | - | C46316 | - | - | C46669 | - |
| 25/32 | .7812 | - | - | - | - | - | C46673 | C46674 | - |
| 13/16 | .8125 | - | - | - | - | - | C46678 | C46679 | - |
| 7/8 | .8750 | - | - | - | - | C46687 | - | - | - |
| 1 | 1.0000 | - | - | - | - | - | - | - | - |
| 1-1/16 | 1.0625 | - | - | - | - | - | - | - | C46716 |
| 1-1/8 | 1.1250 | - | - | - | - | - | - | C46723 | - |

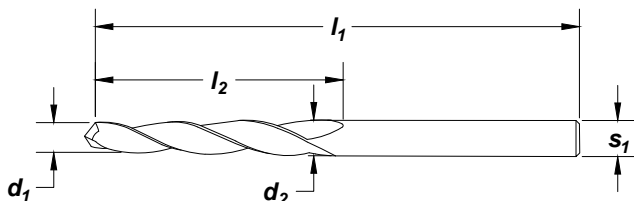
| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | ☆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Style: **655**

ANSI SIZES HSS Straight Shank Surface Treatment Bright



Counterbore

High Speed Steel

| size number | shank diameter s_1 (in) | small end diameter d_1 (in) | large end diameter d_2 (in) | flute length l_2 (in) | overall length l_1 (in) | order no. 655 |
|-------------|---------------------------|-------------------------------|-------------------------------|-------------------------|---------------------------|----------------------|
| #1 | .098 | .081 | .0980 | .813 | 2.000 | C24292 |
| #2 | .128 | .110 | .1280 | .875 | 2.250 | C24293 |
| #3 | .188 | .165 | .1875 | 1.063 | 2.500 | C24294 |
| #4 | .250 | .224 | .2500 | 1.250 | 2.750 | C24295 |

TECH TIPS

Clearance or Taper Router

- Use for cutting, trimming, routing, and elongating existing holes.

| Material Reference | Steel (HRc) | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | >45 |
| Bright | ☆ | | ☆ | | | | ☆ | ☆ | | ☆ | |

☆ = Best Performance ◆ = Acceptable

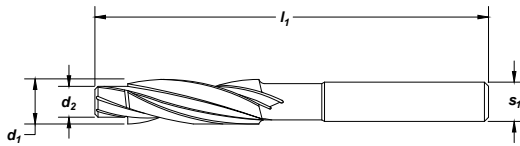
3 Flute
 Continuous Pilot

Style: 183


| | | | | | |
|------------|----------|-----|----------------|-------------------|--------|
| ANSI SIZES | DIN 1897 | HSS | Straight Shank | Surface Treatment | Bright |
|------------|----------|-----|----------------|-------------------|--------|

Counterbore

High Speed Steel



| counterbore number | cutter diameter d_1 (in) | pilot diameter d_2 (in) | shank diameter s_1 (in) | overall length l_1 (in) | cap screw size | order no. 183 |
|--------------------|-------------------------------|------------------------------|------------------------------|------------------------------|----------------|-------------------------|
| 183-CSS-6 | .230 | .135 | .219 | 3.000 | No. 6 | C91695 |
| 183-CSS-7 | .242 | .150 | .219 | 3.000 | No. 6 | C91696 |
| 183-CSS-8 | .274 | .161 | .250 | 3.000 | No. 8 | C91697 |
| 183-CSS-9 | .286 | .178 | .250 | 3.000 | No. 8 | C91698 |
| 183-CSS-10 | .316 | .187 | .313 | 3.500 | No. 10 | C91699 |
| 183-CSS-11 | .328 | .204 | .313 | 3.500 | No. 10 | C91700 |
| 183-CSS-12 | .348 | .213 | .344 | 3.500 | No. 12 | C91701 |
| 183-CSS-16 | .375 | .250 | .375 | 3.500 | No. 12 | C91703 |
| 183-CSS-17 | .391 | .266 | .375 | 5.750 | 1/4 | C92704 |
| 183-CSS-18 | .406 | .281 | .375 | 5.750 | 1/4 | C92705 |
| 183-CSM-6 | .433 | .268 | .438 | 6.000 | 6mm | C91830 |
| 183-CSS-20 | .438 | .313 | .438 | 6.000 | 5/16 | C92706 |
| 183-CSS-21 | .453 | .328 | .438 | 6.000 | 5/16 | C92708 |
| 183-CSS-20-60 | .469 | .313 | .438 | 6.000 | 5/16 | C92707 |
| 183-CSS-22 | .469 | .344 | .438 | 6.000 | 5/16 | C91710 |
| 183-CSS-21-60 | .484 | .328 | .438 | 6.000 | 5/16 | C91709 |
| 183-CSS-22-60 | .500 | .344 | .438 | 6.000 | 5/16 | C91711 |
| 183-CSS-24 | .563 | .375 | .500 | 6.500 | 3/8 | C91712 |
| 183-CSS-25 | .578 | .391 | .500 | 6.500 | 3/8 | C91713 |
| 183-CSS-26 | .594 | .406 | .500 | 6.500 | 3/8 | C91714 |
| 183-CSS-28 | .625 | .438 | .500 | 7.000 | 7/16 | C91715 |
| 183-CSS-29 | .641 | .453 | .500 | 7.000 | 7/16 | C91717 |
| 183-CSS-30 | .656 | .469 | .500 | 7.000 | 7/16 | C91719 |
| 183-CSS-30-60 | .688 | .469 | .500 | 7.000 | 7/16 | C91720 |
| 183-CSM-10 | .709 | .433 | .500 | 7.000 | 10mm | C91832 |
| 183-CSS-32 | .750 | .500 | .500 | 7.250 | 1/2 | C91721 |
| 183-CSS-33 | .766 | .516 | .500 | 7.250 | 1/2 | C91722 |
| 183-CSS-34 | .781 | .531 | .500 | 7.250 | 1/2 | C91723 |
| 183-CSM-12 | .787 | .531 | .500 | 7.000 | 12mm | C91833 |
| 183-CSS-36 | .813 | .563 | .750 | 7.500 | 9/16 | C91724 |
| 183-CSS-40 | .875 | .625 | .750 | 8.250 | 5/8 | C91726 |
| 183-CSS-42 | .906 | .656 | .750 | 8.250 | 5/8 | C91728 |
| 183-CSS-42-60 | .969 | .656 | .750 | 8.250 | 5/8 | C91729 |
| 183-CSM-16 | 1.024 | .689 | .750 | 8.250 | 16mm | C91834 |
| 183-CSS-50 | 1.031 | .781 | 1.000 | 8.813 | 3/4 | C91734 |
| 183-CSS-50-60 | 1.156 | .781 | 1.000 | 8.813 | 3/4 | C91735 |
| 183-CSS-52-60 | 1.188 | .813 | 1.000 | 8.813 | 3/4 | C91737 |
| 183-CSM-20 | 1.299 | .866 | 1.000 | 8.813 | 20mm | C91835 |
| 183-CSS-68-60 | 1.563 | 1.063 | 1.000 | 8.813 | 1 | C91749 |
| 183-CSM-24 | 1.575 | 1.024 | 1.000 | 8.813 | 24mm | C92836 |



| set number | no. of pieces | size range | order number |
|------------|---------------|--|--------------|
| 183-CSS-1 | 9 | CSS-6, -8, -10, -12, -16, -20, -24, -28, -32 | C91750 |
| 183-CSS-3 | 8 | CSS-18, -20-60, -21-60, -22-60, -22, -26, -30, -34 | C91770 |



Counterbore

High Speed Steel

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable

Sets

Cost Saving Sets

SETS

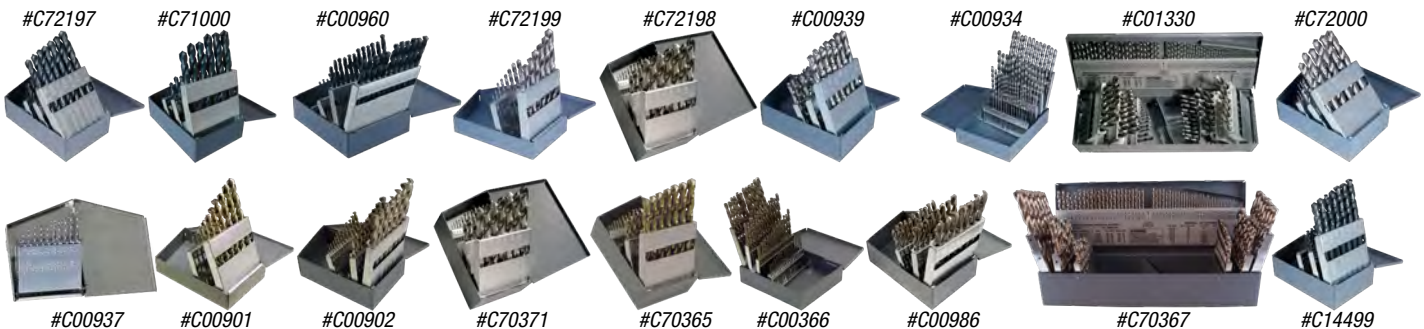
Screw Machine / Stub Length Drills

| Image | Type | Style | Order No. | Number of pieces | Surface Treatment | | | | Material | | Size Range | Case Type | | |
|-------|---------------------|-------|-----------|------------------|-------------------|-------------|-------------|-----|----------|--------|----------------------------|----------------------------|----------------------------|---|
| | | | | | Bright | Black Oxide | Straw Oxide | TIN | HSS | Cobalt | | Metal | Plastic | |
| | General Purpose | 2120 | C00980 | 29 | • | • | • | • | • | • | 1/16" through 1/2" x 1/64" | • | • | |
| | | | C01332 | 26 | • | • | • | • | • | • | • | letter A through Z | • | • |
| | NAS907-C Heavy Duty | 2330 | C70370 | 15 | • | • | • | • | • | • | 1/16" through 1/2" x 1/32" | • | • | |
| | | | C70369 | 21 | • | • | • | • | • | • | • | 1/16" through 3/8" x 1/64" | • | • |
| | | | C70368 | 29 | • | • | • | • | • | • | • | • | 1/16" through 1/2" x 1/64" | • |



Jobber Drills

| Image | Type | Style | Order No. | Number of pieces | Surface Treatment | | | | Material | | Size Range | Case Type | | | |
|--------|---------------------|-------|------------------------------|------------------|-------------------|-------------|-------------|-----|----------|--------|----------------------------|-----------------------------|--|---|---|
| | | | | | Bright | Black Oxide | Straw Oxide | TIN | HSS | Cobalt | | Metal | Plastic | | |
| | General Purpose | 2001G | C72197 | 29 | • | • | • | • | • | • | 1/16" through 1/2" x 1/64" | • | • | | |
| | | | C71000 | 25 | • | • | • | • | • | • | • | 1 mm through 13 mm x 0.5 mm | • | • | |
| | | | C00960 | 50 | • | • | • | • | • | • | • | • | 1 mm through 5.9 mm x 0.1 mm | • | • |
| | General Purpose | 2002G | C72199 | 15 | • | • | • | • | • | • | 1/16" through 1/2" x 1/32" | • | • | | |
| | | | C72198 | 29 | • | • | • | • | • | • | • | 1/16" through 1/2" x 1/64" | • | • | |
| | | | C00939 | 26 | • | • | • | • | • | • | • | • | letter A through Z | • | • |
| | | | C00934 | 60 | • | • | • | • | • | • | • | • | wire gauge #1 through #60 | • | • |
| | | | C01330 | 115 | • | • | • | • | • | • | • | • | 1/16" through 1/2" x 1/16", A through Z and #1 through #60 | • | • |
| | | | C72000 | 25 | • | • | • | • | • | • | • | • | 1 mm through 13 mm x 0.5 mm | • | • |
| | General Purpose | 2002 | C00937 | 20 | • | • | • | • | • | • | #61-#80 | • | • | | |
| | | | Q-Cobalt Wide Land Parabolic | 2075 | C00901 | 15 | • | • | • | • | • | • | 1/16" through 1/2" x 1/32" | • | • |
| C00902 | 29 | • | | | • | • | • | • | • | • | • | 1/16" through 1/2" x 1/64" | • | • | |
| | NAS907-B Heavy Duty | 2222 | C70371 | 20 | • | • | • | • | • | • | 1/16" through 1/2" x 1/64" | • | • | | |
| | NAS907-J Heavy Duty | 2213 | C70365 | 29 | • | • | • | • | • | • | 1/16" through 1/2" x 1/64" | • | • | | |
| | | | C00986 | 26 | • | • | • | • | • | • | • | A through Z letter | • | • | |
| | | | C70366 | 60 | • | • | • | • | • | • | • | #1 through #60 wire gauge | • | • | |
| | | | C70367 | 115 | • | • | • | • | • | • | • | • | 1/16" through 1/2" x 1/64", A through Z and #1 through #60 | • | • |
| | Q-AMD Short Flute | 3780 | C14499 | 29 | • | • | • | • | • | • | 1/16" through 1/2" x 1/64" | • | • | | |





Cost Saving Sets

SETS

Taper Length Drills

| Image | Type | Style | Order No. | Number of pieces | Surface Treatment | | | | | Material | | Size Range | Case Type | |
|-------|-----------------|-------|-----------|------------------|-------------------|-------------|-------------|-----|-----|----------|----------------------------|------------|-----------|--|
| | | | | | Bright | Black Oxide | Straw Oxide | TIN | HSS | Cobalt | Metal | Plastic | | |
| | General Purpose | 2510 | C00962 | 29 | • | • | • | • | • | • | 1/16" through 1/2" x 1/64" | • | • | |

Misc. Drills

| Image | Type | Style | Order No. | Number of pieces | Surface Treatment | | | | | Material | | Size Range | Case Type | |
|-------|------------------------------|-------|-----------|------------------|-------------------|-------------|-------------|-----|-----|--------------------------------|--------------------------------|--------------------------------|-----------|---|
| | | | | | Bright | Black Oxide | Straw Oxide | TIN | HSS | Cobalt | Metal | Plastic | | |
| | Spotting / Centering | 2636 | C26173 | 6 | • | • | • | • | • | • | 90° - 1/4" through 1" (short) | • | • | |
| | | | C26180 | 6 | • | • | • | • | • | • | 120° - 1/4" through 1" (short) | • | • | |
| | | 2646 | C26187 | 6 | • | • | • | • | • | • | • | 90° - 1/4" through 1" (long) | • | • |
| | | | C26194 | 6 | • | • | • | • | • | • | • | 120° - 1/4" through 1" (long) | • | • |
| | | 2635 | C24173 | 6 | • | • | • | • | • | • | • | 90° - 1/4" through 1" (short) | • | • |
| | | | C24180 | 6 | • | • | • | • | • | • | • | 120° - 1/4" through 1" (short) | • | • |
| 2645 | C24187 | 6 | • | • | • | • | • | • | • | 90° - 1/4" through 1" (long) | • | • | | |
| | C24194 | 6 | • | • | • | • | • | • | • | 120° - 1/4" through 1" (long) | • | • | | |
| | Countersink / Deburring | 3001 | C94588 | 4 | • | • | • | • | • | • | 60° - 5/16, 3/8, 1/2, 5/8 | • | • | |
| | | | C94589 | 4 | • | • | • | • | • | • | 82° - 5/16, 3/8, 1/2, 5/8 | • | • | |
| | | | C94590 | 4 | • | • | • | • | • | • | • | 90° - 5/16, 3/8, 1/2, 5/8 | • | • |
| | | | C94591 | 4 | • | • | • | • | • | • | • | 100° - 5/16, 3/8, 1/2, 5/8 | • | • |
| | | | C94592 | 5 | • | • | • | • | • | • | • | 60° - 5/16, 3/8, 1/2, 3/4, 1 | • | • |
| | | | C94593 | 5 | • | • | • | • | • | • | • | 82° - 5/16, 3/8, 1/2, 3/4, 1 | • | • |
| | | | C94594 | 5 | • | • | • | • | • | • | • | 90° - 5/16, 3/8, 1/2, 3/4, 1 | • | • |
| | | | C94595 | 5 | • | • | • | • | • | • | • | 100° - 5/16, 3/8, 1/2, 3/4, 1 | • | • |
| | Countersink / Drill Plain | 998 | C00944 | 5 | • | • | • | • | • | #1 through #5 | • | • | | |
| | Single Flute Countersink | 10001 | C00970 | 5 | • | • | • | • | • | • | 60° - 1/4" through 3/4" x 1/8" | • | • | |
| | | | C00971 | 5 | • | • | • | • | • | • | 82° - 1/4" through 3/4" x 1/8" | • | • | |
| | 3 Flute Countersink | 10003 | C00972 | 5 | • | • | • | • | • | • | 60° - 1/4" through 3/4" x 1/8" | • | • | |
| | | | C00973 | 5 | • | • | • | • | • | • | 82° - 1/4" through 3/4" x 1/8" | • | • | |
| | 4 Flute Reamer / Countersink | 610 | C00969 | 5 | • | • | • | • | • | 82° - 1/4" through 3/4" x 1/8" | • | • | | |

#C26173

#C24173

#C24180

#C24187

#C24194

#C00944



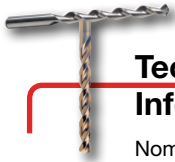
Reamers

| Image | Type | Style | Order No. | Number of pieces | Surface Treatment | | | | | Material | | Size Range | Case Type | |
|-------|--------------------------------|-------|-----------|------------------|-------------------|-------------|-------------|-----|-----|----------|----------------------------|------------|-----------|--|
| | | | | | Bright | Black Oxide | Straw Oxide | TIN | HSS | Cobalt | Metal | Plastic | | |
| | Straight Shank, Straight Flute | 4001 | C00964 | 29 | • | • | • | • | • | • | 1/16" through 1/2" x 1/64" | • | • | |

Counterbores

| Image | Type | Style | Order No. | Number of pieces | Surface Treatment | | | | | Material | | Size Range | Case Type | |
|-------|--------------------------|--------------------------------|-----------|------------------|-------------------|-------------|-------------|-----|-----|----------|---|------------|-----------|--|
| | | | | | Bright | Black Oxide | Straw Oxide | TIN | HSS | Cobalt | Metal | Plastic | | |
| | 3 Flute Continuous Pilot | 183 <i>(Set #183-CSS-1)</i> | C91750 | 9 | • | • | • | • | • | • | #C91750 #C91770 CSS-6, -8, -10, -12, -16, -20, -24, -28, -32 | • | • | |
| | | 183 <i>(Set #183-CSS-3)</i> | C91770 | 8 | • | • | • | • | • | • | CSS-18, -20-60, -21-60, -22-60, -22, -26, -30, -34 | • | • | |





Technical Information

| | | | |
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Drill Nomenclature

Axis

The imaginary straight line which forms the longitudinal center line of the drill.

Back Taper

A slight decrease in diameter, from front to back in the body of the drill.

Body

The portion of the drill extending from the shank or neck to the outer corners of the cutting lips.

Body Diameter Clearance

That portion of the land that has been cut away so it will not rub against the walls of the hole.

Chisel Edge

The edge at the end of the web that connects the cutting lips.

Drill Diameter

The diameter over the margins of the drill measured at the point.

Flutes

Helical or straight grooves cut or formed in the body of the drill to provide cutting lips, to permit removal of chips, and to allow cutting fluid to reach the cutting lips.

Flute Length

The length from the outer corners of the cutting lips to the extreme back end of the flutes. However, metric drills are measured from the extreme end of the shank to the end of the flute at the point.

Land

The peripheral portion of the body between adjacent flutes.

Land Width

The distance between the leading edge and the heel of the land measured at a right angle to the leading edge.

Lip Relief

The axial relief on the drill point.

Margin

The cylindrical portion of the land which is not cut away to provide clearance.

Neck

The section of reduced diameter between the body and the shank of a drill.

Overall Length

The length from the extreme end of the shank to the outer corners of the cutting lips. However, metric drills are measured from the extreme end of the shank to the end of the flute at the point.

Point

The cutting end of a drill, made up of the ends of the lands and the web. In form it resembles a cone, but departs from a true cone to furnish clearance behind the cutting lips.

Point Angle

The angle included between the cutting lips projected upon a plane parallel to the drill axis and parallel to the two cutting lips.

Shank

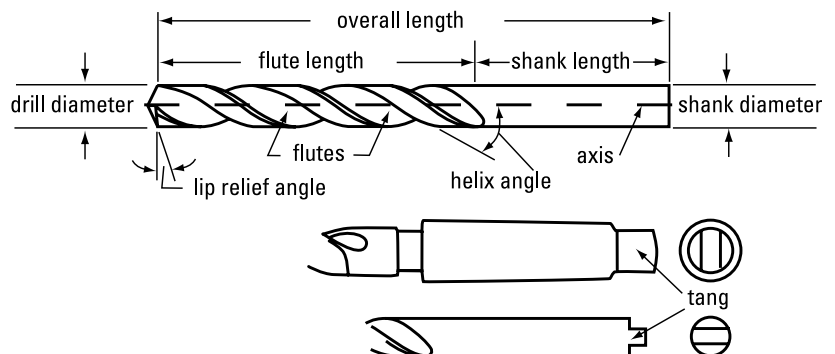
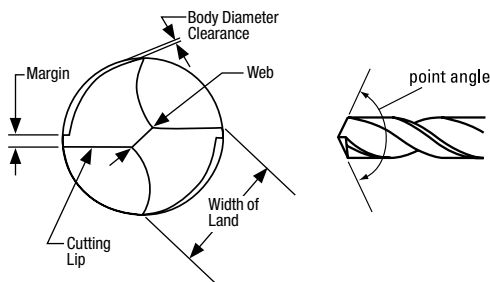
The part of the drill by which it is held and driven.

Tang

The flattened end of a taper shank, intended to fit into a driving slot in a socket.

Web

The central portion of the body that joins the lands. The extreme end of the web forms the chisel edge on a two flute drill.





Recommended Surface Feet per Minute (SFM) and Coolant by Material Application

Ferrous Materials

| Materials | Brinell Hardness | geometry | SFM | coolant |
|--|------------------|-----------------|---------|-------------|
| Low Carbon Steel | 85-125 | general-purpose | 80-95 | soluble oil |
| Medium Carbon Steel | 125-175 | general-purpose | 70-85 | soluble oil |
| High Carbon Steel | 175-225 | heavy-duty | 45-65 | soluble oil |
| Steels Alloyed | under 200 | general-purpose | 60-90 | soluble oil |
| | 200-300 | heavy-duty | 40-70 | soluble oil |
| | over 300 | cobalt | 20-30 | soluble oil |
| Steel Drop Forgings Heat Treated | 330-370 | | 30-40 | cutting oil |
| | 370-420 | | 20-30 | cutting oil |
| | over 420 | | 10-20 | cutting oil |
| Grey Cast Iron Soft | 125 | general-purpose | 140-150 | dry |
| Grey Cast Iron Medium | 120-200 | heavy-duty | 50-80 | soluble oil |
| Grey Cast Iron Hard | up to 350 | heavy-duty | 25-40 | soluble oil |
| Titanium Alloys (Ti)-75A | 300-440 | cobalt | 50-60 | cutting oil |
| Ti-150A, RS-120 | 300-440 | cobalt | 40-50 | cutting oil |
| Ti-140A, RC 130B | 300-440 | cobalt | 30-40 | cutting oil |
| Ti-6AL -4V | 300-440 | cobalt | 20-30 | cutting oil |
| 300 Series Stainless | 120-200 | cobalt | 20-40 | cutting oil |
| 400 Series Stainless | 200-300 | cobalt | 40-70 | cutting oil |
| Martensitic 416, 420, F416 Plus K, 400F,4165SE, 440F | 135-185 | cobalt | 40-50 | cutting oil |
| Precipitation Hardening | 325-375 | cobalt | 30 | cutting oil |
| Stainless Steel, Cast | 400-450 | cobalt | 20 | cutting oil |
| Heat Resisting Steels | 175-225 | cobalt | 10-25 | cutting oil |
| Nimonic Alloys | 200-300 | cobalt | 10-20 | cutting oil |
| Manganese 12-14% min | 125-220 | heavy-duty | 10-12 | cutting oil |
| Spring Steels | 402 | cobalt | 15-30 | soluble oil |
| Armor Plate | 200-250 | cobalt | 40 | soluble oil |
| | 250-300 | cobalt | 35 | soluble oil |
| | 300-350 | cobalt | 30 | cutting oil |

Non-Ferrous Materials

| Materials | Brinell Hardness | geometry | SFM | coolant |
|------------------------------------|------------------|------------------|---------|------------------------|
| Aluminum Pure | 140-350 | fast spiral* | 130-200 | soluble oil |
| Aluminum Alloys | 140-330 | fast spiral* | 150-300 | soluble oil |
| Aluminum Leaded | 40-100 | fast spiral* | 200-325 | soluble oil |
| Aluminum Silicon Alloy Die Cast | 40-100 | fast spiral* | 25-50 | soluble oil |
| Brass | 190-210 | slow spiral* | 200-250 | cutting or soluble oil |
| Bronze | 150-200 | slow spiral* | 200-250 | soluble oil |
| Copper - Nickel & Copper Tin Alloy | 65-100 | general-purpose* | 140-200 | cutting or soluble oil |
| Copper - Aluminum Alloys | 30-100 | general-purpose* | 120-200 | cutting or soluble oil |
| Magnesium Alloys - Wrought | 50-90 | general-purpose* | 140-330 | cutting or soluble oil |
| Magnesium Alloys - Cast | 50-90 | general-purpose* | 140-365 | cutting or soluble oil |
| Nickel Alloys - Wrought and Cast | 80-170 | cobalt | 15-20 | cutting or soluble oil |
| Nickel Alloys - Monel | 115-240 | cobalt | 15-20 | cutting or soluble oil |
| Nickel Alloys - Beryllium Nickel | 200-250 | cobalt | 10-12 | cutting or soluble oil |
| Zinc Alloy | 112-126 | general-purpose | 200-250 | soluble oil |

*bright only

Determining Feed and Speed

This Cleveland catalog offers starting feed and speed parameters for each style of tool. The recommended operating parameters are found in front of each tool style for high-performance tools and in the beginning of the general application section for those tools. Drill cutting speed tables for individual sizes of drills can be found in this section, titled "Drill Cutting Speeds".

To determine your own starting speeds and feeds, follow this procedure.

Look up the material to be drilled in the Recommended SFM (surface feet per minute) by material class table in this section, titled "Material Class" and determine the geometry class.

Determine the drill style from the Drill Style by Geometry and Length/Construction table on page 3 based on recommended drill type and drill length desired.

Review each drill style to understand the geometry differences. Select the appropriate geometry and check to ensure the desired size is available.

Starting speed and feed recommendations for the drill can be determined from the formulas below.

Recommended operating parameters for high-performance drills are generally 20% faster than for conventional geometries and are shown with the individual drill styles. Feed rates for high performance drills are heavier than for conventional geometries by 50% or more.

Drill Diameter Tolerances

| Diameter Range (inches) | Plus (+) (inches) | Minus (-) (inches) |
|-------------------------|-------------------|--------------------|
| through 1/8 | .0000 | .0005 |
| over 1/8 through 1/4 | .0000 | .0007 |
| over 1/4 through 1/2 | .0000 | .0010 |
| over 1/2 through 1 | .0000 | .0012 |
| over 1 through 2 | .0000 | .0015 |
| over 2 through 3-1/2 | .0000 | .0020 |

Drill Overall Length and Flute Length Tolerances

| Diameter Range (inches) | Plus (+) (inches) | Minus (-) (inches) |
|-------------------------|-------------------|--------------------|
| #80 through 1/8 | .1250 | .0625 |
| over 1/8 through 1/2 | .1250 | .1250 |
| over 1/2 through 1 | .2500 | .1250 |
| over 1 through 2 | .2500 | .2500 |
| over 2 through 3-1/2 | .3750 | .3750 |

Drill Point Angle Tolerances

| Diameter Range (inches) | Included Angle (degrees) | Tolerance (degrees) |
|--------------------------|--------------------------|---------------------|
| 1/16 through 1/2 | 118° or 135° | ± 5° |
| over 1/2 through 1-1/2 | 118° | ± 3° |
| over 1-1/2 through 3-1/2 | 118° | ± 2° |

Drill Lip Height Tolerances

| Diameter Range (inches) | Total Indicator Variation (inches) |
|-------------------------|------------------------------------|
| 1/16 through 1/8 | .0020 |
| over 1/8 through 1/4 | .0030 |
| over 1/4 through 1/2 | .0040 |
| over 1/2 through 1 | .0050 |
| over 1 through 3-1/2 | .0060 |

Drill Definitions

RPM = revolutions per minute
 SFM = surface feet per minute
 FR = feed rate in inches per minute
 IPR = inches per revolution

Drill Formula

RPM = 3.8 x SFM/drill diameter
 SFM = 0.26 x RPM x drill diameter
 FR = RPM x IPR

Drill Feeds

| Diameter Range (inches) | IPR (inches per revolution) | |
|-------------------------|-----------------------------|-------------|
| | Normal Feeds | Heavy Feed |
| 1/16 through 1/8 | .001 - .002 | .002 - .004 |
| over 1/8 through 1/4 | .002 - .004 | .004 - .008 |
| over 1/4 through 1/2 | .004 - .008 | .008 - .016 |
| over 1/2 through 1 | .008 - .016 | .016 - .024 |
| over 1 | .016 - .024 | .024 - .032 |

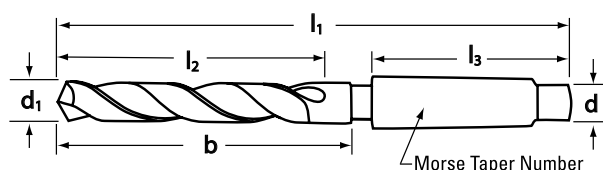
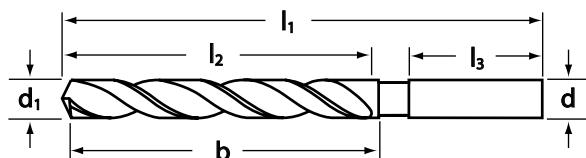


| Surface Treatment | Recommended Applications | Precautions |
|---|--|--|
| TiN (Titanium Nitride) | For ferrous and non-metallic materials: free-machining steels and irons, high tensile steels, tough machining steels, plastics, hard rubber, and fiber. The hard, smooth treatment increases tool life, improves finish, and allows higher speeds. | Avoid titanium and titanium alloys due to tendency to gall. |
| TiCN (Titanium Carbonitride) | For ferrous and non-ferrous materials: cast iron, aluminum, stainless steel, brass, abrasive materials, high-silicon automotive aluminum, glass-filled plastics, and composites. The hard, smooth treatment increases tool life and improves finish. | Use with caution in titanium, titanium alloys, and aluminum die casting due to tendency to gall. |
| TiAlN (Titanium Aluminum Nitride) | For ferrous materials, high-temperature alloys, and titanium: stainless steels, gray cast irons or nodular irons, and steels containing high-nickel, cobalt, chromium, and tungsten. Most effective where higher speeds are available. | Avoid in most non-ferrous materials. |
| CrN (Chromium Nitride) | For non-ferrous materials: brass, bronze, zinc alloys, and magnesium alloys. CrN is medium-hard and has a lower wear resistance than TiN, TiCN, and TiAlN. However, unlike these treatments, CrN does not gall in non-ferrous materials. | Ineffective in ferrous materials. |

TECHNICAL

High Speed Steel

Special Drills



If you know the specs for your special tool, please send a blueprint and/or provide this information:

- Material/hardness to be drilled.
- d = shank diameter or size.**
 - If standard taper shank is ordered, specify as No. 2 American National Standard Taper, No. 3 American National Standard Taper, etc.
 - If taper shank is special, give diameter at small end, length of shank, diameter at large end, taper per foot, and furnish a sample of gauge if possible.
 - If tang is special, give thickness and length.

b = body length.

d¹ = diameter of fluted section. For multiple diameter drills, indicate the diameter of the large fluted section

l¹ = overall length.

- When ordering extra-length drills, specify: type of material being drilled, depth of hole, whether drilling in a vertical or horizontal position, and whether feed is intermittent or with only occasional withdrawals.

l² = flute length.

l³ = shank length.

For multiple-diameter drills, provide:

- the diameter of the small, fluted section
- the included angle of cutting shoulder. Note: this is measured as an angle between the two cutting edges (included angle) and not as an angle with the center line.
- the length of small diameter. Note: this is measured from the outer corner of the point to the bottom or inner corner of the cutting shoulder.

For special accuracy requirements, give tolerances on the important dimensions.

For assistance in designing your special tool, provide

- Workpiece material hardness
- Hole diameter
- Depth of hole
- Thru hole or blind hole
- Shank type
- Coolant or non-coolant
- Step length if necessary
- Step angle

Make sure that suitable allowance has been made for re-sharpening and for clearance for the spindle above the drill bushings. If a particular style of flute-construction is desired, it should be specified by reference to the regular drill of the required flute-style.

Speed & Feeds

TECHNICAL

Carbide

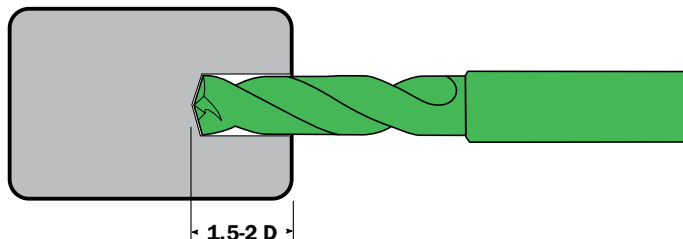
| | | | Average Cutting Speed Vc (SFM) | | | | | |
|-----|---|--|-----------------------------------|----------|-----|----------|------|----------|
| | | | 5xD | | 8xD | | 12xD | |
| ISO | Material Group | Tensile Strength (N/mm ²) Rockwell Hardness (HRc) | Vc | Feed Ltr | Vc | Feed Ltr | Vc | Feed Ltr |
| P | Structural Steel | ≤ 25 HRC (≤ 850 N/mm ²) | 459 | E | 344 | E | 312 | D |
| | Heat Treatable, Case Hardening, Free Cutting Steels | ≤ 42 HRC (≤ 1300 N/mm ²) | 443 | E | 312 | E | 295 | E |
| M | Stainless Steels | ≤ 23 HRC (500 - 800 N/mm ²) | 180 | B | 148 | B | 131 | B |
| | Heat Resisting Steels | ≤ 23 HRC | 180 | C | 148 | C | 131 | C |
| K | Cast Material | ≤ 22 HRC | 541 | F | 476 | F | 361 | F |
| | Cast Material | ≤ 30 HRC | 476 | F | 361 | F | 312 | F |
| S | Titanium Materials | ≤ 23 HRC (800 N/mm ²) | 148 | C | 131 | C | 98 | C |
| | Titanium Alloys | ≤ 38 HRC (1200 N/mm ²) | 131 | C | 115 | C | 82 | C |
| H | Hardened Steels | ≤ 60 HRC | 115 | A | 115 | A | 82 | A |

| Nominal Diameter mm - Inch per rev | | | | | | |
|------------------------------------|-------------------|------------------|--------------------|-------------------|-------------------|-------------------|
| Feed Ltr | 2.5mm (0.098") | 4mm (0.1575") | 6.3mm (0.2362") | 10mm (0.3932") | 16mm (0.6300") | 25mm (0.9842") |
| A | 0.001 | 0.002 | 0.002 | 0.004 | 0.005 | 0.008 |
| B | 0.002 | 0.002 | 0.003 | 0.005 | 0.006 | 0.010 |
| C | 0.002 | 0.003 | 0.004 | 0.006 | 0.008 | 0.012 |
| D | 0.002 | 0.004 | 0.005 | 0.008 | 0.010 | 0.016 |
| E | 0.003 | 0.005 | 0.006 | 0.010 | 0.012 | 0.020 |
| F | 0.004 | 0.006 | 0.008 | 0.012 | 0.016 | 0.025 |

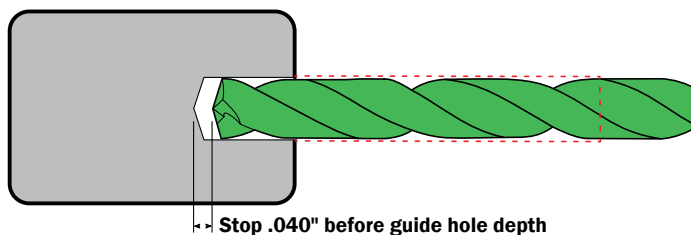


Drilling method for Cleveland® 12x diameter common shank drill

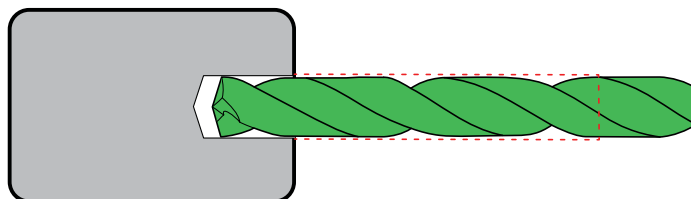
1. Create guide hole using Cleveland® carbide common shank 3x diameter drill.



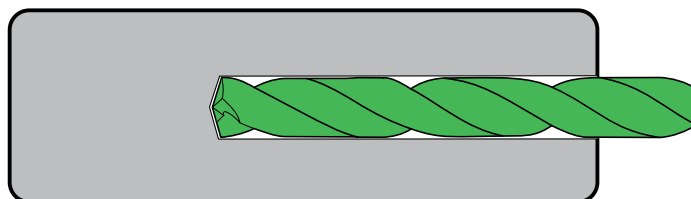
2. Insert the 12x diameter drill at low RPM and feed (500 RPM / 40-80 IPM).



3. Increase rotation to full speed and begin normal drilling cycle.



4. After drilling is complete, reduce RPM and feed during retract (500 RPM / 40-80 IPM).



Important Note:



If the hole to be drilled is on a curved surface, or otherwise not perpendicular to the drilling axis, a flat must be cut for accurate drilling.

Coolant Options:

Through spindle coolant or minimum quantity lube (MQL) through spindle coolant.

Material Class

Technical Information

TECHNICAL

| Ferrous Material | | Speeds (SFM) Drill Surface Treatment | | | | Feed Rate (IPR) increase by 25% for TiCN | | | | |
|-----------------------------------|--------------------------|---|------|-------|--------|---|--------|---------|-------|-------|
| Material | Hardness | Bright, Black Oxide & Straw | | | | 1/8" | 1/4" | 3/8" | 1/2" | |
| | | TiN | TiCN | TiAlN | 3.17mm | 6.35mm | 9.52mm | 12.70mm | | |
| low carbon steel | 85-125 Bhn | 90 | 125 | 135 | - | .0040 | .0065 | .0080 | .0100 | |
| medium carbon steel | 125-175 Bhn | 90 | 125 | 135 | - | .0040 | .0065 | .0080 | .0100 | |
| high carbon steel | 175-225 Bhn | 90 | 125 | 135 | - | .0030 | .0050 | .0065 | .0080 | |
| alloyed steel | 200-300 Bhn | 60 | 80 | 90 | - | .0025 | .0040 | .0050 | .0065 | |
| heat-treatable steel and forgings | 370-420 Bhn | 40 | 50 | 60 | 70 | .0025 | .0040 | .0050 | .0065 | |
| tool steels | < 24 HRC | 60 | 80 | 90 | 110 | .0030 | .0050 | .0065 | .0080 | |
| | > 24-30 HRC | 30 | 40 | 45 | 55 | .0025 | .0040 | .0050 | .0065 | |
| high-speed steels | 14-30 HRC | 35 | 50 | 55 | 60 | .0025 | .0040 | .0050 | .0065 | |
| gray cast iron | 240 Bhn | 115 | 160 | 175 | - | .0050 | .0080 | .0100 | .0125 | |
| | <300 Bhn | 90 | 125 | 135 | - | .0050 | .0080 | .0100 | .0125 | |
| malleable cast iron | <300 Bhn | 70 | 95 | 105 | - | .0050 | .0080 | .0100 | .0125 | |
| chilled cast iron | <350 Bhn | 25 | 35 | 40 | - | .0025 | .0040 | .0050 | .0065 | |
| stainless steel | 300 series (Austenitic) | 120-200 Bhn | 60 | 80 | 90 | 100 | .0025 | .0040 | .0050 | .0065 |
| | 400 series (Martensitic) | 200-300 Bhn | 40 | 50 | 60 | 80 | .0025 | .0040 | .0050 | .0065 |
| sulphurized | > 25 HRC | 45 | 65 | 70 | 80 | .0025 | .0040 | .0050 | .0065 | |
| spring steel | 400 Bhn | 25 | 35 | 40 | 45 | .0020 | .0030 | .0040 | .0050 | |

| Non-Ferrous Material | | Bright, Black Oxide & Straw | | | | 1/8" | 1/4" | 3/8" | 1/2" | |
|------------------------|-------------|------------------------------|------------|-------|--------|--------|--------|---------|-------|-------|
| Material | Hardness | TiN | TiCN | TiAlN | 3.17mm | 6.35mm | 9.52mm | 12.70mm | | |
| | | aluminum and aluminum alloys | 40-100 Bhn | 180 | - | - | - | .0050 | .0080 | .0100 |
| cast aluminum | < 10% Si | 200 Bhn | 200 | 275 | - | - | .0050 | .0080 | .0100 | .0125 |
| | > 10% Si | 200 Bhn | 180 | 225 | - | 250 | .0040 | .0065 | .0080 | .0100 |
| brass, long chipping | 190-210 Bhn | 150 | - | - | - | .0040 | .0065 | .0080 | .0100 | |
| bronze, long chipping | 150-200 Bhn | 90 | 115 | - | 130 | .0030 | .0050 | .0065 | .0080 | |
| copper, low alloy | 65-100 Bhn | 120 | 145 | - | - | .0040 | .0065 | .0080 | .0100 | |
| plastics, duraplastics | N/A | 55 | 75 | 80 | - | .0030 | .0050 | .0065 | .0080 | |

The speeds and feeds listed here are conservative recommendations for initial setup. In actual use, depending on the machine environment and workpiece material, significantly higher speeds and feeds may be achievable.

Use these speeds and feeds as a starting point. Cutting conditions can be gradually adjusted until the optimum settings for the application are found. Questions? Contact Technical Support at 800.892.4281.



Q-Cobalt Advantages

- Deliver close hole tolerance for high-precision work.
- Use higher speeds and feeds for increased productivity.
- Ideal for deep-hole drilling in a wide range of materials.



Technical Information

Operating Parameters

TECHNICAL

| Material | Hardness | Speeds (SFM) | | Feed Rate (IPR) for drill diameter | | | | | |
|--------------------------------|-------------|--------------|------|------------------------------------|--------|--------|--------|--------|---------|
| | | Bright | | .0625" | .1250" | .2500" | .5000" | .7500" | 1.0000" |
| low carbon steel, annealed | 85-125 Bhn | 85-150 | low | .0005 | .0010 | .0020 | .0040 | .0050 | .0060 |
| | | | high | .0015 | .0030 | .0050 | .0090 | .0100 | .0120 |
| medium carbon steel | 275-425 Bhn | 65-120 | low | .0005 | .0010 | .0020 | .0030 | .0040 | .0040 |
| | | | high | .0010 | .0020 | .0040 | .0080 | .0900 | .0100 |
| hardened steel | 48-52 Rc C | 30-90 | low | .0005 | .0010 | .0020 | .0030 | .0040 | .0040 |
| | | | high | .0010 | .0030 | .0030 | .0050 | .0060 | .0070 |
| stainless steel (soft) | 135-275 Bhn | 50-150 | low | .0005 | .0005 | .0020 | .0040 | .0050 | .0060 |
| | | | high | .0010 | .0030 | .0060 | .0060 | .0080 | .0100 |
| stainless steel (hard) | 275-425 Bhn | 30-90 | low | .0005 | .0005 | .0010 | .0015 | .0020 | .0025 |
| | | | high | .0010 | .0020 | .0030 | .0040 | .0060 | .0070 |
| cast iron (soft) | 120-220 Bhn | 100-300 | low | .0010 | .0020 | .0040 | .0050 | .0070 | .0090 |
| | | | high | .0020 | .0040 | .0080 | .0100 | .0120 | .0140 |
| cast iron (hard) | 220-320 Bhn | 60-200 | low | .0015 | .0010 | .0020 | .0030 | .0040 | .0050 |
| | | | high | .0020 | .0030 | .0040 | .0070 | .0080 | .0100 |
| ductile iron | | 70-250 | low | .0010 | .0020 | .0030 | .0050 | .0060 | .0070 |
| | | | high | .0020 | .0040 | .0060 | .0080 | .0090 | .0150 |
| malleable iron | | 80-250 | low | .0010 | .0020 | .0030 | .0050 | .0060 | .0070 |
| | | | high | .0020 | .0050 | .0060 | .0120 | .0140 | .0150 |
| high-temp alloys, nickel-based | | 15-20 | low | .0005 | .0005 | .0010 | .0015 | .0020 | .0025 |
| | | | high | .0010 | .0030 | .0040 | .0050 | .0600 | .0070 |
| monel, high nickel steels | | 15-20 | low | .0005 | .0005 | .0010 | .0015 | .0020 | .0025 |
| | | | high | .0010 | .0020 | .0030 | .0040 | .0050 | .0060 |
| titanium (soft) | | 60-200 | low | .0005 | .0020 | .0040 | .0050 | .0060 | .0070 |
| | | | high | .0010 | .0030 | .0060 | .0060 | .0080 | .0100 |
| titanium (hard) | | 45-200 | low | .0005 | .0010 | .0020 | .0040 | .0040 | .0050 |
| | | | high | .0020 | .0040 | .0070 | .0090 | .0100 | .0120 |
| refractory alloys | | 50-200 | low | .0005 | .0005 | .0020 | .0040 | .0050 | .0050 |
| | | | high | .0010 | .0030 | .0060 | .0100 | .0120 | .0120 |
| aluminum, aluminum alloys | | 150-400 | low | .0010 | .0020 | .0030 | .0050 | - | - |
| | | | high | .0020 | .0040 | .0070 | .0130 | - | - |
| brass, bronze | | 100-300 | low | .0005 | .0010 | .0020 | .0040 | - | - |
| | | | high | .0015 | .0030 | .0040 | .0100 | - | - |
| copper, copper alloys | | 150-400 | low | .0010 | .0030 | .0050 | .0060 | - | - |
| | | | high | .0030 | .0050 | .0120 | .0140 | - | - |
| magnesium, magnesium alloys | | 200-650 | low | .0015 | .0030 | .0050 | .0080 | - | - |
| | | | high | .0030 | .0070 | .0120 | .0150 | - | - |
| plastics, glass filled | | 150-300 | low | .0010 | .0020 | .0030 | .0050 | - | - |
| | | | high | .0020 | .0040 | .0060 | .0120 | - | - |
| plastics | | 250-600 | low | .0015 | .0030 | .0040 | .0060 | - | - |
| | | | high | .0030 | .0050 | .0120 | .0160 | - | - |

Higher feed and speed values should be favored for softer materials; lower feed and speed values should be used for harder materials. The above recommendations are for hole depths up to 2 drill diameters.

When hole depths run 3 to 6 times diameters, speeds should be reduced 10% to 35% respectively, and feeds should be reduced 10% to 20% respectively.

Drill Cutting Speeds

Technical Information

TECHNICAL

High Speed Steel

Fractional

| Drill Size Frac / Dec | Feet per Minute | | | | | | | | | | | | | | |
|--------------------------|-----------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 10' | 20' | 30' | 40' | 50' | 60' | 70' | 80' | 90' | 100' | 110' | 120' | 130' | 140' | 150' |
| 1/16 .0625 | 611 | 1222 | 1833 | 2445 | 3056 | 3667 | 4278 | 4889 | 5500 | 6111 | 6722 | 7334 | 7945 | 8556 | 9167 |
| 1/8 .1250 | 306 | 611 | 917 | 1222 | 1528 | 1833 | 2139 | 2445 | 2750 | 3056 | 3361 | 3667 | 3973 | 4278 | 4584 |
| 3/16 .1875 | 204 | 407 | 611 | 815 | 1019 | 1222 | 1426 | 1630 | 1833 | 2037 | 2241 | 2445 | 2648 | 2852 | 3056 |
| 1/4 .2500 | 153 | 306 | 458 | 611 | 764 | 917 | 1070 | 1222 | 1375 | 1528 | 1681 | 1833 | 1986 | 2139 | 2292 |
| 5/16 .3125 | 122 | 244 | 367 | 489 | 611 | 733 | 856 | 978 | 1100 | 1222 | 1345 | 1467 | 1589 | 1711 | 1833 |
| 3/8 .3750 | 102 | 204 | 306 | 407 | 509 | 611 | 713 | 815 | 917 | 1019 | 1120 | 1222 | 1324 | 1426 | 1528 |
| 7/16 .4375 | 87 | 175 | 262 | 349 | 437 | 524 | 611 | 698 | 786 | 873 | 960 | 1048 | 1135 | 1222 | 1310 |
| 1/2 .5000 | 76 | 153 | 229 | 306 | 382 | 458 | 535 | 611 | 688 | 764 | 840 | 917 | 993 | 1070 | 1146 |
| 5/8 .6250 | 61 | 122 | 183 | 244 | 306 | 367 | 428 | 489 | 550 | 611 | 672 | 733 | 794 | 856 | 917 |
| 3/4 .7500 | 51 | 102 | 153 | 203 | 255 | 306 | 357 | 407 | 458 | 509 | 560 | 611 | 662 | 713 | 764 |
| 7/8 .8750 | 44 | 87 | 131 | 175 | 218 | 262 | 306 | 349 | 393 | 436 | 480 | 524 | 568 | 611 | 655 |
| 1 1.0000 | 38 | 76 | 115 | 153 | 191 | 229 | 267 | 306 | 344 | 382 | 420 | 458 | 497 | 535 | 573 |
| 1-1/8 1.1250 | 34 | 68 | 102 | 136 | 170 | 204 | 238 | 272 | 306 | 340 | 373 | 407 | 441 | 475 | 509 |
| 1-1/4 1.2500 | 31 | 61 | 92 | 122 | 153 | 183 | 214 | 244 | 275 | 306 | 336 | 367 | 397 | 428 | 458 |
| 1-3/8 1.3750 | 28 | 56 | 83 | 111 | 139 | 167 | 194 | 222 | 250 | 278 | 306 | 333 | 361 | 389 | 417 |
| 1-1/2 1.5000 | 26 | 51 | 76 | 102 | 127 | 153 | 178 | 204 | 229 | 255 | 280 | 306 | 331 | 357 | 382 |
| 1-5/8 1.6250 | 24 | 47 | 70 | 94 | 117 | 141 | 165 | 188 | 212 | 235 | 259 | 282 | 306 | 329 | 353 |
| 1-3/4 1.7500 | 22 | 44 | 65 | 87 | 109 | 131 | 153 | 175 | 196 | 218 | 240 | 262 | 284 | 306 | 327 |
| 1-7/8 1.8750 | 20 | 41 | 61 | 81 | 102 | 122 | 143 | 163 | 183 | 204 | 224 | 244 | 265 | 285 | 306 |
| 2 2.0000 | 19 | 38 | 57 | 76 | 95 | 115 | 134 | 153 | 172 | 191 | 210 | 229 | 248 | 267 | 287 |
| 2-1/4 2.2500 | 17 | 34 | 51 | 68 | 85 | 102 | 119 | 136 | 153 | 170 | 187 | 204 | 221 | 238 | 255 |
| 2-1/2 2.5000 | 15 | 31 | 46 | 61 | 76 | 92 | 107 | 122 | 137 | 153 | 168 | 183 | 199 | 214 | 229 |
| 2-3/4 2.7500 | 14 | 28 | 42 | 56 | 69 | 83 | 97 | 111 | 125 | 139 | 153 | 167 | 181 | 194 | 208 |
| 3 3.0000 | 13 | 25 | 38 | 51 | 64 | 76 | 89 | 102 | 115 | 127 | 140 | 153 | 166 | 178 | 191 |

Letter

| Drill Size Letter / Dec | Feet per Minute | | | | | | | | | | | | | | |
|----------------------------|-----------------|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|
| | 10' | 20' | 30' | 40' | 50' | 60' | 70' | 80' | 90' | 100' | 110' | 120' | 130' | 140' | 150' |
| A .2340 | 163 | 326 | 491 | 654 | 818 | 982 | 1145 | 1309 | 1472 | 1636 | 1796 | 1959 | 2122 | 2285 | 2448 |
| B .2380 | 161 | 321 | 482 | 642 | 803 | 963 | 1124 | 1284 | 1445 | 1605 | 1765 | 1926 | 2086 | 2247 | 2407 |
| C .2420 | 158 | 316 | 473 | 631 | 789 | 947 | 1105 | 1262 | 1420 | 1578 | 1736 | 1894 | 2052 | 2210 | 2368 |
| D .2460 | 155 | 311 | 467 | 622 | 778 | 934 | 1089 | 1245 | 1400 | 1556 | 1708 | 1863 | 2018 | 2174 | 2329 |
| E .2500 | 153 | 306 | 458 | 611 | 764 | 917 | 1070 | 1222 | 1375 | 1528 | 1681 | 1834 | 1986 | 2139 | 2292 |
| F .2570 | 149 | 297 | 446 | 594 | 743 | 892 | 1040 | 1189 | 1337 | 1486 | 1635 | 1784 | 1932 | 2081 | 2229 |
| G .2610 | 146 | 293 | 440 | 585 | 732 | 878 | 1024 | 1170 | 1317 | 1463 | 1610 | 1756 | 1903 | 2049 | 2195 |
| H .2660 | 144 | 287 | 430 | 574 | 718 | 862 | 1005 | 1149 | 1292 | 1436 | 1580 | 1723 | 1867 | 2010 | 2154 |
| I .2720 | 140 | 281 | 421 | 562 | 702 | 842 | 983 | 1123 | 1264 | 1404 | 1545 | 1685 | 1826 | 1966 | 2106 |
| J .2770 | 138 | 276 | 414 | 552 | 690 | 827 | 965 | 1103 | 1241 | 1379 | 1517 | 1655 | 1793 | 1930 | 2068 |
| K .2810 | 136 | 272 | 408 | 544 | 680 | 815 | 951 | 1087 | 1223 | 1359 | 1495 | 1631 | 1767 | 1903 | 2039 |
| L .2900 | 132 | 263 | 395 | 527 | 659 | 790 | 922 | 1054 | 1185 | 1317 | 1449 | 1581 | 1712 | 1844 | 1976 |
| M .2950 | 129 | 259 | 389 | 518 | 648 | 777 | 907 | 1036 | 1166 | 1295 | 1424 | 1554 | 1683 | 1813 | 1942 |
| N .3020 | 126 | 253 | 380 | 506 | 633 | 759 | 886 | 1012 | 1139 | 1265 | 1391 | 1518 | 1644 | 1771 | 1897 |
| O .3160 | 121 | 242 | 363 | 484 | 605 | 725 | 846 | 967 | 1088 | 1209 | 1330 | 1450 | 1571 | 1692 | 1813 |
| P .3230 | 118 | 237 | 355 | 473 | 592 | 710 | 828 | 946 | 1065 | 1183 | 1301 | 1419 | 1537 | 1657 | 1774 |
| Q .3320 | 115 | 230 | 345 | 460 | 575 | 690 | 805 | 920 | 1035 | 1150 | 1266 | 1384 | 1496 | 1611 | 1726 |
| R .3390 | 113 | 225 | 338 | 451 | 564 | 676 | 789 | 902 | 1014 | 1127 | 1239 | 1355 | 1465 | 1577 | 1690 |
| S .3480 | 110 | 220 | 329 | 439 | 549 | 659 | 769 | 878 | 988 | 1098 | 1207 | 1317 | 1427 | 1537 | 1646 |
| T .3580 | 107 | 213 | 320 | 426 | 533 | 640 | 746 | 853 | 959 | 1066 | 1173 | 1280 | 1387 | 1494 | 1600 |
| U .3680 | 104 | 208 | 311 | 415 | 519 | 623 | 727 | 830 | 934 | 1038 | 1142 | 1246 | 1349 | 1453 | 1557 |
| V .3770 | 101 | 203 | 304 | 405 | 507 | 608 | 709 | 810 | 912 | 1013 | 1114 | 1219 | 1317 | 1418 | 1520 |
| W .3860 | 99 | 198 | 297 | 396 | 495 | 594 | 693 | 792 | 891 | 989 | 1088 | 1188 | 1286 | 1385 | 1484 |
| X .3970 | 96 | 192 | 289 | 385 | 481 | 576 | 672 | 769 | 865 | 962 | 1058 | 1155 | 1251 | 1347 | 1443 |
| Y .4040 | 95 | 189 | 284 | 378 | 473 | 567 | 662 | 756 | 851 | 945 | 1040 | 1135 | 1229 | 1324 | 1418 |
| Z .4130 | 92 | 185 | 277 | 370 | 462 | 555 | 647 | 740 | 832 | 925 | 1017 | 1110 | 1202 | 1295 | 1387 |



Technical Information

Drill Cutting Speeds

TECHNICAL
High Speed Steel

| Diameter Range (inches) | Normal Feeds (IPR) | Heavy Feed (IPR) |
|-------------------------|--------------------|------------------|
| from 1/16 thru 1/8 | .001-.002 | .002-.004 |
| over 1/8 thru 1/4 | .002-.004 | .004-.008 |
| over 1/4 thru 1/2 | .004-.008 | .008-.016 |
| over 1/2 thru 1 | .008-.016 | .016-.024 |
| over 1 | .016-.024 | .024-.032 |

Wire Gage

| Drill Size Wire / Dec | Feet per Minute | | | | | | | | | | | | | | |
|--------------------------|-----------------|-----|------|------|------|------|------|------|------|------|------|-------|------|------|------|
| | 10' | 20' | 30' | 40' | 50' | 60' | 70' | 80' | 90' | 100' | 110' | 120' | 130' | 140' | 150' |
| 1 .2280 | 168 | 335 | 503 | 670 | 838 | 1005 | 1173 | 1340 | 1508 | 1675 | 1843 | 2010 | 2179 | 2346 | 2513 |
| 2 .2210 | 173 | 345 | 518 | 691 | 864 | 1037 | 1210 | 1382 | 1555 | 1728 | 1901 | 2074 | 2247 | 2420 | 2593 |
| 3 .213 | 179 | 359 | 538 | 717 | 897 | 1076 | 1255 | 1434 | 1614 | 1793 | 1974 | 2152 | 2331 | 2511 | 2690 |
| 4 .2090 | 183 | 365 | 548 | 731 | 914 | 1097 | 1280 | 1462 | 1645 | 1828 | 2010 | 2193 | 2376 | 2560 | 2741 |
| 5 .2055 | 186 | 372 | 558 | 744 | 930 | 1115 | 1301 | 1487 | 1673 | 1859 | 2045 | 2230 | 2416 | 2602 | 2788 |
| 6 .2040 | 187 | 374 | 562 | 749 | 936 | 1123 | 1310 | 1498 | 1685 | 1872 | 2060 | 2247 | 2434 | 2621 | 2809 |
| 7 .2010 | 190 | 380 | 570 | 760 | 950 | 1140 | 1330 | 1520 | 1710 | 1900 | 2090 | 2281 | 2470 | 2660 | 2850 |
| 8 .1990 | 192 | 384 | 576 | 768 | 960 | 1151 | 1343 | 1535 | 1727 | 1919 | 2111 | 2303 | 2495 | 2687 | 2879 |
| 9 .1960 | 195 | 390 | 585 | 780 | 975 | 1169 | 1364 | 1559 | 1754 | 1949 | 2144 | 2339 | 2534 | 2728 | 2923 |
| 10 .1935 | 197 | 395 | 592 | 790 | 987 | 1184 | 1382 | 1579 | 1777 | 1974 | 2171 | 2369 | 2566 | 2764 | 2961 |
| 11 .1910 | 200 | 400 | 600 | 800 | 1000 | 1200 | 1400 | 1600 | 1800 | 2000 | 2200 | 2400 | 2600 | 2800 | 3001 |
| 12 .1890 | 202 | 404 | 606 | 808 | 1010 | 1213 | 1415 | 1617 | 1819 | 2021 | 2223 | 2425 | 2627 | 2829 | 3032 |
| 13 .1850 | 206 | 413 | 620 | 826 | 1032 | 1239 | 1450 | 1652 | 1859 | 2065 | 2271 | 2479 | 2684 | 2891 | 3097 |
| 14 .1820 | 210 | 420 | 630 | 840 | 1050 | 1259 | 1469 | 1679 | 1889 | 2099 | 2309 | 2518 | 2728 | 2938 | 3148 |
| 15 .1800 | 213 | 425 | 638 | 851 | 1064 | 1276 | 1489 | 1702 | 1914 | 2127 | 2334 | 2546 | 2759 | 2971 | 3183 |
| 16 .1770 | 216 | 432 | 647 | 863 | 1079 | 1295 | 1511 | 1726 | 1942 | 2158 | 2374 | 2590 | 2806 | 3021 | 3237 |
| 17 .1730 | 221 | 442 | 662 | 883 | 1104 | 1325 | 1546 | 1766 | 1987 | 2208 | 2429 | 2650 | 2870 | 3091 | 3313 |
| 18 .1695 | 226 | 452 | 678 | 904 | 1130 | 1356 | 1582 | 1808 | 2034 | 2260 | 2479 | 2704 | 2930 | 3155 | 3380 |
| 19 .1660 | 230 | 460 | 690 | 920 | 1151 | 1381 | 1611 | 1841 | 2071 | 2301 | 2531 | 2761 | 2991 | 3222 | 3453 |
| 20 .1610 | 237 | 475 | 712 | 949 | 1186 | 1423 | 1660 | 1898 | 2135 | 2372 | 2610 | 2847 | 3084 | 3322 | 3559 |
| 21 .1590 | 240 | 480 | 721 | 961 | 1201 | 1441 | 1681 | 1922 | 2162 | 2402 | 2644 | 2883 | 3123 | 3363 | 3604 |
| 22 .1570 | 243 | 487 | 730 | 973 | 1217 | 1460 | 1703 | 1946 | 2190 | 2433 | 2676 | 2920 | 3164 | 3406 | 3649 |
| 23 .1540 | 248 | 496 | 744 | 992 | 1240 | 1488 | 1736 | 1984 | 2232 | 2480 | 2728 | 2976 | 3224 | 3472 | 3720 |
| 24 .1520 | 251 | 503 | 754 | 1005 | 1257 | 1508 | 1759 | 2010 | 2262 | 2513 | 2764 | 3016 | 3267 | 3518 | 3769 |
| 25 .1495 | 256 | 511 | 767 | 1022 | 1276 | 1533 | 1789 | 2044 | 2300 | 2555 | 2810 | 3066 | 3322 | 3577 | 3832 |
| 26 .1470 | 260 | 520 | 779 | 1039 | 1299 | 1559 | 1819 | 2078 | 2338 | 2598 | 2858 | 3118 | 3378 | 3638 | 3898 |
| 27 .1440 | 265 | 531 | 796 | 1061 | 1327 | 1592 | 1857 | 2122 | 2388 | 2653 | 2919 | 3183 | 3448 | 3714 | 3979 |
| 28 .1405 | 272 | 544 | 816 | 1088 | 1360 | 1631 | 1903 | 2175 | 2447 | 2719 | 2990 | 3262 | 3534 | 3806 | 4078 |
| 29 .1360 | 281 | 562 | 843 | 1124 | 1405 | 1685 | 1966 | 2247 | 2528 | 2809 | 3090 | 33701 | 3651 | 3932 | 4213 |
| 30 .1285 | 297 | 595 | 892 | 1189 | 1487 | 1784 | 2081 | 2378 | 2676 | 2973 | 3270 | 3567 | 3864 | 4162 | 4459 |
| 31 .1200 | 318 | 637 | 955 | 1273 | 1592 | 1910 | 2228 | 2546 | 2865 | 3183 | 3501 | 3821 | 4138 | 4456 | 4775 |
| 32 .1160 | 329 | 659 | 988 | 1317 | 1647 | 1976 | 2305 | 2634 | 2964 | 3293 | 3622 | 3951 | 4281 | 4610 | 4939 |
| 33 .1130 | 338 | 676 | 1014 | 1352 | 1690 | 2028 | 2366 | 2704 | 3042 | 3380 | 3718 | 4056 | 4394 | 4732 | 5070 |
| 34 .1110 | 344 | 688 | 1032 | 1376 | 1721 | 2065 | 2409 | 2753 | 3097 | 3442 | 3785 | 4129 | 4474 | 4818 | 5162 |
| 35 .1100 | 347 | 694 | 1042 | 1389 | 1736 | 2083 | 2430 | 2778 | 3125 | 3472 | 3821 | 4167 | 4514 | 4861 | 5209 |
| 36 .1065 | 359 | 717 | 1076 | 1435 | 1794 | 2152 | 2511 | 2870 | 3228 | 3587 | 3945 | 4304 | 4663 | 5021 | 5380 |
| 37 .1040 | 367 | 735 | 1102 | 1469 | 1837 | 2204 | 2571 | 2938 | 3306 | 3673 | 4040 | 4407 | 4775 | 5142 | 5509 |
| 38 .1015 | 376 | 753 | 1129 | 1505 | 1882 | 2258 | 2634 | 3010 | 3387 | 3763 | 4140 | 4516 | 4892 | 5269 | 5645 |

continued on next page



Drill Cutting Speeds

Technical Information

Wire Gage (continued)

TECHNICAL

High Speed Steel

| Drill Size Wire / Dec | Feet per Minute | | | | | | | | | | | | | | |
|--------------------------|-----------------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 10' | 20' | 30' | 40' | 50' | 60' | 70' | 80' | 90' | 100' | 110' | 120' | 130' | 140' | 150' |
| 39 .0995 | 384 | 768 | 1152 | 1536 | 1920 | 2303 | 2687 | 3071 | 3455 | 3839 | 4222 | 4607 | 4991 | 5374 | 5758 |
| 40 .0980 | 390 | 780 | 1169 | 1559 | 1949 | 2339 | 2729 | 3118 | 3508 | 3898 | 4287 | 4677 | 5067 | 5457 | 5846 |
| 41 .0960 | 398 | 796 | 1194 | 1592 | 1990 | 2387 | 2785 | 3183 | 3581 | 3979 | 4377 | 4775 | 5172 | 5570 | 5968 |
| 42 .0935 | 408 | 817 | 1226 | 1634 | 2043 | 2451 | 2860 | 3268 | 3677 | 4085 | 4494 | 4902 | 5311 | 5719 | 6128 |
| 43 .0890 | 429 | 858 | 1288 | 1717 | 2146 | 2575 | 3004 | 3434 | 3863 | 4292 | 4721 | 5150 | 5579 | 6008 | 6438 |
| 44 .0860 | 444 | 888 | 1333 | 1777 | 2221 | 2665 | 3109 | 3554 | 3999 | 4442 | 4886 | 5330 | 5774 | 6218 | 6662 |
| 45 .0820 | 466 | 932 | 1397 | 1863 | 2329 | 2795 | 3261 | 3726 | 4192 | 4658 | 5124 | 5590 | 6056 | 6522 | 6987 |
| 46 .0810 | 472 | 943 | 1415 | 1886 | 2358 | 2830 | 3301 | 3773 | 4244 | 4716 | 5187 | 5659 | 6130 | 6602 | 7074 |
| 47 .0785 | 487 | 973 | 1460 | 1946 | 2433 | 2920 | 3406 | 3893 | 4379 | 4866 | 5352 | 5839 | 6326 | 6812 | 7299 |
| 48 .0760 | 503 | 1005 | 1508 | 2010 | 2513 | 3016 | 3518 | 4021 | 4523 | 5026 | 5528 | 6031 | 6534 | 7036 | 7539 |
| 49 .0730 | 523 | 1047 | 1570 | 2093 | 2617 | 3140 | 3663 | 4186 | 4710 | 5233 | 5756 | 6279 | 6808 | 7326 | 7849 |
| 50 .0700 | 546 | 1091 | 1637 | 2183 | 2729 | 3274 | 3820 | 4366 | 4911 | 5457 | 6002 | 6548 | 7094 | 7640 | 8185 |
| 51 .0670 | 570 | 1140 | 1710 | 2280 | 2851 | 3421 | 3991 | 4561 | 5131 | 5701 | 6271 | 6841 | 7413 | 798 | 8552 |
| 52 .0635 | 602 | 1203 | 1805 | 2406 | 3008 | 3609 | 4211 | 4812 | 5414 | 6015 | 6619 | 7218 | 7820 | 8421 | 9023 |
| 53 .0595 | 641 | 1283 | 1924 | 2566 | 3207 | 3848 | 4490 | 5131 | 5773 | 6414 | 7062 | 7704 | 8346 | 8988 | 9630 |
| 54 .0550 | 694 | 1389 | 2084 | 2778 | 3473 | 4167 | 4862 | 5556 | 6251 | 6945 | 7639 | 8334 | 9028 | 9723 | 10417 |
| 55 .0520 | 735 | 1469 | 2204 | 2938 | 3673 | 4408 | 5142 | 5877 | 6611 | 7346 | 8080 | 8815 | 9549 | 10284 | 11028 |
| 56 .0465 | 821 | 1643 | 2465 | 3286 | 4108 | 4929 | 5751 | 6572 | 7394 | 8215 | 9036 | 9857 | 10678 | 11500 | 12322 |
| 57 .0430 | 888 | 1777 | 2671 | 3561 | 4452 | 5342 | 6232 | 7122 | 8013 | 8903 | 9771 | 10660 | 11548 | 12436 | 13325 |
| 58 .0420 | 910 | 1819 | 2729 | 3637 | 4547 | 5456 | 6367 | 7275 | 8186 | 9095 | 10004 | 10913 | 11823 | 12732 | 13642 |
| 59 .0410 | 932 | 1863 | 2795 | 3726 | 4658 | 5590 | 6521 | 7453 | 8388 | 9316 | 10248 | 11180 | 12111 | 13043 | 13975 |
| 60 .0400 | 955 | 1910 | 2865 | 3820 | 4775 | 5729 | 6684 | 7639 | 8594 | 9549 | 10504 | 11459 | 12414 | 13369 | 14324 |
| 61 .0390 | 979 | 1959 | 2938 | 3918 | 4897 | 5876 | 6856 | 7835 | 8815 | 9794 | 10774 | 11753 | 12732 | 13712 | 14691 |
| 62 .0380 | 1005 | 2010 | 3015 | 4020 | 5025 | 6030 | 7035 | 8040 | 9045 | 10050 | 11057 | 12060 | 13068 | 14073 | 15078 |
| 63 .0370 | 1032 | 2064 | 3096 | 4128 | 5160 | 6192 | 7224 | 8256 | 9288 | 10320 | 11366 | 12398 | 13421 | 14453 | 15485 |
| 64 .0360 | 1061 | 2122 | 3183 | 4244 | 5305 | 6366 | 7427 | 8488 | 9549 | 10610 | 11671 | 12732 | 13793 | 14854 | 15915 |
| 65 .0350 | 1091 | 2182 | 3273 | 4364 | 5455 | 6546 | 7637 | 8728 | 9819 | 10910 | 12005 | 13096 | 14187 | 15279 | 16370 |
| 66 .0330 | 1158 | 2316 | 3474 | 4632 | 5790 | 6948 | 8106 | 9264 | 10422 | 11580 | 12732 | 13890 | 15047 | 16205 | 17362 |
| 67 .0320 | 1194 | 2388 | 3582 | 4776 | 5970 | 7164 | 8358 | 9552 | 10746 | 11940 | 13130 | 14324 | 15517 | 16712 | 17905 |
| 68 .0310 | 1232 | 2465 | 3696 | 4928 | 6160 | 7392 | 8624 | 9856 | 11088 | 12320 | 13554 | 14786 | 16018 | 17250 | 18482 |
| 69 .0292 | 1308 | 2616 | 3918 | 5224 | 6530 | 7836 | 9142 | 10448 | 11754 | 13060 | 14389 | 15697 | 17006 | 18314 | 19622 |
| 70 .0280 | 1364 | 2729 | 4091 | 5456 | 6820 | 8184 | 9548 | 10912 | 12276 | 13640 | 15006 | 16370 | 17734 | 19099 | 20463 |
| 71 .0260 | 1469 | 2938 | 4419 | 5892 | 7365 | 8838 | 10311 | 11784 | 13257 | 14730 | 16160 | 17629 | 19099 | 20568 | 22037 |
| 72 .0250 | 1528 | 3056 | 4584 | 6112 | 7640 | 9168 | 10696 | 12224 | 13752 | 15280 | 16807 | 18335 | 19863 | 21390 | 22918 |
| 73 .0240 | 1592 | 3183 | 4776 | 6368 | 7960 | 9552 | 11144 | 12736 | 14328 | 15920 | 17507 | 19099 | 20690 | 22282 | 23873 |
| 74 .0225 | 1698 | 3396 | 5106 | 6808 | 8510 | 10212 | 11914 | 13616 | 15318 | 17020 | 18674 | 20372 | 22069 | 23767 | 25465 |
| 75 .0210 | 1819 | 3638 | 5457 | 7276 | 9095 | 10914 | 12733 | 14552 | 16371 | 18190 | 20008 | 21827 | 23646 | 25465 | 27284 |
| 76 .0200 | 1910 | 3820 | 5730 | 7640 | 9550 | 11460 | 13370 | 15280 | 17190 | 19100 | 21008 | 22918 | 24828 | 26738 | 28648 |
| 77 .0180 | 2122 | 4244 | 6366 | 8488 | 10610 | 12732 | 14854 | 16976 | 19098 | 21220 | 23343 | 25465 | 27587 | 29709 | 31831 |
| 78 .0160 | 2388 | 4775 | 7161 | 9548 | 11935 | 14322 | 16709 | 19096 | 21483 | 23870 | 26260 | 28648 | 31035 | 33422 | 35810 |
| 79 .0145 | 2634 | 5269 | 7902 | 10536 | 13170 | 15804 | 18438 | 21072 | 23706 | 26340 | 28988 | 31611 | 34246 | 36880 | 39514 |
| 80 .0135 | 2830 | 5659 | 8490 | 11320 | 14150 | 16980 | 19810 | 22640 | 25470 | 28300 | 31123 | 33953 | 36782 | 39612 | 42441 |



Technical Information

Dimensional Specs

Inch Drill Sizes

Conversion formulas:

Inch = mm x .03937

Metric = inch x 25.4

TECHNICAL
High Speed Steel

| Drill Sizes | Decimal Equiv. | Screw Machine Length | | | | Jobbers Length | | | | Taper Length | | | |
|-------------|----------------|----------------------|---------|----------------|---------|----------------|---------|----------------|---------|--------------|---------|----------------|---------|
| | | flute length | | overall length | | flute length | | overall length | | flute length | | overall length | |
| | | fraction | decimal | fraction | decimal | fraction | decimal | fraction | decimal | fraction | decimal | fraction | decimal |
| 1/64 | .0156 | — | — | — | — | 3/16 | .1875 | 3/4 | .7500 | 5/16 | .3125 | 1-1/2 | 1.5000 |
| 80 | .0135 | — | — | — | — | 1/8 | .1250 | 3/4 | .7500 | 5/16 | .3125 | 1-1/2 | 1.5000 |
| 79 | .0145 | — | — | — | — | 1/8 | .1250 | 3/4 | .7500 | 5/16 | .3125 | 1-1/2 | 1.5000 |
| 78 | .0160 | — | — | — | — | 3/16 | .1875 | 7/8 | .8750 | 5/16 | .3125 | 1-1/2 | 1.5000 |
| 77 | .0180 | — | — | — | — | 3/16 | .1875 | 7/8 | .8750 | 5/16 | .3125 | 1-1/2 | 1.5000 |
| 76 | .0200 | — | — | — | — | 3/16 | .1875 | 7/8 | .8750 | 5/16 | .3125 | 1-1/2 | 1.5000 |
| 75 | .0210 | — | — | — | — | 1/4 | .2500 | 1 | 1.0000 | 5/16 | .3125 | 1-1/2 | 1.5000 |
| 74 | .0225 | — | — | — | — | 1/4 | .2500 | 1 | 1.0000 | 5/16 | .3125 | 1-1/2 | 1.5000 |
| 73 | .0240 | — | — | — | — | 5/16 | .3125 | 1-1/8 | 1.1250 | 5/16 | .3125 | 1-1/2 | 1.5000 |
| 72 | .0250 | — | — | — | — | 5/16 | .3125 | 1-1/8 | 1.1250 | 5/16 | .3125 | 1-1/2 | 1.5000 |
| 71 | .0260 | — | — | — | — | 3/8 | .3750 | 1-1/4 | 1.2500 | 3/4 | .7500 | 2 | 2.0000 |
| 70 | .0280 | — | — | — | — | 3/8 | .3750 | 1-1/4 | 1.2500 | 3/4 | .7500 | 2 | 2.0000 |
| 69 | .0292 | — | — | — | — | 1/2 | .5000 | 1-3/8 | 1.3750 | 3/4 | .7500 | 2 | 2.0000 |
| 68 | .0310 | — | — | — | — | 1/2 | .5000 | 1-3/8 | 1.3750 | 3/4 | .7500 | 2 | 2.0000 |
| 1/32 | .0312 | 1/2 | .5000 | 1-3/8 | 1.3750 | 1/2 | .5000 | 1-3/8 | 1.3750 | 3/4 | .7500 | 2 | 2.0000 |
| 67 | .0320 | — | — | — | — | 1/2 | .5000 | 1-3/8 | 1.3750 | 3/4 | .7500 | 2 | 2.0000 |
| 66 | .0330 | — | — | — | — | 1/2 | .5000 | 1-3/8 | 1.3750 | 3/4 | .7500 | 2 | 2.0000 |
| 65 | .0350 | — | — | — | — | 5/8 | .6250 | 1-1/2 | 1.5000 | 3/4 | .7500 | 2 | 2.0000 |
| 64 | .0360 | — | — | — | — | 5/8 | .6250 | 1-1/2 | 1.5000 | 3/4 | .7500 | 2 | 2.0000 |
| 63 | .0370 | — | — | — | — | 5/8 | .6250 | 1-1/2 | 1.5000 | 3/4 | .7500 | 2 | 2.0000 |
| 62 | .0380 | — | — | — | — | 5/8 | .6250 | 1-1/2 | 1.5000 | 3/4 | .7500 | 2 | 2.0000 |
| 61 | .0390 | — | — | — | — | 11/16 | .6875 | 1-5/8 | 1.6250 | 1-1/8 | 1.1250 | 2-1/4 | 2.2500 |
| 60 | .0400 | 1/2 | .5000 | 1-3/8 | 1.3750 | 11/16 | .6875 | 1-5/8 | 1.6250 | 1-1/8 | 1.1250 | 2-1/4 | 2.2500 |
| 59 | .0410 | 1/2 | .5000 | 1-3/8 | 1.3750 | 11/16 | .6875 | 1-5/8 | 1.6250 | 1-1/8 | 1.1250 | 2-1/4 | 2.2500 |
| 58 | .0420 | 1/2 | .5000 | 1-3/8 | 1.3750 | 11/16 | .6875 | 1-5/8 | 1.6250 | 1-1/8 | 1.1250 | 2-1/4 | 2.2500 |
| 57 | .0430 | 1/2 | .5000 | 1-3/8 | 1.3750 | 3/4 | .7500 | 1-3/4 | 1.7500 | 1-1/8 | 1.1250 | 2-1/4 | 2.2500 |
| 56 | .0465 | 1/2 | .5000 | 1-3/8 | 1.3750 | 3/4 | .7500 | 1-3/4 | 1.7500 | 1-1/8 | 1.1250 | 2-1/4 | 2.2500 |
| 3/64 | .0469 | 1/2 | .5000 | 1-3/8 | 1.3750 | 3/4 | .7500 | 1-3/4 | 1.7500 | 1-1/8 | 1.1250 | 2-1/4 | 2.2500 |
| 55 | .0520 | 5/8 | .6250 | 1-5/8 | 1.6250 | 7/8 | .8750 | 1-7/8 | 1.8750 | 1-3/4 | 1.7500 | 3 | 3.0000 |
| 54 | .0550 | 5/8 | .6250 | 1-5/8 | 1.6250 | 7/8 | .8750 | 1-7/8 | 1.8750 | 1-3/4 | 1.7500 | 3 | 3.0000 |
| 53 | .0595 | 5/8 | .6250 | 1-5/8 | 1.6250 | 7/8 | .8750 | 1-7/8 | 1.8750 | 1-3/4 | 1.7500 | 3 | 3.0000 |
| 1/16 | .0625 | 5/8 | .6250 | 1-5/8 | 1.6250 | 7/8 | .8750 | 1-7/8 | 1.8750 | 1-3/4 | 1.7500 | 3 | 3.0000 |
| 52 | .0635 | 11/16 | .6875 | 1-11/16 | 1.6875 | 7/8 | .8750 | 1-7/8 | 1.8750 | 2 | 2.0000 | 3-3/4 | 3.7500 |
| 51 | .0670 | 11/16 | .6875 | 1-11/16 | 1.6875 | 1 | 1.0000 | 2 | 2.0000 | 2 | 2.0000 | 3-3/4 | 3.7500 |
| 50 | .0700 | 11/16 | .6875 | 1-11/16 | 1.6875 | 1 | 1.0000 | 2 | 2.0000 | 2 | 2.0000 | 3-3/4 | 3.7500 |
| 49 | .0730 | 11/16 | .6875 | 1-11/16 | 1.6875 | 1 | 1.0000 | 2 | 2.0000 | 2 | 2.0000 | 3-3/4 | 3.7500 |
| 48 | .0760 | 11/16 | .6875 | 1-11/16 | 1.6875 | 1 | 1.0000 | 2 | 2.0000 | 2 | 2.0000 | 3-3/4 | 3.7500 |
| 5/64 | .0781 | 11/16 | .6875 | 1-11/16 | 1.6875 | 1 | 1.0000 | 2 | 2.0000 | 2 | 2.0000 | 3-3/4 | 3.7500 |
| 47 | .0785 | 3/4 | .7500 | 1-3/4 | 1.7500 | 1 | 1.0000 | 2 | 2.0000 | 2-1/4 | 2.2500 | 4-1/4 | 4.2500 |
| 46 | .0810 | 3/4 | .7500 | 1-3/4 | 1.7500 | 1-1/8 | 1.1250 | 2-1/8 | 2.1250 | 2-1/4 | 2.2500 | 4-1/4 | 4.2500 |
| 45 | .0820 | 3/4 | .7500 | 1-3/4 | 1.7500 | 1-1/8 | 1.1250 | 2-1/8 | 2.1250 | 2-1/4 | 2.2500 | 4-1/4 | 4.2500 |
| 44 | .0860 | 3/4 | .7500 | 1-3/4 | 1.7500 | 1-1/8 | 1.1250 | 2-1/8 | 2.1250 | 2-1/4 | 2.2500 | 4-1/4 | 4.2500 |
| 43 | .0890 | 3/4 | .7500 | 1-3/4 | 1.7500 | 1-1/4 | 1.2500 | 2-1/4 | 2.2500 | 2-1/4 | 2.2500 | 4-1/4 | 4.2500 |
| 42 | .0935 | 3/4 | .7500 | 1-3/4 | 1.7500 | 1-1/4 | 1.2500 | 2-1/4 | 2.2500 | 2-1/4 | 2.2500 | 4-1/4 | 4.2500 |
| 3/32 | .0938 | 3/4 | .7500 | 1-3/4 | 1.7500 | 1-1/4 | 1.2500 | 2-1/4 | 2.2500 | 2-1/4 | 2.2500 | 4-1/4 | 4.2500 |
| 41 | .0960 | 13/16 | .8125 | 1-13/16 | 1.8125 | 1-3/8 | 1.3750 | 2-3/8 | 2.3750 | 2-1/2 | 2.5000 | 4-5/8 | 4.6250 |
| 40 | .0980 | 13/16 | .8125 | 1-13/16 | 1.8125 | 1-3/8 | 1.3750 | 2-3/8 | 2.3750 | 2-1/2 | 2.5000 | 4-5/8 | 4.6250 |
| 39 | .0995 | 13/16 | .8125 | 1-13/16 | 1.8125 | 1-3/8 | 1.3750 | 2-3/8 | 2.3750 | 2-1/2 | 2.5000 | 4-5/8 | 4.6250 |
| 38 | .1015 | 13/16 | .8125 | 1-13/16 | 1.8125 | 1-7/16 | 1.4375 | 2-1/2 | 2.5000 | 2-1/2 | 2.5000 | 4-5/8 | 4.6250 |
| 37 | .1040 | 13/16 | .8125 | 1-13/16 | 1.8125 | 1-7/16 | 1.4375 | 2-1/2 | 2.5000 | 2-1/2 | 2.5000 | 4-5/8 | 4.6250 |
| 36 | .1065 | 13/16 | .8125 | 1-13/16 | 1.8125 | 1-7/16 | 1.4375 | 2-1/2 | 2.5000 | 2-1/2 | 2.5000 | 4-5/8 | 4.6250 |
| 7/64 | .1094 | 13/16 | .8125 | 1-13/16 | 1.8125 | 1-1/2 | 1.5000 | 2-5/8 | 2.6250 | 2-1/2 | 2.5000 | 4-5/8 | 4.6250 |
| 35 | .1100 | 7/8 | .8750 | 1-7/8 | 1.8750 | 1-1/2 | 1.5000 | 2-5/8 | 2.6250 | 2-3/4 | 2.7500 | 5-1/8 | 5.1250 |
| 34 | .1110 | 7/8 | .8750 | 1-7/8 | 1.8750 | 1-1/2 | 1.5000 | 2-5/8 | 2.6250 | 2-3/4 | 2.7500 | 5-1/8 | 5.1250 |
| 33 | .1130 | 7/8 | .8750 | 1-7/8 | 1.8750 | 1-1/2 | 1.5000 | 2-5/8 | 2.6250 | 2-3/4 | 2.7500 | 5-1/8 | 5.1250 |
| 32 | .1160 | 7/8 | .8750 | 1-7/8 | 1.8750 | 1-5/8 | 1.6250 | 2-3/4 | 2.7500 | 2-3/4 | 2.7500 | 5-1/8 | 5.1250 |

continued on next page



Dimensional Specs

Technical Information

Conversion formulas:
 Inch = mm x .03937
 Metric = inch x 25.4

Inch Drill Sizes (continued)

TECHNICAL

High Speed Steel

| Drill Sizes | Decimal Equiv. | Screw Machine Length | | | | Jobbers Length | | | | Taper Length | | | |
|-------------|----------------|----------------------|---------|----------------|---------|----------------|---------|----------------|---------|--------------|---------|----------------|---------|
| | | flute length | | overall length | | flute length | | overall length | | flute length | | overall length | |
| | | fraction | decimal | fraction | decimal | fraction | decimal | fraction | decimal | fraction | decimal | fraction | decimal |
| 1/8 | .1250 | 7/8 | .8750 | 1-7/8 | 1.8750 | 1-5/8 | 1.6250 | 2-3/4 | 2.7500 | 2-3/4 | 2.7500 | 5-1/8 | 5.1250 |
| 30 | .1285 | 15/16 | .9375 | 1-15/16 | 1.9375 | 1-5/8 | 1.6250 | 2-3/4 | 2.7500 | 3 | 3.0000 | 5-3/8 | 5.3750 |
| 29 | .1360 | 15/16 | .9375 | 1-15/16 | 1.9375 | 1-3/4 | 1.7500 | 2-7/8 | 2.8750 | 3 | 3.0000 | 5-3/8 | 5.3750 |
| 28 | .1405 | 15/16 | .9375 | 1-15/16 | 1.9375 | 1-3/4 | 1.7500 | 2-7/8 | 2.8750 | 3 | 3.0000 | 5-3/8 | 5.3750 |
| 9/64 | .1406 | 15/16 | .9375 | 1-15/16 | 1.9375 | 1-3/4 | 1.7500 | 2-7/8 | 2.8750 | 3 | 3.0000 | 5-3/8 | 5.3750 |
| 27 | .1440 | 1 | 1.0000 | 2-1/16 | 2.0625 | 1-7/8 | 1.8750 | 3 | 3.0000 | 3 | 3.0000 | 5-3/8 | 5.3750 |
| 26 | .1470 | 1 | 1.0000 | 2-1/16 | 2.0625 | 1-7/8 | 1.8750 | 3 | 3.0000 | 3 | 3.0000 | 5-3/8 | 5.3750 |
| 25 | .1495 | 1 | 1.0000 | 2-1/16 | 2.0625 | 1-7/8 | 1.8750 | 3 | 3.0000 | 3 | 3.0000 | 5-3/8 | 5.3750 |
| 24 | .1520 | 1 | 1.0000 | 2-1/16 | 2.0625 | 2 | 2.0000 | 3-1/8 | 3.1250 | 3 | 3.0000 | 5-3/8 | 5.3750 |
| 23 | .1540 | 1 | 1.0000 | 2-1/16 | 2.0625 | 2 | 2.0000 | 3-1/8 | 3.1250 | 3 | 3.0000 | 5-3/8 | 5.3750 |
| 5/32 | .1562 | 1 | 1.0000 | 2-1/16 | 2.0625 | 2 | 2.0000 | 3-1/8 | 3.1250 | 3 | 3.0000 | 5-3/8 | 5.3750 |
| 22 | .1570 | 1-1/16 | 1.0625 | 2-1/8 | 2.1250 | 2 | 2.0000 | 3-1/8 | 3.1250 | 3-3/8 | 3.3750 | 5-3/4 | 5.7500 |
| 21 | .1590 | 1-1/16 | 1.0625 | 2-1/8 | 2.1250 | 2-1/8 | 2.1250 | 3-1/4 | 3.2500 | 3-3/8 | 3.3750 | 5-3/4 | 5.7500 |
| 20 | .1610 | 1-1/16 | 1.0625 | 2-1/8 | 2.1250 | 2-1/8 | 2.1250 | 3-1/4 | 3.2500 | 3-3/8 | 3.3750 | 5-3/4 | 5.7500 |
| 19 | .1660 | 1-1/16 | 1.0625 | 2-1/8 | 2.1250 | 2-1/8 | 2.1250 | 3-1/4 | 3.2500 | 3-3/8 | 3.3750 | 5-3/4 | 5.7500 |
| 18 | .1695 | 1-1/16 | 1.0625 | 2-1/8 | 2.1250 | 2-1/8 | 2.1250 | 3-1/4 | 3.2500 | 3-3/8 | 3.3750 | 5-3/4 | 5.7500 |
| 11/64 | .1719 | 1-1/16 | 1.0625 | 2-1/8 | 2.1250 | 2-1/8 | 2.1250 | 3-1/4 | 3.2500 | 3-3/8 | 3.3750 | 5-3/4 | 5.7500 |
| 17 | .1730 | 1-1/8 | 1.2500 | 2-3/16 | 2.1875 | 2-3/16 | 2.1875 | 3-3/8 | 3.3750 | 3-3/8 | 3.3750 | 5-3/4 | 5.7500 |
| 16 | .1770 | 1-1/8 | 1.2500 | 2-3/16 | 2.1875 | 2-3/16 | 2.1875 | 3-3/8 | 3.3750 | 3-3/8 | 3.3750 | 5-3/4 | 5.7500 |
| 15 | .1800 | 1-1/8 | 1.2500 | 2-3/16 | 2.1875 | 2-3/16 | 2.1875 | 3-3/8 | 3.3750 | 3-3/8 | 3.3750 | 5-3/4 | 5.7500 |
| 14 | .1820 | 1-1/8 | 1.2500 | 2-3/16 | 2.1875 | 2-3/16 | 2.1875 | 3-3/8 | 3.3750 | 3-3/8 | 3.3750 | 5-3/4 | 5.7500 |
| 13 | .1850 | 1-1/8 | 1.2500 | 2-3/16 | 2.1875 | 2-5/16 | 2.3125 | 3-1/2 | 3.5000 | 3-3/8 | 3.3750 | 5-3/4 | 5.7500 |
| 3/16 | .1875 | 1-1/8 | 1.2500 | 2-3/16 | 2.1875 | 2-5/16 | 2.3125 | 3-1/2 | 3.5000 | 3-3/8 | 3.3750 | 5-3/4 | 5.7500 |
| 12 | .1890 | 1-3/16 | 1.1875 | 2-1/4 | 2.2500 | 2-5/16 | 2.3125 | 3-1/2 | 3.5000 | 3-5/8 | 3.6250 | 6 | 6.0000 |
| 11 | .1910 | 1-3/16 | 1.1875 | 2-1/4 | 2.2500 | 2-5/16 | 2.3125 | 3-1/2 | 3.5000 | 3-5/8 | 3.6250 | 6 | 6.0000 |
| 10 | .1935 | 1-3/16 | 1.1875 | 2-1/4 | 2.2500 | 2-7/16 | 2.4375 | 3-5/8 | 3.6250 | 3-5/8 | 3.6250 | 6 | 6.0000 |
| 9 | .1960 | 1-3/16 | 1.1875 | 2-1/4 | 2.2500 | 2-7/16 | 2.4375 | 3-5/8 | 3.6250 | 3-5/8 | 3.6250 | 6 | 6.0000 |
| 8 | .1990 | 1-3/16 | 1.1875 | 2-1/4 | 2.2500 | 2-7/16 | 2.4375 | 3-5/8 | 3.6250 | 3-5/8 | 3.6250 | 6 | 6.0000 |
| 7 | .2010 | 1-3/16 | 1.1875 | 2-1/4 | 2.2500 | 2-7/16 | 2.4375 | 3-5/8 | 3.6250 | 3-5/8 | 3.6250 | 6 | 6.0000 |
| 13/64 | .2031 | 1-3/16 | 1.1875 | 2-1/4 | 2.2500 | 2-7/16 | 2.4375 | 3-5/8 | 3.6250 | 3-5/8 | 3.6250 | 6 | 6.0000 |
| 6 | .2040 | 1-1/4 | 1.2500 | 2-3/8 | 2.3750 | 2-1/2 | 2.5000 | 3-3/4 | 3.7500 | 3-5/8 | 3.6250 | 6 | 6.0000 |
| 5 | .2055 | 1-1/4 | 1.2500 | 2-3/8 | 2.3750 | 2-1/2 | 2.5000 | 3-3/4 | 3.7500 | 3-5/8 | 3.6250 | 6 | 6.0000 |
| 4 | .2090 | 1-1/4 | 1.2500 | 2-3/8 | 2.3750 | 2-1/2 | 2.5000 | 3-3/4 | 3.7500 | 3-5/8 | 3.6250 | 6 | 6.0000 |
| 3 | .2130 | 1-1/4 | 1.2500 | 2-3/8 | 2.3750 | 2-1/2 | 2.5000 | 3-3/4 | 3.7500 | 3-5/8 | 3.6250 | 6 | 6.0000 |
| 7/32 | .2188 | 1-1/4 | 1.2500 | 2-3/8 | 2.3750 | 2-1/2 | 2.5000 | 3-3/4 | 3.7500 | 3-5/8 | 3.6250 | 6 | 6.0000 |
| 2 | .2210 | 1-5/16 | 1.3125 | 2-7/16 | 2.4375 | 2-5/8 | 2.6250 | 3-7/8 | 3.8750 | 3-3/4 | 3.7500 | 6-1/8 | 6.1250 |
| 1 | .2280 | 1-5/16 | 1.3125 | 2-7/16 | 2.4375 | 2-5/8 | 2.6250 | 3-7/8 | 3.8750 | 3-3/4 | 3.7500 | 6-1/8 | 6.1250 |
| A | .2340 | 1-5/16 | 1.3125 | 2-7/16 | 2.4375 | 2-5/8 | 2.6250 | 3-7/8 | 3.8750 | 3-3/4 | 3.7500 | 6-1/8 | 6.1250 |
| 15/64 | .2344 | 1-5/16 | 1.3125 | 2-7/16 | 2.4375 | 2-5/8 | 2.6250 | 3-7/8 | 3.8750 | 3-3/4 | 3.7500 | 6-1/8 | 6.1250 |
| B | .2380 | 1-3/8 | 1.3750 | 2-1/2 | 2.5000 | 2-3/4 | 2.7500 | 4 | 4.0000 | 3-3/4 | 3.7500 | 6-1/8 | 6.1250 |
| C | .2420 | 1-3/8 | 1.3750 | 2-1/2 | 2.5000 | 2-3/4 | 2.7500 | 4 | 4.0000 | 3-3/4 | 3.7500 | 6-1/8 | 6.1250 |
| D | .2460 | 1-3/8 | 1.3750 | 2-1/2 | 2.5000 | 2-3/4 | 2.7500 | 4 | 4.0000 | 3-3/4 | 3.7500 | 6-1/8 | 6.1250 |
| 1/4-E | .2500 | 1-3/8 | 1.3750 | 2-1/2 | 2.5000 | 2-3/4 | 2.7500 | 4 | 4.0000 | 3-3/4 | 3.7500 | 6-1/8 | 6.1250 |
| F | .2570 | 1-7/16 | 1.4375 | 2-5/8 | 2.6250 | 2-7/8 | 2.8750 | 4-1/8 | 4.1250 | 3-3/4 | 3.7500 | 6-1/8 | 6.1250 |
| G | .2610 | 1-7/16 | 1.4375 | 2-5/8 | 2.6250 | 2-7/8 | 2.8750 | 4-1/8 | 4.1250 | 3-3/4 | 3.7500 | 6-1/8 | 6.1250 |
| 17/64 | .2656 | 1-7/16 | 1.4375 | 2-5/8 | 2.6250 | 2-7/8 | 2.8750 | 4-1/8 | 4.1250 | 3-7/8 | 3.8750 | 6-1/4 | 6.2500 |
| H | .2660 | 1-1/2 | 1.5000 | 2-11/16 | 2.6875 | 2-7/8 | 2.8750 | 4-1/8 | 4.1250 | 3-7/8 | 3.8750 | 6-1/4 | 6.2500 |
| I | .2720 | 1-1/2 | 1.5000 | 2-11/16 | 2.6875 | 2-7/8 | 2.8750 | 4-1/8 | 4.1250 | 3-7/8 | 3.8750 | 6-1/4 | 6.2500 |
| J | .2770 | 1-1/2 | 1.5000 | 2-11/16 | 2.6875 | 2-7/8 | 2.8750 | 4-1/8 | 4.1250 | 3-7/8 | 3.8750 | 6-1/4 | 6.2500 |
| 9/32 | .2812 | 1-1/2 | 1.5000 | 2-11/16 | 2.6875 | 2-5/16 | 2.9375 | 4-1/4 | 4.2500 | 3-7/8 | 3.8750 | 6-1/4 | 6.2500 |
| K | .2812 | 1-1/2 | 1.5000 | 2-11/16 | 2.6875 | 2-15/16 | 2.9375 | 4-1/4 | 4.2500 | 3-7/8 | 3.8750 | 6-1/4 | 6.2500 |
| L | .2900 | 1-9/16 | 1.5625 | 2-3/4 | 2.7500 | 2-15/16 | 2.9375 | 4-1/4 | 4.2500 | 3-7/8 | 3.8750 | 6-1/4 | 6.2500 |
| M | .2950 | 1-9/16 | 1.5625 | 2-3/4 | 2.7500 | 3-1/16 | 3.0625 | 4-3/8 | 4.3750 | 4 | 4.0000 | 6-3/8 | 6.3750 |
| 19/64 | .2969 | 1-9/16 | 1.5625 | 2-3/4 | 2.7500 | 3-1/16 | 3.0625 | 4-3/8 | 4.3750 | 4 | 4.0000 | 6-3/8 | 6.3750 |
| N | .3020 | 1-5/8 | 1.6250 | 2-13/16 | 2.8125 | 3-1/16 | 3.0625 | 4-3/8 | 4.3750 | 4 | 4.0000 | 6-3/8 | 6.3750 |
| 5/16 | .3125 | 1-5/8 | 1.6250 | 2-13/16 | 2.8125 | 3-3/16 | 3.1875 | 4-1/2 | 4.5000 | 4 | 4.0000 | 6-3/8 | 6.3750 |

continued on next page



Technical Information

Dimensional Specs

Conversion formulas:
 Inch = mm x .03937
 Metric = inch x 25.4

Inch Drill Sizes (continued)

TECHNICAL
High Speed Steel

| Drill Sizes | Decimal Equiv. | Screw Machine Length | | | | Jobbers Length | | | | Taper Length | | | |
|-------------|----------------|----------------------|---------|----------------|---------|----------------|---------|----------------|---------|--------------|---------|----------------|---------|
| | | flute length | | overall length | | flute length | | overall length | | flute length | | overall length | |
| | | fraction | decimal | fraction | decimal | fraction | decimal | fraction | decimal | fraction | decimal | fraction | decimal |
| O | .3160 | 1-11/16 | 1.6875 | 2-15/16 | 2.9375 | 3-3/16 | 3.1875 | 4-1/2 | 4.5000 | 4 | 4.0000 | 6-3/8 | 6.3750 |
| P | .3230 | 1-11/16 | 1.6875 | 2-15/16 | 2.9375 | 3-5/16 | 3.1875 | 4-5/8 | 4.6250 | 4 | 4.0000 | 6-3/8 | 6.3750 |
| 21/64 | .3281 | 1-11/16 | 1.6875 | 2-15/16 | 2.9375 | 3-5/16 | 3.1875 | 4-5/8 | 4.6250 | 4-1/8 | 4.1250 | 6-1/2 | 6.5000 |
| Q | .3320 | 1-11/16 | 1.6875 | 3 | 3.0000 | 3-7/16 | 3.4375 | 4-3/4 | 4.7500 | 4-1/8 | 4.1250 | 6-1/2 | 6.5000 |
| R | .3390 | 1-11/16 | 1.6875 | 3 | 3.0000 | 3-7/16 | 3.4375 | 4-3/4 | 4.7500 | 4-1/8 | 4.1250 | 6-1/2 | 6.5000 |
| 11/32 | .3438 | 1-11/16 | 1.6875 | 3 | 3.0000 | 3-7/16 | 3.4375 | 4-3/4 | 4.7500 | 4-1/8 | 4.1250 | 6-1/2 | 6.5000 |
| S | .3480 | 1-3/4 | 1.7500 | 3-1/16 | 3.0625 | 3-1/2 | 3.5000 | 4-7/8 | 4.8750 | 4-1/4 | 4.2500 | 6-3/4 | 6.7500 |
| T | .3580 | 1-3/4 | 1.7500 | 3-1/16 | 3.0625 | 3-1/2 | 3.5000 | 4-7/8 | 4.8750 | 4-1/4 | 4.2500 | 6-3/4 | 6.7500 |
| 23/64 | .3594 | 1-3/4 | 1.7500 | 3-1/16 | 3.0625 | 3-1/2 | 3.5000 | 4-7/8 | 4.8750 | 4-1/4 | 4.2500 | 6-3/4 | 6.7500 |
| U | .3680 | 1-13/16 | 1.8125 | 3-1/8 | 3.1250 | 3-5/8 | 3.6250 | 5 | 5.0000 | 4-1/4 | 4.2500 | 6-3/4 | 6.7500 |
| 3/8 | .3750 | 1-13/16 | 1.8125 | 3-1/8 | 3.1250 | 3-5/8 | 3.6250 | 5 | 5.0000 | 4-1/4 | 4.2500 | 6-3/4 | 6.7500 |
| V | .3770 | 1-7/8 | 1.8750 | 3-1/4 | 3.2500 | 3-5/8 | 3.6250 | 5 | 5.0000 | 4-1/4 | 4.2500 | 6-3/4 | 6.7500 |
| W | .3860 | 1-7/8 | 1.8750 | 3-1/4 | 3.2500 | 3-3/4 | 3.7500 | 5-1/8 | 5.1250 | 4-1/4 | 4.2500 | 6-3/4 | 6.7500 |
| 25/64 | .3906 | 1-7/8 | 1.8750 | 3-1/4 | 3.2500 | 3-3/4 | 3.7500 | 5-1/8 | 5.1250 | 4-3/8 | 4.3750 | 7 | 7.0000 |
| X | .3970 | 1-15/16 | 1.9375 | 3-5/16 | 3.3125 | 3-3/4 | 3.7500 | 5-1/8 | 5.1250 | 4-3/8 | 4.3750 | 7 | 7.0000 |
| Y | .4040 | 1-15/16 | 1.9375 | 3-5/16 | 3.3125 | 3-7/8 | 3.8750 | 5-1/4 | 5.2500 | 4-3/8 | 4.3750 | 7 | 7.0000 |
| 13/32 | .4062 | 1-15/16 | 1.9375 | 3-5/16 | 3.3125 | 3-7/8 | 3.8750 | 5-1/4 | 5.2500 | 4-3/8 | 4.3750 | 7 | 7.0000 |
| Z | .4130 | 2 | 2.0000 | 3-3/8 | 3.3750 | 3-7/8 | 3.8750 | 5-1/4 | 5.2500 | 4-5/8 | 4.6250 | 7-1/4 | 7.2500 |
| 27/64 | .4219 | 2 | 2.0000 | 3-3/8 | 3.3750 | 3-15/16 | 3.9375 | 5-3/8 | 5.3750 | 4-5/8 | 4.6250 | 7-1/4 | 7.2500 |
| 7/16 | .4375 | 2-1/16 | 2.0625 | 3-7/16 | 3.4375 | 4-1/16 | 4.0625 | 5-1/2 | 5.5000 | 4-5/8 | 4.6250 | 7-1/4 | 7.2500 |
| 29/64 | .4531 | 2-1/8 | 2.1250 | 3-9/16 | 3.5625 | 4-3/16 | 4.1875 | 5-5/8 | 5.6250 | 4-3/4 | 4.7500 | 7-1/2 | 7.5000 |
| 15/32 | .4688 | 2-1/8 | 2.1250 | 3-5/8 | 3.6250 | 4-5/16 | 4.3125 | 5-3/4 | 5.7500 | 4-3/4 | 4.7500 | 7-1/2 | 7.5000 |
| 31/64 | .4844 | 2-3/16 | 2.1875 | 3-11/16 | 3.6875 | 4-3/8 | 4.3750 | 5-7/8 | 5.8750 | 4-3/4 | 4.7500 | 7-3/4 | 7.7500 |
| 1/2 | .5000 | 2-1/4 | 2.2500 | 3-3/4 | 3.7500 | 4-1/2 | 4.5000 | 6 | 6.0000 | 4-3/4 | 4.7500 | 7-3/4 | 7.7500 |
| 33/64 | .5156 | 2-3/8 | 2.3750 | 3-7/8 | 3.8750 | 4-13/16 | 4.8125 | 6-5/8 | 6.6250 | 4-3/4 | 4.7500 | 8 | 8.0000 |
| 17/32 | .5312 | 2-3/8 | 2.3750 | 3-7/8 | 3.8750 | 4-13/16 | 4.8125 | 6-5/8 | 6.6250 | 4-3/4 | 4.7500 | 8 | 8.0000 |
| 35/64 | .5469 | 2-1/2 | 2.5000 | 4 | 4.0000 | 4-13/16 | 4.8125 | 6-5/8 | 6.6250 | 4-7/8 | 4.8750 | 8-1/4 | 8.2500 |
| 9/16 | .5625 | 2-1/2 | 2.5000 | 4 | 4.0000 | 4-13/16 | 4.8125 | 6-5/8 | 6.6250 | 4-7/8 | 4.8750 | 8-1/4 | 8.2500 |
| 37/64 | .5781 | 2-5/8 | 2.6250 | 4-1/8 | 4.1250 | 4-13/16 | 4.8125 | 6-5/8 | 6.6250 | 4-7/8 | 4.8750 | 8-3/4 | 8.7500 |
| 19/32 | .5938 | 2-5/8 | 2.6250 | 4-1/8 | 4.1250 | 5-3/16 | 5.1875 | 7-1/8 | 7.1250 | 4-7/8 | 4.8750 | 8-3/4 | 8.7500 |
| 39/64 | .6094 | 2-3/4 | 2.7500 | 4-1/4 | 4.2500 | 5-3/16 | 5.1875 | 7-1/8 | 7.1250 | 4-7/8 | 4.8750 | 8-3/4 | 8.7500 |
| 5/8 | .6250 | 2-3/4 | 2.7500 | 4-1/4 | 4.2500 | 5-3/16 | 5.1875 | 7-1/8 | 7.1250 | 4-7/8 | 4.8750 | 8-3/4 | 8.7500 |
| 41/64 | .6406 | 2-7/8 | 2.8750 | 4-1/2 | 4.5000 | 5-3/16 | 5.1875 | 7-1/8 | 7.1250 | 5-1/8 | 5.1250 | 9 | 9.0000 |
| 21/32 | .6562 | 2-7/8 | 2.8750 | 4-1/2 | 4.5000 | 5-3/16 | 5.1875 | 7-1/8 | 7.1250 | 5-1/8 | 5.1250 | 9 | 9.0000 |
| 43/64 | .6719 | 2-7/8 | 2.8750 | 4-5/8 | 4.6250 | 5-5/8 | 5.6250 | 7-5/8 | 7.6250 | 5-3/8 | 5.3750 | 9-1/4 | 9.2500 |
| 11/16 | .6875 | 2-7/8 | 2.8750 | 4-5/8 | 4.6250 | 5-5/8 | 5.6250 | 7-5/8 | 7.6250 | 5-3/8 | 5.3750 | 9-1/4 | 9.2500 |
| 45/64 | .7031 | 3 | 3.0000 | 4-3/4 | 4.7500 | — | — | — | — | 5-5/8 | 5.6250 | 9-1/2 | 9.5000 |
| 23/32 | .7188 | 3 | 3.0000 | 4-3/4 | 4.7500 | — | — | — | — | 5-5/8 | 5.6250 | 9-1/2 | 9.5000 |
| 47/64 | .7344 | 3-1/8 | 3.1250 | 5 | 5.0000 | — | — | — | — | 5-7/8 | 5.8750 | 9-3/4 | 9.7500 |
| 3/4 | .7500 | 3-1/8 | 3.1250 | 5 | 5.0000 | — | — | — | — | 5-7/8 | 5.8750 | 9-3/4 | 9.7500 |
| 49/64 | .7656 | 3-1/4 | 3.2500 | 5-1/8 | 5.1250 | — | — | — | — | 6 | 6.0000 | 9-7/8 | 9.8750 |
| 25/32 | .7812 | 3-1/4 | 3.2500 | 5-1/8 | 5.1250 | — | — | — | — | 6 | 6.0000 | 9-7/8 | 9.8750 |
| 51/64 | .7969 | 3-3/8 | 3.3750 | 5-1/4 | 5.2500 | — | — | — | — | 6-1/8 | 6.1250 | 10 | 10.0000 |
| 13/16 | .8125 | 3-3/8 | 3.3750 | 5-1/4 | 5.2500 | — | — | — | — | 6-1/8 | 6.1250 | 10 | 10.0000 |
| 53/64 | .8281 | 3-1/2 | 3.5000 | 5-3/8 | 5.3750 | — | — | — | — | 6-1/8 | 6.1250 | 10 | 10.0000 |
| 27/32 | .8438 | 3-1/2 | 3.5000 | 5-3/8 | 5.3750 | — | — | — | — | 6-1/8 | 6.1250 | 10 | 10.0000 |
| 55/64 | .8594 | 3-1/2 | 3.5000 | 5-1/2 | 5.5000 | — | — | — | — | 6-1/8 | 6.1250 | 10 | 10.0000 |
| 7/8 | .8750 | 3-1/2 | 3.5000 | 5-1/2 | 5.5000 | — | — | — | — | 6-1/8 | 6.1250 | 10 | 10.0000 |
| 57/64 | .8906 | 3-5/8 | 3.6250 | 5-5/8 | 5.6250 | — | — | — | — | 6-1/8 | 6.1250 | 10 | 10.0000 |
| 29/32 | .9062 | 3-5/8 | 3.6250 | 5-5/8 | 5.6250 | — | — | — | — | 6-1/8 | 6.1250 | 10 | 10.0000 |
| 59/64 | .9219 | 3-3/4 | 3.7500 | 5-3/4 | 5.7500 | — | — | — | — | 6-1/8 | 6.1250 | 10-3/4 | 10.7500 |
| 15/16 | .9375 | 3-3/4 | 3.7500 | 5-3/4 | 5.7500 | — | — | — | — | 6-1/8 | 6.1250 | 10-3/4 | 10.7500 |
| 61/64 | .9531 | 3-7/8 | 3.8750 | 5-7/8 | 5.8750 | — | — | — | — | 6-3/8 | 6.3750 | 11 | 11.0000 |
| 31/32 | .9688 | 3-7/8 | 3.8750 | 5-7/8 | 5.8750 | — | — | — | — | 6-3/8 | 6.3750 | 11 | 11.0000 |
| 63/64 | .9844 | 4 | 4.0000 | 6 | 6.0000 | — | — | — | — | 6-3/8 | 6.3750 | 11 | 11.0000 |
| 1 | 1.0000 | 4 | 4.0000 | 6 | 6.0000 | — | — | — | — | 6-3/8 | 6.3750 | 11 | 11.0000 |



Dimensional Specs

Technical Information

Conversion formulas:

Inch = mm x .03937

Metric = inch x 25.4

Metric Drill Sizes

TECHNICAL

High Speed Steel

| Drill Size (mm) | Decimal Equivalent (in) | Screw Machine Length DIN 1897 | | Jobbers Length DIN 338 | | Taper Length DIN 340 | |
|--------------------|-------------------------------|----------------------------------|----------------|---------------------------|----------------|-------------------------|----------------|
| | | flute length | overall length | flute length | overall length | flute length | overall length |
| | | mm | mm | mm | mm | mm | mm |
| 0.2 | .0079 | 1.5 | 19 | 2.5 | 19 | — | — |
| 0.22 | .0087 | 1.5 | 19 | 2.5 | 19 | — | — |
| 0.25 | .0098 | 1.5 | 19 | 3 | 19 | — | — |
| 0.28 | .0110 | 1.5 | 19 | 3 | 19 | — | — |
| 0.3 | .0118 | 1.5 | 19 | 3 | 19 | — | — |
| 0.32 | .0126 | 2 | 19 | 4 | 19 | — | — |
| 0.35 | .0138 | 2 | 19 | 4 | 19 | — | — |
| 0.38 | .0150 | 2 | 19 | 4 | 19 | — | — |
| 0.4 | .0157 | 2.5 | 19 | 5 | 20 | — | — |
| 0.42 | .0165 | 2.5 | 19 | 5 | 20 | — | — |
| 0.45 | .0177 | 2.5 | 19 | 5 | 20 | — | — |
| 0.48 | .0189 | 2.5 | 19 | 5 | 20 | — | — |
| 0.5 | .0197 | 3 | 20 | 6 | 22 | — | — |
| 0.52 | .0205 | 3 | 20 | 6 | 22 | — | — |
| 0.55 | .0217 | 3.5 | 21 | 7 | 24 | — | — |
| 0.58 | .0228 | 3.5 | 21 | 7 | 24 | — | — |
| 0.6 | .0236 | 3.5 | 21 | 7 | 24 | — | — |
| 0.62 | .0244 | 4 | 22 | 8 | 26 | — | — |
| 0.65 | .0256 | 4 | 22 | 8 | 26 | — | — |
| 0.68 | .0268 | 4.5 | 23 | 9 | 28 | — | — |
| 0.7 | .0276 | 4.5 | 23 | 9 | 28 | — | — |
| 0.72 | .0283 | 4.5 | 23 | 9 | 28 | — | — |
| 0.75 | .0295 | 4.5 | 23 | 9 | 28 | — | — |
| 0.78 | .0307 | 5 | 24 | 10 | 30 | — | — |
| 0.8 | .0315 | 5 | 24 | 10 | 30 | — | — |
| 0.82 | .0322 | 5 | 24 | 10 | 30 | — | — |
| 0.85 | .0335 | 5 | 24 | 10 | 30 | — | — |
| 0.88 | .0346 | 5.5 | 25 | 11 | 32 | — | — |
| 0.9 | .0354 | 5.5 | 25 | 11 | 32 | — | — |
| 0.92 | .0362 | 5.5 | 25 | 11 | 32 | — | — |
| 0.95 | .0374 | 5.5 | 25 | 11 | 32 | — | — |
| 0.98 | .0385 | 6 | 26 | 12 | 34 | — | — |
| 1.0 | .0394 | 6 | 26 | 12 | 34 | 33 | 56 |
| 1.05 | .0413 | 6 | 26 | 12 | 34 | — | — |
| 1.1 | .0433 | 7 | 28 | 14 | 36 | 37 | 60 |
| 1.15 | .0453 | 7 | 28 | 14 | 36 | — | — |
| 1.2 | .0472 | 8 | 30 | 16 | 38 | 41 | 65 |
| 1.25 | .0492 | 8 | 30 | 16 | 38 | — | — |
| 1.3 | .0512 | 8 | 30 | 16 | 38 | 41 | 65 |
| 1.35 | .0531 | 9 | 32 | 18 | 40 | — | — |
| 1.4 | .0551 | 9 | 32 | 18 | 40 | 45 | 70 |
| 1.45 | .0571 | 9 | 32 | 18 | 40 | — | — |
| 1.5 | .0591 | 9 | 32 | 18 | 40 | 45 | 70 |
| 1.55 | .0610 | 10 | 34 | 20 | 43 | — | — |
| 1.6 | .0630 | 10 | 34 | 20 | 43 | 50 | 76 |
| 1.65 | .0650 | 10 | 34 | 20 | 43 | — | — |
| 1.7 | .0669 | 10 | 34 | 20 | 43 | 50 | 76 |
| 1.75 | .0689 | 11 | 36 | 22 | 46 | — | — |
| 1.8 | .0709 | 11 | 36 | 22 | 46 | 53 | 80 |
| 1.85 | .0728 | 11 | 36 | 22 | 46 | — | — |
| 1.9 | .0748 | 11 | 36 | 22 | 46 | 53 | 80 |
| 1.95 | .0767 | 12 | 38 | 24 | 49 | — | — |
| 2.0 | .0787 | 12 | 38 | 24 | 49 | 56 | 85 |
| 2.05 | .0807 | 12 | 38 | 24 | 49 | — | — |
| 2.1 | .0827 | 12 | 38 | 24 | 49 | 56 | 85 |
| 2.15 | .0846 | 13 | 40 | 27 | 53 | — | — |

continued on next page



Technical Information

Dimensional Specs

Conversion formulas:

Inch = mm x .03937

Metric = inch x 25.4

Metric Drill Sizes (continued)

| Drill Size (mm) | Decimal Equivalent (in) | Screw Machine Length DIN 1897 | | Jobbers Length DIN 338 | | Taper Length DIN 340 | |
|--------------------|-------------------------------|----------------------------------|----------------|---------------------------|----------------|-------------------------|----------------|
| | | flute length | overall length | flute length | overall length | flute length | overall length |
| | | mm | mm | mm | mm | mm | mm |
| 2.2 | .0866 | 13 | 40 | 27 | 53 | 59 | 90 |
| 2.25 | .0886 | 13 | 40 | 27 | 53 | — | — |
| 2.3 | .0906 | 13 | 40 | 27 | 53 | 59 | 90 |
| 2.35 | .0925 | 13 | 40 | 27 | 53 | — | — |
| 2.4 | .0945 | 14 | 43 | 30 | 57 | 62 | 95 |
| 2.45 | .0964 | 14 | 43 | 30 | 57 | — | — |
| 2.5 | .0984 | 14 | 43 | 30 | 57 | 62 | 95 |
| 2.55 | .1003 | 14 | 43 | 30 | 57 | — | — |
| 2.6 | .1024 | 14 | 43 | 30 | 57 | 62 | 95 |
| 2.65 | .1043 | 14 | 43 | 30 | 57 | — | — |
| 2.7 | .1062 | 16 | 46 | 33 | 61 | 66 | 100 |
| 2.75 | .1082 | 16 | 46 | 33 | 61 | — | — |
| 2.8 | .1102 | 16 | 46 | 33 | 61 | 66 | 100 |
| 2.85 | .1122 | 16 | 46 | 33 | 61 | — | — |
| 2.9 | .1142 | 16 | 46 | 33 | 61 | 66 | 100 |
| 2.95 | .1161 | 16 | 46 | 33 | 61 | — | — |
| 3.0 | .1181 | 16 | 46 | 33 | 61 | 66 | 100 |
| 3.1 | .1220 | 18 | 49 | 36 | 65 | 69 | 106 |
| 3.2 | .1260 | 18 | 49 | 36 | 65 | 69 | 106 |
| 3.3 | .1299 | 18 | 49 | 36 | 65 | 69 | 106 |
| 3.4 | .1339 | 20 | 52 | 39 | 70 | 73 | 112 |
| 3.5 | .1378 | 20 | 52 | 39 | 70 | 73 | 112 |
| 3.6 | .1417 | 20 | 52 | 39 | 70 | 73 | 112 |
| 3.7 | .1457 | 20 | 52 | 39 | 70 | 73 | 112 |
| 3.8 | .1496 | 22 | 55 | 43 | 75 | 78 | 119 |
| 3.9 | .1535 | 22 | 55 | 43 | 75 | 78 | 119 |
| 4.0 | .1575 | 22 | 55 | 43 | 75 | 78 | 119 |
| 4.1 | .1614 | 22 | 55 | 43 | 75 | 78 | 119 |
| 4.2 | .1654 | 22 | 55 | 43 | 75 | 78 | 119 |
| 4.3 | .1692 | 24 | 58 | 47 | 80 | 82 | 126 |
| 4.4 | .1732 | 24 | 58 | 47 | 80 | 82 | 126 |
| 4.5 | .1772 | 24 | 58 | 47 | 80 | 82 | 126 |
| 4.6 | .1811 | 24 | 58 | 47 | 80 | 82 | 126 |
| 4.7 | .1850 | 24 | 58 | 47 | 80 | 82 | 126 |
| 4.8 | .1890 | 26 | 62 | 52 | 86 | 87 | 132 |
| 5.0 | .1969 | 26 | 62 | 52 | 86 | 87 | 132 |
| 5.1 | .2008 | 26 | 62 | 52 | 86 | 87 | 132 |
| 5.2 | .2047 | 26 | 62 | 52 | 86 | 87 | 132 |
| 5.3 | .2086 | 26 | 62 | 52 | 86 | 87 | 132 |
| 5.4 | .2125 | 28 | 66 | 57 | 93 | 91 | 139 |
| 5.5 | .2165 | 28 | 66 | 57 | 93 | 91 | 139 |
| 5.6 | .2205 | 28 | 66 | 57 | 93 | 91 | 139 |
| 5.7 | .2244 | 28 | 66 | 57 | 93 | 91 | 139 |
| 5.8 | .2283 | 28 | 66 | 57 | 93 | 91 | 139 |
| 5.9 | .2322 | 28 | 66 | 57 | 93 | 91 | 139 |
| 6.0 | .2362 | 28 | 66 | 57 | 93 | 91 | 139 |
| 6.1 | .2401 | 31 | 70 | 63 | 101 | 97 | 148 |
| 6.2 | .2440 | 31 | 70 | 63 | 101 | 97 | 148 |
| 6.3 | .2480 | 31 | 70 | 63 | 101 | 97 | 148 |
| 6.4 | .2520 | 31 | 70 | 63 | 101 | 97 | 148 |
| 6.5 | .2559 | 31 | 70 | 63 | 101 | 97 | 148 |
| 6.6 | .2598 | 31 | 70 | 63 | 101 | 97 | 148 |
| 6.7 | .2638 | 31 | 70 | 63 | 101 | 97 | 148 |
| 6.8 | .2677 | 34 | 74 | 69 | 109 | 102 | 156 |
| 6.9 | .2717 | 34 | 74 | 69 | 109 | 102 | 156 |
| 7.0 | .2756 | 34 | 74 | 69 | 109 | 102 | 156 |

TECHNICAL
High Speed Steel

continued on next page



Dimensional Specs

Technical Information

Conversion formulas:

Inch = mm x .03937

Metric = inch x 25.4

Metric Drill Sizes (continued)

TECHNICAL

High Speed Steel

| Drill Size (mm) | Decimal Equivalent (in) | Screw Machine Length DIN 1897 | | Jobbers Length DIN 338 | | Taper Length DIN 340 | |
|--------------------|-------------------------------|----------------------------------|----------------|---------------------------|----------------|-------------------------|----------------|
| | | flute length | overall length | flute length | overall length | flute length | overall length |
| | | mm | mm | mm | mm | mm | mm |
| 7.1 | .2795 | 34 | 74 | 69 | 109 | 102 | 156 |
| 7.2 | .2835 | 34 | 74 | 69 | 109 | 102 | 156 |
| 7.3 | .2874 | 34 | 74 | 69 | 109 | 102 | 156 |
| 7.4 | .2913 | 34 | 74 | 69 | 109 | 102 | 156 |
| 7.5 | .2953 | 34 | 74 | 69 | 109 | 102 | 156 |
| 7.6 | .2992 | 37 | 79 | 75 | 117 | 109 | 165 |
| 7.7 | .3031 | 37 | 79 | 75 | 117 | 109 | 165 |
| 7.8 | .3070 | 37 | 79 | 75 | 117 | 109 | 165 |
| 7.9 | .3110 | 37 | 79 | 75 | 117 | 109 | 165 |
| 8.0 | .3150 | 37 | 79 | 75 | 117 | 109 | 165 |
| 8.1 | .3189 | 37 | 79 | 75 | 117 | 109 | 165 |
| 8.2 | .3228 | 37 | 79 | 75 | 117 | 109 | 165 |
| 8.3 | .3267 | 37 | 79 | 75 | 117 | 109 | 165 |
| 8.4 | .3307 | 37 | 79 | 75 | 117 | 109 | 165 |
| 8.5 | .3346 | 37 | 79 | 75 | 117 | 109 | 165 |
| 8.6 | .3386 | 40 | 84 | 81 | 125 | 115 | 175 |
| 8.7 | .3425 | 40 | 84 | 81 | 125 | 115 | 175 |
| 8.8 | .3464 | 40 | 84 | 81 | 125 | 115 | 175 |
| 8.9 | .3503 | 40 | 84 | 81 | 125 | 115 | 175 |
| 9.0 | .3543 | 40 | 84 | 81 | 125 | 115 | 175 |
| 9.1 | .3582 | 40 | 84 | 81 | 125 | 115 | 175 |
| 9.2 | .3622 | 40 | 84 | 81 | 125 | 115 | 175 |
| 9.3 | .3661 | 40 | 84 | 81 | 125 | 115 | 175 |
| 9.4 | .3700 | 40 | 84 | 81 | 125 | 115 | 175 |
| 9.5 | .3740 | 40 | 84 | 81 | 125 | 115 | 175 |
| 9.6 | .3779 | 43 | 89 | 87 | 133 | 121 | 184 |
| 9.7 | .3817 | 43 | 89 | 87 | 133 | 121 | 184 |
| 9.8 | .3858 | 43 | 89 | 87 | 133 | 121 | 184 |
| 9.9 | .3897 | 43 | 89 | 87 | 133 | 121 | 184 |
| 10.0 | .3937 | 43 | 89 | 87 | 133 | 121 | 184 |
| 10.1 | .3976 | 43 | 89 | 87 | 133 | 121 | 184 |
| 10.2 | .4016 | 43 | 89 | 87 | 133 | 121 | 184 |
| 10.3 | .4055 | 43 | 89 | 87 | 133 | 121 | 184 |
| 10.4 | .4094 | 43 | 89 | 87 | 133 | 121 | 184 |
| 10.5 | .4134 | 43 | 89 | 87 | 133 | 121 | 184 |
| 10.6 | .4173 | 43 | 89 | 87 | 133 | 121 | 184 |
| 10.7 | .4212 | 47 | 95 | 94 | 142 | 128 | 195 |
| 10.8 | .4252 | 47 | 95 | 94 | 142 | 128 | 195 |
| 10.9 | .4291 | 47 | 95 | 94 | 142 | 128 | 195 |
| 11.0 | .4331 | 47 | 95 | 94 | 142 | 128 | 195 |
| 11.1 | .4370 | 47 | 95 | 94 | 142 | 128 | 195 |
| 11.2 | .4409 | 47 | 95 | 94 | 142 | 128 | 195 |
| 11.3 | .4448 | 47 | 95 | 94 | 142 | 128 | 195 |
| 11.4 | .4488 | 47 | 95 | 94 | 142 | 128 | 195 |
| 11.5 | .4527 | 47 | 95 | 94 | 142 | 128 | 195 |
| 11.6 | .4566 | 47 | 95 | 94 | 142 | 128 | 195 |
| 11.7 | .4606 | 47 | 95 | 94 | 142 | 128 | 195 |
| 11.8 | .4645 | 47 | 95 | 94 | 142 | 128 | 195 |
| 11.9 | .4685 | 51 | 102 | 101 | 151 | 134 | 205 |
| 12.0 | .4724 | 51 | 102 | 101 | 151 | 134 | 205 |
| 12.1 | .4763 | 51 | 102 | 101 | 151 | 134 | 205 |
| 12.2 | .4823 | 51 | 102 | 101 | 151 | 134 | 205 |
| 12.3 | .4842 | 51 | 102 | 101 | 151 | 134 | 205 |
| 12.4 | .4881 | 51 | 102 | 101 | 151 | 134 | 205 |
| 12.5 | .4921 | 51 | 102 | 101 | 151 | 134 | 205 |
| 12.6 | .4960 | 51 | 102 | 101 | 151 | 134 | 205 |

continued on next page

Technical Information

Dimensional Specs

Conversion formulas:

Inch = mm x .03937

Metric = inch x 25.4

Metric Drill Sizes (continued)

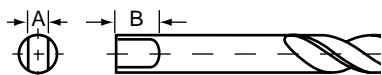
| Drill Size (mm) | Decimal Equivalent (in) | Screw Machine Length DIN 1897 | | Jobbers Length DIN 338 | | Taper Length DIN 340 | |
|-----------------|-------------------------|-------------------------------|----------------|------------------------|----------------|----------------------|----------------|
| | | flute length | overall length | flute length | overall length | flute length | overall length |
| | | mm | mm | mm | mm | mm | mm |
| 12.7 | .5000 | 51 | 102 | 101 | 151 | 134 | 205 |
| 12.8 | .5039 | 51 | 102 | 101 | 151 | 134 | 205 |
| 12.9 | .5078 | 51 | 102 | 101 | 151 | 134 | 205 |
| 13.0 | .5118 | 51 | 102 | 101 | 151 | 134 | 205 |
| 13.1 | .5157 | 51 | 102 | 101 | 151 | 134 | 205 |
| 13.2 | .5197 | 51 | 102 | 101 | 151 | 134 | 205 |
| 13.3 | .5236 | 54 | 107 | 108 | 160 | 140 | 214 |
| 13.4 | .5118 | 54 | 107 | 108 | 160 | 140 | 214 |
| 13.5 | .5315 | 54 | 107 | 108 | 160 | 140 | 214 |
| 13.6 | .5354 | 54 | 107 | 108 | 160 | 140 | 214 |
| 13.7 | .5394 | 54 | 107 | 108 | 160 | 140 | 214 |
| 13.8 | .5433 | 54 | 107 | 108 | 160 | 140 | 214 |
| 13.9 | .5472 | 54 | 107 | 108 | 160 | 140 | 214 |
| 14.0 | .5512 | 54 | 107 | 108 | 160 | 140 | 214 |
| 14.25 | .5610 | 56 | 111 | 114 | 169 | 144 | 220 |
| 14.5 | .5709 | 56 | 111 | 114 | 169 | 144 | 220 |
| 14.75 | .5807 | 56 | 111 | 114 | 169 | 144 | 220 |
| 15.0 | .5906 | 56 | 111 | 114 | 169 | 144 | 220 |
| 15.25 | .6004 | 58 | 115 | 120 | 178 | 149 | 227 |
| 15.5 | .6102 | 58 | 115 | 120 | 178 | 149 | 227 |
| 15.75 | .6201 | 58 | 115 | 120 | 178 | 149 | 227 |
| 16.0 | .6299 | 58 | 115 | 120 | 178 | 149 | 227 |

TECHNICAL



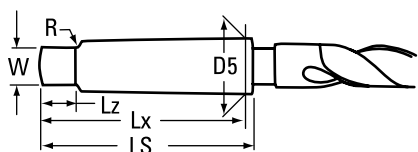
High Speed Steel

Shank / Tang



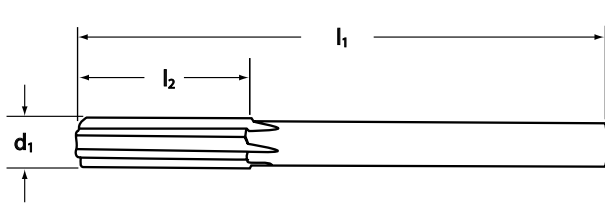
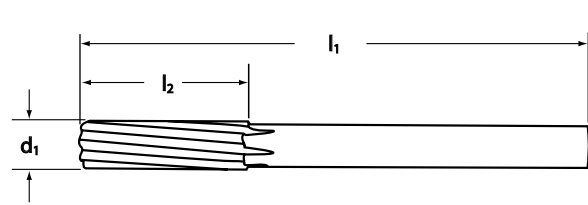
| Shank Diameter (inches) | | Tang Dimensions (inches) | |
|-------------------------|-------|--------------------------|----------|
| from | to | A width | B length |
| 1/8 | 3/16 | .092 | 9/32 |
| over 3/16 | 1/4 | .120 | 5/16 |
| over 1/4 | 5/16 | .160 | 11/32 |
| over 5/16 | 3/8 | .201 | 3/8 |
| over 3/8 | 15/32 | .241 | 7/16 |
| over 15/32 | 9/16 | .300 | 1/2 |
| over 9/16 | 21/32 | .370 | 9/16 |
| over 21/32 | 3/4 | .440 | 5/8 |
| over 3/4 | 7/8 | .511 | 11/16 |
| over 7/8 | 1 | .605 | 3/4 |
| over 1-3/16 | 1-3/8 | .813 | 7/8 |

Morse Taper Shank



| morse taper shank number | taper per foot | taper per inch | D5 maximum shank dia. | LS length of shank | Lx length of shank to gage line | Lz length of tang | W thickness of tang | R radius |
|--------------------------|----------------|----------------|-----------------------|--------------------|---------------------------------|-------------------|---------------------|----------|
| 1 | .5985 | .0498 | .475 | 2.56 | 2.44 | .37 | .20 | .19 |
| 2 | .5994 | .0499 | .700 | 3.12 | 2.94 | .44 | .25 | .25 |
| 3 | .6023 | .0501 | .938 | 3.87 | 3.69 | .56 | .31 | .28 |
| 4 | .6232 | .0519 | 1.231 | 4.87 | 4.62 | .62 | .47 | .31 |
| 5 | .6315 | .0526 | 1.749 | 6.12 | 5.87 | .75 | .62 | .37 |
| 6 | .6256 | .0521 | 2.494 | 8.56 | 8.25 | 1.12 | .75 | .50 |

Straight Shank Chucking Reamer Dimensions

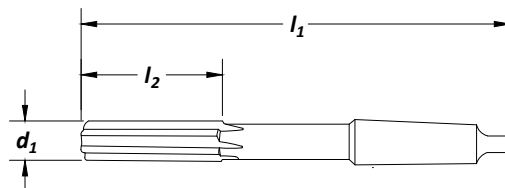
Straight Flute

Spiral Flute

TECHNICAL
High Speed Steel

| decimal size range | | reamer dia d ₁ (in) | | overall length l ₁ (in) | flute length l ₂ (in) | no. of flutes |
|--------------------|-------|--------------------------------|-------|------------------------------------|----------------------------------|---------------|
| min | max | max | min | | | |
| .0394 | .0460 | .0390 | .0380 | 2.500 | .500 | 4 |
| .0461 | .0515 | .0455 | .0445 | 2.500 | .500 | 4 |
| .0516 | .0590 | .0510 | .0500 | 2.500 | .500 | 4 |
| .0591 | .0635 | .0585 | .0575 | 2.500 | .500 | 4 |
| .0636 | .0665 | .0585 | .0575 | 3.000 | .750 | 4 |
| .0666 | .0755 | .0660 | .0650 | 3.000 | .750 | 4 |
| .0756 | .0805 | .0720 | .0710 | 3.000 | .750 | 4 |
| .0806 | .0855 | .0771 | .0761 | 3.000 | .750 | 4 |
| .0856 | .0930 | .0810 | .0800 | 3.000 | .750 | 4 |
| .0931 | .0938 | .0880 | .0870 | 3.000 | .750 | 4 |
| .0939 | .0955 | .0880 | .0870 | 3.500 | .875 | 4 |
| .0956 | .1005 | .0928 | .0918 | 3.500 | .875 | 4 |
| .1006 | .1060 | .0950 | .0940 | 3.500 | .875 | 4 |
| .1061 | .1105 | .1030 | .1020 | 3.500 | .875 | 4 |
| .1106 | .1155 | .1055 | .1045 | 3.500 | .875 | 4 |
| .1156 | .1160 | .1120 | .1110 | 3.500 | .875 | 4 |
| .1161 | .1225 | .1120 | .1110 | 3.500 | .875 | 6 |
| .1226 | .1285 | .1190 | .1180 | 3.500 | .875 | 6 |
| .1286 | .1355 | .1190 | .1180 | 4.000 | 1.000 | 6 |
| .1356 | .1400 | .1275 | .1265 | 4.000 | 1.000 | 6 |
| .1401 | .1465 | .1350 | .1340 | 4.000 | 1.000 | 6 |
| .1466 | .1515 | .1430 | .1420 | 4.000 | 1.000 | 6 |
| .1516 | .1560 | .1460 | .1450 | 4.000 | 1.000 | 6 |
| .1561 | .1570 | .1510 | .1500 | 4.000 | 1.000 | 6 |
| .1571 | .1585 | .1510 | .1500 | 4.500 | 1.125 | 6 |
| .1586 | .1655 | .1530 | .1520 | 4.500 | 1.125 | 6 |
| .1656 | .1715 | .1595 | .1585 | 4.500 | 1.125 | 6 |
| .1716 | .1765 | .1645 | .1635 | 4.500 | 1.125 | 6 |
| .1766 | .1795 | .1704 | .1694 | 4.500 | 1.125 | 6 |
| .1796 | .1845 | .1755 | .1745 | 4.500 | 1.125 | 6 |

| decimal size range | | reamer dia d ₁ (in) | | overall length l ₁ (in) | flute length l ₂ (in) | no. of flutes |
|--------------------|--------|--------------------------------|--------|------------------------------------|----------------------------------|---------------|
| min | max | max | min | | | |
| .1846 | .1890 | .1805 | .1795 | 4.500 | 1.125 | 6 |
| .1891 | .1905 | .1805 | .1795 | 5.000 | 1.250 | 6 |
| .1906 | .1955 | .1860 | .1850 | 5.000 | 1.250 | 6 |
| .1956 | .2005 | .1895 | .1885 | 5.000 | 1.250 | 6 |
| .2006 | .2050 | .1945 | .1935 | 5.000 | 1.250 | 6 |
| .2051 | .2125 | .2016 | .2006 | 5.000 | 1.250 | 6 |
| .2126 | .2188 | .2075 | .2065 | 5.000 | 1.250 | 6 |
| .2189 | .2205 | .2075 | .2065 | 6.000 | 1.500 | 6 |
| .2206 | .2335 | .2173 | .2163 | 6.000 | 1.500 | 6 |
| .2336 | .2375 | .2265 | .2255 | 6.000 | 1.500 | 6 |
| .2376 | .2475 | .2329 | .2319 | 6.000 | 1.500 | 6 |
| .2476 | .2530 | .2405 | .2395 | 6.000 | 1.500 | 6 |
| .2531 | .2840 | .2485 | .2475 | 6.000 | 1.500 | 6 |
| .2841 | .3438 | .2792 | .2782 | 6.000 | 1.500 | 6 |
| .3439 | .4062 | .3105 | .3095 | 7.000 | 1.750 | 6 |
| .4063 | .4688 | .3730 | .3720 | 7.000 | 1.750 | 6 |
| .4689 | .5010 | .4355 | .4345 | 8.000 | 2.000 | 6 |
| .5011 | .6000 | .4355 | .4345 | 8.000 | 2.000 | 8 |
| .6001 | .7230 | .5620 | .5605 | 9.000 | 2.250 | 8 |
| .7231 | .8490 | .6245 | .6230 | 9.500 | 2.500 | 8 |
| .8491 | .9740 | .7495 | .7480 | 10.000 | 2.625 | 8 |
| .9741 | 1.0000 | .8745 | .8730 | 10.500 | 2.750 | 8 |
| 1.0001 | 1.0625 | .8745 | .8730 | 10.500 | 2.750 | 10 |
| 1.0626 | 1.1250 | .8745 | .8730 | 11.000 | 2.875 | 10 |
| 1.1251 | 1.1875 | .9995 | .9980 | 11.000 | 2.875 | 10 |
| 1.1876 | 1.3125 | .9995 | .9980 | 11.500 | 3.000 | 10 |
| 1.3126 | 1.3750 | .9995 | .9980 | 12.000 | 3.250 | 10 |
| 1.3751 | 1.4375 | 1.2495 | 1.2480 | 12.000 | 3.250 | 10 |
| 1.4376 | 1.5000 | 1.2495 | 1.2480 | 12.500 | 3.500 | 12 |



Taper Shank Chucking Reamers - Straight Flute



| diameter size range | | overall length | flute length | morse taper shank number | no. of flutes |
|---------------------|--------|----------------|--------------|--------------------------|---------------|
| min | max | | | | |
| .1750 | .1890 | 4.500 | 1.125 | 1 | 6 |
| .1891 | .2041 | 5.000 | 1.250 | 1 | 6 |
| .2042 | .2188 | 5.000 | 1.250 | 1 | 6 |
| .2189 | .2630 | 6.000 | 1.500 | 1 | 6 |
| .2531 | .2840 | 6.000 | 1.500 | 1 | 6 |
| .2841 | .3135 | 6.000 | 1.500 | 1 | 6 |
| .3136 | .3438 | 6.000 | 1.500 | 1 | 6 |
| .3439 | .3770 | 7.000 | 1.750 | 1 | 6 |
| .3771 | .4062 | 7.000 | 1.750 | 1 | 6 |
| .4063 | .4385 | 7.000 | 1.750 | 1 | 6 |
| .4386 | .4688 | 7.000 | 1.750 | 1 | 6 |
| .4689 | .5010 | 8.000 | 2.000 | 1 | 6 |
| .5011 | .5330 | 8.000 | 2.000 | 1 | 8 |
| .5331 | .5635 | 8.000 | 2.000 | 1 | 8 |
| .5636 | .5938 | 8.000 | 2.000 | 1 | 8 |
| .5939 | .6260 | 9.000 | 2.250 | 2 | 8 |
| .6261 | .6719 | 9.000 | 2.250 | 2 | 8 |
| .6720 | .7230 | 9.000 | 2.250 | 2 | 8 |
| .7231 | .7656 | 9.500 | 2.500 | 2 | 8 |
| .7657 | .8125 | 9.500 | 2.500 | 2 | 8 |
| .8126 | .8490 | 9.500 | 2.500 | 2 | 8 |
| .8491 | .9062 | 1.000 | 2.625 | 2 | 8 |
| .9063 | .9740 | 1.000 | 2.625 | 3 | 8 |
| .9741 | 1.0000 | 1.500 | 2.750 | 3 | 8 |
| 1.0001 | 1.0625 | 1.500 | 2.750 | 3 | 10 |
| 1.0626 | 1.1250 | 11.000 | 2.875 | 3 | 10 |
| 1.1251 | 1.1875 | 11.000 | 2.875 | 3 | 10 |
| 1.1876 | 1.2500 | 11.500 | 3.000 | 4 | 10 |
| 1.2501 | 1.3125 | 11.500 | 3.000 | 4 | 10 |
| 1.3126 | 1.3750 | 12.000 | 3.250 | 4 | 10 |
| 1.3751 | 1.4375 | 12.000 | 3.250 | 4 | 10 |
| 1.4376 | 1.5000 | 12.500 | 3.500 | 4 | 12 |

TECHNICAL

High Speed Steel

Reaming Speeds

Speeds for machine reaming may vary considerably depending in part on the material to be reamed, type of machine, and required finish and accuracy. In general most machine reaming is done at about 2/3 the speed used for drilling the same material. Speeds for reaming are shown on pages 128-129.

Reaming Feeds

Feeds for reaming are usually much higher than those used for drilling, often running 200% to 300% of drill feeds. Too low a feed may result in excessive reamer wear. At all times it is necessary that the feed be high enough to permit the reamer to cut rather than to rub or burnish. Too high a feed may tend to reduce the accuracy of the hole and may also lower the quality of the finish. The basic idea is to use as high a feed as possible and still produce the required finish and accuracy.

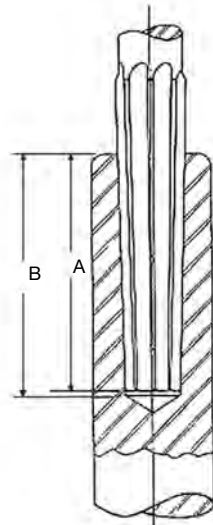
Stock to be Removed

For the same reason, insufficient stock for reaming may result in a burnishing rather than a cutting action. It is difficult to generalize on this phase as it is tied in closely with type of material, feed, finish required, depth of hole, and chip capacity of the reamer. For machine reaming, 0.010" on a 1/4" hole, 0.015" on a 1/2" hole, up to 0.025" on a 1-1/2" hole, seems a good starting point. For hand reaming, stock allowances are much smaller, partly because of the difficulty in forcing the reamer through greater stock. A common allowance is 0.001" to 0.003".

American National Standard Reamer Taper (Morse Taper) Dimensions

| Taper No. | Depth of Hole | |
|-----------|---------------------|--------------------|
| | A <i>Drilled</i> | B <i>Reamed</i> |
| 0* | 2-1/16 | 2-1/32 |
| 1 | 2-3/16 | 2-5/32 |
| 2 | 3-1/8 | 2-15/16 |
| 3 | 3-7/8 | 3-11/16 |
| 4 | 4-7/8 | 4-5/8 |
| 4-1/2 | 5-1/8 | 4-5/8 |
| 5 | 6-1/8 | 5-7/8 |
| 6 | 8-9/16 | 8-1/4 |
| 7 | 11-5/8 | 11-1/4 |

*Size 0 taper shank not listed in American National Standards.



Alignment

In the ideal reaming job, the spindle, reamer, bushing, and hole to be machined are all in perfect alignment. Any variation from this tends to increase reamer wear and detracts from the accuracy of the hole. Tapered, oversize, or bell-mouthed holes should call for a check of alignment. Sometimes the bad effects of misalignment can be reduced through the use of floating or adjustable holders. Quite often if the user will grind a slight back taper on the reamer it will also be of help in overcoming the effects of misalignment.

Chatter

The presence of chatter while reaming has a very bad effect on reamer life and on the finish in the hole. Chatter may be the result of one of several causes, some of which are listed:

- Excessive speed.
- Too much clearance on reamer.
- Lack of rigidity in jig or machine.
- Insecure holding of work.
- Excessive overhang of reamer or spindle.
- Excessive looseness in floating holder.
- Too light a feed.

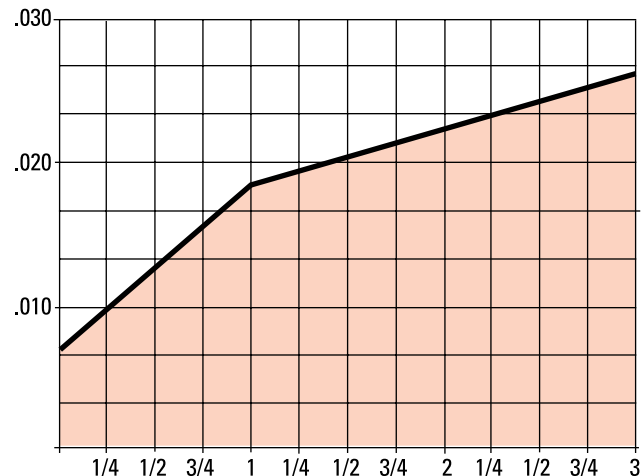
Correcting the cause can materially increase both reamer life and the quality of the reamed holes.

Coolant

In reaming, the emphasis is usually on finish, and a coolant is normally chosen for this purpose rather than for cooling. Quite often this means a change from that recommended for drilling as shown on page 2, but in general this list will be found satisfactory.

Reamer Stock Removal

Stock removal is dependent on material, feed, and finish required. The stock removal chart below illustrates starting points for various diameters when using machine and chucking reamers.



Reamer Diameter Tolerances

| Reamer Diameter inches | + inches | + inches |
|------------------------|----------|-----------|
| through 1/2 | .0001 | .0004 |
| over 1/2 through 1 | .0001 | .0005 |
| over 1 | .0002 | .0006 |
| dowel pin sizes | + .0000 | - (.0002) |

Reamer Overall Length and Flute Length Tolerances

| Reamer Diameter inches | + inches | - inches |
|------------------------|----------|----------|
| 3/64 through 1 | .0625 | .0625 |
| over 1 through 2 | .0938 | .0938 |
| over 2 through 3 | .1250 | .1250 |

Reamer Lip Height Tolerances

| Reamer Diameter inches | Total Indicator Variation inches |
|------------------------|----------------------------------|
| through 1/8 | .0010 |
| 1/8 through 1/4 | .0012 |
| over 1/4 through 1/2 | .0015 |
| over 1/2 through 1 | .0020 |
| over 1 through 3-1/2 | .0025 |

Reamer Straight Shank Diameter Tolerances

| Reamer Diameter | + inches | - inches |
|------------------------------|----------|----------|
| Tool Style 4001, 4030 | | |
| .0390 to .4335 | .0000 | .0010 |
| .4396 to 1.2495 | .0000 | .0015 |
| Tool Style 657, 659 | | |
| .0781 to .6250 | .0010 | .0050 |
| Tool Style 650 | | |
| .0781 to .6250 | .0005 | .0020 |

Reamer Regrinding

In obtaining maximum economy from reamers the same principles apply as in the case of most other cutting tools. One of these principles is not to allow a tool to become too dull. It is best to regrind the chamfer on a reamer long before it exhibits excessive wear or refuses to cut. This sharpening is usually restricted to the entering taper or chamfer. It can be done on almost any tool and cutter grinder. Care must be taken so that each flute is ground exactly even or the tool is apt to cut oversize.

Sharpening the chamfer on a reamer by hand is not recommended as it is practically impossible to keep the cutting edges even.

The following figures show three common types of grinds used on reamers:

In grinding down a reamer to special size it is usually necessary to relieve or clear the lands. No hard or fast rule may be given as to the amount of this clearance but the following table may be of help:

| Size of Reamer | Circular Land Width | Primary Clearance |
|----------------|---------------------|-------------------|
| 1/4" | .007 | 14° |
| 1/2" | .009 | 11° |
| 1" | .013 | 9° |
| 1-1/2" | .016 | 7° |
| 2" | .023 | 7° |

Figure A

Ordinary reamer grind for most jobs.

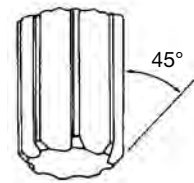


Figure B

Hand reamer grind also used on some machine reamer applications to obtain required finish or tolerance.

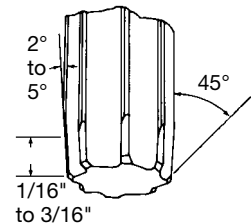


Figure C

Semi-finish reamer grind to straighten out bent or misaligned holes. Corners must be kept sharp.

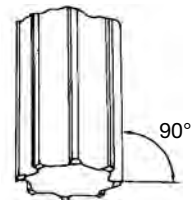
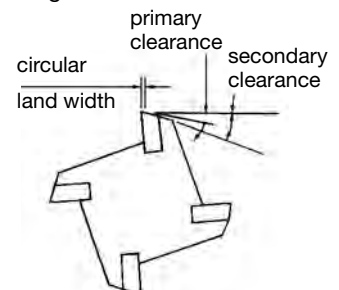


Figure D

A secondary clearance is often ground on reamers as shown in Fig. D. This clearance is only to insure the back of the land being well away from the wall of the reamed hole in order to prevent rubbing.



Reamer Cutting Speeds

Technical Information

TECHNICAL

High Speed Steel

Fractional Sizes

| Drill Size Fraction / Dec | Feet per Minute | | | | | | | | | | | | | | |
|------------------------------|-----------------|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 10' | 20' | 30' | 40' | 50' | 60' | 70' | 80' | 90' | 100' | 110' | 120' | 130' | 140' | 150' |
| 1/16 .0625 | 403 | 807 | 1210 | 1614 | 2017 | 2420 | 2823 | 3227 | 3663 | 4033 | 4437 | 4840 | 5244 | 5647 | 6050 |
| 1/8 .1250 | 202 | 403 | 605 | 807 | 1008 | 1210 | 1412 | 1614 | 1815 | 2017 | 2218 | 2420 | 2622 | 2823 | 3025 |
| 3/16 .1875 | 135 | 269 | 403 | 538 | 673 | 807 | 941 | 1076 | 1210 | 1344 | 1479 | 1614 | 1748 | 1882 | 2017 |
| 1/4 .2500 | 101 | 202 | 302 | 403 | 504 | 605 | 706 | 807 | 908 | 1008 | 1109 | 1210 | 1311 | 1412 | 1513 |
| 5/16 .3125 | 81 | 161 | 242 | 323 | 403 | 484 | 565 | 645 | 726 | 807 | 888 | 968 | 1049 | 1129 | 1210 |
| 3/8 .3750 | 67 | 135 | 202 | 269 | 336 | 403 | 471 | 538 | 605 | 673 | 739 | 807 | 874 | 941 | 1008 |
| 7/16 .4375 | 57 | 116 | 173 | 230 | 288 | 346 | 403 | 461 | 519 | 576 | 634 | 692 | 749 | 807 | 865 |
| 1/2 .5000 | 50 | 101 | 151 | 202 | 252 | 302 | 353 | 403 | 454 | 504 | 554 | 605 | 655 | 706 | 756 |
| 5/8 .6250 | 40 | 81 | 121 | 161 | 202 | 242 | 282 | 323 | 363 | 403 | 444 | 484 | 524 | 565 | 605 |
| 3/4 .7500 | 34 | 67 | 101 | 134 | 168 | 202 | 236 | 269 | 302 | 336 | 370 | 403 | 437 | 471 | 504 |
| 7/8 .8750 | 29 | 57 | 86 | 116 | 144 | 173 | 202 | 230 | 259 | 288 | 317 | 346 | 375 | 403 | 432 |
| 1 1.0000 | 25 | 50 | 76 | 101 | 126 | 151 | 176 | 202 | 227 | 252 | 277 | 302 | 328 | 353 | 378 |
| 1-1/8 1.1250 | 22 | 45 | 67 | 90 | 112 | 135 | 157 | 180 | 202 | 224 | 246 | 269 | 291 | 314 | 336 |
| 1-1/4 1.2500 | 20 | 40 | 61 | 81 | 101 | 121 | 141 | 161 | 182 | 202 | 222 | 242 | 262 | 282 | 302 |
| 1-3/8 1.3750 | 18 | 37 | 55 | 73 | 92 | 110 | 128 | 147 | 165 | 183 | 202 | 220 | 238 | 257 | 275 |
| 1-1/2 1.5000 | 17 | 34 | 50 | 67 | 84 | 101 | 117 | 135 | 151 | 168 | 185 | 202 | 218 | 236 | 252 |
| 1-5/8 1.6250 | 16 | 31 | 46 | 62 | 77 | 93 | 109 | 124 | 140 | 155 | 171 | 186 | 202 | 217 | 233 |
| 1-3/4 1.7500 | 15 | 29 | 43 | 57 | 72 | 86 | 101 | 116 | 129 | 144 | 158 | 173 | 187 | 202 | 216 |
| 1-7/8 1.8750 | 13 | 27 | 40 | 53 | 67 | 81 | 94 | 108 | 121 | 135 | 148 | 161 | 175 | 188 | 202 |
| 2 2.0000 | 13 | 25 | 38 | 50 | 63 | 76 | 88 | 101 | 114 | 126 | 139 | 151 | 164 | 176 | 189 |
| 2-1/4 2.2500 | 11 | 22 | 34 | 45 | 56 | 67 | 79 | 90 | 101 | 112 | 123 | 135 | 146 | 157 | 168 |
| 2-1/2 2.5000 | 10 | 20 | 30 | 40 | 50 | 61 | 71 | 81 | 90 | 101 | 111 | 121 | 131 | 141 | 151 |
| 2-3/4 2.7500 | 9 | 18 | 28 | 37 | 46 | 55 | 64 | 73 | 83 | 92 | 101 | 110 | 119 | 128 | 137 |
| 3 3.0000 | 9 | 17 | 25 | 34 | 42 | 50 | 59 | 67 | 76 | 84 | 92 | 101 | 110 | 117 | 126 |

Letter Sizes

| Drill Size Letter / Dec | Feet per Minute | | | | | | | | | | | | | | |
|----------------------------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| | 10' | 20' | 30' | 40' | 50' | 60' | 70' | 80' | 90' | 100' | 110' | 120' | 130' | 140' | 150' |
| A .2340 | 108 | 215 | 324 | 432 | 540 | 648 | 756 | 864 | 972 | 1080 | 1185 | 1293 | 1401 | 1508 | 1616 |
| B .2380 | 106 | 212 | 318 | 424 | 530 | 636 | 742 | 847 | 954 | 1059 | 1165 | 1271 | 1377 | 1483 | 1589 |
| C .2420 | 104 | 209 | 312 | 416 | 521 | 625 | 729 | 833 | 937 | 1041 | 1146 | 1250 | 1354 | 1459 | 1563 |
| D .2460 | 102 | 205 | 308 | 411 | 513 | 616 | 719 | 822 | 924 | 1027 | 1127 | 1230 | 1332 | 1435 | 1537 |
| E .2500 | 101 | 202 | 302 | 403 | 504 | 605 | 706 | 807 | 908 | 1008 | 1109 | 1210 | 1299 | 1412 | 1513 |
| F .2570 | 98 | 196 | 294 | 392 | 490 | 589 | 686 | 785 | 882 | 981 | 1079 | 1177 | 1275 | 1373 | 1471 |
| G .2610 | 96 | 193 | 290 | 386 | 483 | 579 | 676 | 772 | 869 | 966 | 1063 | 1159 | 1256 | 1352 | 1449 |
| H .2660 | 95 | 189 | 284 | 379 | 474 | 569 | 663 | 758 | 853 | 948 | 1043 | 1137 | 1232 | 1327 | 1422 |
| I .2720 | 92 | 185 | 278 | 371 | 463 | 556 | 649 | 741 | 834 | 927 | 1020 | 1112 | 1205 | 1298 | 1390 |
| J .2770 | 91 | 182 | 273 | 364 | 455 | 546 | 637 | 728 | 819 | 910 | 1001 | 1092 | 1183 | 1274 | 1365 |
| K .2810 | 90 | 180 | 269 | 359 | 449 | 538 | 628 | 717 | 807 | 897 | 987 | 1076 | 1166 | 1256 | 1346 |
| L .2900 | 87 | 174 | 261 | 348 | 435 | 521 | 609 | 696 | 782 | 869 | 956 | 1043 | 1130 | 1217 | 1304 |
| M .2950 | 85 | 171 | 257 | 342 | 428 | 513 | 599 | 684 | 770 | 855 | 940 | 1026 | 1111 | 1197 | 1282 |
| N .3020 | 83 | 167 | 251 | 334 | 418 | 501 | 585 | 668 | 752 | 835 | 918 | 1002 | 1085 | 1169 | 1252 |
| O .3160 | 80 | 160 | 240 | 319 | 399 | 479 | 558 | 638 | 718 | 798 | 878 | 957 | 1037 | 1117 | 1197 |
| P .3230 | 78 | 156 | 234 | 312 | 391 | 469 | 546 | 624 | 703 | 781 | 859 | 937 | 1014 | 1094 | 1171 |
| Q .3320 | 76 | 152 | 228 | 304 | 380 | 455 | 531 | 607 | 683 | 759 | 836 | 913 | 987 | 1063 | 1139 |
| R .3390 | 75 | 149 | 223 | 298 | 372 | 446 | 521 | 595 | 669 | 744 | 818 | 894 | 967 | 1041 | 1115 |
| S .3480 | 73 | 145 | 217 | 290 | 362 | 435 | 508 | 579 | 652 | 725 | 797 | 869 | 942 | 1014 | 1086 |
| T .3580 | 71 | 141 | 211 | 281 | 352 | 422 | 492 | 563 | 633 | 704 | 774 | 845 | 915 | 986 | 1056 |
| U .3680 | 69 | 137 | 205 | 274 | 343 | 411 | 480 | 548 | 616 | 685 | 754 | 822 | 890 | 959 | 1028 |
| V .3770 | 67 | 134 | 201 | 267 | 335 | 401 | 468 | 535 | 602 | 669 | 735 | 805 | 869 | 936 | 1003 |
| W .3860 | 65 | 131 | 196 | 261 | 327 | 392 | 457 | 523 | 588 | 653 | 718 | 784 | 849 | 914 | 979 |
| X .3970 | 63 | 127 | 191 | 254 | 317 | 380 | 444 | 508 | 571 | 635 | 698 | 762 | 826 | 889 | 952 |
| Y .4040 | 63 | 125 | 187 | 249 | 312 | 374 | 437 | 499 | 562 | 624 | 686 | 749 | 811 | 874 | 936 |
| Z .4130 | 61 | 122 | 183 | 244 | 305 | 366 | 427 | 488 | 549 | 611 | 671 | 733 | 793 | 855 | 915 |



Technical Information

Reamer Cutting Speeds

TECHNICAL

High Speed Steel

Wire Gauge Sizes

| Drill Size Wire / Dec | Feet per Minute | | | | | | | | | | | | | | |
|--------------------------|------------------------|------|------|------|------|------|------|------|------|------|------|-------|------|------|------|
| | 10' | 20' | 30' | 40' | 50' | 60' | 70' | 80' | 90' | 100' | 110' | 120' | 130' | 140' | 150' |
| | Revolutions Per Minute | | | | | | | | | | | | | | |
| 1 .2280 | 111 | 221 | 332 | 442 | 553 | 663 | 774 | 884 | 995 | 1106 | 1216 | 1327 | 1438 | 1548 | 1659 |
| 2 .2210 | 114 | 228 | 342 | 456 | 570 | 684 | 799 | 912 | 1026 | 1140 | 1255 | 1369 | 1483 | 1597 | 1711 |
| 3 .2130 | 118 | 237 | 355 | 473 | 592 | 710 | 828 | 946 | 1065 | 1183 | 1303 | 1420 | 1538 | 1657 | 1775 |
| 4 .2090 | 121 | 241 | 362 | 482 | 603 | 724 | 845 | 965 | 1086 | 1206 | 1327 | 1447 | 1568 | 1690 | 1809 |
| 5 .2055 | 123 | 246 | 368 | 491 | 614 | 736 | 859 | 981 | 1104 | 1227 | 1350 | 1472 | 1595 | 1717 | 1840 |
| 6 .2040 | 123 | 247 | 371 | 494 | 618 | 741 | 865 | 989 | 1112 | 1236 | 1360 | 1483 | 1606 | 1730 | 1854 |
| 7 .2010 | 125 | 251 | 376 | 502 | 627 | 752 | 878 | 1003 | 1129 | 1254 | 1379 | 1505 | 1630 | 1756 | 1881 |
| 8 .1990 | 127 | 253 | 380 | 507 | 634 | 760 | 886 | 1013 | 1140 | 1267 | 1393 | 1520 | 1647 | 1773 | 1900 |
| 9 .1960 | 129 | 257 | 386 | 515 | 644 | 772 | 900 | 1029 | 1158 | 1286 | 1415 | 1544 | 1672 | 1800 | 1929 |
| 10 .1935 | 130 | 261 | 391 | 521 | 651 | 781 | 912 | 1042 | 1173 | 1303 | 1433 | 1564 | 1694 | 1824 | 1954 |
| 11 .1910 | 132 | 264 | 396 | 528 | 660 | 792 | 924 | 1056 | 1188 | 1320 | 1452 | 1584 | 1716 | 1848 | 1981 |
| 12 .1890 | 133 | 267 | 400 | 533 | 667 | 801 | 934 | 1067 | 1201 | 1334 | 1467 | 1601 | 1734 | 1867 | 2001 |
| 13 .1850 | 136 | 273 | 409 | 545 | 681 | 818 | 957 | 1090 | 1227 | 1363 | 1499 | 1636 | 1771 | 1908 | 2044 |
| 14 .1820 | 139 | 277 | 416 | 554 | 693 | 831 | 970 | 1108 | 1247 | 1385 | 1524 | 1662 | 1800 | 1939 | 2078 |
| 15 .1800 | 141 | 281 | 421 | 562 | 702 | 842 | 983 | 1123 | 1263 | 1404 | 1540 | 1680 | 1821 | 1961 | 2101 |
| 16 .1770 | 143 | 285 | 427 | 570 | 712 | 855 | 997 | 1139 | 1282 | 1424 | 1567 | 1709 | 1852 | 1994 | 2136 |
| 17 .1730 | 146 | 292 | 437 | 583 | 729 | 875 | 1020 | 1166 | 1311 | 1457 | 1603 | 1749 | 1894 | 2040 | 2187 |
| 18 .1695 | 149 | 298 | 447 | 597 | 746 | 895 | 1044 | 1193 | 1342 | 1492 | 1636 | 1785 | 1934 | 2082 | 2231 |
| 19 .1660 | 152 | 304 | 455 | 607 | 760 | 911 | 1063 | 1215 | 1367 | 1519 | 1670 | 1822 | 1974 | 2127 | 2279 |
| 20 .1610 | 156 | 314 | 470 | 626 | 783 | 939 | 1096 | 1253 | 1409 | 1566 | 1723 | 1879 | 2035 | 2193 | 2349 |
| 21 .1590 | 158 | 317 | 476 | 634 | 793 | 951 | 1109 | 1269 | 1427 | 1585 | 1745 | 1903 | 2061 | 2220 | 2379 |
| 22 .1570 | 160 | 321 | 482 | 642 | 803 | 964 | 1124 | 1284 | 1445 | 1606 | 1766 | 1927 | 2088 | 2248 | 2408 |
| 23 .1540 | 164 | 327 | 491 | 655 | 818 | 982 | 1146 | 1309 | 1473 | 1637 | 1800 | 1964 | 2128 | 2292 | 2455 |
| 24 .1520 | 166 | 332 | 498 | 663 | 830 | 995 | 1161 | 1327 | 1493 | 1659 | 1824 | 1991 | 2156 | 2322 | 2488 |
| 25 .1495 | 169 | 337 | 506 | 675 | 842 | 1012 | 1181 | 1349 | 1518 | 1686 | 1855 | 2024 | 2193 | 2361 | 2529 |
| 26 .1470 | 172 | 343 | 514 | 686 | 857 | 1029 | 1201 | 1371 | 1543 | 1715 | 1886 | 2058 | 2229 | 2401 | 2573 |
| 27 .1440 | 175 | 350 | 525 | 700 | 876 | 1051 | 1226 | 1401 | 1576 | 1751 | 1927 | 2101 | 2276 | 2451 | 2626 |
| 28 .1405 | 180 | 359 | 539 | 718 | 898 | 1076 | 1256 | 1436 | 1615 | 1795 | 1973 | 2153 | 2332 | 2512 | 2691 |
| 29 .1360 | 185 | 371 | 556 | 742 | 927 | 1112 | 1298 | 1483 | 1668 | 1854 | 2039 | 22243 | 2410 | 2595 | 2781 |
| 30 .1285 | 196 | 393 | 589 | 785 | 981 | 1177 | 1373 | 1569 | 1766 | 1962 | 2158 | 2354 | 2550 | 2747 | 2943 |
| 31 .1200 | 210 | 420 | 630 | 840 | 1051 | 1261 | 1470 | 1680 | 1891 | 2101 | 2311 | 2522 | 2731 | 2941 | 3152 |
| 32 .1160 | 217 | 435 | 652 | 869 | 1087 | 1304 | 1521 | 1738 | 1956 | 2173 | 2391 | 2608 | 2825 | 3043 | 3260 |
| 33 .1130 | 223 | 446 | 669 | 892 | 1115 | 1338 | 1562 | 1785 | 2008 | 2231 | 2454 | 2677 | 2900 | 3123 | 3346 |
| 34 .1110 | 227 | 454 | 681 | 908 | 1136 | 1363 | 1590 | 1817 | 2044 | 2272 | 2498 | 2725 | 2953 | 3180 | 3407 |
| 35 .1100 | 229 | 458 | 688 | 917 | 1146 | 1375 | 1604 | 1833 | 2063 | 2292 | 2522 | 2750 | 2979 | 3208 | 3438 |
| 36 .1065 | 237 | 473 | 710 | 947 | 1184 | 1420 | 1657 | 1894 | 2130 | 2367 | 2604 | 2841 | 3078 | 3314 | 3551 |
| 37 .1040 | 242 | 485 | 727 | 970 | 1212 | 1455 | 1697 | 1939 | 2182 | 2424 | 2666 | 2909 | 3152 | 3394 | 3636 |
| 38 .1015 | 248 | 497 | 745 | 993 | 1242 | 1490 | 1738 | 1987 | 2235 | 2484 | 2732 | 2981 | 3229 | 3478 | 3726 |
| 39 .0995 | 253 | 507 | 760 | 1014 | 1267 | 1520 | 1773 | 2027 | 2280 | 2534 | 2787 | 3041 | 3294 | 3547 | 3800 |
| 40 .0980 | 257 | 515 | 772 | 1029 | 1286 | 1544 | 1801 | 2058 | 2315 | 2573 | 2829 | 3087 | 3344 | 3602 | 3858 |
| 41 .0960 | 263 | 525 | 788 | 1051 | 1313 | 1575 | 1838 | 2101 | 2363 | 2626 | 2889 | 3152 | 3414 | 3676 | 3939 |
| 42 .0935 | 269 | 539 | 809 | 1078 | 1348 | 1618 | 1888 | 2157 | 2427 | 2696 | 2966 | 3235 | 3505 | 3775 | 4044 |
| 43 .0890 | 283 | 566 | 850 | 1133 | 1416 | 1700 | 1983 | 2266 | 2550 | 2833 | 3116 | 3399 | 3682 | 3965 | 4249 |
| 44 .0860 | 293 | 586 | 880 | 1173 | 1466 | 1759 | 2052 | 2346 | 2639 | 2932 | 3225 | 3518 | 3811 | 4104 | 4397 |
| 45 .0820 | 308 | 615 | 922 | 1230 | 1537 | 1845 | 2152 | 2459 | 2767 | 3074 | 3382 | 3689 | 3997 | 4305 | 4611 |
| 46 .0810 | 312 | 622 | 934 | 1245 | 1556 | 1868 | 2179 | 2490 | 2801 | 3113 | 3423 | 3735 | 4046 | 4357 | 4669 |
| 47 .0785 | 321 | 642 | 964 | 1284 | 1606 | 1927 | 2248 | 2569 | 2890 | 3212 | 3532 | 3854 | 4175 | 4496 | 4817 |
| 48 .0760 | 332 | 663 | 995 | 1327 | 1659 | 1991 | 2322 | 2654 | 2985 | 3317 | 3648 | 3980 | 4312 | 4644 | 4976 |
| 49 .0730 | 345 | 691 | 1036 | 1381 | 1727 | 2072 | 2418 | 2763 | 3109 | 3454 | 3799 | 4144 | 4493 | 4835 | 5180 |
| 50 .0700 | 360 | 720 | 1080 | 1441 | 1801 | 2161 | 2521 | 2882 | 3241 | 3602 | 3961 | 4322 | 4682 | 5042 | 5402 |
| 51 .0670 | 376 | 752 | 1129 | 1505 | 1882 | 2258 | 2634 | 3010 | 3386 | 3763 | 4139 | 4515 | 4893 | 527 | 5644 |
| 52 .0635 | 397 | 794 | 1191 | 1588 | 1985 | 2382 | 2779 | 3176 | 3573 | 3970 | 4369 | 4764 | 5161 | 5558 | 5955 |
| 53 .0595 | 423 | 847 | 1270 | 1694 | 2117 | 2540 | 2963 | 3386 | 3810 | 4233 | 4661 | 5085 | 5508 | 5932 | 6356 |
| 54 .0550 | 458 | 917 | 1375 | 1833 | 2292 | 2750 | 3209 | 3667 | 4126 | 4584 | 5042 | 5500 | 5958 | 6417 | 6875 |
| 55 .0520 | 485 | 970 | 1455 | 1939 | 2424 | 2909 | 3394 | 3879 | 4363 | 4848 | 5333 | 5818 | 6302 | 6787 | 7278 |
| 56 .0465 | 542 | 1084 | 1627 | 2169 | 2711 | 3253 | 3796 | 4338 | 4880 | 5422 | 5964 | 6506 | 7047 | 7590 | 8133 |
| 57 .0430 | 586 | 1173 | 1763 | 2350 | 2938 | 3526 | 4113 | 4701 | 5289 | 5876 | 6449 | 7036 | 7622 | 8208 | 8795 |
| 58 .0420 | 601 | 1201 | 1801 | 2400 | 3001 | 3601 | 4202 | 4802 | 5403 | 6003 | 6603 | 7203 | 7803 | 8403 | 9004 |
| 59 .0410 | 615 | 1230 | 1845 | 2459 | 3074 | 3689 | 4304 | 4919 | 5536 | 6149 | 6764 | 7379 | 7993 | 8608 | 9224 |
| 60 .0400 | 630 | 1261 | 1891 | 2521 | 3152 | 3781 | 4411 | 5042 | 5672 | 6302 | 6933 | 7563 | 8193 | 8824 | 9454 |



Cleveland offers an extensive array of threading tools. The Cleveland brand is known for performance tools that run faster, longer, and with more precision than competitive tools. This Threading section includes: high performance taps, various hand, flute, spiral, forming, and pipe taps as well as dies and assemblies. Also included are our carbide mini, and carbide helical thread mills. We have a large selection of surface treatments, and industry specific application products.



FAST TAP

Common Special Taps and Special Taps from Blanks



Delivery Matrix

Quantities listed are *maximum* pieces for working days listed. Common special taps and special taps from blanks.

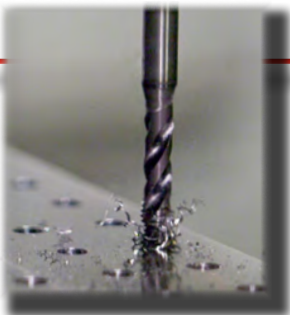
Surface Treatments

(added days to lead times below)

| | |
|------------------------------------|--------|
| Steam Oxide | 2 days |
| Steam Oxide over Nitride | 2 days |
| TiN | 5 days |
| TiCN | 7 days |

| | 24 Hrs | 2 Days | 3 Days | 4 Days | 5 Days | 6 Days |
|-------------------------------|-----------------------------------|--------|--------|--------|--------|--------|
| 60 Degree Thread Forms | | | | | | |
| Smaller Than #4 | 12 | 24 | 48 | | | |
| #4 thru 1/4" | 24 | 48 | | | | |
| 5/16" thru 1/2" | 24 | 48 | | | | |
| 9/16" thru 1" | 12 | 24 | 48 | | | |
| ** 1-1/16 thru 1-1/2" | 6 | 12 | 24 | | | |
| 1-9/16 thru 3" | 3 | 6 | | | | |
| Over 3" | 1 | 3 | | | | |
| Pipe Taps | | | | | | |
| 1/16" thru 3/8" | 6 | 24 | 48 | | | |
| 1/2" thru 1" | 3 | 12 | 24 | | | |
| 1-1/4" thru 2" | 2 | 6 | 12 | | | |
| Over 2" | Delivery is 12 to 15 Working Days | | | | | |
| Form Taps | | | | | | |
| 0 thru 3/8" | 12 | 24 | 48 | | | |
| 7/16" thru 3/4" | 12 | 24 | | 48 | | |
| 13/16" thru 1" | | 12 | 24 | | | |
| ACME/Buttress | | | | | | |
| 1/4" thru 1-1/2" | | | | | 12 | 24 |
| Tandem ACMEs | | | | | | |
| 3/8" thru 2" | | | | | 12 | |

** Spiral Point add 1 day.



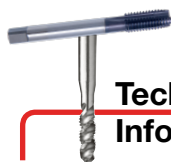
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- Hand Taps
- Straight Flute Taps
- Spiral Point Taps
- Spiral Flute Taps
- Form Taps
- Pipe Taps
- Dies
- Wrenches
- Thread Mills

Cost Saving Sets



- Complete list of Threading Sets **204**



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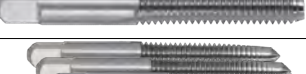




| | |
|-------------|--------------------|
| Bright | TiCN |
| Black Oxide | TiAlN |
| TiN | Oxide Over Nitride |
| | AlCrN |


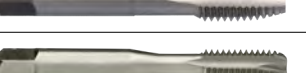




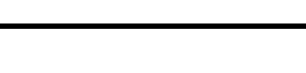

Additional treatments available upon request.



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| Straight Flute | | | | | Tool Material | Blank | Chamfer | Application | Hole | Surface Treatment | | | | | | | | | | | | | | | | | | | |
|----------------|---------------------|---|-----------------------------------|-----|---------------|-------|---------|-------------|------------|-------------------|------|-----------|---------------|-------|-----------|-----------|-------------|-----------------|----------------|-------|------|--------|-------------|-----|------|-------|-------|--------------------|----------|
| Style | Page |  | Type | Set | HSS | HSS-E | 302A | 311 | DIN / ANSI | Taper | Plug | Bottoming | Mod Bottoming | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Blind | Thru | Bright | Black Oxide | TiN | TiCN | TiAlN | AlCrN | Oxide over Nitride | Hardlube |
| 1001 | 162 |  | General Purpose | yes | • | • | | | | • | | | | • | • | • | • | | | | • | • | • | | | | | | |
| 1002 | 162 |  | General Purpose | yes | • | • | | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| 1003 | 162 |  | General Purpose | yes | • | • | | | | | | • | | • | • | • | • | | | | • | • | • | | | | | | |
| 1004 | 162 |  | Set (Styles: 1001, 1002, 1003) | yes | • | • | | | | • | • | • | | • | • | • | • | | | | • | • | • | | | | | | |
| 1002L | 168 |  | General Purpose - Left Hand | | • | • | | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| CI-1000 | 169 |  | Cast Iron | | • | • | | | | | | | • | • | • | • | • | | | | • | • | • | | | | • | | |

| Spiral Point | | | | | Tool Material | Blank | Chamfer | Application | Hole | Surface Treatment | | | | | | | | | | | | | | | | | | | |
|--------------|---------------------|---|-------------------------|-----|---------------|-------|---------|-------------|------------|-------------------|------|-----------|---------------|-------|-----------|-----------|-------------|-----------------|----------------|-------|------|--------|-------------|-----|------|-------|-------|--------------------|----------|
| Style | Page |  | Type | Set | HSS | HSS-E | 302A | 311 | DIN / ANSI | Taper | Plug | Bottoming | Mod Bottoming | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Blind | Thru | Bright | Black Oxide | TiN | TiCN | TiAlN | AlCrN | Oxide over Nitride | Hardlube |
| 1011 | 170 |  | General Purpose | | • | • | | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| 1053 | 173 |  | Low Shear | | • | • | | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| 1012 | 174 |  | Bottoming | | • | • | | | | | | • | | • | • | • | • | | | | • | • | • | | | | | | |
| 1011E | 175 |  | 6" Extended Length | | • | • | 303-A | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| T-101 | 175 |  | Stainless Steel & Steel | | • | • | | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| PRO-961SP | 176 |  | Universal | | • | • | | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| PRO-861SP | | | Universal | | • | • | | | | | | • | | | • | • | • | • | | | | • | • | • | | | • | | |
| PER-862SP | 178 |  | Stainless Steel | | • | • | | | | | • | | | • | • | • | • | | | | • | • | • | | | | | | |
| PER-960SP | | | Stainless Steel | | • | • | | | | | | • | | | • | • | • | • | | | | • | • | • | | | | | • |

| Spiral Flute | | | | | Tool Material | Blank | Chamfer | Application | Hole | Surface Treatment | | | | | | | | | | | | | | | | | | | |
|--------------|------|--|-------------------------|-----|---------------|-------|---------|-------------|------------|-------------------|------|-----------|---------------|-------|-----------|-----------|-------------|-----------------|----------------|-------|------|--------|-------------|-----|------|-------|-------|--------------------|----------|
| Style | Page | | Type | Set | HSS | HSS-E | 302A | 311 | DIN / ANSI | Taper | Plug | Bottoming | Mod Bottoming | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Blind | Thru | Bright | Black Oxide | TiN | TiCN | TiAlN | AlCrN | Oxide over Nitride | Hardlube |
| 1093 | 180 | | General Purpose | | • | | • | | | | • | | | • | • | | | | | • | | • | • | | | | | | |
| 1094 | 180 | | General Purpose | | • | | • | | | | | • | | • | • | | | | | • | | • | • | | | | | | |
| 1095 | 181 | | Heavy Duty | | • | | • | | | | • | | | • | • | | | | | • | | • | • | | | | | | |
| 1096 | 181 | | Heavy Duty | | • | | • | | | | | • | | • | • | | | | | • | | • | • | | | | | | |
| **B-101 | 182 | | Stainless Steel & Steel | | • | • | | | | | | | • | • | • | | | | | • | | • | • | | | | | | |
| PRO-981SF | 183 | | Universal | | • | | | | • | | | | • | • | • | | | | | • | | • | • | | | | | | |
| PRO-892SF | | | Universal | | • | | | | • | | | | • | • | • | | | | | • | | • | • | | | | | | |
| PER-893SF | 185 | | Stainless Steel | | • | | | | • | | | | • | • | • | | | | | • | | • | • | | | | | | |
| PER-980SF | | | Stainless Steel | | • | | | | • | | | | • | • | • | | | | | • | | • | • | | | | | | • |

| Form | | | | | Tool Material | Blank | Chamfer | Application | Hole | Surface Treatment | | | | | | | | | | | | | | | | | | | |
|-------|------|--|-----------------|-----|---------------|-------|---------|-------------|------------|-------------------|------|-----------|---------------|-------|-----------|-----------|-------------|-----------------|----------------|-------|------|--------|-------------|-----|------|-------|-------|--------------------|----------|
| Style | Page | | Type | Set | HSS | HSS-E | 302A | 311 | DIN / ANSI | Taper | Plug | Bottoming | Mod Bottoming | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Blind | Thru | Bright | Black Oxide | TiN | TiCN | TiAlN | AlCrN | Oxide over Nitride | Hardlube |
| 1091 | 187 | | General Purpose | | • | | • | | | | • | | | • | • | | | | | • | | • | • | | | | | | |
| 1092 | 187 | | General Purpose | | • | | • | | | | | • | | • | • | | | | | • | | • | • | | | | | | |












| Pipe | | | | | Tool Material | Blank | Chamfer | Application | Hole | Surface Treatment | | | | | | | | | | | | | | | | | | | |
|-------|------|--|-------------------------|-----|---------------|-------|---------|-------------|------------|-------------------|------|-----------|---------------|-------|-----------|-----------|-------------|-----------------|----------------|-------|------|--------|-------------|-----|------|-------|-------|--------------------|----------|
| Style | Page | | Type | Set | HSS | HSS-E | 302A | 311 | DIN / ANSI | Taper | Plug | Bottoming | Mod Bottoming | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Blind | Thru | Bright | Black Oxide | TiN | TiCN | TiAlN | AlCrN | Oxide over Nitride | Hardlube |
| 965 | 188 | | NPT Medium Hook | | • | | • | | | | | | | • | • | | | | | • | | • | • | | | | | | |
| 975 | 188 | | NPTF Medium Hook | | • | | • | | | | | | | • | • | | | | | • | | • | • | | | | | | |
| 964B | 189 | | NPT Interrupted Thread | | • | | • | | | | | | | • | • | | | | | • | | • | • | | | | | | |
| 966B | 189 | | NPTF Interrupted Thread | | • | | • | | | | | | | • | • | | | | | • | | • | • | | | | | | |
| 963B | 190 | | NPS | | • | | • | | | | | | | • | • | | | | | • | | • | • | | | | | | |
| 967B | 190 | | NPSF | | • | | • | | | | | | | • | • | | | | | • | | • | • | | | | | | |

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| Style | Page | Type | HSS | Cobalt | Carbide | UNC | UNF | NPT | NPTF | Metric Coarse | Metric Fine | BSPP | BSPT | DIN | Steel | Stainless | Cast Iron | Non-Ferrous | Special Alloy | Hardened Steel | Non | Thru | TiAIN | AlCrN | Hardlube |
| CMTM2, CMTMM2 | 191 | Mini | | | • | • | • | | | • | • | | | | • | • | • | • | • | • | • | | | • | |
| CMTM3, CMTMM3 | 192 | Mini | | | • | • | • | | | • | • | | | | • | • | • | • | • | • | • | | | • | |
| CTM, CTMC | 193 | General Purpose - Inch | | | • | • | • | | | | | | | | • | • | • | • | • | • | • | • | | | |
| CTMM, CTMMC | 194 | General Purpose - Metric | | | • | | | | | | | | | • | • | • | • | • | • | • | • | • | | | |
| CTMNP, CTMNPC | 194 | National Pipe Tapered | | | • | | | • | • | | | | | | • | • | • | • | • | • | • | • | | | |
| CTMBPP, CTMBPPC | 195 | British Pipe Tapered | | | • | | | | | | | | | | • | • | • | • | • | • | • | • | | | |
| CTMBPT, CTMBPTC | 195 | British Pipe Parallel | | | • | | | | | | | | | | • | • | • | • | • | • | • | • | | | |

| Dies | | | | Tool Material | | Surface Treatment | | | | | | | | | |
|------------------|---------------------|---|---|---------------------|-----|-------------------|-------|--------|-------------|-----|------|-------|-------|--------------------|----------|
| Style | Page | | Type | Set | HSS | Carbon Steel | Steel | Bright | Black Oxide | TiN | TiCN | TiAlN | AlCrN | Oxide over Nitride | Hardtube |
| 0650, 0650M, 492 | 196 |  | Hexagon Rethreading | yes | • | • | | • | | | | | | | |
| 0660 | | | Taper Pipe | | • | • | | • | | | | | | | |
| 0610, 0710 | 198 |  | Round Adjustable | | • | • | | • | | | | | | | |
| 0710M | | | Round Adjustable | | • | | | • | | | | | | | |
| 0620 | | | Round Adjustable - Pipe | | | • | | | • | | | | | | |
| 222 | 200 |  | Die Stock, Adjustable | | | | | | | | | | | | |
| **224 | 200 |  | Die Stock, Built-in Workpiece Guide | | | | | | | | | | | | |
| 0550 | 201 |  | Die Set: Die Halves | | | | • | • | | | | | | | |
| 0551 | |  | Die Set: Cap | | | | • | • | | | | | | | |
| 0552 | |  | Die Set: Guide | | | | | • | • | | | | | | |
| 0553 | |  | Die Set: Collet (cap and guide) | | | | | • | • | | | | | | |
| 0554 | |  | Die Set Assembly (0550,0553,0551,0552) | | | | | • | • | | | | | | |
| 223 | | 202 |  | Quick Set Die Stock | | | • | | • | | | | | | |
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Wrenches

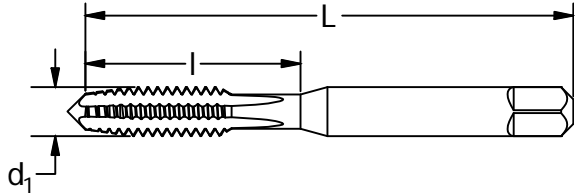
| Style | Page | | Type | Style | Page | | Type |
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| 240 | 203 |  | Straight Wrench | 244 | 203 |  | Combo Ratchet & Slip Handle Wrench |
| 242 | 203 |  | Plain T-Handle Wrench | 245 | 203 |  | Long Shank T-Handle Wrench |
| 243 | 203 |  | Slip T-Handle Wrench | | | | |

General Purpose Inch

Styles: **1001, 1001TN, 1002, 1002SO, 1002TN, 1002TC, 1003, 1003TN, 1004**

Note
Tapping Speeds and Feeds
see Technical section.

Set # 1004 consists of
one each taper, plug, and
bottoming chamfers - Bright.



Feature:

New neck down style. Three different chamfers for maintenance and repair versatility.

Hand Tap

High Speed Steel

| tap size pitch | thrd form | dec. equiv. | # of flutes | H- limit | overall length L (in) | thread length l (in) | order number | | | | | | | | | |
|-------------------|--------------|----------------|----------------|-------------|-----------------------------|----------------------------|----------------|---------------|----------------|---------------------|---------------|----------------|----------------|---------------|----------------|---------------|
| | | | | | | | Taper | | Plug | | | Bottoming | | Set | | |
| | | | | | | | 1001 Bright | 1001TN TiN | 1002 Bright | 1002SO Bl. oxide | 1002TN TiN | 1002TC TiCN | 1003 Bright | 1003TN TiN | 1004 Bright | 1004TN TiN |
| *0-80 | UNF | .0600 | 2 | H1 | 1.625 | .313 | C54025 | — | C54026 | — | — | — | C54027 | — | — | — |
| *0-80 | UNF | .0600 | 2 | H2 | 1.625 | .313 | C83360 | — | C54029 | — | C55156 | — | C54030 | C83931 | C83982 | — |
| *1-64 | UNC | .0730 | 2 | H1 | 1.688 | .375 | C54055 | — | C54056 | — | C83842 | — | C54057 | C83932 | C83983 | — |
| *1-64 | UNC | .0730 | 2 | H2 | 1.688 | .375 | C83361 | — | C83817 | — | — | — | C83899 | — | — | — |
| *1-72 | UNF | .0730 | 2 | H1 | 1.688 | .375 | C54060 | — | C54061 | — | C83843 | — | C54062 | C83933 | C83984 | — |
| *1-72 | UNF | .0730 | 2 | H2 | 1.688 | .375 | C83362 | — | C83818 | — | — | — | C83900 | — | — | — |
| *2-56 | UNC | .0860 | 2 | H2 | 1.750 | .375 | C83363 | — | C54087 | — | — | — | C54088 | — | — | — |
| *2-56 | UNC | .0860 | 3 | H1 | 1.750 | .375 | C54083 | — | C54084 | — | — | — | C54085 | — | — | — |
| *2-56 | UNC | .0860 | 3 | H2 | 1.750 | .375 | C54089 | C83383 | C54090 | — | C55158 | C56050 | C54091 | C83934 | C54092 | C84221 |
| *2-64 | UNF | .0860 | 3 | H2 | 1.750 | .438 | C54093 | — | C54094 | — | — | — | C54095 | — | C83985 | — |
| *3-48 | UNC | .0990 | 3 | H2 | 1.813 | .500 | C54115 | C83384 | C54116 | — | C83844 | — | C54117 | C83935 | C54118 | C84222 |
| *3-56 | UNF | .0990 | 3 | H2 | 1.813 | .500 | C54120 | C83385 | C54121 | — | C83845 | — | C54122 | C83936 | C54123 | C84223 |
| 4-40 | UNC | .1120 | 2 | H1 | 1.875 | .563 | — | — | C54142 | — | — | — | — | — | — | — |
| 4-40 | UNC | .1120 | 2 | H2 | 1.875 | .563 | — | — | C54147 | — | — | — | C54148 | — | — | — |
| 4-40 | UNC | .1120 | 3 | H1 | 1.875 | .563 | C54134 | — | C54135 | — | — | — | C54136 | — | — | — |
| 4-40 | UNC | .1120 | 3 | H2 | 1.875 | .563 | C54149 | C83386 | C54150 | — | C55160 | C56052 | C54151 | C83937 | C54152 | C84224 |
| 4-36 | UNC | .1120 | 3 | H2 | 1.875 | .563 | — | — | C54140 | — | — | — | — | — | — | — |
| 4-48 | UNF | .1120 | 3 | H2 | 1.875 | .563 | C54153 | C83387 | C54154 | — | C83846 | — | C54155 | C83938 | C54156 | C84225 |
| 5-40 | UNC | .1250 | 2 | H2 | 1.938 | .625 | — | — | C54186 | — | — | — | C54187 | — | — | — |
| 5-40 | UNC | .1250 | 3 | H1 | 1.938 | .625 | — | — | C54185 | — | — | — | C54184 | — | — | — |
| 5-40 | UNC | .1250 | 3 | H2 | 1.938 | .625 | C54188 | C83388 | C54189 | — | C55162 | — | C54190 | C83939 | C54191 | C84226 |
| 5-44 | UNF | .1250 | 3 | H2 | 1.938 | .625 | C54192 | C83389 | C54193 | — | C83847 | — | C54194 | C83940 | C54195 | C84227 |
| 6-32 | UNC | .1380 | 2 | H2 | 2.000 | .688 | C83364 | — | C54215 | — | C83848 | — | C54216 | C83941 | C83986 | — |
| 6-32 | UNC | .1380 | 2 | H3 | 2.000 | .688 | C83365 | C83390 | C54221 | — | C83849 | C83889 | C54222 | C83942 | C83987 | C84228 |
| 6-32 | UNC | .1380 | 3 | H1 | 2.000 | .688 | C54211 | — | C54212 | — | — | — | C54213 | — | — | — |
| 6-32 | UNC | .1380 | 3 | H2 | 2.000 | .688 | — | C83391 | — | — | — | — | — | C83943 | — | C84229 |
| 6-32 | UNC | .1380 | 3 | H3 | 2.000 | .688 | C54223 | C83392 | C54224 | C56000 | C55100 | C56054 | C54225 | C55200 | C54226 | C84230 |
| 6-32 | UNC | .1380 | 3 | H7 | 2.000 | .688 | — | — | C54227 | — | — | — | C54228 | — | — | — |
| 6-40 | UNF | .1380 | 2 | H2 | 2.000 | .688 | — | — | C54229 | — | — | — | — | — | — | — |
| 6-40 | UNF | .1380 | 3 | H2 | 2.000 | .688 | C54232 | C83393 | C54233 | — | C55102 | — | C54234 | C55202 | C54235 | C84231 |
| 8-32 | UNC | .1640 | 2 | H1 | 2.125 | .750 | — | — | C54256 | — | — | — | C83901 | — | — | — |
| 8-32 | UNC | .1640 | 2 | H2 | 2.125 | .750 | C83366 | C83394 | C54264 | — | C83850 | — | C54265 | — | C83988 | — |
| 8-32 | UNC | .1640 | 2 | H3 | 2.125 | .750 | C83367 | — | C54273 | — | — | C83890 | C54274 | C83944 | C83989 | C84232 |
| 8-32 | UNC | .1640 | 3 | H1 | 2.125 | .750 | — | — | C54258 | — | — | — | — | — | — | — |
| 8-32 | UNC | .1640 | 3 | H2 | 2.125 | .750 | C83368 | C83395 | C54267 | — | C83851 | — | C54268 | — | — | — |
| 8-32 | UNC | .1640 | 3 | H3 | 2.125 | .750 | C83500 | — | C54275 | — | C83852 | — | C54276 | C83945 | C83990 | — |

* #0 - #3 and larger than 1": 302 blank style.

continued on next page



Styles: **1001, 1001TN, 1002, 1002SO, 1002TN, 1002TC, 1003, 1003TN, 1004** (continued)

General Purpose
Inch

| tap size pitch d₁ | thrd form | dec. equiv. | # of flutes | H- limit | overall length L (in) | thread length l (in) | order number | | | | | | | | | |
|---|--------------|----------------|----------------|-------------|------------------------------------|-----------------------------------|-----------------------|----------------------|-----------------------|----------------------------|----------------------|-----------------------|-----------------------|----------------------|-----------------------|----------------------|
| | | | | | | | Taper | | Plug | | | | Bottoming | | Set | |
| | | | | | | | 1001 Bright | 1001TN TiN | 1002 Bright | 1002SO Bl. oxide | 1002TN TiN | 1002TC TiCN | 1003 Bright | 1003TN TiN | 1004 Bright | 1004TN TiN |
| 8-32 | UNC | .1640 | 3 | H7 | 2.125 | .750 | — | — | C54285 | — | — | — | C54282 | — | — | — |
| 8-32 | UNC | .1640 | 4 | H1 | 2.125 | .750 | C54260 | — | C54261 | — | — | — | C54262 | — | — | — |
| 8-32 | UNC | .1640 | 4 | H2 | 2.125 | .750 | C54269 | C83396 | C54270 | — | C55166 | — | C54271 | — | C54272 | — |
| 8-32 | UNC | .1640 | 4 | H3 | 2.125 | .750 | C54277 | C54307 | C54278 | C56002 | C55104 | C56056 | C54279 | C55204 | C54280 | C84233 |
| 8-36 | UNF | .1640 | 4 | H1 | 2.125 | .750 | — | — | C54288 | — | — | — | — | — | — | — |
| 8-36 | UNF | .1640 | 4 | H2 | 2.125 | .750 | C54289 | C83397 | C54290 | — | C55106 | — | C54291 | C83946 | C54292 | C84234 |
| 10-24 | UNC | .1900 | 2 | H2 | 2.375 | .875 | — | — | C54318 | — | — | — | C83902 | — | — | — |
| 10-24 | UNC | .1900 | 2 | H3 | 2.375 | .875 | C83369 | — | C54325 | — | C83853 | — | C54326 | C83947 | C83991 | — |
| 10-24 | UNC | .1900 | 3 | H1 | 2.375 | .875 | — | — | C54335 | — | — | — | — | — | — | — |
| 10-24 | UNC | .1900 | 3 | H2 | 2.375 | .875 | — | — | C54320 | — | — | — | — | — | — | — |
| 10-24 | UNC | .1900 | 3 | H3 | 2.375 | .875 | C83370 | — | C54327 | — | C83854 | — | C54328 | C83948 | C83992 | — |
| 10-24 | UNC | .1900 | 3 | H7 | 2.375 | .875 | — | — | C54336 | — | — | — | C54334 | — | — | — |
| 10-24 | UNC | .1900 | 4 | H1 | 2.375 | .875 | C54314 | — | C54315 | — | — | — | — | — | — | — |
| 10-24 | UNC | .1900 | 4 | H2 | 2.375 | .875 | C54321 | — | C54322 | — | — | — | C54323 | — | C54324 | — |
| 10-24 | UNC | .1900 | 4 | H3 | 2.375 | .875 | C54329 | C83398 | C54330 | C56004 | C55108 | C56058 | C54331 | C55208 | C54332 | C84235 |
| 10-24 | UNC | .1900 | 4 | H7 | 2.375 | .875 | — | — | C54333 | — | — | — | C54334 | — | — | — |
| 10-32 | UNF | .1900 | 2 | H1 | 2.375 | .875 | — | — | C54338 | — | — | — | C54345 | — | — | — |
| 10-32 | UNF | .1900 | 2 | H2 | 2.375 | .875 | C83370 | — | C54343 | — | C83855 | — | C83903 | — | — | — |
| 10-32 | UNF | .1900 | 2 | H3 | 2.375 | .875 | C83372 | C83399 | C54352 | — | C83856 | C83891 | C54353 | C83949 | C83993 | C84236 |
| 10-32 | UNF | .1900 | 3 | H1 | 2.375 | .875 | — | — | C54364 | — | — | — | — | — | — | — |
| 10-32 | UNF | .1900 | 3 | H2 | 2.375 | .875 | — | — | C83819 | — | C83857 | — | C83904 | — | — | — |
| 10-32 | UNF | .1900 | 3 | H3 | 2.375 | .875 | — | — | C54354 | — | C55170 | — | C54355 | — | — | — |
| 10-32 | UNF | .1900 | 4 | H1 | 2.375 | .875 | C54339 | — | C54340 | — | — | — | C54341 | — | — | — |
| 10-32 | UNF | .1900 | 4 | H2 | 2.375 | .875 | C54348 | C83400 | C54349 | — | C83858 | — | C54350 | C83950 | C54351 | C84237 |
| 10-32 | UNF | .1900 | 4 | H3 | 2.375 | .875 | C54356 | C54309 | C54357 | C56006 | C55110 | C56060 | C54358 | C55210 | C54359 | C84238 |
| 12-24 | UNC | .2160 | 4 | H3 | 2.375 | .938 | C54385 | C83480 | C54386 | — | C55112 | — | C54387 | C55212 | C54388 | C84239 |
| 12-28 | UNF | .2160 | 4 | H3 | 2.375 | .938 | C54389 | — | C54390 | — | C55114 | — | C54391 | C55214 | C54392 | — |
| 1/4-20 | UNC | .2500 | 2 | H3 | 2.500 | 1.000 | C83373 | C83481 | C54456 | — | C83859 | C83892 | C54457 | C83951 | C83994 | C84241 |
| 1/4-20 | UNC | .2500 | 3 | H1 | 2.500 | 1.000 | — | — | C54446 | — | — | — | — | — | — | — |
| 1/4-20 | UNC | .2500 | 3 | H2 | 2.500 | 1.000 | — | — | C54451 | — | — | — | C83905 | — | — | — |
| 1/4-20 | UNC | .2500 | 3 | H3 | 2.500 | 1.000 | C83374 | C83482 | C54458 | — | C83860 | C83893 | C54459 | C83952 | C83995 | C84242 |
| 1/4-20 | UNC | .2500 | 3 | H5 | 2.500 | 1.000 | — | — | C54463 | — | — | — | C83906 | — | — | — |
| 1/4-20 | UNC | .2500 | 4 | H1 | 2.500 | 1.000 | C54443 | — | C54444 | — | — | — | C54445 | — | C54447 | — |
| 1/4-20 | UNC | .2500 | 4 | H2 | 2.500 | 1.000 | C54448 | — | C54449 | — | — | — | C54450 | — | C54452 | — |
| 1/4-20 | UNC | .2500 | 4 | H3 | 2.500 | 1.000 | C54453 | C83483 | C54454 | C56008 | C55116 | C56062 | C54455 | C55216 | C54460 | C84243 |
| 1/4-20 | UNC | .2500 | 4 | H5 | 2.500 | 1.000 | C83375 | — | C54461 | — | C83861 | — | C54462 | C83953 | C83996 | — |
| 1/4-20 | UNC | .2500 | 4 | H11 | 2.500 | 1.000 | — | — | C54464 | — | — | — | — | — | — | — |
| 1/4-28 | UNF | .2500 | 2 | H3 | 2.500 | 1.000 | — | — | C54472 | — | — | — | C54473 | — | — | — |
| 1/4-28 | UNF | .2500 | 3 | H3 | 2.500 | 1.000 | — | — | C54474 | — | C83862 | — | C54475 | — | — | — |
| 1/4-28 | UNF | .2500 | 4 | H1 | 2.500 | 1.000 | — | — | C54465 | — | — | — | C54466 | — | — | — |
| 1/4-28 | UNF | .2500 | 4 | H2 | 2.500 | 1.000 | — | — | C54467 | — | — | — | C54468 | C83954 | — | — |
| 1/4-28 | UNF | .2500 | 4 | H3 | 2.500 | 1.000 | C54469 | C83484 | C54470 | C56010 | C55118 | C56064 | C54471 | C55218 | C54476 | C84244 |
| 1/4-28 | UNF | .2500 | 4 | H4 | 2.500 | 1.000 | — | — | C83820 | — | — | — | C83907 | — | — | — |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|--------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | 18-22 | 22-32 | | | >45 | |
| | | Bright | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ |
| | TiN | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | |
| | TiCN | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | |

☆ = Best Performance ◆ = Acceptable



CUSTOMER SERVICE: telephone 800.348.2885 • fax 800.892.4290

Hand Tap

High Speed Steel

General Purpose
Inch

Styles: **1001, 1001TN, 1002, 1002SO, 1002TN, 1002TC, 1003, 1003TN, 1004** (continued)

Hand Tap

High Speed Steel

| tap size pitch | third form | dec. equiv. | # of flutes | H- limit | overall length L (in) | thread length I (in) | order number | | | | | | | | | |
|-------------------|---------------|----------------|----------------|-------------|-----------------------------|----------------------------|----------------|---------------|----------------|---------------------|---------------|----------------|----------------|---------------|----------------|---------------|
| | | | | | | | Taper | | Plug | | | | Bottoming | | Set | |
| | | | | | | | 1001 Bright | 1001TN TiN | 1002 Bright | 1002SO Bl. oxide | 1002TN TiN | 1002TC TiCN | 1003 Bright | 1003TN TiN | 1004 Bright | 1004TN TiN |
| 5/16-18 | UNC | .3125 | 2 | H3 | 2.719 | 1.125 | C83376 | — | C54507 | — | C83863 | — | C54508 | C83955 | C83997 | — |
| 5/16-18 | UNC | .3125 | 3 | H3 | 2.719 | 1.125 | C83377 | — | C54509 | — | C83864 | — | C54510 | C83956 | — | — |
| 5/16-18 | UNC | .3125 | 3 | H5 | 2.719 | 1.125 | — | — | C83821 | — | — | — | C83908 | — | — | — |
| 5/16-18 | UNC | .3125 | 4 | H1 | 2.719 | 1.125 | C54498 | — | C54499 | — | — | — | C54500 | — | — | — |
| 5/16-18 | UNC | .3125 | 4 | H2 | 2.719 | 1.125 | C54501 | — | C54502 | — | — | — | C54503 | — | — | — |
| 5/16-18 | UNC | .3125 | 4 | H3 | 2.719 | 1.125 | C54504 | C83485 | C54505 | C56012 | C55120 | C56066 | C54506 | C55220 | C54511 | C84245 |
| 5/16-18 | UNC | .3125 | 4 | H5 | 2.719 | 1.125 | — | — | C54512 | — | — | — | C54513 | — | — | — |
| 5/16-18 | UNC | .3125 | 4 | H11 | 2.719 | 1.125 | — | — | C54514 | — | — | — | — | — | — | — |
| 5/16-24 | UNF | .3125 | 3 | H3 | 2.719 | 1.125 | — | — | C54521 | — | — | — | C54522 | — | — | — |
| 5/16-24 | UNF | .3125 | 4 | H1 | 2.719 | 1.125 | — | — | C54515 | — | — | — | C54516 | — | — | — |
| 5/16-24 | UNF | .3125 | 4 | H2 | 2.719 | 1.125 | C83378 | — | C83822 | — | — | — | C83909 | — | — | — |
| 5/16-24 | UNF | .3125 | 4 | H3 | 2.719 | 1.125 | C54518 | C83486 | C54519 | — | C55122 | — | C54520 | C55222 | C54523 | C84246 |
| 5/16-24 | UNF | .3125 | 4 | H4 | 2.719 | 1.125 | — | — | C54524 | — | — | — | C54525 | — | — | — |
| 3/8-16 | UNC | .3750 | 3 | H1 | 2.938 | 1.250 | — | — | C54576 | — | — | — | — | — | — | — |
| 3/8-16 | UNC | .3750 | 3 | H3 | 2.938 | 1.250 | C83379 | — | C54585 | — | C55180 | — | C54586 | C83957 | C83998 | — |
| 3/8-16 | UNC | .3750 | 3 | H5 | 2.938 | 1.250 | — | — | C83823 | — | — | — | C83910 | — | — | — |
| 3/8-16 | UNC | .3750 | 4 | H2 | 2.938 | 1.250 | C54579 | — | C54580 | — | C55124 | — | C54581 | — | — | — |
| 3/8-16 | UNC | .3750 | 4 | H3 | 2.938 | 1.250 | C54582 | C83487 | C54583 | C56014 | C83865 | C56070 | C54584 | C55224 | C54587 | C84247 |
| 3/8-16 | UNC | .3750 | 4 | H5 | 2.938 | 1.250 | — | — | C54588 | — | C83866 | — | C54589 | C83958 | — | — |
| 3/8-24 | UNF | .3750 | 3 | H3 | 2.938 | 1.250 | — | — | C54598 | — | — | — | C54599 | — | — | — |
| 3/8-24 | UNF | .3750 | 4 | H2 | 2.938 | 1.250 | — | — | C83824 | — | — | — | C83911 | — | — | — |
| 3/8-24 | UNF | .3750 | 4 | H3 | 2.938 | 1.250 | C54595 | C83488 | C54596 | C56016 | C55126 | C83894 | C54597 | C55226 | C54600 | C84248 |
| 3/8-24 | UNF | .3750 | 4 | H4 | 2.938 | 1.250 | — | — | C54601 | — | — | — | C54602 | — | — | — |
| 3/8-24 | UNF | .3750 | 4 | H5 | 2.938 | 1.250 | — | — | C83825 | — | — | — | C83912 | — | — | — |
| 7/16-14 | UNC | .4375 | 3 | H3 | 3.156 | 1.438 | — | — | C83826 | — | — | — | C83913 | — | — | — |
| 7/16-14 | UNC | .4375 | 4 | H2 | 3.156 | 1.438 | — | — | C83827 | — | — | — | C83914 | — | — | — |
| 7/16-14 | UNC | .4375 | 4 | H3 | 3.156 | 1.438 | C54652 | C83489 | C54653 | — | C55128 | C83895 | C54654 | C55228 | C54656 | C84249 |
| 7/16-14 | UNC | .4375 | 4 | H5 | 3.156 | 1.438 | — | — | C54658 | — | C83867 | — | C54659 | C83959 | — | — |
| 7/16-20 | UNF | .4375 | 3 | H3 | 3.156 | 1.438 | — | — | C83828 | — | — | — | C83915 | — | — | — |
| 7/16-20 | UNF | .4375 | 4 | H2 | 3.156 | 1.438 | — | — | C83829 | — | — | — | C83916 | — | — | — |
| 7/16-20 | UNF | .4375 | 4 | H3 | 3.156 | 1.438 | C54661 | C83490 | C54662 | — | C55130 | — | C54663 | C55230 | C54665 | C84250 |
| 7/16-20 | UNF | .4375 | 4 | H5 | 3.156 | 1.438 | — | — | C54666 | — | C83868 | — | C54667 | C83960 | — | — |
| 1/2-13 | UNC | .5000 | 3 | H3 | 3.375 | 1.656 | C83380 | — | C54729 | — | C83869 | — | C54730 | C83961 | C83999 | — |
| 1/2-13 | UNC | .5000 | 4 | H1 | 3.375 | 1.656 | — | — | C54724 | — | — | — | C54725 | — | — | — |
| 1/2-13 | UNC | .5000 | 4 | H2 | 3.375 | 1.656 | C83381 | — | C83830 | — | — | — | C83917 | — | — | — |
| 1/2-13 | UNC | .5000 | 4 | H3 | 3.375 | 1.656 | C54726 | C83491 | C54727 | C56020 | C55132 | C56076 | C54728 | C55232 | C54731 | C84251 |
| 1/2-13 | UNC | .5000 | 4 | H5 | 3.375 | 1.656 | — | — | C54732 | — | — | — | C54733 | C83962 | — | — |
| 1/2-20 | UNF | .5000 | 3 | H3 | 3.375 | 1.656 | — | — | C54740 | — | — | — | — | — | — | — |
| 1/2-20 | UNF | .5000 | 4 | H1 | 3.375 | 1.656 | C54743 | — | — | — | — | — | C54736 | — | — | — |
| 1/2-20 | UNF | .5000 | 4 | H3 | 3.375 | 1.656 | C54737 | C83492 | C54738 | — | C55134 | — | C54739 | C55234 | C54741 | C84252 |
| 1/2-20 | UNF | .5000 | 4 | H5 | 3.375 | 1.656 | — | — | C54742 | — | — | — | — | — | — | — |
| 9/16-12 | UNC | .5625 | 4 | H2 | 3.594 | 1.656 | — | — | C54770 | — | — | — | — | — | — | — |

* #0 - #3 and larger than 1": 302 blank style.

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | | 22-32 | | |
| Bright | ♦ | | ♦ | | ♦ | | | ♦ | ♦ | ♦ | | | |
| TiN | ♦ | | ♦ | | ♦ | | | ♦ | ♦ | | | | |
| TiCN | ☆ | | ☆ | | ☆ | ♦ | | ☆ | ☆ | ☆ | | | |

☆ = Best Performance ♦ = Acceptable



Styles: **1001, 1001TN, 1002, 1002SO, 1002TN, 1002TC, 1003, 1003TN, 1004** (continued)

General Purpose
Inch

| tap size pitch | thrd form | dec. equiv. | # of flutes | H- limit | overall length L (in) | thread length l (in) | order number | | | | | | | | | |
|-------------------|--------------|----------------|----------------|-------------|-----------------------------|----------------------------|----------------|---------------|----------------|---------------------|---------------|----------------|----------------|---------------|----------------|---------------|
| | | | | | | | Taper | | Plug | | | | Bottoming | | Set | |
| | | | | | | | 1001 Bright | 1001TN TiN | 1002 Bright | 1002SO Bl. oxide | 1002TN TiN | 1002TC TiCN | 1003 Bright | 1003TN TiN | 1004 Bright | 1004TN TiN |
| 9/16-12 | UNC | .5625 | 4 | H3 | 3.594 | 1.656 | C54759 | C83493 | C54760 | — | C55136 | — | C54761 | C55236 | C54762 | C84253 |
| 9/16-12 | UNC | .5625 | 4 | H5 | 3.594 | 1.656 | — | — | C83831 | — | — | — | C83918 | — | — | — |
| 9/16-18 | UNF | .5625 | 4 | H2 | 3.594 | 1.656 | — | — | C54764 | — | — | — | — | — | — | — |
| 9/16-18 | UNF | .5625 | 4 | H3 | 3.594 | 1.656 | C54765 | — | C54766 | — | C55138 | — | C54767 | C55238 | C54768 | — |
| 9/16-18 | UNF | .5625 | 4 | H5 | 3.594 | 1.656 | — | — | C83832 | — | — | — | C83919 | — | — | — |
| 5/8-11 | UNC | .6250 | 4 | H2 | 3.813 | 1.813 | — | — | C83833 | — | — | — | C83920 | — | — | — |
| 5/8-11 | UNC | .6250 | 4 | H3 | 3.813 | 1.813 | C54779 | C83494 | C54780 | C56028 | C55140 | C83896 | C54781 | C55240 | C54782 | C84254 |
| 5/8-11 | UNC | .6250 | 4 | H5 | 3.813 | 1.813 | — | — | C54783 | — | — | — | C54784 | C83963 | — | — |
| 5/8-18 | UNF | .6250 | 4 | H2 | 3.813 | 1.813 | — | — | C54786 | — | — | — | C54793 | — | — | — |
| 5/8-18 | UNF | .6250 | 4 | H3 | 3.813 | 1.813 | C54787 | C83495 | C54788 | — | C55142 | — | C54789 | C55242 | C54790 | C84255 |
| 5/8-18 | UNF | .6250 | 4 | H5 | 3.813 | 1.813 | — | — | C83834 | — | — | — | C83921 | — | — | — |
| 11/16-11 | UNS | .6875 | 4 | H3 | 4.031 | 1.813 | C54813 | — | C54814 | — | — | — | C54815 | — | C54816 | — |
| 11/16-16 | UNS | .6875 | 4 | H3 | 4.031 | 1.813 | C54817 | — | C54818 | — | — | — | C54819 | — | C54820 | — |
| 3/4-10 | UNC | .7500 | 4 | H2 | 4.250 | 2.000 | — | — | C83835 | — | — | — | C83922 | — | — | — |
| 3/4-10 | UNC | .7500 | 4 | H3 | 4.250 | 2.000 | C54838 | C83496 | C54839 | — | C55144 | C83897 | C54840 | C55244 | C54841 | C84256 |
| 3/4-10 | UNC | .7500 | 4 | H5 | 4.250 | 2.000 | — | — | C83836 | — | — | — | C83923 | — | — | — |
| 3/4-16 | UNF | .7500 | 4 | H2 | 4.250 | 2.000 | — | — | C83837 | — | — | — | C83924 | — | — | — |
| 3/4-16 | UNF | .7500 | 4 | H3 | 4.250 | 2.000 | C54846 | C83497 | C54847 | — | C55146 | — | C54848 | C55246 | C54849 | C84257 |
| 3/4-16 | UNF | .7500 | 4 | H5 | 4.250 | 2.000 | — | — | C83838 | — | — | — | C83925 | — | — | — |
| 7/8-9 | UNC | .8750 | 4 | H4 | 4.688 | 2.219 | C54884 | C83498 | C54885 | — | C55148 | — | C54886 | C55248 | C54887 | C84258 |
| 7/8-9 | UNC | .8750 | 4 | H6 | 4.688 | 2.219 | — | — | C83839 | — | — | — | C83926 | — | — | — |
| 7/8-14 | UNF | .8750 | 4 | H4 | 4.688 | 2.219 | C54890 | C83499 | C54891 | — | C55150 | C83898 | C54892 | C55250 | C54893 | C84259 |
| 7/8-14 | UNF | .8750 | 4 | H6 | 4.688 | 2.219 | — | — | C83840 | — | — | — | C83927 | — | — | — |
| 1-8 | UNC | 1.0000 | 4 | H4 | 5.125 | 2.500 | C54923 | C83800 | C54924 | — | C55152 | — | C54925 | C55252 | C54926 | C84260 |
| 1-12 | UNF | 1.0000 | 4 | H4 | 5.125 | 2.500 | C54928 | — | C54929 | — | C55154 | — | C54930 | — | — | — |
| 1-14 | UNS | 1.0000 | 4 | H4 | 5.125 | 2.500 | C54933 | — | C54934 | — | — | — | C54935 | — | C54936 | — |
| *1-1/8-7 | UNC | 1.1250 | 4 | H4 | 5.438 | 2.563 | C54965 | — | C54966 | — | — | — | C54967 | — | — | — |
| *1-1/8-12 | UNF | 1.1250 | 4 | H4 | 5.438 | 2.563 | C54971 | — | C54972 | — | — | — | C54973 | — | — | — |
| *1-1/4-7 | UNC | 1.2500 | 4 | H4 | 5.750 | 2.563 | C54994 | — | C54995 | — | — | — | C54996 | — | — | — |
| *1-1/4-12 | UNF | 1.2500 | 6 | H4 | 5.750 | 2.563 | C55000 | — | C55001 | — | — | — | C55002 | — | — | — |
| *1-3/8-6 | UNC | 1.3750 | 4 | H4 | 6.0625 | 3.000 | — | — | C55028 | — | — | — | — | — | — | — |
| *1-3/8-12 | UNF | 1.3750 | 6 | H4 | 6.0625 | 3.000 | — | — | C55031 | — | — | — | C55032 | — | — | — |
| *1-1/2-6 | UNC | 1.5000 | 4 | H4 | 6.375 | 3.000 | C55057 | — | C55058 | — | — | — | C55059 | — | — | — |
| *1-1/2-12 | UNF | 1.5000 | 6 | H4 | 6.375 | 3.000 | C55063 | — | C55064 | — | — | — | C55065 | — | — | — |

Hand Tap

High Speed Steel

Metric on Next Page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | |
| Bright | ◆ | | ◆ | | ◆ | | | ◆ | ◆ | ◆ | | | |

◆ = Best Performance ◆ = Acceptable





General Purpose
Inch

Styles: **1001, 1001TN, 1002, 1002SO, 1002TN, 1002TC, 1003, 1003TN, 1004** (continued)



Hand Taps

SET

Style: **1002**



| | plug chamfer | bright finish | order number |
|------------|--------------|--|-----------------------|
| Tap Sizes: | UNC | 1/4-20, 5/16-18, 3/8-16, 7/16-14, 1/2-13 | 1002 C55090 |
| | UNF | 1/4-28, 5/16-24, 3/8-24, 7/16-20, 1/2-20 | |

Hand Tap

High Speed Steel

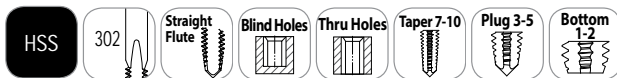


Styles: **1001, 1002, 1003, 1004**

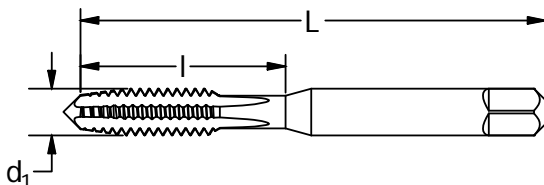
Note

Tapping Speeds and Feeds see Technical section.

Set #1004 consists of one each taper, plug, and bottoming chamfers - Bright.



Surface Treatment



Feature:

New neck down style.

| tap size pitch | thrd form | dec. equiv. | # of flutes | H- limit | overall length L (in) | | thread length l (in) | | order number | | | | | | | |
|-------------------|--------------|----------------|----------------|-------------|-----------------------------|--------|----------------------------|-------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
| | | | | | in | mm | in | mm | Taper | | Plug | | Bottoming | | Set | |
| | | | | | | | | | 1001 Bright | 1001TN TiN | 1002 Bright | 1002TN TiN | 1003 Bright | 1003TN TiN | 1004 Bright | 1004TN TiN |
| *M1.6 x 0.35 | .0630 | 1.60 | 2 | D3 | 1.625 | 41.28 | .313 | 7.94 | C54043 | — | C54044 | — | C54045 | — | — | — |
| *M2 x 0.4 | .0787 | 2.00 | 3 | D3 | 1.750 | 44.45 | .438 | 11.11 | C54073 | C83801 | C54074 | C83870 | C54075 | C83964 | C84210 | C84261 |
| *M2.5 x 0.45 | .0984 | 2.50 | 3 | D3 | 1.813 | 46.04 | .500 | 12.70 | C54131 | C83802 | C54132 | C83871 | C54133 | C83965 | C84211 | C84262 |
| M3 x 0.5 | .1181 | 3.00 | 3 | D3 | 1.938 | 49.21 | .625 | 15.88 | C54164 | C83803 | C54165 | C83872 | C54166 | C83966 | C54167 | C84263 |
| M3.5 x 0.6 | .1378 | 3.50 | 3 | D4 | 2.000 | 50.80 | .688 | 17.46 | C54203 | C83804 | C54204 | C83873 | C54205 | C83967 | C84212 | C84264 |
| M4 x 0.7 | .1575 | 4.00 | 4 | D4 | 2.125 | 53.98 | .750 | 19.05 | C54246 | C83805 | C54247 | C83874 | C54248 | C83968 | C54249 | C84265 |
| M4.5 x 0.75 | .1771 | 4.50 | 4 | D4 | 2.375 | 60.33 | .875 | 22.23 | C54303 | — | C54304 | C83875 | C54305 | — | C84213 | — |
| M5 x 0.8 | .1968 | 5.00 | 4 | D4 | 2.375 | 60.33 | .875 | 22.23 | C54374 | C83806 | C54375 | C83876 | C54376 | C83969 | C54377 | C84266 |
| M6 x 1 | .2362 | 6.00 | 4 | D5 | 2.500 | 63.50 | 1.000 | 25.40 | C54413 | C83807 | C54414 | C83877 | C54415 | C83970 | C54416 | C84267 |
| M7 x 1 | .2756 | 7.00 | 4 | D5 | 2.719 | 69.06 | 1.125 | 28.58 | C54489 | — | C54490 | — | C54491 | — | — | — |
| M8 x 1 | .3150 | 8.00 | 4 | D5 | 2.719 | 69.06 | 1.125 | 28.58 | C54536 | C83808 | C54537 | C83878 | C54538 | C83971 | C84214 | — |
| M8 x 1.25 | .3150 | 8.00 | 4 | D5 | 2.719 | 69.06 | 1.125 | 28.58 | C54546 | C83809 | C54547 | C83879 | C54548 | C83972 | C54539 | C84268 |
| M10 x 1.25 | .3937 | 10.00 | 4 | D5 | 2.938 | 74.61 | 1.250 | 31.75 | C54617 | C83810 | C54618 | C83880 | C54619 | C83973 | C84215 | C84269 |
| M10 x 1.5 | .3937 | 10.00 | 4 | D6 | 2.938 | 74.61 | 1.250 | 31.75 | C54624 | C83811 | C54625 | C83881 | C54626 | C83974 | C54627 | C84270 |
| M12 x 1.25 | .4724 | 12.00 | 4 | D5 | 3.375 | 85.73 | 1.656 | 42.07 | C54675 | C83812 | C54676 | C83882 | C54677 | C83975 | C84216 | C84271 |
| M12 x 1.75 | .4724 | 12.00 | 4 | D6 | 3.375 | 85.73 | 1.656 | 42.07 | C54689 | C83813 | C54690 | C83883 | C54691 | C83976 | C54692 | C84272 |
| M14 x 1.5 | .5512 | 14.00 | 4 | D6 | 3.594 | 91.28 | 1.656 | 42.07 | C54751 | C83814 | C54752 | C83884 | C54753 | C83977 | C84217 | C84273 |
| M14 x 2 | .5512 | 14.00 | 4 | D7 | 3.594 | 91.28 | 1.656 | 42.07 | C54755 | C83815 | C54756 | C83885 | C54757 | C83978 | C54758 | C84274 |
| M16 x 1.5 | .6299 | 16.00 | 4 | D6 | 3.813 | 96.84 | 1.813 | 46.04 | C54797 | — | C54798 | — | C54799 | — | — | — |
| M16 x 2 | .6299 | 16.00 | 4 | D7 | 3.813 | 96.84 | 1.813 | 46.04 | C54801 | C83816 | C54802 | C83886 | C54803 | C83979 | C54804 | C84275 |
| M18 x 1.5 | .7087 | 18.00 | 4 | D6 | 4.031 | 102.39 | 1.813 | 46.04 | C54825 | — | C54826 | — | C83929 | — | — | — |
| M18 x 2.5 | .7087 | 18.00 | 4 | D7 | 4.031 | 102.39 | 1.813 | 46.04 | C54833 | — | C54834 | — | C54835 | — | C84218 | — |
| M20 x 1.5 | .7874 | 20.00 | 4 | D6 | 4.469 | 113.51 | 2.000 | 50.80 | C83382 | — | C54857 | — | C54858 | — | C84219 | — |
| M20 x 2.5 | .7874 | 20.00 | 4 | D7 | 4.469 | 113.51 | 2.000 | 50.80 | C54864 | — | C54865 | C83887 | C54866 | C83980 | C54867 | — |
| M24 x 3 | .9449 | 24.00 | 4 | D8 | 4.906 | 124.62 | 2.219 | 56.36 | C54907 | — | C54908 | C83888 | C54909 | C83981 | C84220 | — |
| M30 x 3.5 | 1.1811 | 30.00 | 4 | D9 | 5.438 | 138.11 | 2.563 | 65.09 | — | — | C54991 | — | C83930 | — | — | — |

*M1.6-M2.5 and larger than M25: 302 blank style

Straight Flute

High Speed Steel

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | |
| Bright | ♦ | | ♦ | | ♦ | | | ♦ | ♦ | ♦ | | | |

☆ = Best Performance ♦ = Acceptable





General Purpose Left

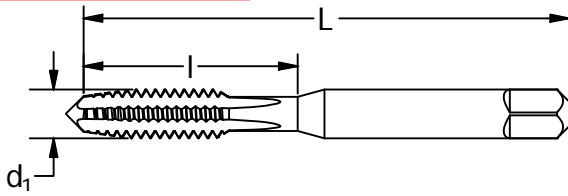
Styles: **1002L**

Note

Tapping Speeds and Feeds see Technical section.



Surface Treatment



Straight Flute

High Speed Steel

| tap size and pitch d₁ | thread form | decimal equiv. | number of flutes | H-limit | overall length L (in) | thread length l (in) | order number 1002L Bright |
|--|-------------|----------------|------------------|---------|---------------------------------|--------------------------------|--|
| #10-32 | UNF | .1900 | 4 | H3 | 2.3750 | .8750 | C60732 |
| 1/4-20 | UNC | .2500 | 4 | H3 | 2.5000 | 1.0000 | C60748 |
| 1/4-28 | UNF | .2500 | 4 | H3 | 2.5000 | 1.0000 | C60752 |
| 5/16-18 | UNC | .3125 | 4 | H3 | 2.7190 | 1.1250 | C60760 |
| 5/16-24 | UNF | .3125 | 4 | H3 | 2.7190 | 1.1250 | C60764 |
| 3/8-16 | UNC | .3750 | 4 | H3 | 2.9380 | 1.2500 | C60776 |
| 3/8-24 | UNF | .3750 | 4 | H3 | 2.9380 | 1.2500 | C60780 |
| 7/16-20 | UNF | .4375 | 4 | H3 | 3.1560 | 1.4380 | C60796 |
| 1/2-13 | UNC | .5000 | 4 | H3 | 3.3750 | 1.6560 | C60808 |
| 1/2-20 | UNF | .5000 | 4 | H3 | 3.3750 | 1.6560 | C60812 |
| 5/8-18 | UNF | .6250 | 4 | H3 | 3.8130 | 1.8130 | C60831 |
| 3/4-10 | UNC | .7500 | 4 | H3 | 4.2500 | 2.0000 | C60835 |
| 3/4-16 | UNF | .7500 | 4 | H3 | 4.2500 | 2.0000 | C60866 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|-----|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | >38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | | ☆ | | | | | ◆ | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable





Cast Iron - Inch & Harder Materials

Styles: **CI-1000, CI-1000-TC**

Note

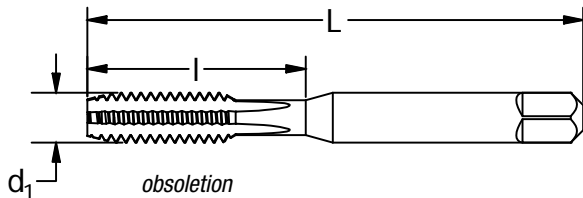
Tapping Speeds and Feeds see Technical section.



Surface Treatment

Oxide over Nitride

TiCN



Feature:

Premium steel substrate.

| tap size and pitch | thread form | decimal equiv. | number of flutes | H-limit | overall length L (in) | thread length I (in) | order number | |
|--------------------|-------------|----------------|------------------|---------|-----------------------|----------------------|----------------------------|-----------------|
| | | | | | | | CI-1000 Oxide over Nitride | CI-1000-TC TiCN |
| 10-24 | UNC | .1900 | 4 | H3 | 2.375 | .875 | C27636 | — |
| 10-32 | UNF | .1900 | 4 | H3 | 2.375 | .875 | C27637 | — |
| 1/4-20 | UNC | .2500 | 4 | H3 | 2.500 | 1.000 | C27638 | C28022 |
| 1/4-20 | UNC | .2500 | 4 | H5 | 2.500 | 1.000 | C27655 | — |
| 1/4-28 | UNF | .2500 | 4 | H3 | 2.500 | 1.000 | C27639 | — |
| 5/16-18 | UNC | .3125 | 4 | H3 | 2.719 | 1.125 | C27640 | C28024 |
| 5/16-18 | UNC | .3125 | 4 | H5 | 2.719 | 1.125 | C27656 | — |
| 5/16-24 | UNF | .3125 | 4 | H3 | 2.719 | 1.125 | C27641 | — |
| 3/8-16 | UNC | .3750 | 4 | H3 | 2.938 | 1.250 | C27642 | — |
| 3/8-16 | UNC | .3750 | 4 | H5 | 2.938 | 1.250 | C27657 | — |
| 7/16-14 | UNC | .4375 | 4 | H3 | 3.156 | 1.438 | C27644 | — |
| 7/16-14 | UNC | .4375 | 4 | H5 | 3.156 | 1.438 | C27658 | — |
| 1/2-13 | UNC | .5000 | 4 | H3 | 3.375 | 1.656 | C27646 | — |
| 1/2-13 | UNC | .5000 | 4 | H5 | 3.375 | 1.656 | C27660 | — |
| 1/2-20 | UNF | .5000 | 4 | H5 | 3.375 | 1.656 | C27661 | — |
| 3/4-16 | UNF | .7500 | 6 | H5 | 4.250 | 2.000 | C27667 | — |

Straight Flute

High Speed Steel

Styles: **CI-1000, CI-1000-TC**

Cast Iron - Inch & Harder Materials

| tap size and pitch d ₁ | decimal equiv. | number of flutes | D-limit | overall length L | | thread length I | | order number | |
|-----------------------------------|----------------|------------------|---------|------------------|-------|-----------------|-------|----------------------------|-----------------|
| | | | | in | mm | in | mm | CI-1000 Oxide over Nitride | CI-1000-TC TiCN |
| M5x0.8 | 0.1968 | 4 | D4 | 2.375 | 60.33 | .875 | 22.23 | C27668 | — |
| M6x1 | 0.2362 | 4 | D5 | 2.500 | 63.50 | 1.000 | 25.4 | C27669 | — |
| M8x1.25 | 0.3150 | 4 | D5 | 2.719 | 69.06 | 1.125 | 28.58 | C27670 | — |
| M10x1.5 | 0.3937 | 4 | D6 | 2.938 | 74.61 | 1.250 | 31.75 | C27671 | C28055 |
| M12x1.25 | 0.4724 | 4 | D6 | 3.375 | 85.73 | 1.656 | 42.06 | C27672 | — |
| M12x1.75 | 0.4724 | 4 | D6 | 3.375 | 85.73 | 1.656 | 42.06 | C27673 | C28057 |
| M14x1.5 | 0.5512 | 4 | D6 | 3.594 | 91.28 | 1.656 | 42.06 | C27675 | — |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|-----------------|------|--------------------------|---------------|------------------------------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | | Nodular | Ni, Co, Fe Based Super Alloy | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | |
| Oxide over Nitride | | ☆ | | ☆ | | | | ☆ | | | | ☆ |

☆ = Best Performance ◆ = Acceptable



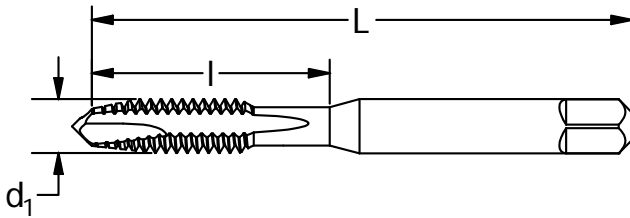


General Purpose Inch

Styles: **1011, 1011SO, 1011TN, 1011TC**

Note

Tapping Speeds and Feeds see Technical section.



Feature:

Thru hole application in a variety of materials.

Spiral Point

High Speed Steel

| tap size and pitch | thread form | decimal equiv | no. of flutes | H-limit | overall length L (in) | thread length l (in) | order number | | | |
|--------------------|-------------|---------------|---------------|---------|-----------------------|----------------------|--------------|--------------------|------------|-------------|
| | | | | | | | 1011 Bright | 1011SO Black Oxide | 1011TN TiN | 1011TC TiCN |
| *0-80 | UNF | .0600 | 2 | H1 | 1.688 | .313 | C57009 | — | — | — |
| *0-80 | UNF | .0600 | 2 | H2 | 1.688 | .313 | C57011 | C57600 | C55290 | C55370 |
| *1-64 | UNC | .0730 | 2 | H2 | 1.688 | .375 | C57022 | — | C83054 | — |
| *1-72 | UNF | .0730 | 2 | H1 | 1.688 | .375 | C57023 | — | — | — |
| *1-72 | UNF | .0730 | 2 | H2 | 1.688 | .375 | C57024 | — | C83055 | — |
| *2-56 | UNC | .0860 | 2 | H1 | 1.750 | .438 | C83040 | — | — | — |
| *2-56 | UNC | .0860 | 2 | H2 | 1.750 | .438 | C57031 | C57602 | C55292 | C55372 |
| *2-64 | UNF | .0860 | 2 | H2 | 1.750 | .438 | C57033 | — | — | — |
| *3-48 | UNC | .0990 | 2 | H2 | 1.813 | .500 | C57038 | — | C55294 | — |
| *3-56 | UNF | .0990 | 2 | H2 | 1.813 | .500 | C57041 | — | C83056 | — |
| 4-40 | UNC | .1120 | 2 | H1 | 1.875 | .563 | C57047 | — | — | — |
| 4-40 | UNC | .1120 | 2 | H2 | 1.875 | .563 | C57048 | C57604 | C55296 | C55374 |
| 4-48 | UNF | .1120 | 2 | H2 | 1.875 | .563 | C57051 | — | C83057 | — |
| 5-40 | UNC | .1250 | 2 | H1 | 1.938 | .625 | C83041 | — | — | — |
| 5-40 | UNC | .1250 | 2 | H2 | 1.938 | .625 | C57062 | C57606 | C55298 | C55376 |
| 6-32 | UNC | .1380 | 2 | H1 | 2.000 | .688 | C57069 | — | — | — |
| 6-32 | UNC | .1380 | 2 | H2 | 2.000 | .688 | C57070 | C57608 | C55299 | C83069 |
| 6-32 | UNC | .1380 | 2 | H3 | 2.000 | .688 | C57072 | C57609 | C55300 | C55378 |
| 6-32 | UNC | .1380 | 2 | H7 | 2.000 | .688 | C57074 | — | — | — |
| 6-40 | UNF | .1380 | 2 | H2 | 2.000 | .688 | C57076 | — | C55302 | — |
| 8-32 | UNC | .1640 | 2 | H1 | 2.125 | .750 | C83042 | — | — | — |
| 8-32 | UNC | .1640 | 2 | H2 | 2.125 | .750 | C57083 | C57610 | C55303 | — |
| 8-32 | UNC | .1640 | 2 | H3 | 2.125 | .750 | C57085 | C57611 | C55304 | C55380 |
| 8-32 | UNC | .1640 | 2 | H7 | 2.125 | .750 | C57087 | — | C55305 | — |
| 8-36 | UNF | .1640 | 2 | H2 | 2.125 | .750 | C57089 | — | C55306 | — |
| 10-24 | UNC | .1900 | 2 | H1 | 2.375 | .875 | C57094 | — | — | — |
| 10-24 | UNC | .1900 | 2 | H2 | 2.375 | .875 | C57095 | — | C55307 | — |
| 10-24 | UNC | .1900 | 2 | H3 | 2.375 | .875 | C57097 | C57001 | C55308 | C55382 |
| 10-24 | UNC | .1900 | 2 | H7 | 2.375 | .875 | C57099 | — | C55309 | — |
| 10-32 | UNF | .1900 | 2 | H1 | 2.375 | .875 | C83043 | — | — | — |
| 10-32 | UNF | .1900 | 2 | H2 | 2.375 | .875 | C57102 | — | C55311 | — |
| 10-32 | UNF | .1900 | 2 | H3 | 2.375 | .875 | C57104 | C57002 | C55310 | C55383 |
| 10-32 | UNF | .1900 | 2 | H7 | 2.375 | .875 | C57106 | — | C55346 | — |
| 12-24 | UNC | .2160 | 2 | H1 | 2.375 | .938 | C83044 | — | — | — |
| 12-24 | UNC | .2160 | 2 | H3 | 2.375 | .938 | C57112 | C57616 | C55312 | C55384 |
| 12-28 | UNF | .2160 | 2 | H3 | 2.375 | .938 | C57114 | — | C55313 | — |
| 1/4-20 | UNC | .2500 | 2 | H1 | 2.500 | 1.000 | C57127 | — | C55348 | — |
| 1/4-20 | UNC | .2500 | 2 | H2 | 2.500 | 1.000 | C57128 | C57618 | C55315 | C83070 |
| 1/4-20 | UNC | .2500 | 2 | H3 | 2.500 | 1.000 | C57129 | C57619 | C55316 | C83071 |
| 1/4-20 | UNC | .2500 | 2 | H5 | 2.500 | 1.000 | C57132 | — | C55317 | — |
| 1/4-20 | UNC | .2500 | 2 | H11 | 2.500 | 1.000 | C57135 | — | — | — |
| 1/4-20 | UNC | .2500 | 2 | H13 | 2.500 | 1.000 | C83045 | — | C83060 | — |

* #0 - #3: 302 blank style.

continued on next page





Styles: 1011, 1011SO, 1011TN, 1011TC (cont'd)

| tap size and pitch d ₁ | thread form | decimal equiv | no. of flutes | H- limit | overall length L (in) | thread length l (in) | order number | | | |
|---|----------------|------------------|------------------|-------------|-----------------------------|----------------------------|----------------|-----------------------|---------------|----------------|
| | | | | | | | 1011 Bright | 1011SO Black Oxide | 1011TN TiN | 1011TC TiCN |
| 1/4-20 | UNC | .2500 | 3 | H3 | 2.500 | 1.000 | C57130 | C57620 | C83058 | C55386 |
| 1/4-20 | UNC | .2500 | 3 | H5 | 2.500 | 1.000 | C57133 | — | C83059 | — |
| 1/4-28 | UNF | .2500 | 2 | H2 | 2.500 | 1.000 | C57137 | — | — | — |
| 1/4-28 | UNF | .2500 | 2 | H3 | 2.500 | 1.000 | C57139 | C57622 | C55318 | C83072 |
| 1/4-28 | UNF | .2500 | 3 | H2 | 2.500 | 1.000 | C57138 | — | — | C55387 |
| 5/16-18 | UNC | .3125 | 2 | H1 | 2.719 | 1.125 | C57149 | — | — | — |
| 5/16-18 | UNC | .3125 | 2 | H2 | 2.719 | 1.125 | C57150 | — | C55319 | — |
| 5/16-18 | UNC | .3125 | 2 | H3 | 2.719 | 1.125 | C57151 | C57624 | C55320 | C83073 |
| 5/16-18 | UNC | .3125 | 2 | H5 | 2.719 | 1.125 | C57154 | — | C55354 | — |
| 5/16-18 | UNC | .3125 | 3 | H3 | 2.719 | 1.125 | C57152 | C57625 | C55321 | C55388 |
| 5/16-18 | UNC | .3125 | 3 | H5 | 2.719 | 1.125 | C57155 | — | C55355 | — |
| 5/16-18 | UNC | .3125 | 3 | H13 | 2.719 | 1.125 | C83046 | — | — | — |
| 5/16-24 | UNF | .3125 | 2 | H1 | 2.719 | 1.125 | C57157 | — | — | — |
| 5/16-24 | UNF | .3125 | 2 | H2 | 2.719 | 1.125 | C83047 | — | — | — |
| 5/16-24 | UNF | .3125 | 2 | H3 | 2.719 | 1.125 | C57160 | C57626 | C55322 | — |
| 5/16-24 | UNF | .3125 | 3 | H4 | 2.719 | 1.125 | C57164 | — | — | C55389 |
| 3/8-16 | UNC | .3750 | 3 | H2 | 2.938 | 1.250 | C57175 | — | C55323 | — |
| 3/8-16 | UNC | .3750 | 3 | H3 | 2.938 | 1.250 | C57176 | C57628 | C55324 | C55390 |
| 3/8-16 | UNC | .3750 | 3 | H5 | 2.938 | 1.250 | C57177 | — | C55325 | — |
| 3/8-24 | UNF | .3750 | 3 | H1 | 2.938 | 1.250 | C57179 | — | — | — |
| 3/8-24 | UNF | .3750 | 3 | H2 | 2.938 | 1.250 | C57180 | — | — | — |
| 3/8-24 | UNF | .3750 | 3 | H3 | 2.938 | 1.250 | C57181 | C57630 | C55326 | C55391 |
| 3/8-24 | UNF | .3750 | 3 | H4 | 2.938 | 1.250 | C57182 | — | — | — |
| 7/16-14 | UNC | .4375 | 3 | H2 | 3.156 | 1.438 | C57191 | — | — | — |
| 7/16-14 | UNC | .4375 | 3 | H3 | 3.156 | 1.438 | C57192 | C57632 | C55328 | C55414 |
| 7/16-14 | UNC | .4375 | 3 | H5 | 3.156 | 1.438 | C57193 | — | — | — |
| 7/16-20 | UNF | .4375 | 3 | H3 | 3.156 | 1.438 | C57195 | — | C55330 | C55392 |
| 7/16-20 | UNF | .4375 | 3 | H5 | 3.156 | 1.438 | C57196 | — | — | — |
| 1/2-13 | UNC | .5000 | 3 | H2 | 3.375 | 1.656 | C57214 | — | — | — |
| 1/2-13 | UNC | .5000 | 3 | H3 | 3.375 | 1.656 | C57215 | C57636 | C55332 | C55394 |
| 1/2-13 | UNC | .5000 | 3 | H5 | 3.375 | 1.656 | C57216 | — | C55333 | — |
| 1/2-20 | UNF | .5000 | 3 | H2 | 3.375 | 1.656 | C83048 | — | — | — |
| 1/2-20 | UNF | .5000 | 3 | H3 | 3.375 | 1.656 | C57220 | C57638 | C55334 | C55395 |
| 1/2-20 | UNF | .5000 | 3 | H5 | 3.375 | 1.656 | C83049 | — | — | — |
| 9/16-12 | UNC | .5625 | 3 | H3 | 3.590 | 1.656 | C83050 | — | — | — |
| 9/16-12 | UNC | .5625 | 3 | H5 | 3.590 | 1.656 | C83051 | — | — | — |
| 9/16-18 | UNF | .5625 | 3 | H3 | 3.590 | 1.656 | C83052 | — | — | — |
| 5/8-11 | UNC | .6250 | 3 | H3 | 3.813 | 1.813 | C57230 | C57640 | C55336 | C55396 |
| 5/8-11 | UNC | .6250 | 3 | H5 | 3.813 | 1.813 | C57232 | — | C83061 | — |
| 5/8-18 | UNF | .6250 | 3 | H3 | 3.813 | 1.813 | C57555 | C57642 | — | — |
| 3/4-10 | UNC | .7500 | 3 | H3 | 4.250 | 2.000 | C57246 | C57644 | C55338 | C55398 |
| 3/4-10 | UNC | .7500 | 3 | H5 | 4.250 | 2.000 | C57247 | — | — | — |
| 3/4-16 | UNF | .7500 | 3 | H3 | 4.250 | 2.000 | C60999 | — | — | — |

Spiral Point

High Speed Steel

continued on next page

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | ★ | | ★ | | ★ | | | | | ★ | | | |
| TiCN | ★ | | ★ | | ★ | | | ★ | | | | | |

★ = Best Performance ★ = Acceptable

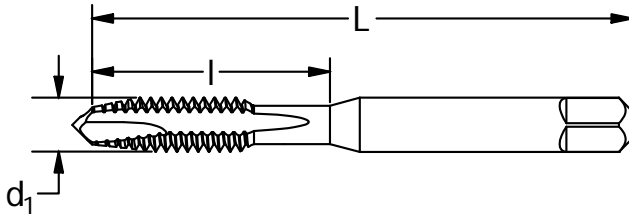


General Purpose
Metric

Styles: **1011, 1011TN, 1011TC** (cont'd)

Note
Tapping Speeds and Feeds see
Technical section.

HSS
302
Spiral Point
Thru Holes
Plug 3-5
Surface Treatment
Bright
TiN
TiCN



Feature:
Thru hole application in a variety of materials.

Spiral Point

High Speed Steel

| tap size and pitch d₁ | decimal equiv | no. of flutes | D-limit | overall length L | | thread length I | | order number | | |
|--|---------------|---------------|---------|----------------------------|--------|---------------------------|-------|-----------------------|----------------------|-----------------------|
| | | | | in | mm | in | mm | 1011 Bright | 1011TN TiN | 1011TC TiCN |
| *M1.6 x 0.35 | .0630 | 2 | D3 | 1.750 | 44.45 | .313 | 11.11 | C57015 | C83062 | — |
| *M1.8 x 0.35 | .0709 | 2 | D3 | 1.750 | 44.45 | .375 | 11.11 | C57019 | — | — |
| *M2 x 0.4 | .0787 | 2 | D3 | 1.750 | 44.45 | .438 | 11.11 | C57027 | C83063 | — |
| *M2.2 x 0.45 | .0866 | 2 | D3 | 1.750 | 44.45 | .438 | 11.11 | C57036 | — | — |
| *M2.5 x 0.45 | .0984 | 2 | D3 | 1.813 | 46.04 | .500 | 12.70 | C57044 | C83064 | — |
| M3 x 0.5 | .1181 | 2 | D3 | 1.938 | 49.21 | .625 | 15.88 | C57055 | C55360 | C55415 |
| M3.5 x 0.6 | .1378 | 2 | D4 | 2.000 | 50.80 | .688 | 17.46 | C57067 | — | — |
| M4 x 0.7 | .1575 | 2 | D4 | 2.125 | 53.98 | .750 | 19.05 | C57080 | C55361 | C55416 |
| M4.5 x 0.75 | .1771 | 2 | D4 | 2.375 | 60.33 | .875 | 22.23 | C57092 | — | — |
| M5 x 0.8 | .1968 | 2 | D4 | 2.375 | 60.33 | .875 | 22.23 | C57110 | C83065 | C55417 |
| M6 x 1 | .2362 | 2 | D5 | 2.500 | 63.50 | 1.000 | 25.40 | C57118 | C55362 | C55418 |
| M7 x 1 | .2756 | 2 | D5 | 2.719 | 69.06 | 1.125 | 28.58 | C57146 | — | — |
| M8 x 1 | .3150 | 2 | D5 | 2.719 | 69.06 | 1.125 | 28.58 | C57168 | C83066 | — |
| M8 x 1.25 | .3150 | 2 | D5 | 2.719 | 69.06 | 1.125 | 28.58 | C57171 | C55363 | C55419 |
| M10 x 1.25 | .3937 | 3 | D5 | 2.938 | 74.61 | 1.250 | 31.75 | C57187 | C83067 | — |
| M10 x 1.5 | .3937 | 3 | D6 | 2.938 | 74.61 | 1.250 | 31.75 | C57189 | C55364 | C55420 |
| M12 x 1.25 | .4724 | 3 | D5 | 3.375 | 85.73 | 1.656 | 42.07 | C57199 | C83068 | — |
| M12 x 1.75 | .4724 | 3 | D6 | 3.375 | 85.73 | 1.656 | 42.07 | C57203 | C55365 | C55421 |
| M14 x 1.5 | .5512 | 3 | D6 | 3.594 | 91.28 | 1.656 | 42.07 | C57226 | — | — |
| M14 x 2 | .5512 | 3 | D7 | 3.594 | 91.28 | 1.656 | 42.07 | C57228 | — | — |
| M16 x 1.5 | .6299 | 3 | D6 | 3.813 | 96.84 | 1.813 | 46.04 | C57234 | — | — |
| M16 x 2 | .6299 | 3 | D7 | 3.813 | 96.84 | 1.813 | 46.04 | C57236 | — | — |
| M18 x 2.5 | .7087 | 3 | D7 | 4.031 | 102.39 | 1.813 | 46.04 | C83053 | — | — |
| M20 x 2.5 | .7874 | 3 | D7 | 3.813 | 96.84 | 2.000 | 46.04 | C57253 | — | — |

*M1.6-M2.5: 302 blank style

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | ◆ | | ◆ | | ◆ | | | | | ☆ | | | |
| TiCN | ☆ | | ☆ | | ☆ | | | ◆ | | | | | |

☆ = Best Performance ◆ = Acceptable



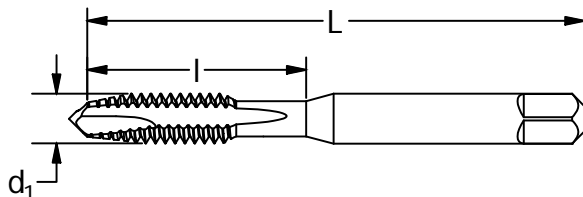
Styles: **1053**

Low Shear

Note
Tapping Speeds and Feeds see
Technical section.



Surface
Treatment



Feature:

Thru hole applications in iron and harder steels.

| tap size and pitch d₁ | thread form | decimal equiv. | number of flutes | H- limit | overall length L (in) | thread length I (in) | order number 1053 |
|---|----------------|-------------------|---------------------|-------------|---------------------------------|--------------------------------|-----------------------------|
| 4-40 | UNC | .1120 | 2 | H2 | 1.875 | .563 | C57324 |
| 5-40 | UNC | .1250 | 2 | H2 | 1.938 | .625 | C57338 |
| 6-32 | UNC | .1380 | 2 | H3 | 2.000 | .688 | C57348 |
| 8-32 | UNC | .1640 | 2 | H3 | 2.125 | .750 | C57361 |
| 10-24 | UNF | .1900 | 2 | H3 | 2.375 | .875 | C57373 |
| 10-32 | UNC | .1900 | 2 | H3 | 2.375 | .875 | C57380 |
| 12-24 | UNC | .2160 | 2 | H3 | 2.375 | .938 | C57388 |
| 1/4-20 | UNC | .2500 | 2 | H1 | 2.500 | 1.000 | C57403 |
| 1/4-20 | UNC | .2500 | 2 | H2 | 2.500 | 1.000 | C57404 |
| 1/4-20 | UNC | .2500 | 2 | H3 | 2.500 | 1.000 | C57406 |
| 1/4-20 | UNC | .2500 | 2 | H11 | 2.500 | 1.000 | C57411 |
| 1/4-28 | UNF | .2500 | 2 | H3 | 2.500 | 1.000 | C57415 |
| 5/16-18 | UNC | .3125 | 2 | H3 | 2.719 | 1.125 | C57428 |
| 5/16-24 | UNF | .3125 | 2 | H3 | 2.719 | 1.125 | C57437 |
| 3/8-16 | UNC | .3750 | 3 | H3 | 2.938 | 1.250 | C57452 |
| 7/16-14 | UNC | .4375 | 3 | H3 | 3.156 | 1.438 | C57469 |
| 1/2-13 | UNC | .5000 | 3 | H3 | 3.375 | 1.656 | C57492 |
| 5/8-11 | UNC | .6250 | 3 | H3 | 3.813 | 1.813 | C57507 |

Spiral Point

High Speed Steel

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | ◆ | | | | |

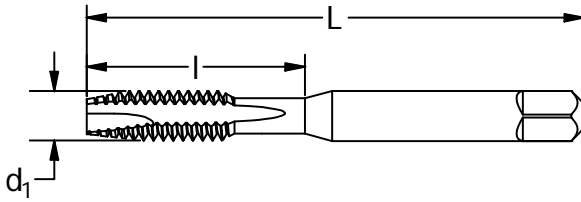
☆ = Best Performance ◆ = Acceptable

Bottoming

Styles: 1012, 1012-TN

Note
Tapping Speeds and Feeds
see Technical section.

HSS
302A
Spiral Point
Blind Holes
Bottom 1-2
Surface Treatment
Bright
TiN



Spiral Point

High Speed Steel

| tap size and pitch d_1 | thread form | decimal equiv. | number of flutes | H-limit | overall length L (in) | thread length I (in) | order number | |
|-----------------------------|-------------|----------------|------------------|---------|--------------------------|-------------------------|--------------|---------|
| | | | | | | | 1012 | 1012-TN |
| *0-80 | UNF | .0600 | 2 | H2 | 1.625 | .313 | C57012 | — |
| *2-56 | UNC | .0860 | 2 | H2 | 1.750 | .438 | C57032 | — |
| 4-40 | UNC | .1120 | 2 | H2 | 1.875 | .563 | C57049 | C83347 |
| 5-40 | UNC | .1250 | 2 | H2 | 1.938 | .625 | C57063 | — |
| 6-32 | UNC | .1380 | 2 | H2 | 2.000 | .688 | C83074 | — |
| 6-32 | UNC | .1380 | 2 | H3 | 2.000 | .688 | C57073 | C83348 |
| 8-32 | UNC | .1640 | 2 | H2 | 2.125 | .750 | C83075 | — |
| 8-32 | UNC | .1640 | 2 | H3 | 2.125 | .750 | C57086 | C83349 |
| 10-24 | UNC | .1900 | 2 | H2 | 2.375 | .875 | C83076 | — |
| 10-24 | UNC | .1900 | 2 | H3 | 2.375 | .875 | C57098 | C83350 |
| 10-32 | UNF | .1900 | 2 | H2 | 2.375 | .875 | C83077 | — |
| 10-32 | UNF | .1900 | 2 | H3 | 2.375 | .875 | C57105 | C83351 |
| 12-24 | UNC | .2160 | 2 | H3 | 2.380 | .500 | C83078 | C83352 |
| 1/4-20 | UNC | .2500 | 2 | H2 | 2.500 | 1.000 | C83079 | — |
| 1/4-20 | UNC | .2500 | 2 | H3 | 2.500 | 1.000 | C57131 | C83353 |
| 1/4-20 | UNC | .2500 | 3 | H3 | 2.500 | 1.000 | C83080 | C83354 |
| 1/4-28 | UNF | .2500 | 2 | H3 | 2.500 | 1.000 | C57140 | C83355 |
| 5/16-18 | UNC | .3125 | 2 | H3 | 2.719 | 1.125 | C83081 | C83356 |
| 5/16-18 | UNC | .3125 | 3 | H3 | 2.719 | 1.125 | C57153 | C83357 |
| 5/16-24 | UNF | .3125 | 2 | H3 | 2.719 | 1.125 | C57162 | — |
| 3/8-16 | UNC | .3750 | 3 | H3 | 2.940 | .7500 | C83082 | C83358 |
| 3/8-24 | UNF | .3750 | 3 | H3 | 2.940 | .7500 | C83083 | — |
| 7/16-14 | UNC | .4375 | 3 | H3 | 3.160 | .8800 | C83084 | — |
| 7/16-20 | UNF | .4375 | 3 | H3 | 3.160 | .8800 | C83085 | — |
| 1/2-13 | UNC | .5000 | 3 | H3 | 3.380 | .9400 | C83086 | C83359 |
| 1/2-20 | UNF | .5000 | 3 | H3 | 3.380 | .9400 | C83087 | — |
| 5/8-11 | UNC | .6275 | 3 | H3 | 3.810 | 1.0900 | C83088 | — |
| 3/4-10 | UNC | .7500 | 3 | H3 | 4.250 | 1.2200 | C83089 | — |

*#0-#2: 302 blank style

Bottoming - Metric

Styles: 1012, 1012-TN

| tap size and pitch d_1 | decimal equiv. | no. of flutes | D-limit | overall length L | | thread length I | | order number 1012 Bright |
|-----------------------------|----------------|---------------|---------|---------------------|-------|--------------------|-------|--------------------------------|
| | | | | in | mm | in | mm | |
| *M1.6 x 0.35 | .0630 | 2 | D3 | 1.625 | 41.27 | .3125 | 7.94 | C83090 |
| *M2 x 0.4 | .0787 | 2 | D3 | 1.750 | 44.45 | .4375 | 11.11 | C83091 |
| *M2.5 x 0.45 | .0984 | 2 | D3 | 1.813 | 46.04 | .5000 | 12.70 | C83092 |
| M3 x 0.5 | .1181 | 2 | D3 | 1.938 | 49.28 | .3100 | 7.87 | C83093 |
| M4 x 0.7 | .1575 | 2 | D4 | 2.125 | 54.10 | .3800 | 9.65 | C83094 |
| M5 x 0.8 | .1968 | 2 | D4 | 2.375 | 60.45 | .5000 | 12.70 | C83095 |
| M6 x 1 | .2362 | 2 | D5 | 2.500 | 63.50 | .6300 | 16.00 | C83096 |
| M8 x 1 | .3150 | 2 | D5 | 2.719 | 69.09 | .6900 | 17.53 | C83097 |
| M8 X 1.25 | .3150 | 2 | D5 | 2.719 | 69.09 | .6900 | 17.53 | C83098 |
| M10 x 1.25 | .3937 | 3 | D5 | 2.938 | 74.61 | 1.250 | 31.75 | C83099 |
| M10 x 1.5 | .3937 | 3 | D6 | 2.938 | 74.61 | 1.250 | 31.75 | C83345 |
| M12 x 1.75 | .4724 | 3 | D6 | 3.375 | 85.73 | 1.656 | 42.07 | C83346 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| 1012 Bright | ☆ | | | | | | | ◆ | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Styles: 1011E

6" Extended Length

Note
Tapping Speeds and Feeds see Technical section.

HSS 303-A Extended Length Spiral Point Thru Holes Plug 3-5

Surface Treatment: Bright



Feature:
Extended length for long reach applications.

| tap size and pitch d ₁ | thread form | decimal equiv. | number of flutes | H-limit | overall length L (in) | thread length l (in) | order number 1011E |
|--------------------------------------|-------------|----------------|------------------|---------|--------------------------|-------------------------|------------------------------|
| #8-32 | UNC | .1640 | 2 | H3 | 6.0000 | .7500 | C59106 |
| #10-24 | UNC | .1900 | 2 | H3 | 6.0000 | .8750 | C59109 |
| #10-32 | UNF | .1900 | 2 | H3 | 6.0000 | .8750 | C59110 |
| 1/4-20 | UNC | .2500 | 2 | H3 | 6.0000 | 1.0000 | C59117 |
| 1/4-28 | UNF | .2500 | 2 | H3 | 6.0000 | 1.0000 | C59118 |
| 5/16-18 | UNC | .3125 | 2 | H3 | 6.0000 | 1.1250 | C59121 |
| 5/16-24 | UNF | .3125 | 2 | H3 | 6.0000 | 1.1250 | C59122 |
| 3/8-16 | UNC | .3750 | 3 | H3 | 6.0000 | 1.2500 | C59126 |
| 3/8-24 | UNF | .3750 | 3 | H3 | 6.0000 | 1.2500 | C59127 |

Spiral Point

Style: T-101

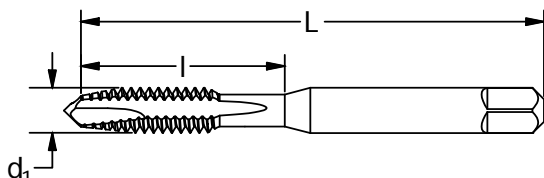
Stainless Steel & Steels SD Powder Metal

Note
Tapping Speeds and Feeds see Technical section.

HSS-E 302A Spiral Point Thru Holes Plug 3-5

Surface Treatment: Black Oxide

****Items are being OBSOLETED, only available until inventory is depleted.**



Feature:
Premium steel substrate for steels and stainless.

| tap size and pitch d ₁ | thread form | decimal equiv. | number of flutes | H-Limit | overall length L (in) | thread length l (in) | order no. T-101 |
|--------------------------------------|-------------|----------------|------------------|---------|--------------------------|-------------------------|---------------------------|
| 6-32 | UNC | .1380 | 2 | H3 | 2.000 | .688 | **C27696 |
| 8-32 | UNC | .1640 | 3 | H3 | 2.125 | .750 | C27697 |
| 8-32 | UNC | .1640 | 3 | H5 | 2.125 | .750 | C27720 |
| 10-24 | UNC | .1900 | 3 | H3 | 2.375 | .875 | C27698 |
| 10-32 | UNF | .1900 | 3 | H3 | 2.375 | .875 | C27699 |
| 1/4-20 | UNC | .2500 | 3 | H3 | 2.500 | 1.000 | C27700 |
| 1/4-20 | UNC | .2500 | 3 | H5 | 2.500 | 1.000 | C27723 |
| 5/16-18 | UNC | .3125 | 3 | H3 | 2.719 | 1.125 | C27702 |
| 5/16-24 | UNF | .3125 | 3 | H3 | 2.719 | 1.125 | C27703 |
| 3/8-16 | UNC | .3750 | 3 | H3 | 2.938 | 1.250 | C27704 |
| 1/2-13 | UNC | .5000 | 3 | H3 | 3.375 | 1.656 | C27708 |

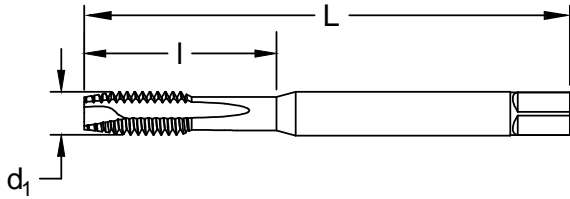
Premium High Speed Steel

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|--|-------|--|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| 1011E | ☆ | | ☆ | | | | | ☆ | ◆ | | | | |
| T-101 | ☆ | | ☆ | | ☆ | ☆ | ◆ | ◆ | ◆ | | | | |

☆ = Best Performance ◆ = Acceptable



Note
Tapping Speeds and Feeds
see Technical section.



Feature:
Premium steel substrate, for use in a wide array of materials.

Spiral Point

Premium High Speed Steel

| tap size and pitch d₁ | thread form | decimal equiv. | no. of flutes | class of fit | shank diameter | overall length L (in) | thread length I (in) | order number | |
|---|----------------|-------------------|------------------|-----------------|-------------------|------------------------------------|-----------------------------------|---------------------------------|---------------------------|
| | | | | | | | | Black Oxide PRO-961SP | TiAlN PRO-861SP |
| 2-56 | UNC | 0.0860 | 3 | 2B | 0.141 | 1.772 | 0.551 | C96101 | C86101 |
| 3-48 | UNC | 0.0990 | 3 | 2B | 0.141 | 1.969 | 0.591 | C96102 | C86102 |
| 4-40 | UNC | 0.1120 | 3 | 2B | 0.141 | 2.205 | 0.669 | C96103 | C86103 |
| 4-48 | UNF | 0.1120 | 3 | 2B | 0.141 | 2.205 | 0.669 | C96104 | C86104 |
| 5-40 | UNC | 0.1250 | 3 | 2B | 0.141 | 2.205 | 0.748 | C96105 | C86105 |
| 6-32 | UNC | 0.1380 | 3 | 2B | 0.141 | 2.205 | 0.787 | C96106 | C86106 |
| 6-40 | UNF | 0.1380 | 3 | 2B | 0.141 | 2.205 | 0.787 | C96107 | C86107 |
| 8-32 | UNC | 0.1640 | 3 | 2B | 0.168 | 2.480 | 0.827 | C96108 | C86108 |
| 8-36 | UNF | 0.1640 | 3 | 2B | 0.168 | 2.480 | 0.827 | C96109 | C86109 |
| 10-24 | UNC | 0.1900 | 3 | 2B | 0.194 | 2.756 | 1.024 | C96110 | C86110 |
| 10-32 | UNF | 0.1900 | 3 | 2B | 0.194 | 2.756 | 1.024 | C96111 | C86111 |
| 12-24 | UNC | 0.2160 | 3 | 2B | 0.220 | 3.150 | 1.063 | C96112 | C86112 |
| 12-28 | UNF | 0.2160 | 3 | 2B | 0.220 | 3.150 | 1.063 | C96113 | C86113 |
| 1/4-20 | UNC | 0.2500 | 3 | 2B | 0.255 | 3.150 | 1.260 | C96114 | C86114 |
| 1/4-28 | UNF | 0.2500 | 3 | 2B | 0.255 | 3.150 | 1.260 | C96115 | C86115 |
| 5/16-18 | UNC | 0.3125 | 3 | 2B | 0.318 | 3.543 | 1.378 | C96116 | C86116 |
| 5/16-24 | UNF | 0.3125 | 3 | 2B | 0.318 | 3.543 | 1.378 | C96117 | C86117 |
| 3/8-16 | UNC | 0.3750 | 3 | 2B | 0.381 | 3.937 | 1.732 | C96118 | C86118 |
| 3/8-24 | UNF | 0.3750 | 3 | 2B | 0.381 | 3.937 | 1.732 | C96119 | C86119 |
| 7/16-14 | UNC | 0.4375 | 3 | 2B | 0.323 | 3.937 | 1.614 | C96120 | C86120 |
| 7/16-20 | UNF | 0.4375 | 3 | 2B | 0.323 | 3.937 | 1.614 | C96121 | C86121 |
| 1/2-13 | UNC | 0.5000 | 3 | 2B | 0.367 | 4.331 | 1.535 | C96122 | C86122 |
| 1/2-20 | UNF | 0.5000 | 3 | 2B | 0.367 | 4.331 | 1.535 | C96123 | C86123 |
| 9/16-12 | UNC | 0.5625 | 3 | 2B | 0.429 | 4.331 | 1.772 | C96124 | C86124 |
| 9/16-18 | UNF | 0.5625 | 3 | 2B | 0.429 | 4.331 | 1.772 | C96125 | C86125 |
| 5/8-11 | UNC | 0.6250 | 3 | 2B | 0.480 | 4.331 | 2.087 | C96126 | C86126 |
| 5/8-18 | UNF | 0.6250 | 3 | 2B | 0.480 | 4.331 | 2.087 | C96127 | C86127 |
| 3/4-10 | UNC | 0.7500 | 4 | 2B | 0.590 | 4.921 | 2.205 | C96128 | C86128 |
| 3/4-16 | UNF | 0.7500 | 4 | 2B | 0.590 | 4.921 | 2.205 | C96129 | C86129 |
| 7/8-9 | UNC | 0.8750 | 4 | 2B | 0.697 | 5.512 | 2.362 | C96130 | C86130 |
| 7/8-14 | UNF | 0.8750 | 4 | 2B | 0.697 | 5.512 | 2.362 | C96131 | C86131 |
| 1-8 | UNC | 1.0000 | 4 | 2B | 0.800 | 6.299 | 2.520 | C96132 | C86132 |
| 1-12 | UNF | 1.0000 | 4 | 2B | 0.800 | 6.299 | 2.520 | C96133 | C86133 |

continued on next page



Styles: **PRO-961SP** and **PRO-861SP** (continued)

| tap size and pitch d ₁ | thread form | decimal equiv. | no. of flutes | class of fit | shank diameter | | overall length L | | thread length I | | order number | |
|---|----------------|-------------------|------------------|-----------------|----------------|-------|---------------------|-----|--------------------|----|------------------|------------------|
| | | | | | in | mm | in | mm | in | mm | Black Oxide | TiAlN |
| | | | | | | | | | | | PRO-961SP | PRO-861SP |
| M2.5x0.45 | M | 0.0866 | 3 | 6H | 0.141 | 3.58 | 2.205 | 56 | 0.748 | 19 | C96152 | C86152 |
| M3x0.5 | M | 0.1181 | 3 | 6H | 0.141 | 3.58 | 2.205 | 56 | 0.748 | 19 | C96134 | C86134 |
| M3.5x0.6 | M | 0.1378 | 3 | 6H | 0.141 | 3.58 | 2.205 | 56 | 0.787 | 20 | C96135 | C86135 |
| M4x0.7 | M | 0.1575 | 3 | 6H | 0.168 | 4.27 | 2.480 | 63 | 0.827 | 21 | C96136 | C86136 |
| M5x0.8 | M | 0.1969 | 3 | 6H | 0.194 | 4.93 | 2.756 | 70 | 1.024 | 26 | C96137 | C86137 |
| M6x1 | M | 0.2362 | 3 | 6H | 0.255 | 6.48 | 3.150 | 80 | 1.260 | 32 | C96138 | C86138 |
| M7x1 | M | 0.2756 | 3 | 6H | 0.318 | 8.08 | 3.150 | 80 | 1.181 | 30 | C96139 | C86139 |
| M8x1 | M | 0.3150 | 3 | 6H | 0.318 | 8.08 | 3.543 | 90 | 1.378 | 35 | C96140 | C86140 |
| M8x1.25 | M | 0.3150 | 3 | 6H | 0.318 | 8.08 | 3.543 | 90 | 1.378 | 35 | C96141 | C86141 |
| M10x1.25 | M | 0.3937 | 3 | 6H | 0.381 | 9.68 | 3.937 | 100 | 1.575 | 40 | C96142 | C86142 |
| M10x1.5 | M | 0.3937 | 3 | 6H | 0.381 | 9.68 | 3.937 | 100 | 1.575 | 40 | C96143 | C86143 |
| M12x1.25 | M | 0.4724 | 3 | 6H | 0.367 | 9.32 | 4.331 | 110 | 1.575 | 40 | C96144 | C86144 |
| M12x1.75 | M | 0.4724 | 3 | 6H | 0.367 | 9.32 | 4.331 | 110 | 1.575 | 40 | C96145 | C86145 |
| M14x1.5 | M | 0.5512 | 3 | 6H | 0.429 | 10.9 | 4.331 | 110 | 1.772 | 45 | C96146 | C86146 |
| M14x2 | M | 0.5512 | 3 | 6H | 0.429 | 10.9 | 4.331 | 110 | 1.772 | 45 | C96147 | C86147 |
| M16x1.5 | M | 0.6299 | 3 | 6H | 0.480 | 12.19 | 4.331 | 110 | 2.087 | 53 | C96148 | C86148 |
| M16x2 | M | 0.6299 | 3 | 6H | 0.480 | 12.19 | 4.331 | 110 | 2.087 | 53 | C96149 | C86149 |
| M18x1.5 | M | 0.7087 | 4 | 6H | 0.542 | 13.77 | 4.921 | 125 | 2.165 | 55 | C96150 | C86150 |
| M18x2.0 | M | 0.7087 | 4 | 6H | 0.542 | 13.77 | 4.921 | 125 | 2.165 | 55 | C96151 | C86151 |

Spiral Point

Premium High Speed Steel

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Black Oxide | ◆ | | ◆ | | ◆ | ◆ | | ◆ | ◆ | | | | |
| TiAlN | ☆ | | ☆ | | ☆ | ☆ | | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable



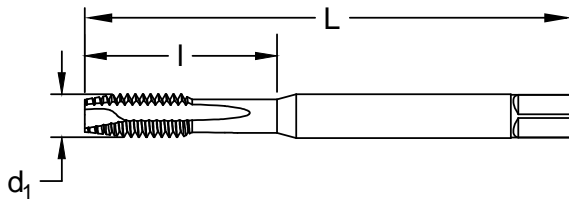


Stainless Steel - Inch Performance



Styles: **PER-862SP** and **PER-960SP**

Note
Tapping Speeds and Feeds see Technical section.



Feature:

Premium steel substrate, for use in a wide array of materials.

Spiral Point

Premium High Speed Steel

| tap size and pitch d₁ | thread form | decimal equiv. | no. of flutes | class of fit | shank diameter | overall length L (in) | thread length I (in) | order number | |
|--|-------------|----------------|---------------|--------------|----------------|---------------------------------|--------------------------------|---------------------------------|------------------------------|
| | | | | | | | | Black Oxide PER-862SP | Hardlube PER-960SP |
| 2-56 | UNC | 0.0860 | 3 | 2B | 0.141 | 1.772 | 0.551 | C86201 | C96001 |
| 3-48 | UNC | 0.0990 | 3 | 2B | 0.141 | 1.969 | 0.591 | C86202 | C96002 |
| 4-40 | UNC | 0.1120 | 3 | 2B | 0.141 | 2.205 | 0.669 | C86203 | C96003 |
| 4-48 | UNF | 0.1120 | 3 | 2B | 0.141 | 2.205 | 0.669 | C86204 | C96004 |
| 5-40 | UNC | 0.1250 | 3 | 2B | 0.141 | 2.205 | 0.748 | C86205 | C96005 |
| 6-32 | UNC | 0.1380 | 3 | 2B | 0.141 | 2.205 | 0.787 | C86206 | C96006 |
| 6-40 | UNF | 0.1380 | 3 | 2B | 0.141 | 2.205 | 0.787 | C86207 | C96007 |
| 8-32 | UNC | 0.1640 | 3 | 2B | 0.168 | 2.480 | 0.827 | C86208 | C96008 |
| 8-36 | UNF | 0.1640 | 3 | 2B | 0.168 | 2.480 | 0.827 | C86209 | C96009 |
| 10-24 | UNC | 0.1900 | 3 | 2B | 0.194 | 2.756 | 1.024 | C86210 | C96010 |
| 10-32 | UNF | 0.1900 | 3 | 2B | 0.194 | 2.756 | 1.024 | C86211 | C96011 |
| 12-24 | UNC | 0.2160 | 3 | 2B | 0.220 | 3.150 | 1.063 | C86212 | C96012 |
| 12-28 | UNF | 0.2160 | 3 | 2B | 0.220 | 3.150 | 1.063 | C86213 | C96013 |
| 1/4-20 | UNC | 0.2500 | 3 | 2B | 0.255 | 3.150 | 1.260 | C86214 | C96014 |
| 1/4-28 | UNF | 0.2500 | 3 | 2B | 0.255 | 3.150 | 1.260 | C86215 | C96015 |
| 5/16-18 | UNC | 0.3125 | 3 | 2B | 0.318 | 3.543 | 1.378 | C86216 | C96016 |
| 5/16-24 | UNF | 0.3125 | 3 | 2B | 0.318 | 3.543 | 1.378 | C86217 | C96017 |
| 3/8-16 | UNC | 0.3750 | 3 | 2B | 0.381 | 3.937 | 1.732 | C86218 | C96018 |
| 3/8-24 | UNF | 0.3750 | 3 | 2B | 0.381 | 3.937 | 1.732 | C86219 | C96019 |
| 7/16-14 | UNC | 0.4375 | 3 | 2B | 0.323 | 3.937 | 1.614 | C86220 | C96020 |
| 7/16-20 | UNF | 0.4375 | 3 | 2B | 0.323 | 3.937 | 1.614 | C86221 | C96021 |
| 1/2-13 | UNC | 0.5000 | 3 | 2B | 0.367 | 4.331 | 1.535 | C86222 | C96022 |
| 1/2-20 | UNF | 0.5000 | 3 | 2B | 0.367 | 4.331 | 1.535 | C86223 | C96023 |
| 9/16-12 | UNC | 0.5625 | 3 | 2B | 0.429 | 4.331 | 1.772 | C86224 | C96024 |
| 9/16-18 | UNF | 0.5625 | 3 | 2B | 0.429 | 4.331 | 1.772 | C86225 | C96025 |
| 5/8-11 | UNC | 0.6250 | 3 | 2B | 0.480 | 4.331 | 2.087 | C86226 | C96026 |
| 5/8-18 | UNF | 0.6250 | 3 | 2B | 0.480 | 4.331 | 2.087 | C86227 | C96027 |
| 3/4-10 | UNC | 0.7500 | 4 | 2B | 0.590 | 4.921 | 2.205 | C86228 | C96028 |
| 3/4-16 | UNF | 0.7500 | 4 | 2B | 0.590 | 4.921 | 2.205 | C86229 | C96029 |
| 7/8-9 | UNC | 0.8750 | 4 | 2B | 0.697 | 5.512 | 2.362 | C86230 | C96030 |
| 7/8-14 | UNF | 0.8750 | 4 | 2B | 0.697 | 5.512 | 2.362 | C86231 | C96031 |
| 1-8 | UNC | 1.0000 | 4 | 2B | 0.800 | 6.299 | 2.520 | C86232 | C96032 |
| 1-12 | UNF | 1.0000 | 4 | 2B | 0.800 | 6.299 | 2.520 | C86233 | C96033 |

continued on next page



Styles: **PER-862SP** and **PER-960SP** (continued)

| tap size and pitch d₁ | thread form | decimal equiv. | no. of flutes | class of fit | shank diameter | | overall length L | | thread length l | | order number | |
|---|----------------|-------------------|------------------|-----------------|----------------|-------|----------------------------|-----|---------------------------|----|---------------------------------|------------------------------|
| | | | | | in | mm | in | mm | in | mm | Black Oxide PER-862SP | Hardlube PER-960SP |
| M2.5x.045 | M | 0.0866 | 3 | 6H | 0.141 | 3.58 | 2.205 | 56 | 0.748 | 19 | C86252 | C96052 |
| M3x0.5 | M | 0.1181 | 3 | 6H | 0.141 | 3.58 | 2.205 | 56 | 0.748 | 19 | C86234 | C96034 |
| M3.5x0.6 | M | 0.1378 | 3 | 6H | 0.141 | 3.58 | 2.205 | 56 | 0.787 | 20 | C86235 | C96035 |
| M4x0.7 | M | 0.1575 | 3 | 6H | 0.168 | 4.27 | 2.480 | 63 | 0.827 | 21 | C86236 | C96036 |
| M5x0.8 | M | 0.1969 | 3 | 6H | 0.194 | 4.93 | 2.756 | 70 | 1.024 | 26 | C86237 | C96037 |
| M6x1 | M | 0.2362 | 3 | 6H | 0.255 | 6.48 | 3.150 | 80 | 1.260 | 32 | C86238 | C96038 |
| M7x1 | M | 0.2756 | 3 | 6H | 0.318 | 8.08 | 3.150 | 80 | 1.181 | 30 | C86239 | C96039 |
| M8x1 | M | 0.3150 | 3 | 6H | 0.318 | 8.08 | 3.543 | 90 | 1.378 | 35 | C86240 | C96040 |
| M8x1.25 | M | 0.3150 | 3 | 6H | 0.318 | 8.08 | 3.543 | 90 | 1.378 | 35 | C86241 | C96041 |
| M10x1.25 | M | 0.3937 | 3 | 6H | 0.381 | 9.68 | 3.937 | 100 | 1.575 | 40 | C86242 | C96042 |
| M10x1.5 | M | 0.3937 | 3 | 6H | 0.381 | 9.68 | 3.937 | 100 | 1.575 | 40 | C86243 | C96043 |
| M12x1.25 | M | 0.4724 | 3 | 6H | 0.367 | 9.32 | 4.331 | 110 | 1.575 | 40 | C86244 | C96044 |
| M12x1.75 | M | 0.4724 | 3 | 6H | 0.367 | 9.32 | 4.331 | 110 | 1.575 | 40 | C86245 | C96045 |
| M14x1.5 | M | 0.5512 | 3 | 6H | 0.429 | 10.9 | 4.331 | 110 | 1.772 | 45 | C86246 | C96046 |
| M14x2 | M | 0.5512 | 3 | 6H | 0.429 | 10.9 | 4.331 | 110 | 1.772 | 45 | C86247 | C96047 |
| M16x1.5 | M | 0.6299 | 3 | 6H | 0.480 | 12.19 | 4.331 | 110 | 2.087 | 53 | C86248 | C96048 |
| M16x2 | M | 0.6299 | 3 | 6H | 0.480 | 12.19 | 4.331 | 110 | 2.087 | 53 | C86249 | C96049 |
| M18x1.5 | M | 0.7087 | 4 | 6H | 0.542 | 13.77 | 4.921 | 125 | 2.165 | 55 | C86250 | C96050 |
| M18x2.0 | M | 0.7087 | 4 | 6H | 0.542 | 13.77 | 4.921 | 125 | 2.165 | 55 | C86251 | C96051 |

Spiral Point

Premium High Speed Steel

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Black Oxide | ◆ | | ◆ | | ◆ | ◆ | | ◆ | ◆ | | | | |
| Hardlube | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ☆ | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable





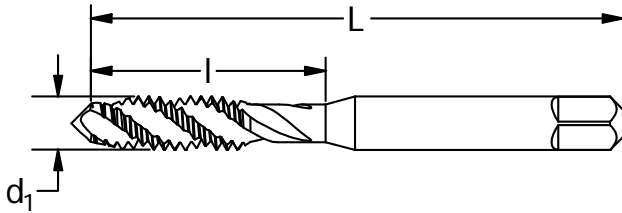
General Purpose - Inch High-Spiral

Styles: **1093, 1093-TN, 1094, 1094-TN**

Note
Tapping Speeds and Feeds see
Technical section.

HSS 302A Avg. Helix $\angle 49^\circ$ Blind Holes Plug 3-5 Bottom 1-2

Surface Treatment: Bright, TiN, TiCN



Spiral Flute

High Speed Steel

order number

| tap size and pitch d_1 | thread form | decimal equiv. | no. of flutes | H- limit | overall length | | thread length | | Plug | | Bottoming | |
|--------------------------------|----------------|-------------------|------------------|-------------|----------------|--------|----------------|----------------|----------------|----------------|-----------|--|
| | | | | | L (in) | I (in) | 1093 Bright | 1093-TN TiN | 1094 Bright | 1094-TN TiN | | |
| 4-40 | UNC | .1120 | 2 | H2 | 1.875 | .563 | C58515 | — | C58516 | C55566 | | |
| 6-32 | UNC | .1380 | 2 | H3 | 2.000 | .688 | C58532 | C55571 | C58533 | C55570 | | |
| 8-32 | UNC | .1640 | 3 | H3 | 2.125 | .750 | C58538 | C55573 | C58539 | C55572 | | |
| 10-24 | UNC | .1900 | 3 | H3 | 2.375 | .875 | C58544 | C55575 | C58545 | — | | |
| 10-32 | UNF | .1900 | 3 | H3 | 2.375 | .875 | C58546 | C55577 | C58547 | C55576 | | |
| 1/4-20 | UNC | .2500 | 3 | H3 | 2.500 | 1.000 | C58562 | — | C58563 | — | | |
| 1/4-28 | UNF | .2500 | 3 | H3 | 2.500 | 1.000 | C58564 | — | C58565 | — | | |
| 5/16-18 | UNC | .3125 | 3 | H3 | 2.719 | 1.125 | C58570 | — | C58571 | — | | |
| 5/16-24 | UNF | .3125 | 3 | H3 | 2.719 | 1.125 | C58572 | — | C58573 | — | | |
| 3/8-16 | UNC | .3750 | 3 | H3 | 2.938 | 1.250 | C58581 | — | C58582 | — | | |
| 3/8-24 | UNF | .3750 | 3 | H3 | 2.938 | 1.250 | C58583 | — | C58584 | — | | |
| 1/2-13 | UNC | .5000 | 3 | H3 | 3.375 | 1.656 | C58613 | — | C58614 | — | | |
| 1/2-20 | UNF | .5000 | 3 | H3 | 3.375 | 1.656 | C58615 | — | C58616 | — | | |

General Purpose - Metric High-Spiral

Styles: **1093, 1093-TC, 1094, 1094-TC**

order number

| tap size and pitch d_1 | decimal equiv. | no. of flutes | D- limit | overall length | | thread length | | Plug | | Bottoming | |
|--------------------------------|-------------------|------------------|-------------|----------------|-------|---------------|-------|----------------|-----------------|----------------|-----------------|
| | | | | in | mm | in | mm | 1093 Bright | 1093-TC TiCN | 1094 Bright | 1094-TC TiCN |
| M3 x 0.5 | .1181 | 2 | D3 | 1.938 | 49.21 | .625 | 15.88 | C58800 | — | C58801 | C58901 |
| M4 x 0.7 | .1575 | 3 | D4 | 2.125 | 53.98 | .750 | 19.05 | C58804 | C58904 | C58805 | C58905 |
| M5 x 0.8 | .1969 | 3 | D4 | 2.375 | 60.33 | .875 | 22.23 | C58806 | C58906 | C58807 | C58907 |
| M6 x 1.0 | .2362 | 3 | D5 | 2.500 | 63.50 | 1.000 | 25.40 | C58808 | C58908 | C58809 | C58909 |
| M8 x 1.25 | .3150 | 3 | D5 | 2.719 | 69.06 | 1.125 | 28.58 | C58810 | C58910 | C58811 | C58911 |
| M10 x 1.5 | .3937 | 3 | D6 | 2.938 | 74.61 | 1.250 | 31.75 | C58812 | C58912 | C58813 | C58913 |
| M12x1.75 | .4724 | 3 | D6 | 3.375 | 85.73 | 1.656 | 42.07 | — | — | C58815 | — |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------------|------------------------------------|----------|-------------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | | | | | >45 |
| | Bright | ◆ | | ◆ | | | | | | ☆ | | | |
| TiN | ☆ | | ☆ | | ☆ | | | | | | | | |
| TiCN | ☆ | | ☆ | | ☆ | | | | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



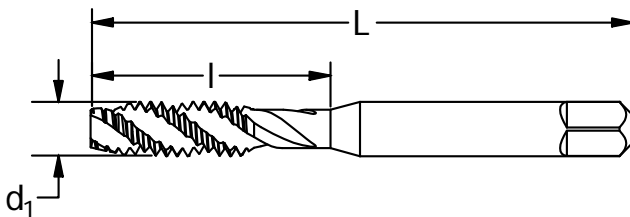


Styles: **1095**, **1096**

Heavy Duty CNC

Note
Tapping Speeds and Feeds see
Technical section.

HSS
302A
Avg. Helix $\angle 48^\circ$
Blind Holes
Plug 3-5
Bottom 1-2
Surface Treatment
Black Oxide



| tap size and pitch d_1 | thread form | decimal equiv. | no of flutes | H- limit | overall length L (in) | thread length l (in) | order number | |
|--------------------------------|----------------|-------------------|-----------------|-------------|--------------------------|-------------------------|---------------------|--------------------------|
| | | | | | | | 1095 Plug | 1096 Bottoming |
| 6-32 | UNC | .1380 | 2 | H3 | 2.000 | .688 | C58432 | C58433 |
| 8-32 | UNC | .1640 | 3 | H3 | 2.125 | .750 | C58434 | C58435 |
| 10-24 | UNC | .1900 | 3 | H3 | 2.375 | .875 | C58436 | C58437 |
| 10-32 | UNF | .1900 | 3 | H3 | 2.375 | .875 | C58438 | C58439 |
| 1/4-20 | UNC | .2500 | 3 | H3 | 2.500 | 1.000 | C58440 | C58441 |
| 1/4-28 | UNF | .2500 | 3 | H3 | 2.500 | 1.000 | C58442 | C58443 |
| 5/16-18 | UNC | .3125 | 3 | H3 | 2.719 | 1.125 | C58444 | C58445 |
| 5/16-24 | UNF | .3125 | 3 | H3 | 2.719 | 1.125 | — | C58447 |
| 3/8-16 | UNC | .3750 | 3 | H3 | 2.938 | 1.250 | C58448 | C58449 |
| 3/8-24 | UNF | .3750 | 3 | H3 | 2.938 | 1.250 | C58450 | C58451 |
| 1/2-13 | UNC | .5000 | 3 | H3 | 3.375 | 1.656 | C58452 | C58453 |

Spiral Flute

High Speed Steel

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Black Oxide | ☆ | | ☆ | | | | | ☆ | ☆ | | | | |

☆ = Best Performance ☆ = Acceptable



Stainless Steel & Steels Inch - SD Powder Metal

Style: **B-101**

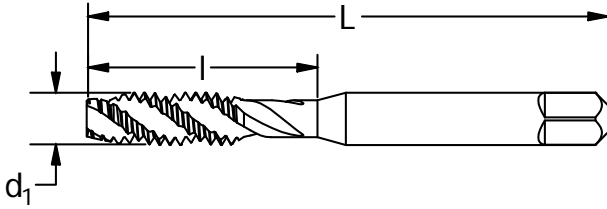
Note
Tapping Speeds and Feeds see
Technical section.



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



Spiral Flute

| tap size and pitch d_1 | thread form | decimal equiv. | number of flutes | H-limit | overall length L (in) | thread length l (in) | order no. B-101 |
|-----------------------------|-------------|----------------|------------------|---------|--------------------------|-------------------------|---------------------------|
| 10-32 | UNF | .1900 | 3 | H3 | 2.375 | .875 | **C27897 |
| 1/4-20 | UNC | .2500 | 3 | H3 | 2.500 | 1.000 | **C27898 |
| 1/4-20 | UNC | .2500 | 3 | H5 | 2.500 | 1.000 | **C27921 |
| 1/2-20 | UNF | .5000 | 3 | H5 | 3.375 | 1.656 | **C27927 |

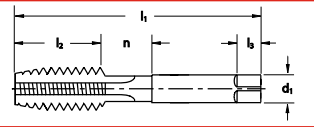
High Speed Steel

Stainless Steels & Steels Metric - SD Powder Metal

Style: **B-101**

| tap size and pitch d_1 | decimal equiv. | number of flutes | D-limit | overall length L | | thread length l | | order no. B-101 |
|-----------------------------|----------------|------------------|---------|---------------------|-------|--------------------|-------|---------------------------|
| | | | | in | mm | in | mm | |
| M5x0.8 | .1968 | 3 | D4 | 2.375 | 60.33 | .875 | 22.23 | **C27931 |

Made To Order Taps Available



| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | | | >45 | |
| Black Oxide | ☆ | | ☆ | | ☆ | ☆ | ☆ | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable

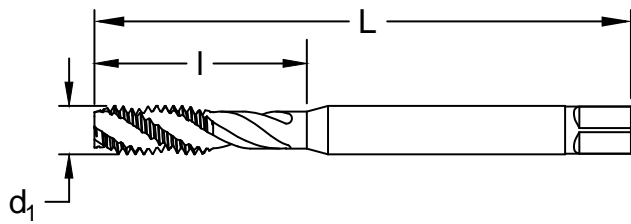


Styles: **PRO-981SF** and **PRO-892SF**

Note
Tapping Speeds and Feeds see Technical section.



Surface Treatment



| tap size and pitch d₁ (in) | thread form | decimal equiv. | no. of flutes | class of fit | shank diameter | overall length L (in) | thread length I (in) | order number | |
|---|-------------|----------------|---------------|--------------|----------------|---------------------------------|--------------------------------|---------------------------------|---------------------------|
| | | | | | | | | Black Oxide PRO-981SF | TiAlN PRO-892SF |
| 2-56 | UNC | 0.0860 | 3 | 2B | 0.141 | 1.772 | 0.551 | C98101 | C89201 |
| 3-48 | UNC | 0.0990 | 3 | 2B | 0.141 | 1.969 | 0.591 | C98102 | C89202 |
| 4-40 | UNC | 0.1120 | 3 | 2B | 0.141 | 2.205 | 0.669 | C98103 | C89203 |
| 4-48 | UNF | 0.1120 | 3 | 2B | 0.141 | 2.205 | 0.669 | C98104 | C89204 |
| 5-40 | UNC | 0.1250 | 3 | 2B | 0.141 | 2.205 | 0.748 | C98105 | C89205 |
| 6-32 | UNC | 0.1380 | 3 | 2B | 0.141 | 2.205 | 0.787 | C98106 | C89206 |
| 6-40 | UNF | 0.1380 | 3 | 2B | 0.141 | 2.205 | 0.787 | C98107 | C89207 |
| 8-32 | UNC | 0.1640 | 3 | 2B | 0.168 | 2.480 | 0.827 | C98108 | C89208 |
| 8-36 | UNF | 0.1640 | 3 | 2B | 0.168 | 2.480 | 0.827 | C98109 | C89209 |
| 10-24 | UNC | 0.1900 | 3 | 2B | 0.194 | 2.756 | 1.024 | C98110 | C89210 |
| 10-32 | UNF | 0.1900 | 3 | 2B | 0.194 | 2.756 | 1.024 | C98111 | C89211 |
| 12-24 | UNC | 0.2160 | 3 | 2B | 0.220 | 3.150 | 1.063 | C98112 | C89212 |
| 12-28 | UNF | 0.2160 | 3 | 2B | 0.220 | 3.150 | 1.063 | C98113 | C89213 |
| 1/4-20 | UNC | 0.2500 | 3 | 2B | 0.255 | 3.150 | 1.260 | C98114 | C89214 |
| 1/4-28 | UNF | 0.2500 | 3 | 2B | 0.255 | 3.150 | 1.260 | C98115 | C89215 |
| 5/16-18 | UNC | 0.3125 | 3 | 2B | 0.318 | 3.543 | 1.378 | C98116 | C89216 |
| 5/16-24 | UNF | 0.3125 | 3 | 2B | 0.318 | 3.543 | 1.378 | C98117 | C89217 |
| 3/8-16 | UNC | 0.3750 | 3 | 2B | 0.381 | 3.937 | 1.732 | C98118 | C89218 |
| 3/8-24 | UNF | 0.3750 | 3 | 2B | 0.381 | 3.937 | 1.732 | C98119 | C89219 |
| 7/16-14 | UNC | 0.4375 | 3 | 2B | 0.323 | 3.937 | 1.614 | C98120 | C89220 |
| 7/16-20 | UNF | 0.4375 | 3 | 2B | 0.323 | 3.937 | 1.614 | C98121 | C89221 |
| 1/2-13 | UNC | 0.5000 | 3 | 2B | 0.367 | 4.331 | 1.535 | C98122 | C89222 |
| 1/2-20 | UNF | 0.5000 | 3 | 2B | 0.367 | 4.331 | 1.535 | C98123 | C89223 |
| 9/16-12 | UNC | 0.5625 | 4 | 2B | 0.429 | 4.331 | 1.772 | C98124 | C89224 |
| 9/16-18 | UNF | 0.5625 | 4 | 2B | 0.429 | 4.331 | 1.772 | C98125 | C89225 |
| 5/8-11 | UNC | 0.6250 | 4 | 2B | 0.480 | 4.331 | 2.087 | C98126 | C89226 |
| 5/8-18 | UNF | 0.6250 | 4 | 2B | 0.480 | 4.331 | 2.087 | C98127 | C89227 |
| 3/4-10 | UNC | 0.7500 | 4 | 2B | 0.590 | 4.921 | 2.205 | C98128 | C89228 |
| 3/4-16 | UNF | 0.7500 | 4 | 2B | 0.590 | 4.921 | 2.205 | C98129 | C89229 |
| 7/8-9 | UNC | 0.8750 | 4 | 2B | 0.697 | 5.512 | 2.362 | C98130 | C89230 |
| 7/8-14 | UNF | 0.8750 | 4 | 2B | 0.697 | 5.512 | 2.362 | C98131 | C89231 |
| 1-8 | UNC | 1.0000 | 4 | 2B | 0.800 | 6.299 | 2.520 | C98132 | C89232 |
| 1-12 | UNF | 1.0000 | 4 | 2B | 0.800 | 6.299 | 2.520 | C98133 | C89233 |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Black Oxide | ★ | | ★ | | ★ | ★ | | ★ | ★ | | | | |
| TiAlN | ★ | | ★ | | ★ | ★ | | ★ | ★ | | | | |

★ = Best Performance ◆ = Acceptable



Spiral Flute

Premium High Speed Steel



Universal - Metric
Progress

Styles: **PRO-981SF** and **PRO-892SF** (continued)

Spiral Flute

Premium High Speed Steel

| tap size and pitch d ₁ | thread form | decimal equiv. | no. of flutes | class of fit | shank diameter | | overall length L | | thread length l | | order number | |
|--------------------------------------|-------------|----------------|---------------|--------------|----------------|-------|---------------------|-----|--------------------|----|--------------------------|--------------------|
| | | | | | in | mm | in | mm | in | mm | Black Oxide PRO-981SF | TiAlN PRO-892SF |
| M3x0.5 | M | 0.1181 | 3 | 6H | 0.141 | 3.58 | 2.205 | 56 | 0.748 | 19 | C98134 | C89234 |
| M3.5x0.6 | M | 0.1378 | 3 | 6H | 0.141 | 3.58 | 2.205 | 56 | 0.787 | 20 | C98135 | C89235 |
| M4x0.7 | M | 0.1575 | 3 | 6H | 0.168 | 4.27 | 2.480 | 63 | 0.827 | 21 | C98136 | C89236 |
| M5x0.8 | M | 0.1969 | 3 | 6H | 0.194 | 4.93 | 2.756 | 70 | 1.024 | 26 | C98137 | C89237 |
| M6x1 | M | 0.2362 | 3 | 6H | 0.255 | 6.48 | 3.150 | 80 | 1.260 | 32 | C98138 | C89238 |
| M7x1 | M | 0.2756 | 3 | 6H | 0.318 | 8.08 | 3.150 | 80 | 1.181 | 30 | C98139 | C89239 |
| M8x1 | M | 0.3150 | 3 | 6H | 0.318 | 8.08 | 3.543 | 90 | 1.378 | 35 | C98140 | C89240 |
| M8x1.25 | M | 0.3150 | 3 | 6H | 0.318 | 8.08 | 3.543 | 90 | 1.378 | 35 | C98141 | C89241 |
| M10x1.25 | M | 0.3937 | 3 | 6H | 0.381 | 9.68 | 3.937 | 100 | 1.575 | 40 | C98142 | C89242 |
| M10x1.5 | M | 0.3937 | 3 | 6H | 0.381 | 9.68 | 3.937 | 100 | 1.575 | 40 | C98143 | C89243 |
| M12x1.25 | M | 0.4724 | 3 | 6H | 0.367 | 9.32 | 4.331 | 110 | 1.575 | 40 | C98144 | C89244 |
| M12x1.75 | M | 0.4724 | 3 | 6H | 0.367 | 9.32 | 4.331 | 110 | 1.575 | 40 | C98145 | C89245 |
| M14x1.5 | M | 0.5512 | 3 | 6H | 0.429 | 10.9 | 4.331 | 110 | 1.772 | 45 | C98146 | C89246 |
| M14x2 | M | 0.5512 | 3 | 6H | 0.429 | 10.9 | 4.331 | 110 | 1.772 | 45 | C98147 | C89247 |
| M16x1.5 | M | 0.6299 | 4 | 6H | 0.480 | 12.19 | 4.331 | 110 | 2.087 | 53 | C98148 | C89248 |
| M16x2 | M | 0.6299 | 4 | 6H | 0.480 | 12.19 | 4.331 | 110 | 2.087 | 53 | C98149 | C89249 |
| M18x1.5 | M | 0.7087 | 4 | 6H | 0.542 | 13.77 | 4.921 | 125 | 2.165 | 55 | C98150 | C89250 |
| M18x2.5 | M | 0.7087 | 4 | 6H | 0.542 | 13.77 | 4.921 | 125 | 2.165 | 55 | C98151 | C89251 |
| M20x2.5 | M | 0.7874 | 4 | 6H | 0.650 | 16.51 | 5.512 | 140 | 2.480 | 63 | C98152 | C89252 |
| M22x2.5 | M | 0.8661 | 4 | 6H | 0.697 | 17.70 | 5.512 | 140 | 2.362 | 60 | C98153 | C89253 |
| M24x3.0 | M | 0.9449 | 4 | 6H | 0.760 | 19.30 | 6.299 | 160 | 2.598 | 66 | C98154 | C89254 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Black Oxide | ★ | | ★ | | ★ | ★ | | ★ | ★ | | | | |
| TiAlN | ★ | | ★ | | ★ | ★ | | ★ | ★ | | | | |

★ = Best Performance ◆ = Acceptable





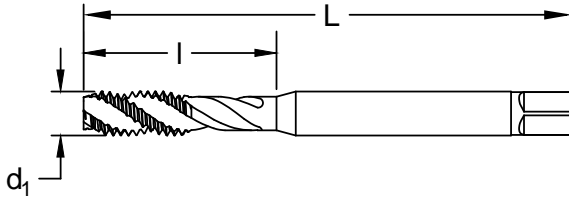
Styles: **PER-893SF** and **PER-980SF**

Note

Tapping Speeds and Feeds see Technical section.



Surface Treatment



| tap size and pitch d ₁ (in) | thread form | decimal equiv. | no. of flutes | class of fit | shank diameter | overall length L (in) | thread length I (in) | order number | |
|---|-------------|----------------|---------------|--------------|----------------|--------------------------|-------------------------|--------------------------|-----------------------|
| | | | | | | | | Black Oxide PER-893SF | Hardlube PER-980SF |
| 2-56 | UNC | 0.0860 | 3 | 2B | 0.141 | 1.772 | 0.551 | C89301 | C98001 |
| 3-48 | UNC | 0.0990 | 3 | 2B | 0.141 | 1.969 | 0.591 | C89302 | C98002 |
| 4-40 | UNC | 0.1120 | 3 | 2B | 0.141 | 2.205 | 0.669 | C89303 | C98003 |
| 4-48 | UNF | 0.1120 | 3 | 2B | 0.141 | 2.205 | 0.669 | C89304 | C98004 |
| 5-40 | UNC | 0.1250 | 3 | 2B | 0.141 | 2.205 | 0.748 | C89305 | C98005 |
| 6-32 | UNC | 0.1380 | 3 | 2B | 0.141 | 2.205 | 0.787 | C89306 | C98006 |
| 6-40 | UNF | 0.1380 | 3 | 2B | 0.141 | 2.205 | 0.787 | C89307 | C98007 |
| 8-32 | UNC | 0.1640 | 3 | 2B | 0.168 | 2.480 | 0.827 | C89308 | C98008 |
| 8-36 | UNF | 0.1640 | 3 | 2B | 0.168 | 2.480 | 0.827 | C89309 | C98009 |
| 10-24 | UNC | 0.1900 | 3 | 2B | 0.194 | 2.756 | 1.024 | C89310 | C98010 |
| 10-32 | UNF | 0.1900 | 3 | 2B | 0.194 | 2.756 | 1.024 | C89311 | C98011 |
| 12-24 | UNC | 0.2160 | 3 | 2B | 0.220 | 3.150 | 1.063 | C89312 | C98012 |
| 12-28 | UNF | 0.2160 | 3 | 2B | 0.220 | 3.150 | 1.063 | C89313 | C98013 |
| 1/4-20 | UNC | 0.2500 | 3 | 2B | 0.255 | 3.150 | 1.260 | C89314 | C98014 |
| 1/4-28 | UNF | 0.2500 | 3 | 2B | 0.255 | 3.150 | 1.260 | C89315 | C98015 |
| 5/16-18 | UNC | 0.3125 | 3 | 2B | 0.318 | 3.543 | 1.378 | C89316 | C98016 |
| 5/16-24 | UNF | 0.3125 | 3 | 2B | 0.318 | 3.543 | 1.378 | C89317 | C98017 |
| 3/8-16 | UNC | 0.3750 | 3 | 2B | 0.381 | 3.937 | 1.732 | C89318 | C98018 |
| 3/8-24 | UNF | 0.3750 | 3 | 2B | 0.381 | 3.937 | 1.732 | C89319 | C98019 |
| 7/16-14 | UNC | 0.4375 | 3 | 2B | 0.323 | 3.937 | 1.614 | C89320 | C98020 |
| 7/16-20 | UNF | 0.4375 | 3 | 2B | 0.323 | 3.937 | 1.614 | C89321 | C98021 |
| 1/2-13 | UNC | 0.5000 | 3 | 2B | 0.367 | 4.331 | 1.535 | C89322 | C98022 |
| 1/2-20 | UNF | 0.5000 | 3 | 2B | 0.367 | 4.331 | 1.535 | C89323 | C98023 |
| 9/16-12 | UNC | 0.5625 | 4 | 2B | 0.429 | 4.331 | 1.772 | C89324 | C98024 |
| 9/16-18 | UNF | 0.5625 | 4 | 2B | 0.429 | 4.331 | 1.772 | C89325 | C98025 |
| 5/8-11 | UNC | 0.6250 | 4 | 2B | 0.480 | 4.331 | 2.087 | C89326 | C98026 |
| 5/8-18 | UNF | 0.6250 | 4 | 2B | 0.480 | 4.331 | 2.087 | C89327 | C98027 |
| 3/4-10 | UNC | 0.7500 | 4 | 2B | 0.590 | 4.921 | 2.205 | C89328 | C98028 |
| 3/4-16 | UNF | 0.7500 | 4 | 2B | 0.590 | 4.921 | 2.205 | C89329 | C98029 |
| 7/8-9 | UNC | 0.8750 | 4 | 2B | 0.697 | 5.512 | 2.362 | C89330 | C98030 |
| 7/8-14 | UNF | 0.8750 | 4 | 2B | 0.697 | 5.512 | 2.362 | C89331 | C98031 |
| 1-8 | UNC | 1.0000 | 4 | 2B | 0.800 | 6.299 | 2.520 | C89332 | C98032 |
| 1-12 | UNF | 1.0000 | 4 | 2B | 0.800 | 6.299 | 2.520 | C89333 | C98033 |

continued on next page

Spiral Flute

Premium High Speed Steel

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|-----|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | >38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Black Oxide | ◆ | | ◆ | | ◆ | ◆ | | ◆ | ◆ | | | | |
| Hardlube | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ☆ | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable



Spiral Flute

Premium High Speed Steel

| tap size and pitch d ₁ | thread form | decimal equiv. | no. of flutes | class of fit | shank diameter | | overall length L | | thread length l | | order number | |
|--------------------------------------|-------------|----------------|---------------|--------------|----------------|-------|---------------------|-----|--------------------|----|--------------------------|-----------------------|
| | | | | | in | mm | in | mm | in | mm | Black Oxide PER-893SF | Hardlube PER-980SF |
| M3x0.5 | M | 0.1181 | 3 | 6H | 0.141 | 3.58 | 2.205 | 56 | 0.748 | 19 | C89334 | C98034 |
| M3.5x0.6 | M | 0.1378 | 3 | 6H | 0.141 | 3.58 | 2.205 | 56 | 0.787 | 20 | C89335 | C98035 |
| M4x0.7 | M | 0.1575 | 3 | 6H | 0.168 | 4.27 | 2.480 | 63 | 0.827 | 21 | C89336 | C98036 |
| M5x0.8 | M | 0.1969 | 3 | 6H | 0.194 | 4.93 | 2.756 | 70 | 1.024 | 26 | C89337 | C98037 |
| M6x1 | M | 0.2362 | 3 | 6H | 0.255 | 6.48 | 3.150 | 80 | 1.260 | 32 | C89338 | C98038 |
| M7x1 | M | 0.2756 | 3 | 6H | 0.318 | 8.08 | 3.150 | 80 | 1.181 | 30 | C89339 | C98039 |
| M8x1 | M | 0.3150 | 3 | 6H | 0.318 | 8.08 | 3.543 | 90 | 1.378 | 35 | C89340 | C98040 |
| M8x1.25 | M | 0.3150 | 3 | 6H | 0.318 | 8.08 | 3.543 | 90 | 1.378 | 35 | C89341 | C98041 |
| M10x1.25 | M | 0.3937 | 3 | 6H | 0.381 | 9.68 | 3.937 | 100 | 1.575 | 40 | C89342 | C98042 |
| M10x1.5 | M | 0.3937 | 3 | 6H | 0.381 | 9.68 | 3.937 | 100 | 1.575 | 40 | C89343 | C98043 |
| M12x1.25 | M | 0.4724 | 3 | 6H | 0.367 | 9.32 | 4.331 | 110 | 1.575 | 40 | C89344 | C98044 |
| M12x1.75 | M | 0.4724 | 3 | 6H | 0.367 | 9.32 | 4.331 | 110 | 1.575 | 40 | C89345 | C98045 |
| M14x1.5 | M | 0.5512 | 3 | 6H | 0.429 | 10.9 | 4.331 | 110 | 1.772 | 45 | C89346 | C98046 |
| M14x2 | M | 0.5512 | 3 | 6H | 0.429 | 10.9 | 4.331 | 110 | 1.772 | 45 | C89347 | C98047 |
| M16x1.5 | M | 0.6299 | 4 | 6H | 0.480 | 12.19 | 4.331 | 110 | 2.087 | 53 | C89348 | C98048 |
| M16x2 | M | 0.6299 | 4 | 6H | 0.480 | 12.19 | 4.331 | 110 | 2.087 | 53 | C89349 | C98049 |
| M18x1.5 | M | 0.7087 | 4 | 6H | 0.542 | 13.77 | 4.921 | 125 | 2.165 | 55 | C89350 | C98050 |
| M18x2.5 | M | 0.7087 | 4 | 6H | 0.542 | 13.77 | 4.921 | 125 | 2.165 | 55 | C89351 | C98051 |
| M20x2.5 | M | 0.7874 | 4 | 6H | 0.650 | 16.51 | 5.512 | 140 | 2.480 | 63 | C89352 | C98052 |
| M22x2.5 | M | 0.8661 | 4 | 6H | 0.697 | 17.70 | 5.512 | 140 | 2.362 | 60 | C89353 | C98053 |
| M24x3.0 | M | 0.9449 | 4 | 6H | 0.760 | 19.30 | 6.299 | 160 | 2.598 | 66 | C89354 | C98054 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Black Oxide | ◆ | | ◆ | | ◆ | ◆ | | ◆ | ◆ | | | | |
| Hardlube | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ☆ | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable



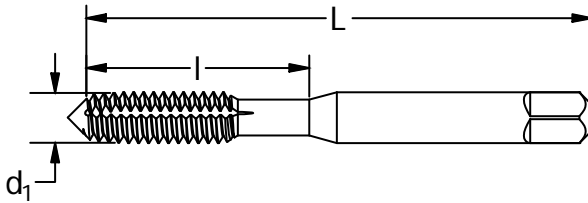
Styles: 1091, 1092

Note

Modify tapping speeds listed in the Technical section as follows: double the speeds versus thread cutting taps.



Surface Treatment



| tap size and pitch d ₁ | thread form | decimal equiv. | H-limit | overall length L (in) | thread length I (in) | order number | |
|--------------------------------------|-------------|----------------|---------|--------------------------|-------------------------|--------------|----------------|
| | | | | | | 1091 Plug | 1092 Bottoming |
| *0-80 | UNF | .0600 | H2 | 1.625 | .313 | - | C59159 |
| *2-56 | UNC | .0860 | H2 | 1.750 | .438 | - | C59177 |
| 4-40 | UNC | .1120 | H3 | 1.875 | .563 | C59193 | C59194 |
| 5-40 | UNC | .1250 | H3 | 1.938 | .625 | C59209 | C59210 |
| 6-32 | UNC | .1380 | H3 | 2.000 | .688 | C59221 | C59222 |
| 6-32 | UNC | .1380 | H5 | 2.000 | .688 | C59223 | C59224 |
| 8-32 | UNC | .1640 | H3 | 2.125 | .750 | C59235 | C59236 |
| 8-32 | UNC | .1640 | H5 | 2.125 | .750 | C59237 | C59238 |
| 10-24 | UNC | .1900 | H4 | 2.375 | .875 | C59249 | C59250 |
| 10-24 | UNC | .1900 | H6 | 2.375 | .875 | C59251 | C59252 |
| 10-32 | UNF | .1900 | H4 | 2.375 | .875 | C59256 | C59257 |
| 10-32 | UNF | .1900 | H6 | 2.375 | .875 | C59258 | C59259 |
| 1/4-20 | UNC | .2500 | H4 | 2.500 | 1.000 | C59282 | C59283 |
| 1/4-20 | UNC | .2500 | H6 | 2.500 | 1.000 | C59284 | C59285 |
| 1/4-28 | UNF | .2500 | H4 | 2.500 | 1.000 | C59289 | C59290 |
| 5/16-18 | UNC | .3125 | H5 | 2.719 | 1.125 | C59299 | C59300 |
| 5/16-18 | UNC | .3125 | H7 | 2.719 | 1.125 | C59301 | C59302 |
| 3/8-16 | UNC | .3750 | H7 | 2.938 | 1.250 | C59317 | C59318 |
| 3/8-24 | UNF | .3750 | H5 | 2.938 | 1.250 | C59321 | - |
| 3/8-24 | UNF | .3750 | H7 | 2.938 | 1.250 | C59323 | - |
| 1/2-13 | UNC | .5000 | H8 | 3.375 | 1.656 | C59361 | C59362 |

*#0-#2: 302 blank style

Thread Forming

High Speed Steel

Styles: 1091, 1092

General Purpose Metric

| tap size and pitch d ₁ | decimal equiv. | D-limit | overall length L | | thread length I | | order number | |
|--------------------------------------|----------------|---------|---------------------|-------|--------------------|-------|--------------|----------------|
| | | | in | mm | in | mm | 1091 Plug | 1092 Bottoming |
| M3 x 0.5 | .1181 | D5 | 1.938 | 49.21 | .625 | 15.88 | C59420 | C59421 |
| M4 x 0.7 | .1575 | D6 | 2.125 | 53.98 | .750 | 19.05 | C59424 | C59425 |
| M5 x 0.8 | .1968 | D7 | 2.375 | 60.33 | .875 | 22.23 | C59428 | C59429 |
| M6 x 1 | .2362 | D8 | 2.500 | 63.50 | 1.000 | 25.40 | C59432 | C59433 |
| M8 x 1.25 | .3150 | D9 | 2.719 | 69.06 | 1.125 | 28.58 | C59436 | C59437 |
| M10 x 1.5 | .3937 | D10 | 2.938 | 74.61 | 1.250 | 31.75 | C59440 | C59441 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | ☆ | | | | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



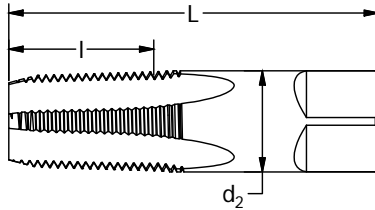


NPT/NPTF Medium Hook - Taper

Styles: **965B**, **965TN**, **975**, **975TN**

Note
Tapping Speeds and Feeds
see Technical section.

HSS
311
3/4" / 12"
Pipe 3-1/2
NPT
NPTF Dryseal
Surface Treatment
Bright
TiN



Pipe Tap

High Speed Steel

| tap size and pitch | decimal equiv. | # of flutes | shank diameter d_2 (in) | overall length l_1 (in) | thread length l_2 (in) | order number | | | |
|--------------------|----------------|-------------|---------------------------|---------------------------|--------------------------|--------------|----------|-----------|------------|
| | | | | | | Bright | | TiN | |
| | | | | | | 965B NPT | 975 NPTF | 965TN NPT | 975TN NPTF |
| 1/16-27 | .0625 | 4 | .3125 | 2.125 | .688 | C64036 | C64058 | C56700 | C55680 |
| 1/8-27* | .1250 | 4 | .3125 | 2.125 | .750 | C64037 | C64059 | C56701 | - |
| 1/8-27 | .1250 | 4 | .4375 | 2.125 | .750 | C64038 | C64060 | C56702 | C55682 |
| 1/4-18 | .2500 | 4 | .5625 | 2.438 | 1.063 | C64039 | C64061 | C56703 | C55683 |
| 3/8-18 | .3750 | 4 | .7000 | 2.563 | 1.063 | C64040 | C64062 | C56704 | C55684 |
| 1/2-14 | .5000 | 4 | .6875 | 3.125 | 1.375 | C64041 | C64063 | C56705 | C55685 |
| 3/4-14 | .7500 | 5 | .9063 | 3.250 | 1.375 | C64042 | C64064 | C56706 | C55686 |
| 1-11-1/2 | 1.0000 | 5 | 1.1250 | 3.750 | 1.750 | C64043 | C64065 | - | C55687 |
| 1-1/4-11-1/2 | 1.2500 | 5 | 1.3125 | 4.000 | 1.750 | C64044 | - | - | - |
| 1-1/2-11-1/2 | 1.5000 | 7 | 1.5000 | 4.250 | 1.750 | C64045 | - | - | - |
| 2-11-1/2 | 2.0000 | 7 | 1.8750 | 4.500 | 1.750 | C64046 | - | - | - |

* small shank

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | | | | ◆ | ◆ | | | | |
| TiN | | | | | | | | | | | | | |

☆ = Best Performance ◆ = Acceptable



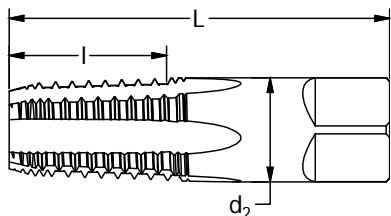


Styles: **964B, 966B**

NPT/NPTF
Interrupted Thread - *Taper*

Note
Tapping Speeds and Feeds
see Technical section.

HSS 311 $3/4" / 12"$ Pipe 3-1/2 NPT NPTF Dryseal Surface Treatment Bright



| tap size and pitch | decimal equiv. | no. of flutes | shank diameter d_2 (in) | overall length L (in) | thread length l (in) | order number | |
|--------------------|----------------|---------------|---------------------------|-----------------------|----------------------|--------------|-----------|
| | | | | | | 964B NPT | 966B NPTF |
| 1/8-27* | .1250 | 5 | .3125 | 2.125 | .750 | - | C64107 |
| 1/8-27 | .1250 | 5 | .4375 | 2.125 | .750 | C64098 | C64108 |
| 1/4-18 | .2500 | 5 | .5625 | 2.438 | 1.063 | C64099 | C64109 |
| 3/8-18 | .3750 | 5 | .7000 | 2.563 | 1.063 | C64100 | C64110 |
| 1/2-14 | .5000 | 5 | .6875 | 3.125 | 1.375 | C64101 | C64111 |
| 3/4-14 | .7500 | 5 | .9063 | 3.250 | 1.375 | C64102 | C64112 |
| 1 - 11-1/2 | 1.0000 | 5 | 1.1250 | 3.750 | 1.750 | C64103 | - |

* small shank

Pipe Tap
High Speed Steel

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable





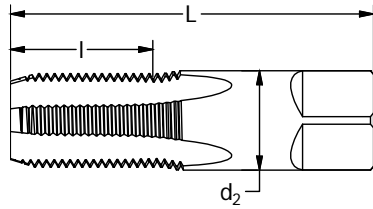
NPS/NPSF Straight



Styles: **963B**, **967B**

Note
Tapping Speeds and Feeds
see Technical section.

HSS
311
Mod 3-5
NPS
NPSF Dryseal
Surface Treatment
Bright



Dies

High Speed Steel

| tap size and pitch | decimal equiv. | no. of flutes | shank diameter d_2 (in) | overall length L (in) | thread length I (in) | order number | |
|--------------------|----------------|---------------|---------------------------|-------------------------|------------------------|--------------------|---------------------|
| | | | | | | 963B NPS | 967B NPSF |
| 1/8-27* | .1250 | 4 | .3125 | 2.125 | .750 | - | C64129 |
| 1/8-27 | .1250 | 4 | .4375 | 2.125 | .750 | C64116 | C64130 |
| 1/4-18 | .2500 | 4 | .5625 | 2.438 | 1.063 | C64117 | C64131 |
| 3/8-18 | .3750 | 4 | .7000 | 2.563 | 1.063 | C64118 | C64132 |
| 1/2-14 | .5000 | 4 | .6875 | 3.125 | 1.375 | C64119 | C64133 |

* small shank

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | | ☆ | | | | | ◆ | ◆ | | | | |

☆ = Best Performance ◆ = Acceptable



Mini - Inch 2x Diameter

Style: CMTM2

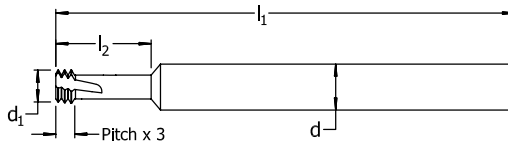
Note

Formula: $2 \times d_1$ ($l_2 \leq 2 \times$ Thread Diameter)

* Bore diameter applies to the smallest thread diameter.

For Internal & External Threads

Carbide Surface Treatment 



Feature:

Excel in internal deep threads in hard to cut materials.

| American UN | thread | shank diameter | cutting diameter | overall length | cut depth | pitch x 3 | no. of flutes | no. of teeth | *bore dia. | order number | |
|-------------|----------|----------------|------------------|----------------|----------------|----------------|----------------|---------------|------------|--------------|--------|
| UNC | UNF | TPI | pitch | d | d ₁ | l ₁ | l ₂ | thread length | | CMTM2 | |
| 1-72 | 72 | 0.014 | 1/4 | .057 | 2.5 | .154 | 0.042 | 3 | 3 | .060 | C95102 |
| 1-64 | 64 | 0.016 | 1/4 | .057 | 2.5 | .165 | 0.047 | 3 | 3 | .060 | C95103 |
| 2-56 | 56 | 0.018 | 1/4 | .065 | 2.5 | .197 | 0.054 | 3 | 3 | .069 | C95104 |
| 3-48 | 48 | 0.021 | 1/4 | .075 | 2.5 | .236 | 0.063 | 3 | 3 | .080 | C95105 |
| 4, 5-40 | 40 | 0.025 | 1/4 | .085 | 2.5 | .236 | 0.075 | 3 | 3 | .090 | C95106 |
| | 8-36 | 36 | 0.028 | 1/4 | 2.5 | .343 | 0.083 | 3 | 3 | .125 | C95107 |
| 6, 8-32 | 32 | 0.031 | 1/4 | .100 | 2.5 | .292 | 0.094 | 3 | 3 | .110 | C95108 |
| 8-32 | 32 | 0.031 | 1/4 | .120 | 2.5 | .394 | 0.094 | 3 | 3 | .130 | C95109 |
| | 1/4"x28 | 28 | 0.036 | 1/4 | 2.5 | .520 | 0.107 | 3 | 3 | .190 | C95110 |
| 10-24 | 24 | 0.042 | 1/4 | .130 | 2.5 | .400 | 0.125 | 3 | 3 | .140 | C95111 |
| | 5/16"x24 | 24 | 0.042 | 1/4 | 2.5 | .650 | 0.125 | 3 | 3 | .255 | C95112 |
| 1/4"x20 | 20 | 0.05 | 1/4 | .185 | 2.5 | .530 | 0.150 | 3 | 3 | .200 | C95113 |
| | 7/16"x20 | 20 | 0.05 | 3/8 | 3 | .900 | 0.150 | 4 | 3 | .355 | C95114 |
| 3/8"x16 | 16 | 0.063 | 3/8 | .290 | 3 | .750 | 0.188 | 4 | 3 | .307 | C95115 |
| 7/16"x14 | 14 | 0.071 | 3/8 | .340 | 3 | .900 | 0.214 | 4 | 3 | .355 | C95116 |
| 1/2-13 | 13 | 0.077 | 3/8 | .350 | 3 | 1.10 | 0.231 | 4 | 3 | .415 | C95117 |

Mini Thread Mills Carbide

Style: CMTMM2

Mini - Metric 2x Diameter

Note

Formula: $2 \times d_1$ ($l_2 \leq 2 \times$ Thread Diameter)

* Bore diameter applies to the smallest thread diameter.

For Internal & External Threads

Carbide Surface Treatment 

| ISO metric | pitch | shank diameter | cutting diameter | overall length | cut depth | pitch x 3 | no. of flutes | no. of teeth | *bore dia. | order number | | |
|------------|--------------|----------------|------------------|----------------|----------------|----------------|----------------|---------------|------------|--------------|------|--------|
| M course | M fine | mm | inch | d | d ₁ | l ₁ | l ₂ | thread length | | CMTMM2 | | |
| M1.6x0.35 | | 0.35 | 0.014 | 3.175 | 1.193 | 63.5 | 3.56 | 1.07 | 3 | 3 | .050 | C95127 |
| M2x0.4 | | 0.40 | 0.016 | 6.350 | 1.524 | 63.5 | 4.19 | 1.22 | 3 | 3 | .065 | C95128 |
| M2.2x0.45 | | 0.45 | 0.018 | 6.350 | 1.651 | 63.5 | 4.57 | 1.37 | 3 | 3 | .070 | C95129 |
| M2.5x0.45 | | 0.45 | 0.018 | 6.350 | 1.905 | 63.5 | 5.08 | 1.37 | 3 | 3 | .080 | C95130 |
| M3x0.5 | M3.5-M16x0.5 | 0.50 | 0.020 | 6.350 | 2.286 | 63.5 | 6.22 | 1.52 | 3 | 3 | .095 | C95131 |
| M3.5x0.6 | | 0.60 | 0.024 | 6.350 | 2.667 | 63.5 | 7.24 | 1.83 | 3 | 3 | .111 | C95132 |
| M4x0.7 | | 0.70 | 0.028 | 6.350 | 3.048 | 63.5 | 8.26 | 2.13 | 3 | 3 | .126 | C95133 |
| M5x0.8 | | 0.80 | 0.031 | 6.350 | 3.937 | 63.5 | 10.16 | 2.36 | 3 | 3 | .161 | C95134 |
| M6x1.0 | M8-M40x1.0 | 1.00 | 0.039 | 6.350 | 4.699 | 63.5 | 12.70 | 2.97 | 3 | 3 | .193 | C95135 |
| M8x1.25 | | 1.25 | 0.049 | 6.350 | 6.223 | 63.5 | 16.51 | 3.73 | 3 | 3 | .257 | C95136 |
| M10x1.5 | M12-M48x1.50 | 1.50 | 0.059 | 9.525 | 8.382 | 76.2 | 20.32 | 4.49 | 3 | 3 | .343 | C95137 |
| M12x1.75 | | 1.75 | 0.069 | 9.525 | 9.144 | 76.2 | 25.40 | 5.26 | 4 | 3 | .395 | C95138 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| AlCrN | ◆ | ☆ | ◆ | ☆ | ☆ | ☆ | ☆ | ◆ | ◆ | ◆ | ☆ | ☆ | ☆ |

☆ = Best Performance ◆ = Acceptable





Mini - Inch 3x Diameter

Style: **CMTM3**

Note

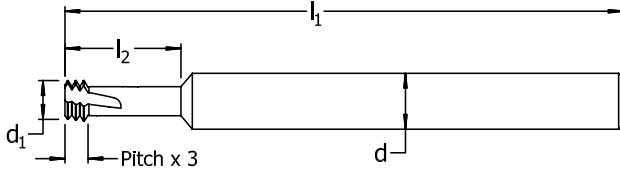
Formula: $3 \times d_1$ ($l_2 \leq 3 \times$ Thread Diameter)

* Bore diameter applies to the smallest thread diameter.

For Internal & External Threads

Carbide

Surface Treatment



Mini Thread Mills

Carbide

| American UN | | thread | | shank diameter | cutting diameter | overall length | cut depth | pitch x 3 thread length | no. of flutes | no. of teeth | *bore dia. | order number |
|-------------|----------|--------|-------|----------------|------------------|----------------|----------------|-------------------------|---------------|--------------|------------|--------------|
| UNC | UNF | TPI | pitch | d | d ₁ | l ₁ | l ₂ | | | | | CMTM3 |
| | 1-72 | 72 | 0.014 | 1/4 | .057 | 2.5 | .240 | 0.042 | 3 | 3 | .060 | C95118 |
| 2-56 | 3-56 | 56 | 0.018 | 1/4 | .065 | 2.5 | .260 | 0.054 | 3 | 3 | .069 | C95119 |
| 4, 5-40 | 6-40 | 40 | 0.025 | 1/4 | .085 | 2.5 | .310 | 0.075 | 3 | 3 | .090 | C95120 |
| 5-40 | 6-40 | 40 | 0.025 | 1/4 | .100 | 2.5 | .400 | 0.075 | 3 | 3 | .110 | C95121 |
| 8-32 | 10-32 | 32 | 0.031 | 1/4 | .120 | 2.5 | .500 | 0.094 | 3 | 3 | .130 | C95122 |
| | 1/4"x28 | 28 | 0.036 | 1/4 | .180 | 2.5 | .750 | 0.107 | 3 | 3 | .190 | C95123 |
| 1/4"x20 | 7/16"x20 | 20 | 0.05 | 1/4 | .185 | 2.5 | .750 | 0.150 | 3 | 3 | .200 | C95124 |
| | 5/16"x24 | 24 | 0.042 | 1/4 | .240 | 2.5 | .940 | 0.125 | 3 | 3 | .255 | C95125 |
| 5/16"x18 | | 18 | 0.056 | 1/4 | .240 | 2.5 | .900 | 0.167 | 3 | 3 | .255 | C95126 |

Mini - Metric 3x Diameter

Style: **CMTMM3**

Note

Formula: $3 \times d_1$ ($l_2 \leq 3 \times$ Thread Diameter)

* Bore diameter applies to the smallest thread diameter.

For Internal & External Threads

Carbide

Surface Treatment



| ISO metric | | pitch | | shank diameter | cutting diameter | overall length | cut depth | pitch x 3 thread length | no. of flutes | no. of teeth | *bore dia. | order number |
|------------|--------------|-------|-------|----------------|------------------|----------------|----------------|-------------------------|---------------|--------------|------------|---------------|
| M course | M fine | mm | inch | d | d ₁ | l ₁ | l ₂ | mm | | | | CMTMM3 |
| M1.6x0.35 | | 0.35 | 0.014 | 3.175 | 1.938 | 63.5 | 5.00 | 1.07 | 3 | 3 | .050 | C95139 |
| M2x0.4 | | 0.40 | 0.016 | 6.350 | 1.524 | 63.5 | 6.22 | 1.22 | 3 | 3 | .065 | C95140 |
| M2.5x0.45 | | 0.45 | 0.018 | 6.350 | 1.905 | 63.5 | 6.99 | 1.37 | 3 | 3 | .080 | C95141 |
| M3x0.5 | M3.5-M16x0.5 | 0.50 | 0.020 | 6.350 | 2.286 | 63.5 | 9.149 | 1.52 | 3 | 3 | .095 | C95142 |
| M4x0.7 | | 0.70 | 0.028 | 6.350 | 3.048 | 63.5 | 12.45 | 2.13 | 3 | 3 | .126 | C95143 |
| M5x0.8 | | 0.80 | 0.031 | 6.350 | 3.937 | 63.5 | 15.49 | 2.36 | 3 | 3 | .161 | C95144 |
| M6x1.0 | M8-M40x1.0 | 1.00 | 0.039 | 6.350 | 4.699 | 63.5 | 18.42 | 2.97 | 3 | 3 | .193 | C95145 |
| M8x1.25 | | 1.25 | 0.049 | 6.350 | 6.223 | 63.5 | 21.64 | 3.73 | 3 | 3 | .257 | C95146 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | >38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| AICrN | ◆ | ☆ | ◆ | ☆ | ☆ | ☆ | ☆ | ◆ | ◆ | ◆ | ☆ | ☆ | ☆ |

☆ = Best Performance ◆ = Acceptable



Styles: **CTM** Solid and **CTMC** Coolant-Thru

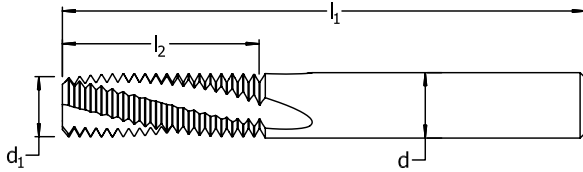
General Purpose
Inch - Helical Thread Mills

Note
For Internal & External Threads

UNC
UNF

Carbide

Surface
Treatment



Feature:

Capable of producing right or left hand threads.

| thread size | shank diameter d | cutting diameter d₁ | overall length l₁ | length of cut l₂ | number of flutes | order number | |
|-------------|----------------------------|--|--|---------------------------------------|------------------|---------------------------|-----------------------------|
| | | | | | | CTM non-coolant | CTMC coolant-thru |
| 6-32 | 1/8 | .095 | 2 | .218 | 3 | C95000 | — |
| 8-32 | 1/8 | .115 | 2 | .250 | 3 | C95001 | — |
| 8-36 | 1/8 | .115 | 2 | .250 | 3 | C95002 | — |
| 10-24 | 3/16 | .120 | 2 | .312 | 3 | C95003 | — |
| 10-32 | 3/16 | .120 | 2 | .312 | 3 | C95004 | — |
| 1/4-20 | 3/16 | .180 | 2-1/2 | .500 | 3 | C95005 | C95026 |
| 1/4-28 | 3/16 | .180 | 2-1/2 | .500 | 3 | C95006 | C95027 |
| 5/16-18 | 1/4 | .240 | 2-1/2 | .625 | 3 | C95007 | C95028 |
| 5/16-24 | 1/4 | .240 | 2-1/2 | .625 | 3 | C95008 | C95029 |
| 3/8-16 | 5/16 | .290 | 3 | .750 | 4 | C95009 | C95030 |
| 3/8-24 | 5/16 | .290 | 3 | .750 | 4 | C95010 | C95031 |
| 7/16-14 | 3/8 | .340 | 3 | .875 | 4 | C95011 | C95032 |
| 7/16-20 | 3/8 | .340 | 3 | .875 | 4 | C95012 | C95033 |
| 1/2-13 | 3/8 | .350 | 3-1/2 | .875 | 4 | C95013 | C95034 |
| 1/2-20 | 3/8 | .350 | 3-1/2 | .875 | 4 | C95014 | — |
| 9/16-12 | 1/2 | .370 | 3-1/2 | .875 | 4 | C95015 | C95035 |
| 9/16-18 | 1/2 | .370 | 3-1/2 | .875 | 4 | C95016 | C95036 |
| 5/8-11 | 1/2 | .470 | 3-1/2 | 1.250 | 5 | C95017 | C95037 |
| 5/8-18 | 1/2 | .470 | 3-1/2 | 1.250 | 5 | C95018 | C95038 |
| 3/4-10 | 1/2 | .495 | 3-1/2 | 1.250 | 5 | C95019 | C95039 |
| 3/4-12 | 1/2 | .495 | 3-1/2 | 1.250 | 5 | C95020 | C95040 |
| 3/4-16 | 1/2 | .495 | 3-1/2 | 1.250 | 5 | C95021 | C95041 |
| 7/8-9 | 1/2 | .495 | 3-1/2 | 1.250 | 5 | C95022 | C95042 |
| 7/8-14 | 1/2 | .495 | 3-1/2 | 1.250 | 5 | C95023 | C95043 |
| 1-8 | 3/4 | .620 | 4 | 1.375 | 5 | C95024 | C95044 |
| 1-12 | 3/4 | .620 | 4 | 1.375 | 5 | C95025 | C95045 |

Thread Mills

Carbide

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiAIN | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ☆ | ◆ | ◆ | | ◆ | ◆ | ◆ |

☆ = Best Performance ◆ = Acceptable



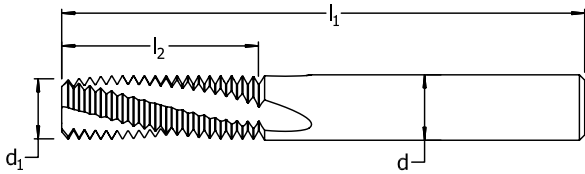


General Purpose Metric - Helical Thread Mills

Styles: **CTMM** Solid and **CTMMC** Coolant-Thru

Note
For Internal & External Threads

DIN Carbide Surface Treatment TiAlN



Feature:
Excellent option in difficult materials.

Thread Mills

Carbide

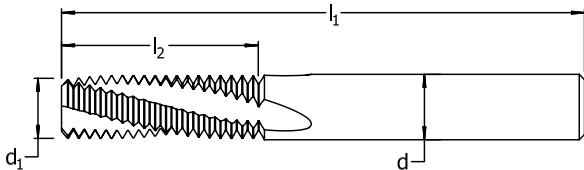
| thread size | shank diameter d | cutting diameter d ₁ | overall length l ₁ | length of cut l ₂ | number of flutes | order number | |
|-------------|------------------|---------------------------------|-------------------------------|------------------------------|------------------|------------------|--------------------|
| | | | | | | CTMM non-coolant | CTMMC coolant-thru |
| M4 X 0.70 | 1/8 | .120 | 2 | .250 | 2 | C95072 | — |
| M4.5 X 0.75 | 1/8 | .120 | 2 | .250 | 3 | C95073 | — |
| M5 X 0.80 | 3/16 | .120 | 2 | .312 | 3 | C95074 | C95088 |
| M6 X 1.00 | 3/16 | .170 | 2-1/2 | .500 | 3 | C95075 | C95089 |
| M8 X 0.75 | 1/4 | .235 | 2-1/2 | .625 | 3 | C95076 | C95090 |
| M8 X 1.00 | 1/4 | .235 | 2-1/2 | .625 | 3 | C95077 | C95091 |
| M8 X 1.25 | 1/4 | .235 | 2-1/2 | .625 | 3 | C95078 | C95092 |
| M10 X 1.25 | 5/16 | .300 | 3 | .750 | 4 | C95079 | C95093 |
| M10 X 1.50 | 5/16 | .300 | 3 | .750 | 4 | C95080 | C95094 |
| M12 X 1.00 | 3/8 | .360 | 3-1/2 | .875 | 4 | C95081 | C95095 |
| M12 X 1.25 | 3/8 | .360 | 3-1/2 | .875 | 4 | C95082 | C95096 |
| M12 X 1.75 | 3/8 | .360 | 3-1/2 | .875 | 4 | C95083 | C95097 |
| M14 X 1.50 | 3/8 | .360 | 3-1/2 | .875 | 4 | C95084 | C95098 |
| M16 X 2.00 | 1/2 | .470 | 3-1/2 | 1.250 | 5 | C95085 | C95099 |
| M18 X 2.50 | 1/2 | .470 | 3-1/2 | 1.250 | 5 | C95086 | C95100 |
| M20 X 3.00 | 1/2 | .470 | 3-1/2 | 1.250 | 5 | C95087 | C95101 |

National Pipe Tapered Inch - Helical Thread Mills

Styles: **CTMNP** Solid and **CTMNPC** Coolant-Thru

Note
For Internal & External Threads

NPT NPTF Carbide Surface Treatment TiAlN



Feature:
Designed to cut internal and external threads.

| thread size | shank diameter d | cutting diameter d ₁ | overall length l ₁ | length of cut l ₂ | number of flutes | order number | |
|-------------|------------------|---------------------------------|-------------------------------|------------------------------|------------------|-------------------|---------------------|
| | | | | | | CTMNP non-coolant | CTMNPC coolant-thru |
| 1/16-27 | 1/4 | .245 | 2-1/2 | .437 | 3 | C95046 | C95051 |
| 1/8-27 | 5/16 | .310 | 2-1/2 | .437 | 4 | C95047 | C95052 |
| 1/4, 3/8-18 | 3/8 | .305 | 3 | .625 | 4 | C95048 | C95053 |
| 1/2, 3/4-14 | 1/2 | .495 | 3-1/2 | .875 | 4 | C95049 | C95054 |
| 1-11.5 | 3/4 | .620 | 4 | 1.125 | 5 | C95050 | C95055 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiAlN | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ☆ | ◆ | ◆ | | ◆ | ◆ | ◆ |

☆ = Best Performance ◆ = Acceptable



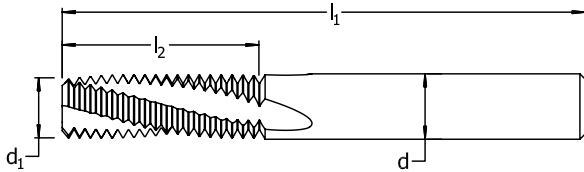


Styles: CTMBPP Solid and CTMBPPC Coolant-Thru

**British Pipe Tapered
Inch - Helical Thread Mills**

Note
For Internal & External Threads

BSPP Carbide Surface Treatment TiAlN



Feature:
55 degree thread profile.

| thread size | shank diameter d | cutting diameter d ₁ | overall length l ₁ | length of cut l ₂ | number of flutes | order number | |
|--------------|---------------------|------------------------------------|----------------------------------|---------------------------------|------------------|--------------------|----------------------|
| | | | | | | CTMBPP non-coolant | CTMBPPC coolant-thru |
| 1/16, 1/8-28 | 1/4 | .240 | 2-1/2 | .572 | 3 | C95056 | C95060 |
| 1/4-19 | 5/16 | .312 | 3 | .737 | 4 | C95057 | C95061 |
| 1/2-14 | 1/2 | .470 | 3-1/2 | 1.143 | 4 | C95058 | C95062 |
| 1-11 | 5/8 | .620 | 4 | 1.546 | 5 | C95059 | C95063 |

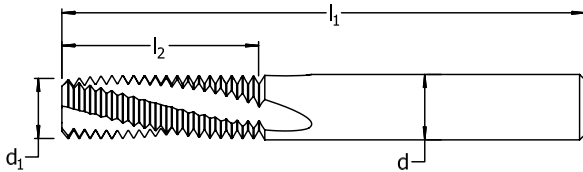
Thread Mills

Styles: CTMBPT Solid and CTMBPTC Coolant-Thru

**British Pipe Parallel
Inch - Helical Thread Mills**

Note
For Internal & External Threads

BSPT Carbide Surface Treatment TiAlN



Feature:
55 degree thread profile.

| thread size | shank diameter d | cutting diameter d ₁ | overall length l ₁ | length of cut l ₂ | number of flutes | order number | |
|--------------|---------------------|------------------------------------|----------------------------------|---------------------------------|------------------|--------------------|----------------------|
| | | | | | | CTMBPT non-coolant | CTMBPTC coolant-thru |
| 1/16, 1/8-28 | 1/4 | .240 | 2-1/2 | .401 | 3 | C95064 | C95068 |
| 1/4-19 | 5/16 | .312 | 3 | .578 | 4 | C95065 | C95069 |
| 1/2-14 | 1/2 | .470 | 3-1/2 | .785 | 4 | C95066 | C95070 |
| 1-11 | 5/8 | .620 | 4 | 1.546 | 5 | C95067 | C95071 |

Carbide

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiAlN | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ☆ | ◆ | ◆ | | ◆ | ◆ | ◆ |

☆ = Best Performance ◆ = Acceptable

HSS

 Carbon
Steel

 Surface
Treatment


 Bright

Feature:

Suitable for the repair of existing threads.

Dies
Carbon Steel / High Speed Steel

| | | | | | | order number | |
|----------------|----|----------------|---------------------|---------|-----------|--------------|------------------|
| die diameter | | decimal equiv. | length across flats | | thickness | 0650 | 492 |
| TPI and series | | | in | in | in | carbon steel | high-speed steel |
| 1/4 | 20 | UNC | .2500 | 19/32 | 1/4 | C65601 | C77600 |
| 1/4 | 28 | UNF | .2500 | 19/32 | 1/4 | C65602 | C77602 |
| 5/16 | 18 | UNC | .3125 | 11/16 | 5/16 | C65603 | C77604 |
| 5/16 | 24 | UNF | .3125 | 11/16 | 5/16 | C65605 | C77606 |
| 3/8 | 16 | UNC | .3750 | 25/32 | 3/8 | C65606 | C77608 |
| 3/8 | 24 | UNF | .3750 | 25/32 | 3/8 | C65607 | C77610 |
| 7/16 | 14 | UNC | .4375 | 7/8 | 7/16 | C65608 | C77612 |
| 7/16 | 20 | UNF | .4375 | 7/8 | 7/16 | C65609 | C77614 |
| 1/2 | 13 | UNC | .5000 | 1 1/16 | 1/2 | C65610 | C77616 |
| 1/2 | 20 | UNF | .5000 | 1 1/16 | 1/2 | C65611 | C77618 |
| 9/16 | 12 | UNC | .5625 | 1 1/16 | 1/2 | C65612 | C77620 |
| 9/16 | 18 | UNF | .5625 | 1 1/16 | 1/2 | C65613 | C77622 |
| 5/8 | 11 | UNC | .6250 | 1 1/4 | 5/8 | C65614 | C77624 |
| 5/8 | 18 | UNF | .6250 | 1 1/4 | 5/8 | C65615 | C77626 |
| 11/16 | 11 | UNS | .6875 | 1 7/16 | 3/4 | C65616 | — |
| 11/16 | 16 | UNS | .6875 | 1 7/16 | 3/4 | C65617 | — |
| 3/4 | 10 | UNC | .7500 | 1 7/16 | 3/4 | C65618 | C77628 |
| 3/4 | 16 | UNF | .7500 | 1 7/16 | 3/4 | C65619 | C77630 |
| 7/8 | 9 | UNC | .8750 | 1 5/8 | 7/8 | C65620 | C77632 |
| 7/8 | 14 | UNF | .8750 | 1 5/8 | 7/8 | C65621 | C77634 |
| 1 | 8 | UNC | 1.0000 | 1 13/16 | 1 | C65622 | C77636 |
| 1 | 12 | UNF | 1.0000 | 1 13/16 | 1 | C65623 | C77638 |
| 1 | 14 | UNS | 1.0000 | 1 13/16 | 1 | C65624 | C77640 |
| 1-1/8 | 7 | UNC | 1.1250 | 2 | 1 | C65625 | C77642 |
| 1-1/8 | 12 | UNF | 1.1250 | 2 | 1 | C65627 | C77644 |
| 1-1/4 | 7 | UNC | 1.2500 | 2 3/16 | 1 | C65628 | C77646 |
| 1-1/4 | 12 | UNF | 1.2500 | 2 3/16 | 1 | C65629 | — |
| 1-3/8 | 6 | UNC | 1.4100 | 2 3/8 | 1 | C65630 | C77648 |
| 1-3/8 | 12 | UNF | 1.4100 | 2 3/8 | 1 | C65631 | — |
| 1-1/2 | 6 | UNC | 1.5000 | 2 9/16 | 1 | C65632 | C77650 |
| 1-1/2 | 12 | UNF | 1.5000 | 2 9/16 | 1 | C65633 | — |



Hexagon Rethreading Taper Pipe

Styles: **0660**



HSS Carbon Steel Surface Treatment Bright

Feature:

Suitable for the repair of existing threads.

| die diameter | | decimal equiv. | length across flats | | thickness | | order number |
|--------------|--------|----------------|---------------------|--------|-----------|-------|-----------------------------|
| TPI | series | | in | mm | in | mm | 0660 carbon steel |
| 1/8 | 27 | NPT | .1250 | 1-1/16 | | 3/8 | C65571 |
| 1/4 | 18 | NPT | .2500 | 1-1/4 | | 5/8 | C65572 |
| 3/8 | 18 | NPT | .3750 | 1-7/16 | | 5/8 | C65573 |
| 1/2 | 14 | NPT | .5000 | 1-5/8 | | 3/4 | C65574 |
| 3/4 | 14 | NPT | .7500 | 2 | | 13/16 | C65575 |
| 1 | 11-1/2 | NPT | 1.0000 | 2-3/8 | | 1 | C65576 |

Styles: **0650M**

Hexagon Rethreading Metric

| die diameter | | decimal equiv. | length across flats | | thickness | | order number |
|--------------|--------|----------------|---------------------|-------|-----------|-------|------------------------------|
| TPI | series | | in | mm | in | mm | 0650M carbon steel |
| M3 x 0.5 | | .1181 | 19/32 | 15.08 | 1/4 | 6.35 | C29192 |
| M4 x 0.7 | | .1575 | 19/32 | 15.08 | 1/4 | 6.35 | C29193 |
| M5 x 0.8 | | .1969 | 19/32 | 15.08 | 1/4 | 6.35 | C65580 |
| M6 x 1 | | .2362 | 19/32 | 15.08 | 1/4 | 6.35 | C65581 |
| M7 x 1 | | .2756 | 11/16 | 17.46 | 5/16 | 7.92 | C29194 |
| M8 x 1.25 | | .3150 | 11/16 | 17.46 | 5/16 | 7.94 | C65582 |
| M10 x 1.25 | | .3937 | 7/8 | 22.23 | 7/16 | 11.11 | C29195 |
| M10 x 1.5 | | .3937 | 7/8 | 22.23 | 7/16 | 11.11 | C65583 |
| M12 x 1.75 | | .4724 | 1-1/16 | 26.98 | 1/2 | 12.70 | C65584 |
| M14 x 2 | | .5513 | 1-1/16 | 26.98 | 1/2 | 12.70 | C29196 |
| M14 x 2 | | .5512 | 1-1/16 | 26.98 | 1/2 | 12.70 | C65585 |
| M16 x 2 | | .6299 | 1-1/4 | 31.75 | 5/8 | 15.88 | C65586 |
| M18 x 1.5 | | .7087 | 1-7/16 | 36.52 | 7/8 | 22.23 | C29197 |
| M18 x 2.5 | | .7087 | 1-7/16 | 36.52 | 7/8 | 22.23 | C29198 |
| M20 x 2.5 | | .7874 | 1-5/8 | 41.28 | 7/8 | 22.23 | C65587 |
| M24 x 3 | | .9449 | 1-13/16 | 46.04 | 1 | 25.40 | C29199 |

SET

Style: **0650, 0650M**

Hexagon Die Carbon Steel

| set number | number of sizes | die sizes | | order number | set number | number of sizes | die sizes | | order number |
|------------|-----------------|------------|------------|--------------|------------|-----------------|------------|--|--------------|
| | | | | 0650 | | | | | 0650M |
| 42NC | 8 | 1/4-20 NC | 1/2-13 NC | C67275 | 49Metric | 7 | M6 x 1 | | C67283 |
| | | 5/16-18 NC | 9/16-12 NC | | | | M8 x 1.25 | | |
| | | 3/8-16 NC | 5/8-11 NC | | | | M10 x 1.5 | | |
| | | 7/16-14 NC | 3/4-10 NC | | | | M12 x 1.75 | | |
| 42NF | 8 | 1/4-28 NF | 1/2-20 NF | C67276 | | | M14 x 2 | | |
| | | 5/16-24 NF | 9/16-18 NF | | | | M16 x 2 | | |
| | | 3/8-24 NF | 5/8-18 NF | | | | M20 x 2.5 | | |
| | | 7/16-20 NF | 3/4-16 NF | | | | | | |
| 44NC | 10 | 1/4-20 NC | 9/16-12 NC | C67278 | | | | | |
| | | 5/16-18 NC | 5/8-11 NC | | | | | | |
| | | 3/8-16 NC | 3/4-10 NC | | | | | | |
| | | 7/16-14 NC | 7/8-9 NC | | | | | | |
| | | 1/2-13 NC | 1-8 NC | | | | | | |
| 45NCNF | 20 | 1/4-20 NC | 1/4-28 NF | C67282 | | | | | |
| | | 5/16-18 NC | 5/16-24 NF | | | | | | |
| | | 3/8-16 NC | 3/8-24 NF | | | | | | |
| | | 7/16-14 NC | 7/16-20 NF | | | | | | |
| | | 1/2-13 NC | 1/2-20 NF | | | | | | |
| | | 9/16-12 NC | 9/16-18 NF | | | | | | |
| | | 5/8-11 NC | 5/8-18 NF | | | | | | |
| | | 3/4-10 NC | 3/4-16 NF | | | | | | |
| | | 7/8-9 NC | 7/8-14 NF | | | | | | |
| | | 1-8 NC | 1-14 NF | | | | | | |



Set C67275



Set C67278



Round Adjustable
Inch

Styles: **0610, 0710**



HSS Carbon Steel Surface Treatment Bright

Feature:

Designed to cut threads in bar stock.

Dies

Carbon Steel / High Speed Steel

| die diameter | | | decimal equiv. | outside diameter | | thickness in | order number | |
|----------------|----|-----|----------------|------------------|-----|--------------|-------------------|-----------------------|
| TPI and series | | | | in | in | | 0610 carbon steel | 0710 high-speed steel |
| 0 | 80 | UNF | .0600 | 13/16 | 1/4 | C65022 | — | |
| 1 | 64 | UNC | .0730 | 13/16 | 1/4 | C65026 | — | |
| 1 | 72 | UNF | .0730 | 13/16 | 1/4 | C65027 | — | |
| 2 | 56 | UNC | .0860 | 13/16 | 1/4 | C65036 | — | |
| 2 | 64 | UNF | .0860 | 13/16 | 1/4 | C65037 | — | |
| 3 | 48 | UNC | .0990 | 13/16 | 1/4 | C65045 | — | |
| 3 | 56 | UNF | .0990 | 13/16 | 1/4 | C65046 | — | |
| 4 | 40 | UNC | .1120 | 13/16 | 1/4 | C65048 | — | |
| 4 | 48 | UNF | .1120 | 13/16 | 1/4 | C65049 | — | |
| 5 | 40 | UNC | .1250 | 13/16 | 1/4 | C65057 | C65729 | |
| 5 | 44 | UNF | .1250 | 13/16 | 1/4 | C65058 | C65730 | |
| 6 | 32 | UNC | .1380 | 13/16 | 1/4 | C65061 | C65733 | |
| 6 | 32 | UNC | .1380 | 1 | 3/8 | C65114 | C65785 | |
| 6 | 40 | UNF | .1380 | 13/16 | 1/4 | C65062 | C65734 | |
| 8 | 32 | UNC | .1640 | 13/16 | 1/4 | C65069 | C65739 | |
| 8 | 32 | UNC | .1640 | 1 | 3/8 | C65119 | C65789 | |
| 8 | 36 | UNF | .1640 | 13/16 | 1/4 | C65070 | C65740 | |
| 10 | 24 | UNC | .1900 | 13/16 | 1/4 | C65075 | C65743 | |
| 10 | 24 | UNC | .1900 | 1 | 3/8 | C65124 | C65792 | |
| 10 | 32 | UNF | .1900 | 13/16 | 1/4 | C65076 | C65744 | |
| 10 | 32 | UNF | .1900 | 1 | 3/8 | C65125 | C65793 | |
| 12 | 24 | UNC | .2160 | 13/16 | 1/4 | C65083 | C65751 | |
| 12 | 24 | UNC | .2160 | 1 | 3/8 | C65132 | C65798 | |
| 12 | 28 | UNF | .2160 | 13/16 | 1/4 | C65084 | C65752 | |
| 1/4 | 20 | UNC | .2500 | 13/16 | 1/4 | C65093 | C65760 | |
| 1/4 | 20 | UNC | .2500 | 1 | 3/8 | C65140 | C65804 | |
| 1/4 | 20 | UNC | .2500 | 1-1/2 | 1/2 | C65192 | C65839 | |
| 1/4 | 20 | UNC | .2500 | 2 | 5/8 | C65264 | — | |
| 1/4 | 28 | UNF | .2500 | 13/16 | 1/4 | — | C65761 | |
| 1/4 | 28 | UNF | .2500 | 1 | 3/8 | C65142 | C65805 | |
| 1/4 | 28 | UNF | .2500 | 1-1/2 | 1/2 | C65193 | C65840 | |
| 1/4 | 28 | UNF | .2500 | 2 | 5/8 | C65265 | — | |
| 5/16 | 18 | UNC | .3125 | 13/16 | 1/4 | — | C65766 | |
| 5/16 | 18 | UNC | .3125 | 1 | 3/8 | C65147 | C65808 | |
| 5/16 | 18 | UNC | .3125 | 1-1/2 | 1/2 | C65197 | C65844 | |
| 5/16 | 18 | UNC | .3125 | 2 | 5/8 | C65269 | — | |
| 5/16 | 24 | UNF | .3125 | 13/16 | 1/4 | — | C65767 | |
| 5/16 | 24 | UNF | .3125 | 1 | 3/8 | C65148 | C65809 | |
| 5/16 | 24 | UNF | .3125 | 1-1/2 | 1/2 | C65198 | C65845 | |
| 5/16 | 24 | UNF | .3125 | 2 | 5/8 | C65270 | — | |
| 3/8 | 16 | UNC | .3750 | 1 | 3/8 | C65159 | C65816 | |
| 3/8 | 16 | UNC | .3750 | 1-1/2 | 1/2 | C65208 | C65855 | |
| 3/8 | 16 | UNC | .3750 | 2 | 5/8 | C65280 | — | |
| 3/8 | 24 | UNF | .3750 | 1 | 3/8 | C65160 | C65817 | |
| 3/8 | 24 | UNF | .3750 | 1-1/2 | 1/2 | C65209 | C65856 | |
| 3/8 | 24 | UNF | .3750 | 2 | 5/8 | C65281 | — | |
| 7/16 | 14 | UNC | .4375 | 1 | 3/8 | C65171 | C65828 | |
| 7/16 | 14 | UNC | .4375 | 1-1/2 | 1/2 | C65220 | C65865 | |
| 7/16 | 14 | UNC | .4375 | 2 | 5/8 | C65292 | — | |
| 7/16 | 20 | UNF | .4375 | 1 | 3/8 | C65172 | C65829 | |
| 7/16 | 20 | UNF | .4375 | 1-1/2 | 1/2 | C65221 | C65866 | |
| 7/16 | 20 | UNF | .4375 | 2 | 5/8 | C65293 | — | |

continued on next page



Styles: 0610, 0710 (continued)

| die diameter TPI and series | | | decimal equiv. | outside diameter in | | thickness in | order number | |
|--------------------------------|----|-----|-------------------|------------------------|-----|-----------------|----------------------|--------------------------|
| | | | | | | | 0610 carbon steel | 0710 high-speed steel |
| 1/2 | 13 | UNC | .5000 | 1 | 3/8 | C65470 | — | |
| 1/2 | 13 | UNC | .5000 | 1-1/2 | 1/2 | C65232 | C65875 | |
| 1/2 | 13 | UNC | .5000 | 2 | 5/8 | C65303 | — | |
| 1/2 | 20 | UNF | .5000 | 1 | 3/8 | C65471 | — | |
| 1/2 | 20 | UNF | .5000 | 1-1/2 | 1/2 | C65233 | C65876 | |
| 1/2 | 20 | UNF | .5000 | 2 | 5/8 | C65304 | — | |
| 9/16 | 12 | UNC | .5625 | 1-1/2 | 1/2 | C65239 | C65881 | |
| 9/16 | 12 | UNC | .5625 | 2 | 5/8 | C65311 | — | |
| 9/16 | 18 | UNF | .5625 | 1-1/2 | 1/2 | C65240 | C65882 | |
| 9/16 | 18 | UNF | .5625 | 2 | 5/8 | C65312 | — | |
| 5/8 | 11 | UNC | .6250 | 1-1/2 | 1/2 | C65243 | C65884 | |
| 5/8 | 11 | UNC | .6250 | 2 | 5/8 | C65315 | C65946 | |
| 5/8 | 11 | UNC | .6250 | 2-1/2 | 3/4 | C65374 | — | |
| 5/8 | 18 | UNF | .6250 | 1-1/2 | 1/2 | C65244 | C65885 | |
| 5/8 | 18 | UNF | .6250 | 2 | 5/8 | C65316 | C65947 | |
| 3/4 | 10 | UNC | .7500 | 1-1/2 | 1/2 | C65250 | — | |
| 3/4 | 10 | UNC | .7500 | 2 | 5/8 | C65328 | C65957 | |
| 3/4 | 10 | UNC | .7500 | 2-1/2 | 3/4 | C65384 | — | |
| 3/4 | 16 | UNF | .7500 | 1-1/2 | 1/2 | C65251 | — | |
| 3/4 | 16 | UNF | .7500 | 2 | 5/8 | C65329 | C65958 | |
| 3/4 | 16 | UNF | .7500 | 2-1/2 | 3/4 | C65385 | — | |
| 7/8 | 9 | UNC | .8750 | 2 | 5/8 | C65339 | C65966 | |
| 7/8 | 9 | UNC | .8750 | 2-1/2 | 3/4 | C65395 | — | |
| 7/8 | 14 | UNF | .8750 | 2 | 5/8 | C65340 | C65967 | |
| 7/8 | 14 | UNF | .8750 | 2-1/2 | 3/4 | C65396 | — | |
| 1 | 8 | UNC | 1.0000 | 2 | 5/8 | C65349 | — | |
| 1 | 8 | UNC | 1.0000 | 2-1/2 | 3/4 | C65405 | — | |
| 1 | 8 | UNC | 1.0000 | 3 | 1 | C65416 | — | |
| 1 | 12 | UNF | 1.0000 | 2 | 5/8 | C65350 | — | |
| 1 | 12 | UNF | 1.0000 | 2-1/2 | 3/4 | C65406 | — | |
| 1 | 12 | UNF | 1.0000 | 3 | 1 | C65417 | — | |
| 1 | 14 | UNS | 1.0000 | 2 | 5/8 | C65407 | — | |
| 1-1/8 | 7 | UNC | 1.1250 | 3 | 1 | C65426 | — | |
| 1-1/8 | 12 | UNF | 1.1250 | 3 | 1 | C65427 | — | |
| 1-1/4 | 7 | UNC | 1.2500 | 3 | 1 | C65433 | — | |
| 1-1/4 | 12 | UNF | 1.2500 | 3 | 1 | C65434 | — | |
| 1-3/8 | 6 | UNC | 1.3750 | 3 | 1 | C65441 | — | |
| 1-3/8 | 12 | UNF | 1.3750 | 3 | 1 | C65442 | — | |
| 1-1/2 | 6 | UNC | 1.5000 | 3 | 1 | C65449 | — | |
| 1-1/2 | 12 | UNF | 1.5000 | 3 | 1 | C65450 | — | |

Dies
High Speed Steel

Style: 0620

Round Adjustable - Pipe
Inch

| die diameter TPI and series | | | decimal equiv. | outside diameter in | | thickness in | order number |
|--------------------------------|----|-----|-------------------|------------------------|-----|-----------------|----------------------|
| | | | | | | | 0620 carbon steel |
| 1/8 | 27 | NPT | .1250 | 1 | 3/8 | C65491 | |
| 1/8 | 27 | NPT | .1250 | 1-1/2 | 1/2 | C65492 | |
| 1/4 | 18 | NPT | .2500 | 1-1/2 | 1/2 | C65493 | |
| 1/4 | 18 | NPT | .2500 | 2 | 5/8 | C65495 | |
| 3/8 | 18 | NPT | .3750 | 1-1/2 | 1/2 | C65494 | |
| 3/8 | 18 | NPT | .3750 | 2 | 5/8 | C65496 | |
| 1/2 | 14 | NPT | .5000 | 2 | 5/8 | C65497 | |

Pipe size round adjustable dies are not split.





Round Adjustable Metric

Styles: **0710M**



HSS

Surface Treatment

Bright

Dies

High Speed Steel

| die diameter and TPI | decimal equiv. | outside diameter | | thickness | | order number |
|-------------------------|-------------------|------------------|-------|-----------|-------|----------------------------------|
| | | in | mm | in | mm | 0710M high-speed steel |
| M2.5 x 0.45 | .0984 | 13/16 | 20.64 | 1/4 | 6.35 | C65721 |
| M3 x 0.5 | .1181 | 13/16 | 20.64 | 1/4 | 6.35 | C65724 |
| M3.5 x 0.6 | .1378 | 13/16 | 20.64 | 1/4 | 6.35 | C65732 |
| M4 x 0.7 | .1575 | 13/16 | 20.64 | 1/4 | 6.35 | C65737 |
| M4.5 x 0.75 | .1772 | 13/16 | 20.64 | 1/4 | 6.35 | C65742 |
| M5 x 0.8 | .1969 | 13/16 | 20.64 | 1/4 | 6.35 | C65747 |
| M6 x 1 | .2362 | 13/16 | 20.64 | 1/4 | 6.35 | C65757 |
| M6 x 1 | .2362 | 1 | 25.40 | 3/8 | 9.53 | C65801 |
| M7 x 1 | .2756 | 1 | 25.40 | 3/8 | 9.53 | C65807 |
| M8 x 1.25 | .3150 | 1 | 25.40 | 3/8 | 9.53 | C65813 |
| M10 x 1.5 | .3937 | 1 | 25.40 | 3/8 | 9.53 | C65824 |
| M12 x 1.75 | .4724 | 1 | 25.40 | 3/8 | 9.53 | C65833 |
| M14 x 2 | .5512 | 1-1/2 | 38.10 | 1/2 | 12.70 | C65880 |
| M16 x 2 | .6300 | 1-1/2 | 38.10 | 1/2 | 12.70 | C65889 |
| M18 x 2.5 | .7087 | 1-1/2 | 38.10 | 1/2 | 12.70 | C65896 |
| M20 x 2.5 | .7874 | 1-1/2 | 38.10 | 1/2 | 12.70 | C65901 |

Adjustable Dies

Die Stock - Round Adjustable

Styles: **222 & 224**

Note

Style 222 holds round adjustable dies with three adjusting screws



Style 222 Die Stock

| product number | die O.D. | overall length | order number |
|----------------|----------|----------------|--------------|
| 2 | 13/16 | 7 | C67223 |
| 3 | 1 | 9-1/4 | C67224 |
| 5 | 1-1/2 | 13-1/4 | C67226 |
| 6 | 2 | 15-3/8 | C67227 |
| 7 | 2-1/2 | 19-1/2 | C67228 |
| 8 | 3 | 23 | C67229 |

Note

Style 224 stocks have built-in workpiece guide and lock in place with two set screws

****Items are being OBSOLETED, only available until inventory is depleted.**



Style 224 Die Stock

| product number | die O.D. | overall length | order number |
|----------------|----------|----------------|--------------|
| 14 | 1 | 13 | **C67236 |



Styles: **0550, 0551, 0552, 0553, 0554**

Steel Construction **Bright**

Surface Treatment

Bright

- **Style 0554** Quick-Set Two-Piece Die System consists of these parts:
 - Style 0550 — Die
 - Style 0551 — Cap
 - Style 0552 — Guide
 - Style 0553 — Collet
- Inch sizes are sold as a complete assembly or in their component parts.
- Metric sizes are sold in their component parts only.
- Use with Quick-Set die stocks.
- Collet assembly for use with Quick-Set dies consists of a cap and a guide; order cap and guide separately, or assembled as a collet.
- Die halves are seated in the beveled cap slot and held in place by the guide, which screws into the underside of the cap.
- Die is adjusted by the set screws at either end of the slot.
- Caps of a given outside diameter are made with several different sizes of slots.
- Separate guide is required for each cutting size.
- To order separate guides, specify cutting size of the die and the size of the collet for 1/4" and 1/2" dies.
- For metric sizes where guide and collet assembly are not available, use Style 225 Quick-Set Jr. die stock to hold dies.



Style 0554 Die Assembly



Style 0550 Die Halves



Style 0553 Collet
(combined Cap and Guide)



Style 0551 Cap



Style 0552 Guide

order number

| nominal size TPI and series | | | decimal equiv. | 0554 complete assembly | 0550 die blank | die halves | 0553 no. collet | 0551 O.D. cap | 0552 guide | | |
|--------------------------------|----|-----|-------------------|-------------------------------------|-----------------------------|---------------|------------------------------|----------------------------|----------------------|--------|--------|
| 4 | 40 | UNC | .1120 | C66782 | A1 | C66693 | A1 | C66754 | 1.250 | C66727 | C66681 |
| 6 | 32 | UNC | .1380 | C66783 | A1 | C66694 | A1 | C66755 | 1.250 | C66727 | C66682 |
| 8 | 32 | UNC | .1640 | C66784 | A1 | C66695 | A1 | C66756 | 1.250 | C66727 | C66683 |
| 10 | 24 | UNC | .1900 | C66785 | A1 | C66696 | A1 | C66757 | 1.250 | C66727 | C66684 |
| 10 | 32 | UNF | .1900 | C66786 | A1 | C66697 | A1 | C66757 | 1.250 | C66727 | C66684 |
| 12 | 24 | UNC | .2160 | C66787 | A1 | C66698 | A1 | C66758 | 1.250 | C66727 | C66685 |
| 1/4 | 20 | UNC | .2500 | C66788 | A1 | C66699 | A1 | C66759 | 1.250 | C66727 | C66686 |
| 1/4 | 20 | UNC | .2500 | C66789 | A | C66701 | 1 | C66760 | 2.000 | C66728 | C66737 |
| 1/4 | 28 | UNF | .2500 | C66790 | A | — | 1 | C66760 | 2.000 | C66728 | C66737 |
| 5/16 | 18 | UNC | .3125 | C66791 | A | C66703 | 1 | C66761 | 2.000 | C66728 | C66738 |
| 5/16 | 24 | UNF | .3125 | C66792 | A | C66704 | 1 | C66761 | 2.000 | C66728 | C66738 |
| 3/8 | 16 | UNC | .3750 | C66793 | B | C66705 | 1 | C66762 | 2.000 | C66729 | C66739 |
| 3/8 | 24 | UNF | .3750 | C66794 | B | C66706 | 1 | C66762 | 2.000 | C66729 | C66739 |
| 7/16 | 14 | UNC | .4375 | C66795 | B | C66707 | 1 | C66763 | 2.000 | C66729 | C66740 |
| 7/16 | 20 | UNF | .4375 | C66796 | B | C66708 | 1 | C66763 | 2.000 | C66729 | C66740 |
| 1/2 | 13 | UNC | .5000 | C66797 | B | C66709 | 1 | C66764 | 2.000 | C66729 | C66741 |
| 1/2 | 20 | UNF | .5000 | C66798 | B | C66711 | 1 | C66764 | 2.000 | C66729 | C66741 |
| 1/2 | 13 | UNC | .5000 | C66801 | C | C66710 | 5 | C66769 | 2.750 | C66732 | C66746 |
| 1/2 | 20 | UNF | .5000 | C66802 | C | C66712 | 5 | C66769 | 2.750 | C66732 | C66746 |
| 9/16 | 12 | UNC | .5625 | C66803 | C | C66713 | 5 | C66770 | 2.750 | C66732 | C66747 |
| 9/16 | 18 | UNF | .5625 | C66804 | C | C66714 | 5 | C66770 | 2.750 | C66732 | C66747 |
| 5/8 | 11 | UNC | .6250 | C66805 | C | C66715 | 5 | C66771 | 2.750 | C66732 | C66748 |
| 5/8 | 18 | UNF | .6250 | C66806 | C | C66716 | 5 | C66771 | 2.750 | C66732 | C66748 |
| 3/4 | 10 | UNC | .7500 | C66807 | C | C66717 | 5 | C66772 | 2.750 | C66732 | C66749 |
| 3/4 | 16 | UNF | .7500 | C66808 | C | C66718 | 5 | C66772 | 2.750 | C66732 | C66749 |
| 7/8 | 9 | UNC | .8750 | C66809 | D | C66719 | 5 | C66773 | 2.750 | C66733 | C66750 |
| 7/8 | 14 | UNF | .8750 | C66810 | D | C66720 | 5 | C66773 | 2.750 | C66733 | C66750 |
| 1 | 8 | UNC | 1.0000 | C66811 | D | C66721 | 5 | C66774 | 2.750 | C66733 | C66751 |
| 1 | 12 | UNF | 1.0000 | C66812 | D | C66722 | 5 | C66774 | 2.750 | C66733 | C66751 |
| 1 | 14 | UNS | 1.0000 | C66813 | D | C66723 | 5 | C66774 | 2.750 | C66733 | C66751 |

continued on next page



Die Set

Quick Set - Metric

Styles: **0550, 0551, 0552, 0553** (continued)

| nominal size TPI | decimal equiv. | order number | | | | | | |
|---------------------|-------------------|--------------|---------------|-------------|--------|-------------|-------------|--------|
| | | 0550 | | 0553 | | 0551 | 0552 | |
| | | die blank | die halves | no. | collet | cap | O.D. | guide |
| M6 x 1 | .2362 | A | C66670 | 5 | * | * | 2.750 | C66820 |
| M8 x 1.25 | .3150 | A | C66671 | 5 | * | * | 2.750 | C66821 |
| M10 x 1.5 | .3937 | B | C66672 | 5 | * | * | 2.750 | C66822 |
| M12 x 1.75 | .4724 | B | C66673 | 5 | * | * | 2.750 | C66823 |
| M14 x 2 | .5512 | C | C66674 | 5 | C66769 | C66732 | 2.750 | C66824 |
| M16 x 2 | .6300 | C | C66675 | 5 | C66770 | C66732 | 2.750 | C66825 |
| M18 x 2.5 | .7087 | C | C66676 | 5 | C66771 | C66732 | 2.750 | C66826 |
| M20 x 2.5 | .7874 | C | C66677 | 5 | C66772 | C66732 | 2.750 | C66827 |
| M22 x 2.5 | .8661 | D | C66678 | 5 | C66773 | C66733 | 2.750 | C66828 |
| M24 x 3 | .9449 | D | C66679 | 5 | C66774 | C66733 | 2.750 | C66829 |

*Use Style 225 Quick-Set Jr. die stock instead of collet assembly for these sizes.

Dies

Die Set

Accessories

Styles: **223, 225**

Surface
Treatment



Style **223** - Regular Quick-Set Die Stock

Carbon Steel **Black Oxide**

- Use with all Series 0554 Quick-Set collets with two-piece dies.
- Quick-Set die stocks have center holes corresponding to the outside diameter of the Quick-Set collets.



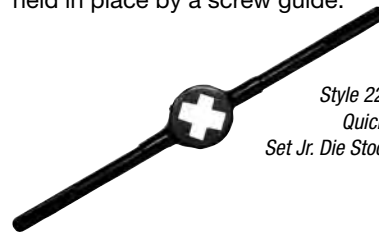
Style 223
Regular Quick-Set Die Stock

| stock no. | collet no. | collet capacity | length of stock | order no. 223 stock |
|-----------|------------|-----------------|-----------------|----------------------------------|
| #A1 | A1 | 1-1/4 | 7-1/2 | C67216 |
| #1 | 1 | 2 | 14-1/2 | C67214 |
| #5 | 5 | 2-3/4 | 23 | C67217 |
| #5A | 5 | 2-3/4 | 26 | C67215 |

Style **225** - Jr. Quick-Set Die Stock

Carbon Steel **Black Oxide**

- Use with all Series 0550 Quick-Set two-piece dies without collet.
- Quick-Set Jr. die stocks are designed to use Quick-Set dies without collets.
- Double slots enable use of two different size blanks in the same stock.
- Dies fit directly into the stock and are held in place by a screw guide.



Style 225
Quick-Set Jr. Die Stock

| stock no. | cutting size | die blank size | guide no. | cutting size range | length of stock | order no. 225 stock |
|-----------|--------------|----------------|-----------|--------------------|-----------------|----------------------------------|
| #1 | 1/4 to 5/16 | A | 1 | 1/4 to 1/2 | 14-1/2 | C67220 |
| | 3/8 to 1/2 | B | | | | |
| #5 | 9/16 to 3/4 | C | 5 | 9/16 to 1 | 26 | C67221 |
| | 7/8 to 1 | D | | | | |

Quick-Set

Spanner Wrench

Style: **226**

| stock no. | collet no. | collet capacity | order no. 226 stock |
|-----------|------------|-----------------|----------------------------------|
| #A1 | A1 | 1-1/4 | C67232 |

- Since A1 guides are so small they are round not square, so you cannot use a standard wrench.
- Fits into two holes to turn guide.



Styles: 240, 242, 243, 244, 245

Tap Wrenches

Style: 240

Standard Straight

| product number | mach screw | tap size ranges | | pipe | overall length | order number |
|----------------|------------|-----------------|--------------|--------------|----------------|--------------|
| | | fractional | metric | | | 240 |
| 0 | 0 to 14 | 1/16 to 1/4 | M1.5 to M6.3 | — | 7 | C67201 |
| 14 | 0 to 14 | 1/16 to 3/8 | M1.5 to M10 | — | 9 | C67197 |
| 5 | 8 to 14 | 5/32 to 1/2 | M4 to M12.5 | 1/8 | 11 | C67202 |
| 6 | 8 to 14 | 5/32 to 3/4 | M4 to M19 | 1/8 to 1/4 | 15 | C67203 |
| 7 | — | 1/4 to 1-1/8 | M12 to M28 | 1/8 to 3/4 | 19 | C67204 |
| 8 | — | 3/4 to 1-5/8 | M19 to M40 | 3/8 to 1-1/4 | 40 | C67205 |
| 22 | — | 1 to 2-1/2 | M25 to M56 | 3/4 to 2 | 54 | C67200 |

Note
Used for hand tapping.



Style: 242

Plain T-Handle

| product number | mach screw | tap size ranges | | overall length | order number |
|----------------|------------|-----------------|---------------|----------------|--------------|
| | | fractional | metric | | 242 |
| T9 | 0 to 14 | 1/16 to 1/4 | M1.5 to M6.3 | 2-3/4 | C67206 |
| T10 | 12 to 14 | 7/32 to 1/2 | M5.5 to M12.5 | 3-5/8 | C67207 |

Note
Used for hand tapping in out-in-the-open jobs.



Style: 243

Slip T-Handle

| product number | mach screw | tap size ranges | | overall length | order number |
|----------------|------------|-----------------|---------------|----------------|--------------|
| | | fractional | metric | | 243 |
| T11 | 0 to 14 | 1/16 to 1/4 | M1.5 to M6.3 | 2-3/4 | C67208 |
| T12 | 12 to 14 | 7/32 to 1/2 | M5.5 to M12.5 | 3-5/8 | C67209 |

Note
Used for hand tapping or in difficult spaces requiring a slip handle.



Style: 244

Combination Ratchet and Slip Handle

| product number | mach screw | tap size ranges | | overall length | order number |
|----------------|------------|-----------------|---------------|----------------|--------------|
| | | fractional | metric | | 244 |
| T13 | 0 to 14 | 1/16 to 1/4 | M1.5 to M6.3 | 3-3/4 | C67210 |
| T14 | 12 to 14 | 7/32 to 1/2 | M5.5 to M12.5 | 5 | C67211 |

Note
Used for hand tapping in difficult spaces needing ratchet drive.



Style: 245 Long Shank T-Handle Tap Wrench

Long Shank T-Handle

| product number | mach screw | tap size ranges | | overall length | order number |
|----------------|------------|-----------------|---------------|----------------|--------------|
| | | fractional | metric | | 245 |
| T16 | 0 to 14 | 1/16 to 1/4 | M1.5 to M6.3 | 8-3/4 | C67212 |
| T17 | 12 to 14 | 7/32 to 1/2 | M5.5 to M12.5 | 10-5/8 | C67213 |

Note
Used for hand tapping where extra reach is required.




Wrenches




Cost Saving Sets

General Purpose Tap

| | | | | Number of pieces | Surface Treatment | H-Limit | Size Range | Case Type | |
|---|-----------------|-----------|--------|------------------|-------------------|---------|--|-----------|--|
| Type | Style | Order No. | Bright | | Inch | | Metal | Plastic | |
|  | General Purpose | 1002 | C55090 | 10 | • | yes | UNC: 1/4-20, 5/16-18, 3/8-16, 7/16-14, 1/2-13 UNF: 1/4-28, 5/16-24, 3/8-24, 7/16-20, 1/2-20 | • | |



Dies - Inch

| | | | | | | Size Range | | Case Type | |
|---|-----------------|-----------|-----------------|------------|--------|---|---|-----------|--|
| Type | Style | Order No. | Number of Sizes | Set Number | Inch | | Metal | Plastic | |
|  | General Purpose | 0650 | C67275 | 8 | 42NC | 1/4-20 NC 5/16-18 NC 3/8-16 NC 7/16-14 NC | 1/2-13 NC 9/16-12 NC 5/8-11 NC 3/4-10 NC | • | |
| | | | C67276 | 8 | 42NF | 1/4-28 NF 5/16-24 NF 3/8-24 NF 7/16-20 NF | 1/2-20 NF 9/16-18 NF 5/8-18 NF 3/4-16 NF | • | |
| | | | C67278 | 10 | 44NC | 1/4-20 NC 5/16-18 NC 3/8-16 NC 7/16-14 NC 1/2-13 NC | 9/16-12 NC 5/8-11 NC 3/4-10 NC 7/8-9 NC 1-8 NC | • | |
| | | | C67284 | 10 | NCNF | 1/4-20 NC 5/16-18 NC 3/8-16 NC 7/16-14 NC 1/2-13 NC | 1/4-28 NF 5/16-24 NF 3/8-24 NF 7/16-20 NF 1/2-20 NF | • | |
| | | | C67282 | 20 | 45NCNF | 1/4-20 NC 5/16-18 NC 3/8-16 NC 7/16-14 NC 1/2-13 NC 9/16-12 NC 5/8-11 NC 3/4-10 NC 7/8-9 NC 1-8 NC | 1/4-28 NF 5/16-24 NF 3/8-24 NF 7/16-20 NF 1/2-20 NF 9/16-18 NF 5/8-18 NF 3/4-16 NF 7/8-14 NF 1-14 NF | • | |



Set C67275



Set C67276




Set C67278



Set C67282

Dies - Metric

| | | | | | Size Range | | Case Type | | |
|---|-----------------|-----------|-----------------|------------|------------|--|---------------------------------|---------|--|
| Drill Type | Style Number | Order No. | Number of Sizes | Set Number | Metric | | Metal | Plastic | |
|  | General Purpose | 0650M | C67283 | 7 | 49Metric | M6 x 1 M8 x 1.25 M10 x 1.5 M12 x 1.75 | M14 x 2 M16 x 2 M20 x 2.5 | • | |



**TECH TIP****Gauging Threaded Holes**

To confirm the accuracy of a tapped hole, always use a Go-No Go gauge. Never use a fastener i.e.: (screw, or bolt) Using a screw, or bolt will not allow you to verify size of the thread produced, but only indicate that the bolt used will fit in that particular hole. Go-No Gauges can give indications as to where the thread produced is within the thread specification. A screw or bolt is not capable of giving such an indication. Accurate gauges will also help predict remaining tool life by indicating tightness or looseness of the gage in the part.

**TECH TIP****NPT vs. NPTF Taper Pipe Threads**

The two most common taper pipe threads used in the United States are NPT and NPTF. Applications range from electrical conduits and hand railings to high-pressure pipe lines that carry gas or caustic fluids. NPT threads are for mechanical or low-pressure air or fluid applications and require the use of sealing compounds like Teflon tape, to provide the seal. When the application is more critical, and the sealing compound may fail due to high heat or pressure, NPTF Dryseal threads are used. This mechanical seal is produced by the mating and slight crushing of the threads when a wrench is applied to tighten the fittings.

Visually, both threads appear to be identical. Both have a $\frac{3}{4}$ " taper over one foot of length. Both have the same pitch diameter at the top of the hole of internal threads or end of the pipe on external threads, and both have the same thread lengths or depths. However, there is a subtle difference in the thread form that differentiates the two. The major and minor diameters of both threads are differ slightly. With NPT threads, after a wrench is applied, slight spaces at the major and minor diameters may exist that would allow the assembly to leak and therefore a sealing compound is used to fill any gaps. On the other hand, NPTF threads are designed to ensure that sufficient crushing of the entire thread form will take place to produce a mechanical seal.

How does the difference in thread forms effect the tooling used to produce NPT and NPTF threads? Taps are available for both NPT and NPTF threads having the appropriate form to produce each type of thread. Since NPT threaded parts require sealing compounds, it is acceptable to use an NPTF tap for NPT applications. However, NPT taps cannot be used for NPTF applications, as it will likely produce a thread that will leak. The same is true of external threads. In most cases the tap drill is the same for both forms.

The most significant difference in the two threads is the inspection required. Since sealing compounds will be used for NPT threads, only a single plug with a step, known as an L1 plug (internal thread) or a single thin L1 ring (external) are required to check size. However, since the taper and the position of major and minor diameters are so critical to the sealing of NPTF threads, the additional threads in the assembly known as L2 and L3, and the major and minor diameters are inspected with either special plug or ring gauges.



Technical Information

Technical Information

| | | | |
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| Tap Nomenclature / Chamfers | 206 | USCTI Table 311..... | 216 |
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| Hardness Conversion Table | 209 | USCTI Table 329..... | 218 |
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| Progress / Performance Taps | 211 | USCTI Table 352..... | 221 |
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| USCTI Table 302..... | 214 | Made to Order, Special Taps, FastTap | 225 |
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Tap Nomenclature

Bottoming Tap

A tap having a chamfer length of 1-2 threads.

Chamfer

The tapering of the threads at the front end of each land of a chaser, tap or die by cutting away and relieving the crest of the first few teeth to distribute the cutting action over several teeth.

Chamfer Angle

The angle formed between the chamfer and the axis of the tap or die by cutting away and relieving the crest of the first few teeth to distribute the cutting action over several teeth.

Crest

The surface of the thread which joins the flanks of the thread and is farthest from the cylinder or cone from which the thread projects.

Flank

The part of a helical thread surface which connects the crest and the root and which is theoretically a straight line in an axial plane section.

Flute

The longitudinal channel formed in a tap to create cutting edges on the thread profile and to provide chip spaces and cutting fluid passage.

Hand of Threads

A thread, when viewed axially, winds in a clockwise and receding direction for LEFT-HAND THREADS and counter-clockwise and receding direction for RIGHT-HAND THREADS.

Hook, Chordal

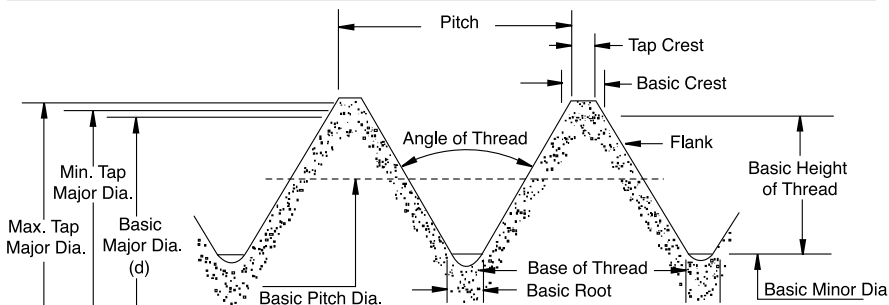
A concave face having an angle of inclination specified between a chord passing through the root and crest of a thread form at the cutting face, and a radial line through the crest at the cutting edge.

Hook, Tangential

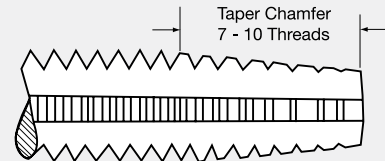
A concave face having an angle of inclination specified between a line tangent to the hook surface at the cutting edge and a radial line to the same point.

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Illustration of Tap Terms

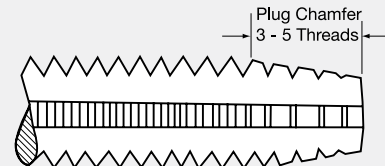


Tap Chamfers



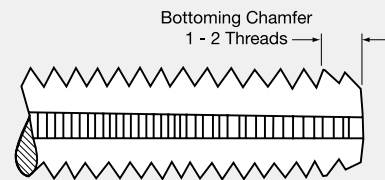
Taper (7 to 10 pitches)

The taper chamfer has the longest standard chamfer ensuring easier starting. It requires less tapping torque because of more working teeth.



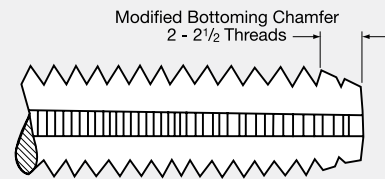
Plug (3 to 5 pitches)

The most common chamfer for use by hand or machine in through or blind holes. This chamfer is more efficient than a bottoming or modified-bottoming chamfer.



Bottoming (1 to 2 pitches)

For threading close to the bottom of blind holes, the bottoming chamfer is the least efficient chamfer available.



Modified-Bottoming (2 to 2 1/2 pitches)

This short chamfer allows for threading close to the bottom of blind holes. Due to the slightly longer chamfer and more working teeth, this chamfer is more efficient than a bottoming chamfer.



Hook Angle

The angle of inclination of a concave face, usually specified either as CHORDAL HOOK or TANGENTIAL HOOK.

Interrupted Thread Tap

A tap having an odd number of lands with alternate teeth in the thread helix removed. In some cases alternate teeth are removed only for a portion of the thread length.

Land

One of the threaded sections between the flutes of a tap.

Lead of Thread

The distance a screw thread advances axially in one complete turn. On a single start tap the lead and pitch are identical. On a multiple start tap the lead is the multiple of the pitch.

Major Diameter

The diameter of the major cylinder or cone, at a given position on the axis, that bounds the crests of an external thread or the roots of an internal thread.

Minor Diameter

The diameter of the minor cylinder or cone, at a given position on the axis, that bounds the roots of an external thread or the crests of an internal thread.

Pitch Diameter

The diameter of an imaginary cylinder or cone, at a given point on the axis, of such a diameter and location of its axis that its surface would pass through the thread in such a manner as to make the thread ridge and the thread groove equal and, therefore, is located equidistant between the sharp major and minor cylinders or cones of a given thread form. On a theoretically perfect thread, these widths are equal to one half of the basic pitch (measured parallel to the axis). See illustration below

Plug Tap

A tap with 3 to 5 chamfered threads.

Spiral Point

The angular fluting in the cutting face of the land at the chamfered end. It is formed at an angle with respect to the tap axis of opposite hand to that of rotation. Its length is usually greater than the chamfer length and its angle with respect to the tap axis is usually made great enough to direct the chips ahead of the tap. The tap may or may not have longitudinal flutes.

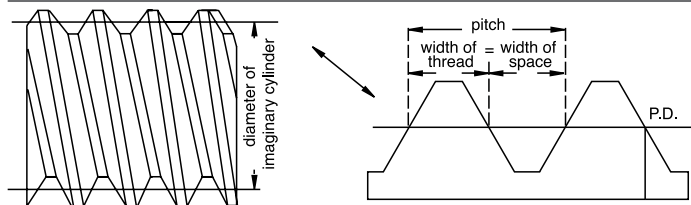
Square

Four driving flats parallel to the axis on a tap shank forming a square or square with round corners.

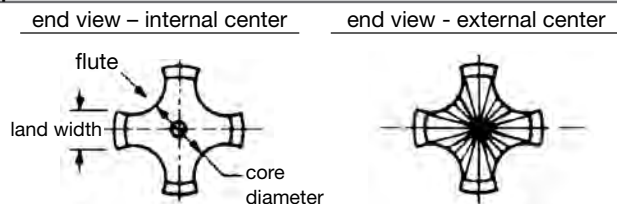
Taper Tap

A tap having a chamfer length of 7 to 10 threads.

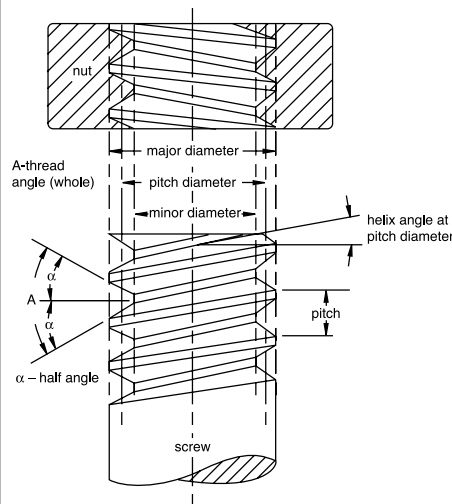
Pitch Diameter



Tap End Views



Screw Thread Tolerances



It is generally recognized that, in mass production, it is impossible to reproduce in exact detail the theoretically perfect product as laid out on the drawing board. The allowed slight variation between the theoretically perfect product and each unit of the actual product is called the TOLERANCE.

Allowance - An intentional difference in correlated dimensions of mating parts. It is the minimum clearance or maximum interference between such parts.

Angle of Thread - The angle included between the flanks of the thread measured in an axial plane.

Half Angle of Thread - The angle included between a flank of the thread and the normal (90°) to the axis, measured in an axial plane.

Lead of Thread - The distance a screw thread advances axially in one turn. On a single-thread screw the lead and pitch are identical. On a double thread the lead is 2X pitch, on a triple thread the lead is 3X pitch, etc.

Major Diameter - The largest diameter of a straight screw thread.

Minor Diameter - The smallest diameter of a straight screw thread.

Pitch - The distance from a point on a screw thread to a corresponding point on the next thread measured parallel to the axis.

$$\text{The pitch in inches} = \frac{1}{\text{no. of threads per inch}}$$

Tap – Drill Recommendations

Technical Information

Inch Sizes (measurements in inches)

| tap size and pitch | cutting taps drill size | decimal equiv | forming taps drill size | decimal equiv. |
|--------------------|-------------------------|---------------|-------------------------|----------------|
| 0-80 | 3/64 | .0469 | 54 | .0550 |
| 1-64 | 53 | .0595 | 51 | .0670 |
| 1-72 | 53 | .0595 | 51 | .0670 |
| 2-56 | 50 | .0700 | 5/64 | .0781 |
| 2-64 | 50 | .0700 | 47 | .0785 |
| 3-48 | 47 | .0785 | 43 | .0890 |
| 3-56 | 46 | .0810 | 2.30 | .0905 |
| 4-40 | 43 | .0890 | 38 | .1015 |
| 4-48 | 42 | .0935 | 2.60 | .1024 |
| 5-40 | 38 | .1015 | 33 | .1130 |
| 5-44 | 37 | .1040 | 2.90 | .1142 |
| 6-32 | 36 | .1065 | 1/8 | .1250 |
| 6-40 | 33 | .1130 | 3.25 | .1280 |
| 8-32 | 29 | .1360 | 25 | .1495 |
| 8-36 | 29 | .1360 | 24 | .1520 |
| 10-24 | 26 | .1470 | 11/64 | .1719 |
| 10-32 | 21 | .1590 | 16 | .1770 |
| 12-24 | 16 | .1770 | 8 | .1990 |
| 12-28 | 15 | .1800 | 7 | .2010 |
| 1/4-20 | 7 | .2010 | 1 | .2280 |
| 1/4-28 | 3 | .2130 | 15/64 | .2340 |
| 5/16-18 | F | .2570 | L | .2900 |
| 5/16-24 | I | .2720 | M | .2950 |
| 3/8-16 | 5/16 | .3125 | S | .3480 |
| 3/8-24 | Q | .3320 | T | .3580 |
| 7/16-14 | U | .3680 | Y | .4040 |
| 7/16-20 | 25/64 | .3906 | Z | .4130 |
| 1/2-13 | 27/64 | .4219 | 15/32 | .4682 |
| 1/2-20 | 29/64 | .4531 | 12.25 | .4823 |
| 9/16-12 | 31/64 | .4844 | 17/32 | .5312 |
| 9/16-18 | 33/64 | .5156 | 13.50 | .5315 |
| 5/8-11 | 17/32 | .5312 | 14.75 | .5807 |
| 5/8-18 | 37/64 | .5781 | 15.25 | .6004 |
| 3/4-10 | 21/32 | .6562 | 45/64 | .7031 |
| 3/4-16 | 11/16 | .6875 | 23/32 | .7188 |
| 7/8-9 | 49/64 | .7656 | * | * |
| 7/8-14 | 13/16 | .8125 | * | * |
| 1-8 | 7/8 | .8750 | * | * |
| 1-12 | 59/64 | .9219 | * | * |
| 1-1/8 - 7 | 63/64 | .9844 | * | * |
| 1-1/8 - 12 | 1 3/64 | 1.0469 | * | * |
| 1-1/4 - 7 | 1 7/64 | 1.1094 | * | * |
| 1-1/4 - 12 | 1 11/64 | 1.1719 | * | * |
| 1-3/8 - 6 | 1 7/32 | 1.2188 | * | * |
| 1-3/8 - 12 | 1 19/64 | 1.2969 | * | * |
| 1-1/2 - 6 | 1 11/32 | 1.3438 | * | * |
| 1-1/2 - 12 | 1 27/64 | 1.4219 | * | * |

Metric Sizes (measurements in millimeters and inches)

| tap size and pitch | cutting taps drill size (mm) | decimal equiv (in) | forming taps drill size (mm) | decimal equiv. (in) |
|--------------------|------------------------------|--------------------|------------------------------|---------------------|
| M1.6 x 0.35 | 1.25 | .0492 | 1.45 | .0571 |
| M1.8 x 0.35 | 1.45 | .0571 | 1.65 | .0650 |
| M2 x 0.40 | 1.60 | .0630 | 1.80 | .0709 |
| M2.2 x 0.45 | 1.75 | .0689 | 2.00 | .0787 |
| M2.5 x 0.45 | 2.05 | .0807 | 2.30 | .0906 |
| M3 x 0.50 | 2.50 | .0984 | 7/64 | .1094 |
| M3.5 x 0.60 | 2.90 | .1142 | 3.20 | .1260 |
| M4 x 0.70 | 3.30 | .1299 | 3.70 | .1476 |
| M4.5 x 0.75 | 3.70 | .1476 | 4.10 | .1614 |
| M5 x 0.80 | 4.20 | .1654 | 14 | .1820 |
| M6 x 1.00 | 5.00 | .1969 | 7/32 | .2188 |
| M7 x 1.00 | 6.00 | .2362 | F | .2570 |
| M8 x 1.25 | 6.70 | .2638 | 7.40 | .2913 |
| M8 x 1.00 | 7.00 | .2756 | 19/64 | .2969 |
| M10 x 1.50 | 8.50 | .3346 | U | .3680 |
| M10 x 1.25 | 8.70 | .3425 | 9.40 | .3701 |
| M12 x 1.75 | 10.20 | .4016 | 11.20 | .4409 |
| M12 x 1.25 | 10.80 | .4252 | 11.50 | .4528 |
| M14 x 2.00 | 12.00 | .4724 | 33/64 | .5156 |
| M16 x 2.00 | 14.00 | .5512 | 19/32 | .5938 |
| M16 x 1.50 | 14.50 | .5709 | 15.25 | .6004 |
| M18 x 2.50 | 15.50 | .6102 | 39/64 | .6094 |
| M18 x 1.50 | 16.50 | .6496 | 17.25 | .6791 |
| M20 x 2.50 | 17.50 | .6890 | * | * |
| M20 x 1.50 | 18.50 | .7283 | * | * |
| M22 x 2.50 | 19.50 | .7677 | * | * |
| M22 x 1.50 | 20.50 | .8071 | * | * |
| M24 x 3.00 | 21.00 | .8268 | * | * |
| M24 x 2.00 | 22.00 | .8661 | * | * |
| M27 x 3.00 | 24.00 | .9449 | * | * |
| M27 x 2.00 | 25.00 | .9843 | * | * |
| M30 x 3.50 | 26.50 | 1.0433 | * | * |
| M30 x 2.00 | 28.00 | 1.1024 | * | * |
| M33 x 3.50 | 29.50 | 1.1614 | * | * |
| M33 x 2.00 | 31.00 | 1.2205 | * | * |
| M36 x 4.00 | 32.00 | 1.2598 | * | * |
| M36 x 3.00 | 33.00 | 1.2992 | * | * |
| M39 x 4.00 | 35.00 | 1.3780 | * | * |
| M39 x 3.00 | 36.00 | 1.4173 | * | * |

Pipe Tap Sizes (measurements in millimeters and inches)

| nominal pipe tap size | NPT & NPTF | | NPSM | NPSC | NPSF |
|-----------------------|----------------|-------------|----------------|----------|----------|
| | without reamer | with reamer | | | |
| 1/16-27 | C (.242) | A (.234) | — | .250 | D (.246) |
| 1/8-27 | Q (.332) | 21/64 | T (.358) | Q (.332) | R (.339) |
| 1/4-18 | 7/16 | 27/64 | 15/32 | 7/16 | 7/16 |
| 3/8-18 | 9/16 | 9/16 | .603 (special) | 37/64 | 37/64 |
| 1/2-14 | 45/64 | 11/16 | 19,0 mm | 18,0 mm | 18,0 mm |
| 3/4-14 | 29/32 | 57/64 | 61/64 | 59/64 | 59/64 |
| 1 - 11-1/2 | 1-9/64 | 1-1/8 | 1-13/64 | 1-5/32 | 1-5/32 |
| 1-1/4-11-1/2 | 1-31/64 | 1-15/32 | 1-35/64 | 1-1/2 | — |
| 1-1/2 - 11-1/2 | 1-23/32 | 1-45/64 | 1-25/32 | 1-47/64 | — |
| 2 - 11-1/2 | 2-3/16 | 2-11/64 | 2-1/4 | 2-13/64 | — |

* Contact Technical Service for recommendations.
Hole sizes shown may not suit UNJ and MJ hole requirements.



Hardness Conversion Table

Technical Information

Use this table to match the hardness of your workpiece material to the correct tap.

| 10 M/M Ball 3000 Kg | 120° Cone 150 Kg | 1/16" Ball 100 Kg | Model C | 1000 Lb. per Sq. In. | 10 M/M Ball 3000 Kg | 120° Cone 150 Kg | 1/16" Ball 100 Kg | Model C | 1000 Lb. per Sq. In. |
|---------------------------|------------------------|-------------------------|----------------------|----------------------------|---------------------------|------------------------|-------------------------|----------------------|----------------------------|
| Brinell | Rockwell C | Rockwell B | Shore Scleroscope | Tensile Strength | Brinell | Rockwell C | Rockwell B | Shore Scleroscope | Tensile Strength |
| 800 | 72 | — | 100 | — | 276 | 30 | 105 | 42 | 136 |
| 780 | 71 | — | 99 | — | 269 | 29 | 104 | 41 | 132 |
| 760 | 70 | — | 98 | — | 261 | 28 | 103 | 40 | 129 |
| 745 | 68 | — | 97 | 367 | 258 | 27 | 102 | 39 | 127 |
| 725 | 67 | — | 96 | 357 | 255 | 26 | 102 | 39 | 125 |
| 712 | 66 | — | 95 | 350 | 249 | 25 | 101 | 38 | 123 |
| 682 | 65 | — | 93 | 337 | 245 | 24 | 100 | 37 | 119 |
| 668 | 64 | — | 91 | 326 | 240 | 23 | 99 | 36 | 117 |
| 652 | 63 | — | 89 | 318 | 237 | 23 | 99 | 35 | 115 |
| 626 | 62 | — | 87 | 306 | 229 | 22 | 98 | 34 | 113 |
| 614 | 61 | — | 85 | 299 | 224 | 21 | 97 | 33 | 110 |
| 601 | 60 | — | 83 | 292 | 217 | 20 | 96 | 33 | 107 |
| 590 | 59 | — | 81 | 290 | 211 | 19 | 95 | 32 | 104 |
| 576 | 57 | — | 79 | 281 | 206 | 18 | 94 | 32 | 102 |
| 552 | 56 | — | 76 | 270 | 203 | 17 | 94 | 31 | 100 |
| 545 | 55 | — | 75 | 268 | 200 | 16 | 93 | 31 | 98 |
| 529 | 54 | — | 74 | 259 | 196 | 15 | 92 | 30 | 96 |
| 514 | 53 | 120 | 72 | 254 | 191 | 14 | 92 | 30 | 94 |
| 502 | 52 | 119 | 70 | 247 | 187 | 13 | 91 | 29 | 92 |
| 495 | 51 | 119 | 69 | 244 | 185 | 12 | 91 | 29 | 91 |
| 477 | 49 | 118 | 67 | 233 | 183 | 11 | 90 | 28 | 90 |
| 461 | 48 | 117 | 66 | 227 | 180 | 10 | 89 | 28 | 89 |
| 451 | 47 | 117 | 65 | 223 | 175 | 9 | 88 | 27 | 86 |
| 444 | 46 | 116 | 64 | 219 | 170 | 7 | 87 | 27 | 84 |
| 427 | 45 | 115 | 62 | 209 | 167 | 6 | 87 | 27 | 82 |
| 415 | 44 | 115 | 60 | 204 | 165 | 5 | 86 | 26 | 81 |
| 401 | 43 | 114 | 58 | 196 | 163 | 4 | 85 | 26 | 80 |
| 388 | 42 | 114 | 57 | 191 | 160 | 3 | 84 | 25 | 78 |
| 375 | 41 | 113 | 55 | 184 | 156 | 2 | 83 | 25 | 76 |
| 370 | 40 | 112 | 54 | 182 | 154 | 1 | 82 | 25 | 75 |
| 362 | 39 | 111 | 53 | 179 | 152 | — | 82 | 24 | 74 |
| 351 | 38 | 111 | 51 | 173 | 150 | — | 81 | 24 | 74 |
| 346 | 37 | 110 | 50 | 170 | 147 | — | 80 | 24 | 72 |
| 341 | 37 | 110 | 49 | 168 | 145 | — | 79 | 23 | 71 |
| 331 | 36 | 109 | 47 | 163 | 143 | — | 79 | 23 | 70 |
| 323 | 35 | 109 | 46 | 158 | 141 | — | 78 | 23 | 69 |
| 311 | 34 | 108 | 46 | 153 | 140 | — | 77 | 22 | 69 |
| 301 | 33 | 107 | 45 | 148 | 135 | — | 75 | 22 | 67 |
| 293 | 32 | 106 | 44 | 144 | 130 | — | 72 | 22 | 65 |
| 285 | 31 | 105 | 43 | 140 | | | | | |

TECHNICAL

High Speed Steel





Standard Tap Marking System

Technical Information

Taps, dies, and other threading tools will be marked with the nominal size, number of threads per inch, and the proper symbol to identify the thread form. The symbols below are in agreement with the ASME B1.7 1965 (R 1972) Standard on nomenclature, definitions and letter symbols for screw threads and other national standards.

| Symbol | Reference |
|--------|--|
| ACME-C | Acme Thread-Centralizing |
| ACME-G | Acme Thread-General Purpose |
| AMO | American Standard Microscope Objective Thread |
| ANPT | Aeronautical National Form Taper Pipe Thread (Ground Thread Tap marked NPT) |
| BA | British Association Standard Thread |
| BSF | British Standard Fine Thread Series |
| BSPP | British Standard Pipe (Parallel) Thread |
| BSPT | British Standard Taper Pipe Thread |
| BSW | British Standard Whitworth Coarse Thread Series |
| M | Metric Standard Threads |
| N | American National 8, 12 and 16 Thread Series (8N, 12N, 16N) |
| N BUTT | American Buttress Thread |
| NC | American National Coarse Thread Series |
| NEF | American National Extra-Fine Thread Series |
| NF | American National Fine Thread Series |
| NGO | National Gas Outlet Thread (specify right or left hand) |
| NGS | National Gas Straight Thread |
| NGT | National Gas Taper Thread (See also "SGT") |
| NH | American National Hose Coupling & Firehose Coupling Threads |
| NPS | For Tap marking Only (See NPSC, NPSM) |
| NPSC | American National Standard Straight Pipe Thread in Pipe Couplings (Tap Marked NPS) |
| NPSF | Dryseal American National Standard Fuel Internal Straight Pipe Thread |
| NPSH | American National Standard Straight Pipe Thread for Hose Couplings |
| NPSI | Dryseal American National Standard Intermediate Internal Straight Pipe Thread |
| NPSL | American National Standard Straight Pipe Thread for Loose-Fitting Mechanical Joints with locknuts. |
| NPSM | American National Standard Straight Pipe Threads for Free-Fitting Mechanical Joints for Fixtures (Tap Marked NPS)" |
| NPT | American National Standard Taper Pipe Thread (see ANPT, NPTR) |

| Symbol | Reference |
|-----------|--|
| NPTF | Dryseal American National Standard Taper Pipe Thread |
| NPTR | American National Standard Taper Pipe Thread for Railing Joints (Tap Marked NPT) |
| NR | American National Thread with a 0.108p to 0.144p Controlled Root Radius |
| NS | American National Thread-Special |
| PTF-SAE | Short Dryseal SAE Short Taper Pipe Thread |
| SGT | Special Gas Taper Thread |
| SPL-PTF | Dryseal Special Taper Pipe Thread |
| STI | Special Thread for Helical Coil Wire Screw Thread Inserts |
| Stub Acme | Stub Acme Thread |
| *UN | Unified Constant-Pitch Thread Series |
| *UNC | Unified Coarse Thread Series |
| *UNEF | Unified Extra-Fine Thread Series |
| *UNF | Unified Fine Thread Series |
| UNJ | Unified Thread Series with a 0.150llp to 0.18042p Controlled Root Radius on External Thread only. |
| UNJC | Unified Coarse Thread Series with a 0.150llp to 0.18042p Controlled Root Radius on External Thread only. |
| UNJF | Unified Fine Thread Series with a 0.150llp to 0.18042p Controlled Root Radius on External Thread only. |
| UNM | Unified Miniature Thread Series |
| UNR | Unified Constant-pitch Thread Series with a 0.108p to 0.144p Controlled Root Radius |
| UNRC | Unified Coarse Thread Series with a 0.108p to 0.144p Controlled Root Radius |
| UNRF | Unified Fine Thread Series with a 0.108p to 0.144p Controlled Root Radius |
| *UNS | Unified Thread-Special |
| V | A 60 "V" thread with Truncated Crest and Root. The theoretical "V" Form is usually flattened to the user's specifications. |

*Taps are not marked with "U", but with the symbol for the corresponding American Standard thread form with which it is compatible.

TECHNICAL

High Speed Steel





These taps were developed for the highest cutting performance to cope with the increasing demands placed on industrial thread cutting. By optimizing the cutting geometry, substrate material, and surface treatment the tap will achieve the best results in CNC as well as in conventional thread cutting environments.

Our **Progress series** of taps are designed to be a "Universal" tool that performs well in a wide range of Steel Alloys as well as Stainless Steels and Ductile Irons. Our **Performance series** of taps are designed for those difficult jobs including Stainless Steels but work well in Steel Alloys and Ductile Irons.

| Material | | Application | | | Tapping Speed (SFM) | | |
|--|-----|---|-------|----------|---|-------|----------|
| | | 1 = First Choice, 2 = Second Choice, (3) = Also Suitable | | | Vc = SFM RPM = (SFM/Diameter) x 3.82 | | |
| | | Black Oxide | TiAlN | Hardlube | Black Oxide | TiAlN | Hardlube |
| Structural steels < 1000 N/mm ² | G01 | | 1 | | 40 | 73 | 77 |
| Structural steels > 1000 N/mm ² | G02 | | (3) | 1 | 27 | 40 | 42 |
| Case hardening steels < 1000 N/mm ² | G03 | | 2 | 1 | 33 | 66 | 70 |
| Case hardening steels > 1000 N/mm ² | G04 | | (3) | 1 | 20 | 33 | 35 |
| Heat treatable steels < 1000 N/mm ² | G05 | | 2 | 1 | 20 | 46 | 49 |
| Heat treatable steels > 1000 N/mm ² | G06 | | (3) | 1 | 14 | 27 | 29 |
| Nitriding steels | G07 | (3) | 2 | 1 | 14 | 27 | 29 |
| Carbon tool steels | G08 | | 1 | 2 | 20 | 30 | 32 |
| Heat Resisting Steels < 1400 N/mm ² | G09 | (3) | (3) | 1 | 14 | 23 | 25 |
| Cr Stainless Steels, Sulphured | G10 | (3) | (3) | 1 | 20 | 33 | 35 |
| Cr Stainless Steels, Ferric & Martensitic | G11 | (3) | (3) | 1 | 20 | 33 | 35 |
| Cr-Ni Stainless Steels, Austenitic | G12 | (3) | (3) | 1 | 17 | 27 | 29 |
| Free Cutting Steels | G13 | | 1 | | 46 | 79 | 83 |
| Cast Steels < 1000 N/mm ² | G14 | | 1 | | 33 | 53 | 56 |
| Cast Steels > 900 N/mm ² | G15 | | 2 | 1 | 20 | 27 | 29 |
| Malleable Cast Iron | G16 | | (3) | | 33 | 53 | 56 |
| Nodular Graphite Cast Iron | G17 | | (3) | | 40 | 53 | 56 |
| Lamellar Graphite Cast Iron (Grey Cast Iron) | G18 | | (3) | | 33 | 46 | 49 |
| Vermicular Graphite Cast Iron | G19 | | (3) | | 40 | 53 | 56 |
| Copper | G20 | | (3) | | 33 | 53 | 56 |
| Hard Brass -- Short Chipping | G21 | | (3) | | 66 | 115 | 121 |
| Soft Brass -- Long Chipping | G22 | | (3) | | 60 | 109 | 115 |
| Red Brass | G23 | | (3) | | 33 | 60 | 63 |
| Phosphor Bronze | G24 | | (3) | | 40 | 69 | 73 |
| Aluminum Alloy - Wrought | G25 | | (3) | | 50 | 79 | 83 |
| Aluminum Alloy - Cast (0.5% to 5% Silicon) | G26 | | (3) | | 66 | 86 | 91 |
| Aluminum Alloy - Cast (5% to 10% Silicon) | G27 | | (3) | | 66 | 86 | 91 |
| Aluminum Alloy - Cast (> 10% Silicon) | G28 | | (3) | | 66 | 86 | 91 |
| Magnesium Alloy - Wrought | G29 | | (3) | | 50 | 79 | 83 |
| Magnesium Alloy - Cast | G30 | | (3) | | 66 | 86 | 91 |
| Nickel Alloy | G31 | | (3) | | 14 | 20 | 21 |
| Titanium Alloy | G32 | | (3) | | 14 | 20 | 21 |
| Ferro - TiC | G33 | | (3) | | 14 | 20 | 21 |
| Thermoplastic Compounds/Synthetics | G34 | | (3) | | 66 | 66 | 70 |
| High Strength Structural Steels - Fine Grained | G35 | | (3) | | 20 | 33 | 35 |



Consider these factors when trying to determine the best tapping speeds.

- Material to be tapped
- Length of chamfer on tap
- Percentage of full thread to be cut
- Length of hole (depth of thread)
- Pitch of thread
- Cutting fluids
- Machine equipment
- Horizontal or vertical tapping

The best and most efficient operating speeds for taps cannot be calculated with the same certainty as for many other metalcutting tools. With other tools, the feed per revolution can be set at any desired point and can be varied as conditions demand. Taps, on the other hand, must always be advanced at a rate equal to one pitch for every revolution. The style of tap may vary the conditions. For example, with a bottoming tap, the first thread on each land cuts the full height of thread, while, with a taper or starting tap, a number of threads do their share of the cutting before the full height of thread is reached.

The depth of thread also varies, depending on the pitch. The coarser the thread, the greater the advance of the tap per revolution and the greater the amount of material removed.

The method of feeding the tap, and the type of equipment for driving, also influence the permissible speeds. If taps are mechanically fed at the proper rate of advance, they can be operated at higher speeds than if they are required to feed themselves and pull some part of the machine along with them.

Speeds may be modified to take into account any or all of the factors listed above. Speeds must be lowered as the length of thread increases, because, in deep thread holes, the accumulated chips increase friction and interfere with lubrication.

Bottoming taps must be run slower than plug taps.

Tapping of full height of thread calls for slower speed than if the commercial 75% height only is required.

Coarse-thread taps in the larger diameters should be run more slowly than fine-thread taps of the same diameters.

The quantity and quality of cutting fluid may affect the permissible speeds as much as 100%.

Taper threaded taps, such as pipe taps, should be operated from 1/2 to 3/4 the speed of a straight thread tap of comparable major diameter.

TECHNICAL
High Speed Steel

Tapping Definitions

- SFM = Surface Feet per Minute
- RPM = Revolutions Per Minute
- IPM = Inches Per Minute
- TPI = Threads Per Inch
- S m/m = Surface Meters per Minute
- $p = 3.1416$
- mm/m = Millimeters per Minute
- P = Pitch (1/ No of Threads Per Inch)

Tapping Formula

Inch Sizes

- SFM = $(RPM \times \text{tool diameter}) / 3.82$
or $0.262 \times RPM \times \text{tool diameter}$
- RPM = $(3.82 \times SFM) / \text{tool diameter}$
- IPM = RPM / TPI^*
or $*P \times RPM$

Metric Sizes

- S m/m = $(p \times \text{tool diameter} \times RPM) / 1000$
- RPM = $(m/m \times 1000) / p \times \text{tool diameter}$
- mm/m = $mm P \times RPM$





Technical Information

Tapping Speeds

UNC/UNF and NPT/NPTF Sizes

| UNC UNF Tap Size | NPT NPTF Taper Pipe | Surface Feet per Minute (SFM) | | | | | | | | | | | | | | | | | |
|---------------------------|------------------------------|-------------------------------|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | | 5' | 10' | 15' | 20' | 25' | 30' | 40' | 50' | 60' | 70' | 80' | 90' | 100' | 110' | 120' | 130' | 140' | 150' |
| 0 | | 318 | 637 | 955 | 1273 | 1592 | 1910 | 2546 | 3183 | 3820 | 4456 | 5093 | 5729 | 6366 | 7003 | 7639 | 8276 | 8913 | 9549 |
| 1 | | 273 | 546 | 819 | 1046 | 1308 | 1570 | 2093 | 2617 | 3140 | 3663 | 4186 | 4710 | 5233 | 5756 | 6279 | 6805 | 7326 | 1849 |
| 2 | | 212 | 424 | 637 | 888 | 1110 | 1333 | 1777 | 2221 | 2665 | 3109 | 3554 | 3999 | 4442 | 4886 | 5330 | 5774 | 6218 | 6662 |
| 3 | | 191 | 382 | 573 | 772 | 964 | 1157 | 1543 | 1929 | 2315 | 2701 | 3086 | 3472 | 3858 | 4244 | 4629 | 5015 | 5401 | 5787 |
| 4 | | 174 | 347 | 521 | 682 | 853 | 1023 | 1364 | 1705 | 2046 | 2387 | 2728 | 3069 | 3411 | 3751 | 4092 | 4434 | 4775 | 5115 |
| 5 | | 147 | 294 | 441 | 611 | 764 | 917 | 1222 | 1528 | 1833 | 2139 | 2445 | 2750 | 3056 | 3361 | 3667 | 3973 | 4278 | 4584 |
| 6 | | 136 | 273 | 409 | 553 | 691 | 829 | 1106 | 1382 | 1859 | 1935 | 2212 | 2488 | 2766 | 3042 | 3318 | 3595 | 3871 | 4148 |
| 8 | | 119 | 239 | 358 | 466 | 583 | 699 | 932 | 1165 | 1398 | 1631 | 1864 | 2097 | 2330 | 2563 | 2796 | 3029 | 3262 | 3495 |
| 10 | | 101 | 201 | 302 | 402 | 502 | 603 | 804 | 1005 | 1205 | 1406 | 1607 | 1808 | 2009 | 2210 | 2411 | 2612 | 2813 | 3014 |
| 12 | | 87 | 174 | 260 | 354 | 442 | 531 | 707 | 884 | 1061 | 1238 | 1415 | 1592 | 1769 | 1945 | 2122 | 2300 | 2476 | 2653 |
| 1/4 | | 76 | 153 | 229 | 306 | 382 | 458 | 611 | 764 | 917 | 1070 | 1222 | 1375 | 1528 | 1681 | 1833 | 1986 | 2139 | 2292 |
| 5/16 | | 62 | 123 | 185 | 245 | 306 | 367 | 489 | 611 | 733 | 856 | 978 | 1100 | 1222 | 1345 | 1467 | 1589 | 1711 | 1833 |
| 3/8 | | 50 | 101 | 151 | 204 | 255 | 305 | 407 | 509 | 611 | 713 | 815 | 917 | 1019 | 1120 | 1222 | 1324 | 1426 | 1528 |
| 7/16 | 1/8 | 43 | 87 | 130 | 175 | 219 | 262 | 349 | 437 | 524 | 611 | 698 | 786 | 873 | 960 | 1048 | 1135 | 1222 | 1310 |
| 1/2 | — | 38 | 76 | 115 | 153 | 191 | 229 | 305 | 382 | 458 | 535 | 611 | 688 | 764 | 840 | 917 | 993 | 1070 | 1146 |
| 9/16 | 1/4 | 34 | 68 | 102 | 137 | 172 | 206 | 274 | 342 | 410 | 478 | 547 | 616 | 683 | 752 | 820 | 888 | 952 | 1020 |
| 5/8 | — | 32 | 64 | 96 | 122 | 153 | 183 | 244 | 306 | 367 | 428 | 489 | 550 | 611 | 672 | 733 | 794 | 856 | 917 |
| 11/16 | 3/8 | 28 | 55 | 83 | 111 | 138 | 167 | 222 | 278 | 333 | 389 | 444 | 500 | 556 | 611 | 667 | 722 | 778 | 833 |
| 3/4 | — | 25 | 51 | 76 | 102 | 128 | 153 | 203 | 255 | 305 | 357 | 407 | 458 | 509 | 560 | 611 | 662 | 713 | 764 |
| 7/8 | 1/2 | 22 | 43 | 65 | 87 | 109 | 131 | 175 | 218 | 262 | 306 | 350 | 392 | 437 | 480 | 524 | 568 | 611 | 655 |
| 1 | — | 19 | 38 | 57 | 76 | 96 | 115 | 153 | 191 | 230 | 268 | 305 | 344 | 382 | 420 | 458 | 497 | 535 | 573 |
| 1-1/8 | 3/4 | 17 | 34 | 51 | 68 | 84 | 102 | 136 | 170 | 204 | 238 | 272 | 306 | 340 | 373 | 407 | 441 | 475 | 509 |
| 1-1/4 | — | 15 | 31 | 46 | 61 | 76 | 92 | 122 | 153 | 183 | 214 | 244 | 275 | 305 | 336 | 367 | 397 | 428 | 458 |
| 1-3/8 | 1 | 14 | 28 | 42 | 56 | 69 | 83 | 111 | 139 | 167 | 194 | 222 | 250 | 278 | 306 | 333 | 361 | 389 | 417 |
| 1-1/2 | — | 13 | 25 | 38 | 51 | 63 | 76 | 102 | 127 | 153 | 178 | 204 | 229 | 255 | 280 | 305 | 331 | 356 | 382 |
| 1-5/8 | | 12 | 23 | 35 | 47 | 59 | 71 | 94 | 118 | 141 | 165 | 188 | 212 | 235 | 259 | 282 | 306 | 329 | 353 |
| 1-3/4 | | 11 | 22 | 33 | 44 | 55 | 65 | 87 | 109 | 131 | 153 | 175 | 196 | 218 | 240 | 262 | 284 | 306 | 327 |
| 1-7/8 | | 10 | 20 | 30 | 41 | 51 | 61 | 81 | 102 | 122 | 143 | 163 | 183 | 204 | 224 | 244 | 265 | 285 | 306 |
| 2 | | 9 | 19 | 29 | 38 | 48 | 57 | 76 | 96 | 115 | 134 | 153 | 172 | 191 | 210 | 229 | 248 | 267 | 287 |

TECHNICAL High Speed Steel

Metric Sizes

| Tap Size | Surface Feet per Minute (SFM) | | | | | | | | | | | | | | | | | |
|-------------|-------------------------------|-----|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
| | 5' | 10' | 15' | 20' | 25' | 30' | 40' | 50' | 60' | 70' | 80' | 90' | 100' | 110' | 120' | 130' | 140' | 150' |
| M1 | 490 | 979 | 1469 | 1959 | 2449 | 2938 | 3918 | 4897 | 5877 | 6856 | 7836 | 8815 | 9795 | 10774 | 11754 | 12733 | 13713 | 14692 |
| M2 | 242 | 484 | 725 | 967 | 1209 | 1451 | 1934 | 2418 | 2901 | 3385 | 3868 | 4352 | 4835 | 5319 | 5803 | 6286 | 6770 | 7253 |
| M3 | 162 | 324 | 486 | 647 | 809 | 971 | 1295 | 1619 | 1942 | 2266 | 2590 | 2914 | 3237 | 3561 | 3885 | 4208 | 4532 | 4856 |
| M3.5 | 138 | 277 | 415 | 554 | 692 | 830 | 1107 | 1384 | 1661 | 1938 | 2214 | 2491 | 2768 | 3045 | 3322 | 3599 | 3875 | 4152 |
| M4 | 122 | 243 | 365 | 487 | 608 | 730 | 973 | 1217 | 1460 | 1703 | 1946 | 2190 | 2433 | 2676 | 2920 | 3163 | 3406 | 3650 |
| M5 | 97 | 194 | 291 | 388 | 485 | 582 | 776 | 970 | 1163 | 1357 | 1551 | 1745 | 1939 | 2133 | 2327 | 2521 | 2715 | 2905 |
| M6 | 81 | 162 | 243 | 324 | 405 | 486 | 647 | 809 | 971 | 1133 | 1295 | 1457 | 1619 | 1781 | 1942 | 2104 | 2266 | 2428 |
| M7 | 69 | 138 | 208 | 277 | 346 | 415 | 554 | 692 | 830 | 969 | 1107 | 1246 | 1384 | 1522 | 1661 | 1799 | 1938 | 2076 |
| M8 | 61 | 121 | 182 | 243 | 303 | 364 | 485 | 606 | 728 | 849 | 970 | 1091 | 1213 | 1334 | 1455 | 1577 | 1698 | 1819 |
| M10 | 48 | 97 | 145 | 194 | 242 | 291 | 388 | 485 | 582 | 679 | 776 | 873 | 970 | 1067 | 1163 | 1260 | 1357 | 1454 |
| M12 | 40 | 81 | 121 | 162 | 202 | 243 | 324 | 405 | 486 | 567 | 647 | 728 | 809 | 890 | 971 | 1052 | 1133 | 1214 |
| M14 | 35 | 69 | 104 | 139 | 173 | 208 | 277 | 347 | 416 | 485 | 555 | 624 | 693 | 763 | 832 | 901 | 971 | 1040 |
| M16 | 30 | 61 | 91 | 121 | 152 | 182 | 243 | 303 | 364 | 424 | 485 | 546 | 606 | 667 | 728 | 788 | 849 | 910 |
| M18 | 27 | 54 | 81 | 108 | 135 | 162 | 216 | 269 | 323 | 377 | 431 | 485 | 539 | 593 | 647 | 700 | 754 | 808 |
| M20 | 24 | 49 | 73 | 97 | 121 | 146 | 194 | 243 | 291 | 340 | 388 | 437 | 485 | 534 | 582 | 631 | 680 | 728 |
| M22 | 22 | 44 | 66 | 88 | 110 | 132 | 176 | 221 | 265 | 309 | 353 | 397 | 441 | 485 | 529 | 573 | 618 | 662 |
| M24 | 20 | 40 | 61 | 81 | 101 | 121 | 162 | 202 | 243 | 283 | 323 | 364 | 404 | 445 | 485 | 526 | 566 | 606 |
| M27 | 18 | 36 | 54 | 72 | 90 | 108 | 144 | 180 | 216 | 252 | 287 | 323 | 359 | 395 | 431 | 467 | 503 | 539 |
| M30 | 16 | 32 | 49 | 65 | 81 | 97 | 129 | 162 | 194 | 226 | 259 | 291 | 323 | 356 | 388 | 420 | 453 | 485 |

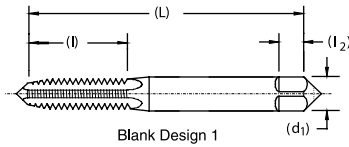


Standard Tap Dimensions

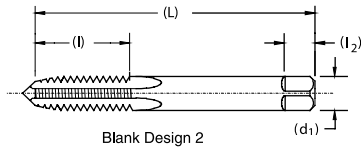
Ground Thread

Technical Information

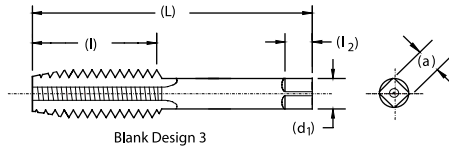
USCTI Table 302



Blank Design 1



Blank Design 2



Blank Design 3

TECHNICAL High Speed Steel

| nominal diameter range inches over to (inc.) | machine screw size number inches | nominal fractional diameter inches | nominal metric diameter millimeters (inches) | blank design no. | L overall length | l thread length | l ₂ square length | d ₁ shank diameter | a square size |
|--|----------------------------------|------------------------------------|--|------------------|------------------|-----------------|------------------------------|-------------------------------|---------------|
| .052 .065 | 0 (.0600) | | M1.6 (.0630) | 1 | 1.63 | .31 | .19 | .1410 | .110 |
| .065 .078 | 1 (.0730) | | M1.8 (.0709) | 1 | 1.69 | .38 | .19 | .1410 | .110 |
| .078 .091 | 2 (.0860) | | M2 (0787) M2.2 (.0866) | 1 | 1.75 | .44 | .19 | .1410 | .110 |
| .091 .104 | 3 (.0990) | | M2.5 (.0984) | 1 | 1.81 | .50 | .19 | .1410 | .110 |
| .104 .117 | 4 (.1120) | | | 1 | 1.88 | .56 | .19 | .1410 | .110 |
| .117 .130 | 5 (.1250) | | M3 (.1181) | 1 | 1.94 | .63 | .19 | .1410 | .110 |
| .130 .145 | 6 (.1380) | | M3.5 (.1378) | 1 | 2.00 | .69 | .19 | .1410 | .110 |
| .145 .171 | 8 (.1640) | | M4 (.1575) | 1 | 2.13 | .75 | .25 | .1680 | .131 |
| .171 .197 | 10 (.1900) | | M4.5 (.1772) M5 (.1969) | 1 | 2.38 | .88 | .25 | .1940 | .152 |
| .197 .223 | 12 (.2160) | | | 1 | 2.38 | .94 | .28 | .2200 | .165 |
| .223 .260 | | 1/4 (.2500) | M6 (.2362) | 2 | 2.50 | 1.00 | .31 | .2550 | .191 |
| .260 .323 | | 5/16 (.3125) | M7 (.2756) M8 (.3150) | 2 | 2.72 | 1.13 | .38 | .3180 | .238 |
| .323 .395 | | 3/8 (.3750) | M10 (.3937) | 2 | 2.94 | 1.25 | .44 | .3810 | .286 |
| .395 .448 | | 7/16 (.4375) | | 3 | 3.16 | 1.44 | .41 | .3230 | .242 |
| .448 .510 | | 1/2 (.5000) | M12 (.4724) | 3 | 3.38 | 1.66 | .44 | .3670 | .275 |
| .510 .573 | | 9/16 (.5625) | M14 (.5512) | 3 | 3.59 | 1.66 | .50 | .4290 | .322 |
| .573 .635 | | 5/8 (.6250) | M16 (.6299) | 3 | 3.81 | 1.81 | .56 | .4800 | .360 |
| .635 .709 | | 11/16 (.6875) | M18 (.7087) | 3 | 4.03 | 1.81 | .63 | .5420 | .406 |
| .709 .760 | | 3/4 (.7500) | | 3 | 4.25 | 2.00 | .69 | .5900 | .442 |
| .760 .823 | | 13/16 (.8125) | M20 (.7874) | 3 | 4.47 | 2.00 | .69 | .6520 | .489 |
| .823 .885 | | 7/8 (.8750) | M22 (.8661) | 3 | 4.69 | 2.22 | .75 | .6970 | .523 |
| .885 .948 | | 15/16 (.9375) | M24 (.9449) | 3 | 4.91 | 2.22 | .75 | .7600 | .570 |
| .948 1.010 | | 1 (1.0000) | M25 (.9843) | 3 | 5.13 | 2.50 | .81 | .8000 | .600 |
| 1.010 1.073 | | 1-1/16 (1.0625) | M27 (1.0630) | 3 | 5.13 | 2.50 | .88 | .8960 | .672 |
| 1.073 1.135 | | 1-1/8 (1.1250) | | 3 | 5.44 | 2.56 | .88 | .8960 | .672 |
| 1.135 1.198 | | 1-3/16 (1.1875) | M30 (1.1811) | 3 | 5.44 | 2.56 | 1.00 | 1.0210 | .766 |
| 1.198 1.260 | | 1-1/4 (1.2500) | | 3 | 5.75 | 2.56 | 1.00 | 1.0210 | .766 |
| 1.260 1.323 | | 1-5/16 (1.3125) | M33 (1.2992) | 3 | 5.75 | 2.56 | 1.06 | 1.1080 | .831 |
| 1.323 1.385 | | 1-3/8 (1.3750) | | 3 | 6.06 | 3.00 | 1.06 | 1.1080 | .831 |
| 1.385 1.448 | | 1-7/16 (1.4375) | M36 (1.4173) | 3 | 6.06 | 3.00 | 1.13 | 1.2330 | .925 |
| 1.448 1.510 | | 1-1/2 (1.5000) | | 3 | 6.38 | 3.00 | 1.13 | 1.2330 | .925 |
| 1.510 1.635 | | 1-5/8 (1.6250) | M39 (1.5354) | 3 | 6.69 | 3.19 | 1.13 | 1.3050 | .979 |
| 1.635 1.760 | | 1-3/4 (1.7500) | M42 (1.6535) | 3 | 7.00 | 3.19 | 1.25 | 1.4300 | 1.072 |
| 1.760 1.885 | | 1-7/8 (1.8750) | | 3 | 7.31 | 3.56 | 1.25 | 1.5190 | 1.139 |
| 1.885 2.010 | | 2 (2.0000) | M48 (1.8898) | 3 | 7.63 | 3.56 | 1.38 | 1.6440 | 1.233 |
| 2.010 2.135 | | 2 1/8 (2.1250) | | 3 | 8.00 | 3.56 | 1.38 | 1.7690 | 1.327 |
| 2.135 2.260 | | 2 1/4 (2.2500) | M56 (2.2047) | 3 | 8.25 | 3.56 | 1.44 | 1.8940 | 1.420 |
| 2.260 2.385 | | 2 3/8 (2.3750) | | 3 | 8.50 | 4.00 | 1.44 | 2.0190 | 1.514 |
| 2.385 2.510 | | 2 1/2 (2.5000) | | 3 | 8.75 | 4.00 | 1.50 | 2.1000 | 1.575 |
| 2.510 2.635 | | 2 5/8 (2.6250) | M64 (2.5197) | 3 | 8.75 | 4.00 | 1.50 | 2.2250 | 1.669 |
| 2.635 2.760 | | 2 3/4 (2.7500) | | 3 | 9.25 | 4.00 | 1.56 | 2.3500 | 1.762 |
| 2.760 2.885 | | 2 7/8 (2.8750) | M72 (2.8346) | 3 | 9.25 | 4.00 | 1.56 | 2.4750 | 1.856 |
| 2.885 3.010 | | 3 (3.0000) | | 3 | 9.75 | 4.56 | 1.63 | 2.5430 | 1.907 |
| 3.010 3.135 | | 3 1/8 (3.1250) | | 3 | 9.75 | 4.56 | 1.63 | 2.6680 | 2.001 |
| 3.135 3.260 | | 3 1/4 (3.2500) | M80 (3.1496) | 3 | 10.00 | 4.56 | 1.75 | 2.7930 | 2.095 |
| 3.260 3.385 | | 3 3/8 (3.3750) | | 3 | 10.00 | 4.56 | 1.75 | 2.8830 | 2.162 |
| 3.385 3.510 | | 3 1/2 (3.5000) | | 3 | 10.25 | 4.94 | 2.00 | 3.0080 | 2.256 |
| 3.510 3.635 | | 3 5/8 (3.6250) | M90 (3.5433) | 3 | 10.25 | 4.94 | 2.00 | 3.1330 | 2.350 |
| 3.635 3.760 | | 3 3/4 (3.7500) | | 3 | 10.50 | 5.31 | 2.13 | 3.2170 | 2.413 |
| 3.760 3.885 | | 3 7/8 (3.8750) | | 3 | 10.50 | 5.31 | 2.13 | 3.3420 | 2.506 |
| 3.885 4.010 | | 4 (4.0000) | M100 (3.9370) | 3 | 10.75 | 5.31 | 2.25 | 3.4670 | 2.600 |

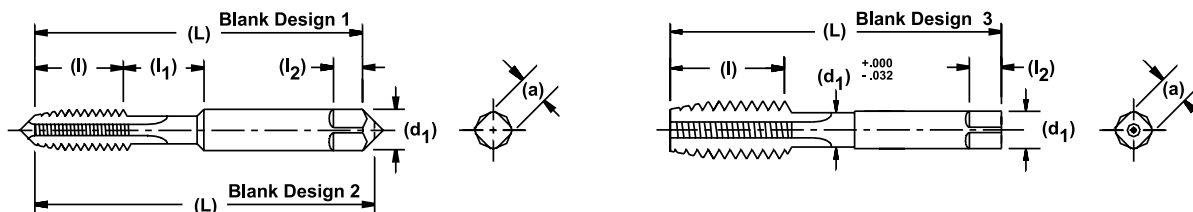


Technical Information

| Element | Nominal Diameter Range in inches | | Direction | Tolerance inches |
|--|----------------------------------|-----------|---------------|------------------|
| | Over | To (inc.) | | |
| Length Overall - L | .0520 | 1.0100 | Plus or Minus | .031 |
| | 1.0100 | 4.0100 | Plus or Minus | .063 |
| Length of Thread - I | .0520 | .2230 | Plus or Minus | .047 |
| | .2230 | .5100 | Plus or Minus | .063 |
| | .5100 | 1.5100 | Plus or Minus | .094 |
| | 1.5100 | 4.0100 | Plus or Minus | .125 |
| Length of square - l₂ | .0520 | 1.0100 | Plus or Minus | .031 |
| | 1.0100 | 4.0100 | Plus or Minus | .063 |
| | | | | |
| Diameter of shank - d₁ | .0520 | .2230 | Minus | .0015 |
| | .2230 | .6350 | Minus | .0015 |
| | .6350 | 1.0100 | Minus | .0020 |
| | 1.0100 | 1.5100 | Minus | .0020 |
| | 1.5100 | 2.0100 | Minus | .0030 |
| | 2.0100 | 4.0100 | Minus | .0030 |
| Size of square - a | .0520 | .5100 | Minus | .004 |
| | .5100 | 1.0100 | Minus | .006 |
| | 1.0100 | 2.0100 | Minus | .008 |
| | 2.0100 | 4.0100 | Minus | .010 |

Optional Neck and Shortened Thread Length

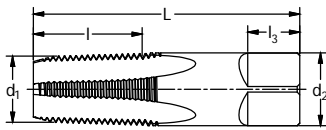
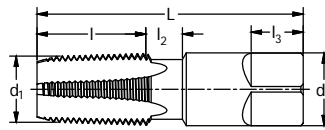
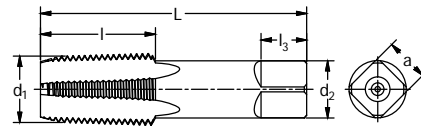
USCTI Table 302A



| nominal diameter range inches over to (inc.) | | machine screw size number inches | nominal fractional diameter inches | nominal metric diameter millimeters (inches) | | blank design no. | L overall length | I thread length | I ₁ neck length | I ₂ square length | d ₁ shank diameter | a square size |
|--|-------|----------------------------------|------------------------------------|--|-----------|------------------|------------------|-----------------|----------------------------|------------------------------|-------------------------------|---------------|
| .104 | .117 | 4 (.1120) | | | | 1 | 1.88 | .31 | .25 | .19 | .1410 | .110 |
| .117 | .130 | 5 (.1250) | | M3 | (.1181) | 1 | 1.94 | .31 | .31 | .19 | .1410 | .110 |
| .130 | .145 | 6 (.1380) | | M3.5 | (.1378) | 1 | 2.00 | .38 | .31 | .19 | .1410 | .110 |
| .145 | .171 | 8 (.1640) | | M4 | (.1575) | 1 | 2.13 | .38 | .38 | .25 | .1680 | .131 |
| .171 | .197 | 10 (.1900) | | M4.5 | (.1772) | 1 | 2.38 | .50 | .38 | .25 | .1940 | .152 |
| | | | | M5 | (.1969) | | | | | | | |
| .197 | .223 | 12 (.2160) | | | | 1 | 2.38 | .50 | .44 | .28 | .2200 | .165 |
| .223 | .260 | | 1/4 (.2500) | M6 | (.2362) | 2 | 2.50 | .63 | .38 | .31 | .2550 | .191 |
| .260 | .323 | | 5/16 (.3125) | M7(.2756) | M8(.3150) | 2 | 2.72 | .69 | .44 | .38 | .3180 | .238 |
| .323 | .395 | | 3/8 (.3750) | M10 | (.3937) | 2 | 2.94 | .75 | .50 | .44 | .3810 | .286 |
| .395 | .448 | | 7/16 (.4375) | | | 3 | 3.16 | .88 | - | .41 | .3230 | .242 |
| .448 | .510 | | 1/2 (.5000) | M12 | (.4724) | 3 | 3.38 | .94 | - | .44 | .3670 | .275 |
| .510 | .573 | | 9/16 (.5625) | M14 | (.5541) | 3 | 3.59 | 1.00 | - | .50 | .4290 | .322 |
| .573 | .635 | | 5/8 (.6250) | M16 | (.6299) | 3 | 3.81 | 1.09 | - | .56 | .4800 | .360 |
| .635 | .709 | | 11/16 (.6875) | M18 | (.7087) | 3 | 4.03 | 1.09 | - | .63 | .5420 | .406 |
| .709 | .760 | | 3/4 (.7500) | | | 3 | 4.25 | 1.22 | - | .69 | .5900 | .442 |
| .760 | .823 | | 13/16 (.8125) | M20 | (.7874) | 3 | 4.47 | 1.22 | - | .69 | .6520 | .489 |
| .823 | .885 | | 7/8 (.8750) | M22 | (.8661) | 3 | 4.69 | 1.34 | - | .75 | .6970 | .523 |
| .885 | .948 | | 15/16 (.9375) | M24 | (.9449) | 3 | 4.91 | 1.34 | - | .75 | .7600 | .570 |
| .948 | 1.010 | | 1 (1.0000) | M25 | (.9843) | 3 | 5.13 | 1.50 | - | .81 | .8000 | .600 |

TECHNICAL High Speed Steel



Standard Pipe Tap, Straight & Taper, Ground Thread
USCTI Table 311
Technical Information

 311
 Pipe Tap Blank Design 1

 311
 Pipe Tap Blank Design 2
 with optional neck

 311
 Pipe Tap Blank Design 3

General Dimensions (all measurements in inches)

| nominal size | tap style | overall length L | thread length l | square length l₃ | shank dia. d₂ | square size a | optional neck l₂ |
|--------------|-----------|----------------------------|---------------------------|---------------------------------------|------------------------------------|-------------------------|---------------------------------------|
| 1/16 | 1 | 2.13 | .69 | .38 | .3125 | .234 | .375 |
| 1/8 | 1 | 2.13 | .75 | .38 | .3125 | .234 | - |
| 1/8 | 1 | 2.13 | .75 | .38 | .4375 | .328 | .375 |
| 1/4 | 1 | 2.44 | 1.06 | .44 | .5625 | .421 | .375 |
| 3/8 | 1 | 2.56 | 1.06 | .50 | .7000 | .531 | .375 |
| 1/2 | 3 | 3.13 | 1.38 | .63 | .6875 | .515 | - |
| 3/4 | 3 | 3.25 | 1.38 | .69 | .9063 | .679 | - |
| 1 | 3 | 3.75 | 1.75 | .81 | 1.1250 | .843 | - |
| 1-1/4 | 3 | 4.00 | 1.75 | .94 | 1.3125 | .984 | - |
| 1-1/2 | 3 | 4.25 | 1.75 | 1.00 | 1.5000 | 1.125 | - |
| 2 | 3 | 4.50 | 1.75 | 1.13 | 1.8750 | 1.406 | - |
| 2-1/2 | 3 | 5.50 | 2.56 | 1.25 | 2.2500 | 1.687 | - |
| 3 | 3 | 6.00 | 2.63 | 1.38 | 2.6250 | 1.968 | - |
| 3-1/2 | 3 | 6.50 | 2.69 | 1.50 | 2.8125 | 2.108 | - |
| 4 | 3 | 6.75 | 2.75 | 1.56 | 3.0000 | 2.250 | - |

Tolerances (all measurements in inches)

| element | range | direction | tolerance |
|------------------------|--------------------|-----------|-----------|
| Length Overall | 1/16" to 3/4" inc. | + / - | .031 |
| - L | 1" to 4" inc. | + / - | .063 |
| Length of Thread | 1/16" to 3/4" inc. | + / - | .063 |
| - l | 1" to 1-1/4" inc. | + / - | .094 |
| | 1-1/2" to 4" | + / - | .125 |
| Length of Square | 1/16" to 3/4" inc. | + / - | .031 |
| - l₃ | 1" to 4" inc. | + / - | .063 |
| Diameter of Shank | 1/16" to 1/8" | - | .0015 |
| - d₂ | 1/4" to 1" inc. | - | .0020 |
| | 1-1/4" to 4" inc. | - | .0030 |
| Size of Square | 1/16" to 1/8" | - | .004 |
| - a | 1/4" to 3/4" inc. | - | .006 |
| | 1" to 4" inc. | - | .008 |

TECHNICAL
 High Speed Steel



Technical Information

Ground Thread Unified & American National Form
USCTI Table 327
Fractional

Lead Tolerance

A maximum lead error of + / - .0005" in 1" of thread is permitted.

Pitch Diameter Limits

for taps through 1" diameter:

- H1 = basic to basic plus .0005"
- H2 = basic plus .0005" to basic plus .001"
- H3 = basic plus .001" to basic plus .0015"
- H4 = basic plus .0015" to basic plus .002"
- H5 = basic plus .002" to basic plus .0025"
- H6 = basic plus .0025" to basic plus .003"

for Taps over 1" Diameter Through 1-1/2" diameter:

- H4 = basic plus .001" to basic plus .002"

Angle Tolerance

Threads Per Inch Error in Half Angle

- 6 to 9 inclusive 25' + / -
- 10 to 28 inclusive 30' + / -

Formula (Approximate)

- Max. Major Diameter = Basic Major Diameter + A*
- Min. Major Diameter = Max. Major Diameter - B*

**See Table 331.*

Thread Limits

| nom size | threads per inch | | | major diameter | | | basic pitch dia | pitch diameter limits | | | | | | | | | | | |
|----------|------------------|--------|--------|----------------|--------|--------|-----------------|-----------------------|-------|----------|-------|----------|-------|----------|--------|----------|-------|----------|-------|
| | NC UNC | NF UNF | NS UNS | basic | min | max | | H1 limit | | H2 limit | | H3 limit | | H4 limit | | H5 limit | | H6 limit | |
| | | | | | | | | min | max | min | max | min | max | min | max | min | max | min | max |
| 1/4 | 20 | — | — | .2500 | .2540 | .2550 | .2175 | .2175 | .2180 | .2180 | .2185 | .2185 | .2190 | — | — | .2195 | .2200 | — | — |
| 1/4 | — | 28 | — | .2500 | .2525 | .2535 | .2268 | .2268 | .2273 | .2273 | .2278 | .2278 | .2283 | .2283 | .2288 | — | — | — | — |
| 5/16 | 18 | — | — | .3125 | .3170 | .3180 | .2764 | .2764 | .2769 | .2769 | .2774 | .2774 | .2779 | — | — | .2784 | .2789 | — | — |
| 5/16 | — | 24 | — | .3125 | .3155 | .3165 | .2854 | .2854 | .2859 | .2859 | .2864 | .2864 | .2869 | .2869 | .2874 | — | — | — | — |
| 3/8 | 16 | — | — | .3750 | .3800 | .3810 | .3344 | .3344 | .3349 | .3349 | .3354 | .3354 | .3359 | — | — | .3364 | .3369 | — | — |
| 3/8 | — | 24 | — | .3750 | .3780 | .3790 | .3479 | .3479 | .3484 | .3484 | .3489 | .3489 | .3494 | .3494 | .3499 | — | — | — | — |
| 7/16 | 14 | — | — | .4375 | .4435 | .4445 | .3911 | — | — | .3916 | .3921 | .3921 | .3926 | — | — | .3931 | .3936 | — | — |
| 7/16 | — | 20 | — | .4375 | .4415 | .4425 | .4050 | — | — | — | — | .4060 | .4065 | — | — | .4070 | .4075 | — | — |
| 1/2 | 13 | — | — | .5000 | .5065 | .5075 | .4500 | .4500 | .4505 | .4505 | .4510 | .4510 | .4515 | — | — | .4520 | .4525 | — | — |
| 1/2 | — | 20 | — | .5000 | .5040 | .5050 | .4675 | .4675 | .4680 | .4680 | .4685 | .4685 | .4690 | — | — | .4695 | .4700 | — | — |
| 9/16 | 12 | — | — | .5625 | .5690 | .5700 | .5084 | — | — | .5089 | — | — | .5099 | — | — | .5104 | .5109 | — | — |
| 9/16 | — | 18 | — | .5625 | .5670 | .5680 | .5264 | — | — | .5269 | .5274 | .5274 | .5279 | — | — | .5284 | .5289 | — | — |
| 5/8 | 11 | — | — | .6250 | .6320 | .6330 | .5660 | — | — | .5665 | .5670 | .5670 | .5675 | — | — | .5680 | .5685 | — | — |
| 5/8 | — | 18 | — | .6250 | .6295 | .6305 | .5889 | — | — | .5894 | .5899 | .5899 | .5904 | — | — | .5909 | .5914 | — | — |
| 11/16 | — | — | 11 | .6875 | .6945 | .6955 | .6285 | — | — | — | — | .6295 | .6300 | — | — | — | — | — | — |
| 11/16 | — | — | 16 | .6875 | .6925 | .6935 | .6469 | — | — | — | — | .6479 | .6484 | — | — | — | — | — | — |
| 3/4 | 10 | — | — | .7500 | .7575 | .7590 | — | — | .6855 | .6855 | .6860 | .6860 | .6865 | — | — | .6870 | .6875 | — | — |
| 3/4 | — | 16 | — | .7500 | .7550 | .7560 | .7094 | .7094 | .7099 | .7099 | .7104 | .7104 | .7109 | — | — | .7114 | .7119 | — | — |
| 7/8 | 9 | — | — | .8750 | .8835 | .8850 | .8028 | — | — | — | — | — | — | .8043 | .8048 | — | — | .8053 | .8058 |
| 7/8 | — | 14 | — | .8750 | .8810 | .8820 | .8286 | — | — | .8291 | .8296 | — | — | .8301 | .8306 | — | — | .8311 | .8316 |
| 1 | 8 | — | — | 1.0000 | 1.0095 | 1.0110 | .9188 | — | — | .9193 | .9198 | — | — | .9203 | .9208 | — | — | .9213 | .9218 |
| 1 | — | 12 | — | 1.0000 | 1.0065 | 1.0075 | .9459 | — | — | — | — | — | — | .9474 | .9479 | — | — | — | — |
| 1 | — | — | 14 | 1.0000 | 1.0060 | 1.0070 | .9536 | — | — | — | — | — | — | .9551 | .9556 | — | — | — | — |
| 1-1/8 | 7 | — | — | 1.1250 | 1.1350 | 1.1370 | 1.0322 | — | — | — | — | — | — | 1.0332 | 1.0342 | — | — | — | — |
| 1-1/8 | — | 12 | — | 1.1250 | 1.132 | 1.1325 | 1.0709 | — | — | — | — | — | — | 1.0719 | 1.0729 | — | — | — | — |
| 1-1/4 | 7 | — | — | 1.2500 | 1.2600 | 1.2620 | 1.1572 | — | — | — | — | — | — | 1.1582 | 1.1592 | — | — | — | — |
| 1-1/4 | — | 12 | — | 1.2500 | 1.2565 | 1.2575 | 1.1959 | — | — | — | — | — | — | 1.1969 | 1.1979 | — | — | — | — |
| 1-3/8 | 6 | — | — | 1.3750 | 1.3870 | 1.3890 | 1.2667 | — | — | — | — | — | — | 1.2677 | 1.2687 | — | — | — | — |
| 1-3/8 | — | 12 | — | 1.3750 | 1.3815 | 1.3825 | 1.3209 | — | — | — | — | — | — | 1.3219 | 1.3229 | — | — | — | — |
| 1-1/2 | 6 | — | — | 1.5000 | 1.5120 | 1.5140 | 1.3917 | — | — | — | — | — | — | 1.3927 | 1.3937 | — | — | — | — |
| 1-1/2 | — | 12 | — | 1.5000 | 1.507 | 1.5075 | 1.4459 | — | — | — | — | — | — | 1.4469 | 1.4479 | — | — | — | — |

TECHNICAL
High Speed Steel





Ground Thread Unified & American National Form

Technical Information

USCTI Table 329 Machine Screw Taps

Lead Tolerance

A maximum lead error of + / - .0005" in 1" of thread is permitted.

Pitch Diameter Limits:

- H1 = basic to basic + .0005" to basic + .001"
- H2 = basic + .0005" to basic + .001"
- H3 = basic + .001" to basic + .0015"
- H7 = basic + .003" to basic + .0035"

Angle Tolerance

| | |
|--------------------|---------------------|
| Threads Per Inch | Error in Half Angle |
| 20 to 80 inclusive | 30' + / - |

Formula

- Max. Major Diameter = Basic Major Diameter + A
- Min. Major Diameter = Max. Major Diameter - B
- A = Constant to add: 45% of the theoretical truncation to nearest .0005"
- B = Major diameter tolerance.

TECHNICAL
High Speed Steel

Thread Limits

| nom size | threads per inch | | | major diameter | | | basic pitch dia | pitch diameter limits | | | | | | | |
|----------|------------------|--------|--------|----------------|-------|-------|-----------------|-----------------------|-------|----------|-------|----------|-------|----------|-------|
| | NC UNC | NF UNF | NS UNS | basic | min | max | | H1 limit | | H2 limit | | H3 limit | | H7 limit | |
| | min | max | min | max | min | max | | min | max | min | max | min | max | min | max |
| 0 | — | 80 | — | .0600 | .0605 | .0615 | .0519 | .0519 | .0524 | .0524 | .0529 | — | — | — | — |
| 1 | 64 | — | — | .0730 | .0735 | .0745 | .0629 | .0629 | .0634 | .0634 | .0639 | — | — | — | — |
| 1 | — | 72 | — | .0730 | .0735 | .0745 | .0640 | .0640 | .0645 | .0645 | .0650 | — | — | — | — |
| 2 | 56 | — | — | .0860 | .0865 | .0875 | .0744 | .0744 | .0749 | .0749 | .0754 | — | — | — | — |
| 2 | — | 64 | — | .0860 | .0865 | .0875 | .0759 | — | — | .0764 | .0769 | — | — | — | — |
| 3 | 48 | — | — | .0990 | .1000 | .1010 | .0855 | .0855 | .0860 | .0860 | .0865 | — | — | — | — |
| 3 | — | 56 | — | .0990 | .0995 | .1005 | .0874 | .0874 | .0879 | .0879 | .0884 | — | — | — | — |
| 4 | — | — | 36 | .1120 | .1135 | .1145 | .0940 | — | — | .0945 | .0950 | — | — | — | — |
| 4 | 40 | — | — | .1120 | .1135 | .1145 | .0958 | .0958 | .0963 | .0963 | .0968 | — | — | — | — |
| 4 | — | 48 | — | .1120 | .1130 | .1140 | .0985 | .0985 | .0990 | .0990 | .0995 | — | — | — | — |
| 5 | 40 | — | — | .1250 | .1265 | .1275 | .1088 | .1088 | .1093 | .1093 | .1098 | — | — | — | — |
| 5 | — | 44 | — | .1250 | .1260 | .1270 | .1102 | — | — | .1107 | .1112 | — | — | — | — |
| 6 | 32 | — | — | .1380 | .1400 | .1410 | .1177 | .1177 | .1182 | .1182 | .1187 | .1187 | .1192 | .1207 | .1212 |
| 6 | — | 40 | — | .1380 | .1395 | .1405 | .1218 | .1218 | .1223 | .1223 | .1228 | — | — | — | — |
| 8 | 32 | — | — | .1640 | .1660 | .1670 | .1437 | .1437 | .1442 | .1442 | .1447 | .1447 | .1452 | .1467 | .1472 |
| 8 | — | 36 | — | .1640 | .1655 | .1665 | .1460 | — | — | .1465 | .1470 | — | — | — | — |
| 10 | 24 | — | — | .1900 | .1930 | .1940 | .1629 | .1629 | .1634 | .1634 | .1639 | .1639 | .1644 | .1659 | .1664 |
| 10 | — | 32 | — | .1900 | .1920 | .1930 | .1697 | .1697 | .1702 | .1702 | .1707 | .1707 | .1712 | .1727 | .1732 |
| 12 | 24 | — | — | .2160 | .2190 | .2200 | .1889 | — | — | — | — | .1899 | .1904 | — | — |
| 12 | — | 28 | — | .2160 | .2185 | .2195 | .1928 | — | — | — | — | .1938 | .1943 | — | — |





Technical Information

General

The following tables and formula are used in determining the limits and tolerances for ground thread taps having special diameter or special pitch or both and having a thread lead angle not in excess of 5%, unless otherwise specified. This table does not apply to the diameter and pitch combinations shown in Tables 327 and 329.

Note: When the tap major diameter must be determined from a specific tap pitch diameter, the maximum major diameter = the minimum specified pitch diameter – constant C, + constant A.

Lead Tolerance

A maximum lead error of + / – .0005" in 1" of thread is permitted.

Angle Tolerance

| Threads Per Inch | Error in Half Angle |
|----------------------|---------------------|
| 4 to 5-1/2 inclusive | 20' + / – |
| 6 to 9 inclusive | 25' + / – |
| 10 to 80 inclusive | 30' + / – |

Formula

- Max. Major Diameter = Basic Major Diameter + A
 - Min. Major Diameter = Max. Major Diameter – B
 - Max. Pitch Diameter = Min. Pitch Diameter + D
 - Min. Pitch Diameter = Basic Pitch Diameter + C
- A = constant to add:
 35% of the theoretical truncation for 4 to 5 threads per inch
 40% for 5-1/2 to 12 threads per inch
 45% for 13 to 80 threads per inch
 to nearest .005" for 8 or more threads per inch
- B = Major diameter tolerance
 C = Amount over basic for minimum pitch diameter
 D = Pitch diameter tolerance

Values for W, X, Y and Z (inches)

| threads per inch | A | B | C thru 5/8 | C over 5/8" thru 2-1/2" | C over 2-1/2 | D thru 1" | D over 1" thru 1-1/2" | D over 1-1/2" thru 2-1/2" | D over 2-1/2" |
|------------------|-------|-------|------------|-------------------------|--------------|-----------|-----------------------|---------------------------|---------------|
| 80 | .0015 | .0010 | .0005 | .0010 | .0015 | .0005 | .0010 | .0010 | .0015 |
| 56 | .0015 | .0010 | .0005 | .0010 | .0015 | .0005 | .0010 | .0010 | .0015 |
| 48 | .0020 | .0010 | .0005 | .0010 | .0015 | .0005 | .0010 | .0010 | .0015 |
| 44 | .0020 | .0010 | .0005 | .0010 | .0015 | .0005 | .0010 | .0010 | .0015 |
| 40 | .0025 | .0010 | .0005 | .0010 | .0015 | .0005 | .0010 | .0010 | .0015 |
| 36 | .0025 | .0010 | .0005 | .0010 | .0015 | .0005 | .0010 | .0010 | .0015 |
| 32 | .0030 | .0010 | .0010 | .0010 | .0015 | .0005 | .0010 | .0010 | .0015 |
| 28 | .0035 | .0010 | .0010 | .0010 | .0015 | .0005 | .0010 | .0010 | .0015 |
| 24 | .0040 | .0010 | .0010 | .0010 | .0015 | .0005 | .0010 | .0015 | .0015 |
| 20 | .0050 | .0010 | .0010 | .0010 | .0015 | .0005 | .0010 | .0015 | .0015 |
| 18 | .0055 | .0010 | .0010 | .0010 | .0015 | .0005 | .0010 | .0015 | .0015 |
| 16 | .0060 | .0010 | .0010 | .0010 | .0015 | .0005 | .0010 | .0015 | .0020 |
| 14 | .0070 | .0010 | .0010 | .0015 | .0015 | .0005 | .0010 | .0015 | .0020 |
| 13 | .0075 | .0010 | .0010 | .0015 | .0015 | .0005 | .0010 | .0015 | .0020 |
| 12 | .0075 | .0010 | .0010 | .0015 | .0015 | .0005 | .0010 | .0015 | .0020 |
| 11 | .0080 | .0010 | .0010 | .0015 | .0020 | .0005 | .0010 | .0015 | .0020 |
| 10 | .0090 | .0015 | — | .0015 | .0020 | .0005 | .0010 | .0015 | .0020 |
| 9 | .0100 | .0015 | — | .0015 | .0020 | .0005 | .0010 | .0015 | .0020 |
| 8 | .0110 | .0015 | — | .0015 | .0020 | .0005 | .0010 | .0015 | .0020 |
| 7 | .0120 | .0020 | — | .0015 | .0020 | .0010 | .0010 | .0020 | .0025 |
| 6 | .0140 | .0020 | — | .0015 | .0020 | .0010 | .0010 | .0020 | .0025 |
| 5-1/2 | .0160 | .0025 | — | .0015 | .0020 | .0010 | .0015 | .0020 | .0025 |
| 5 | .0160 | .0025 | — | .0015 | .0020 | .0010 | .0015 | .0020 | .0025 |
| 4-1/2 | .0170 | .0025 | — | .0015 | .0020 | .0010 | .0015 | .0020 | .0025 |
| 4 | .0190 | .0025 | — | .0015 | .0020 | .0010 | .0015 | .0020 | .0025 |

For intermediate pitches use value for next coarser pitch.

TECHNICAL High Speed Steel



Ground Thread

Tap Limits

USCTI Table 341

Metric Taps

Technical Information

General

These tables and formula are used in determining the limits and tolerances for ground thread metric taps unless otherwise specified. They apply only to metric threads having a 60° form with a P/8 flat at the major diameter of the basic thread form.

Note: When the tap major diameter must be determined from a specific tap pitch diameter, the minimum major diameter equals the maximum specified tap pitch diameter minus constant Y, plus the basic size height of thread (.64952P), plus constant W.

Lead Tolerance

A maximum lead error of + / - .0005" in 1" of thread is permitted.

Angle Tolerance

| Pitch mm | Deviation in Half Angle |
|----------------------------|-------------------------|
| over 0.25 to 2.5 inclusive | 30' + / - |
| over 2.5 to 4 inclusive | 25' + / - |
| over 4 to 6 inclusive | 20' + / - |

Formula

- Max. Major Diameter = Min. + X
- Min. Major Diameter = Basic + W
- Max. Pitch Diameter = Basic + Y
- Min. Pitch Diameter = Max. - Z
- W = Constant to add to Basic Major Diameter (.080P converted to inches)
- X = Major Diameter Tolerance
- Y = Amount over Basic for Maximum Pitch Diameter
- Z = Pitch Diameter Tolerance

Values for W, X, Y and Z (inches)

| pitch mm | inch equivalent | W | X | Y | Y | Y | Y | Z | Z | Z | Z |
|----------|-----------------|-------|-------|----------------|--------------------|-------------------|----------|----------------|--------------------|-------------------|----------|
| | | inch | inch | M1.6 thru M6.3 | over M6.3 thru M25 | over M25 thru M90 | over M90 | M1.6 thru M6.3 | over M6.3 thru M25 | over M25 thru M90 | over M90 |
| 0.3 | .01181 | .0009 | .0010 | .0015 | .0015 | .0020 | .0020 | .0006 | .0006 | .0008 | .0008 |
| 0.35 | .01378 | .0011 | .0010 | .0015 | .0015 | .0020 | .0020 | .0006 | .0006 | .0008 | .0008 |
| 0.4 | .01575 | .0013 | .0010 | .0015 | .0020 | .0020 | .0020 | .0006 | .0006 | .0008 | .0010 |
| 0.45 | .01772 | .0014 | .0010 | .0015 | .0020 | .0020 | .0020 | .0006 | .0008 | .0008 | .0010 |
| 0.5 | .01968 | .0016 | .0010 | .0015 | .0020 | .0020 | .0025 | .0006 | .0008 | .0010 | .0010 |
| 0.6 | .02362 | .0019 | .0010 | .0020 | .0020 | .0025 | .0025 | .0008 | .0008 | .0010 | .0010 |
| 0.7 | .02756 | .0022 | .0016 | .0020 | .0020 | .0025 | .0025 | .0008 | .0008 | .0010 | .0010 |
| 0.75 | .02953 | .0024 | .0016 | .0020 | .0025 | .0025 | .0030 | .0008 | .0010 | .0010 | .0012 |
| 0.8 | .03150 | .0025 | .0016 | .0020 | .0025 | .0025 | .0030 | .0008 | .0010 | .0010 | .0012 |
| 0.9 | .03543 | .0028 | .0016 | .0020 | .0025 | .0025 | .0030 | .0008 | .0010 | .0010 | .0012 |
| 1 | .03937 | .0032 | .0016 | .0025 | .0025 | .0030 | .0030 | .0010 | .0010 | .0012 | .0012 |
| 1.25 | .04921 | .0039 | .0025 | .0025 | .0025 | .0030 | .0035 | .0010 | .0012 | .0012 | .0016 |
| 1.5 | .05906 | .0047 | .0025 | .0025 | .0030 | .0030 | .0035 | .0010 | .0012 | .0012 | .0016 |
| 1.75 | .06890 | .0055 | .0025 | — | .0030 | .0035 | .0040 | — | .0012 | .0016 | .0016 |
| 2 | .07874 | .0063 | .0025 | — | .0035 | .0035 | .0040 | — | .0016 | .0016 | .0016 |
| 2.5 | .09843 | .0079 | .0025 | — | .0035 | .0040 | .0045 | — | .0016 | .0016 | .0020 |
| 3 | .11811 | .0095 | .0039 | — | .0040 | .0040 | .0050 | — | .0016 | .0020 | .0020 |
| 3.5 | .13780 | .0110 | .0039 | — | .0040 | .0045 | .0050 | — | .0016 | .0020 | .0020 |
| 4 | .15748 | .0126 | .0039 | — | .0040 | .0045 | .0055 | — | .0020 | .0020 | .0025 |
| 4.5 | .17717 | .0142 | .0039 | — | — | .0050 | .0055 | — | .0020 | .0020 | .0025 |
| 5 | .19685 | .0158 | .0039 | — | — | .0050 | .0060 | — | — | .0025 | .0025 |
| 5.5 | .21654 | .0158 | .0039 | — | — | .0050 | .0060 | — | — | .0025 | .0025 |
| 6 | .23622 | .0189 | .0039 | — | — | .0055 | .0060 | — | — | .0025 | .0025 |

TECHNICAL High Speed Steel


Technical Information
Basic Thread Dimensions
USCTI Table 352
Machine Screw Taps
Thread Dimensions

| nominal size & pitch | | basic major diameter | basic pitch diameter | basic minor diameter | max minor diameter Class 3B internal thread | nominal size & pitch | | basic major diameter | basic pitch diameter | basic minor diameter | max minor diameter Class 3B internal thread |
|----------------------|----|----------------------|----------------------|----------------------|---|----------------------|----|----------------------|----------------------|----------------------|---|
| 0 | 80 | .0600 | .0519 | .0438 | .0514 | 6 | 32 | .1380 | .1177 | .0974 | .1140 |
| 1 | 64 | .0730 | .0629 | .0527 | .0623 | 6 | 36 | .1380 | .1200 | .1019 | .1165 |
| 1 | 72 | .0730 | .0640 | .0550 | .0635 | 6 | 40 | .1380 | .1218 | .1055 | .1186 |
| 2 | 56 | .0860 | .0744 | .0628 | .0737 | 8 | 32 | .1640 | .1437 | .1234 | .1389 |
| 2 | 64 | .0860 | .0759 | .0657 | .0753 | 8 | 36 | .1640 | .1460 | .1279 | .1416 |
| 3 | 48 | .0990 | .0855 | .0719 | .0845 | 8 | 40 | .1640 | .1478 | .1315 | .1437 |
| 3 | 56 | .0990 | .0874 | .0758 | .0865 | 10 | 24 | .1900 | .1629 | .1359 | .1516 |
| 4 | 32 | .1120 | .0917 | .0714 | .0880 | 10 | 28 | .1900 | .1668 | .1436 | .1604 |
| 4 | 36 | .1120 | .0940 | .0759 | .0919 | 10 | 30 | .1900 | .1684 | .1467 | .1630 |
| 4 | 40 | .1120 | .0958 | .0795 | .0939 | 10 | 32 | .1900 | .1697 | .1494 | .1641 |
| 4 | 48 | .1120 | .0985 | .0849 | .0968 | 12 | 24 | .2160 | .1889 | .1619 | .1807 |
| 5 | 40 | .1250 | .1088 | .0925 | .1062 | 12 | 28 | .2160 | .1928 | .1696 | .1857 |
| 5 | 44 | .1250 | .1102 | .0955 | .1079 | 12 | 32 | .2160 | .1957 | .1754 | .1895 |
| | | | | | | 14 | 20 | .2420 | .2095 | .1770 | .1987 |
| | | | | | | 14 | 24 | .2420 | .2149 | .1879 | .2059 |

Constants for Finding Pitch Diameter and Minor Diameter of Screw Threads

Basic Pitch Diameter = Basic Major Diameter – Constant for Basic Pitch Diameter for TPI

Basic Minor Diameter = Basic Major Diameter – Constant for Basic Minor Diameter for TPI

| threads per inch | pitch | | constant for basic pitch dia. | | constant for basic minor dia. | | threads per inch | pitch | | constant for basic pitch dia. | | constant for basic minor dia. | |
|------------------|-------|-------|-------------------------------|--------|-------------------------------|--------|------------------|-------|------|-------------------------------|--------|-------------------------------|--------|
| | in | mm | Unified | ISO | Unified | ISO | | in | mm | Unified | ISO | Unified | ISO |
| - | .0079 | 0.2 | - | .00511 | - | .01022 | 20 | .0500 | - | .03248 | - | .06496 | - |
| - | .0088 | 0.225 | - | .00575 | - | .01150 | 18 | .0555 | - | .03608 | - | .07216 | - |
| - | .0098 | 0.25 | - | .00639 | - | .01278 | - | .0590 | 1.5 | - | .03836 | - | .07672 |
| - | .0118 | 0.3 | - | .00767 | - | .01534 | 16 | .0625 | - | .04060 | - | .08120 | - |
| 80 | .0125 | - | .00812 | - | .01624 | - | - | .0689 | 1.75 | - | .04475 | - | .08950 |
| - | .0138 | 0.35 | - | .00895 | - | .01790 | 14 | .0714 | - | .04639 | - | .09278 | - |
| 72 | .0139 | - | .00902 | - | .01804 | - | 13 | .0769 | - | .04996 | - | .09992 | - |
| 64 | .0156 | - | .01015 | - | .02030 | - | - | .0787 | 2.0 | - | .05117 | - | .10228 |
| - | .0157 | 0.4 | - | .01023 | - | .02046 | 12 | .0833 | - | .05413 | - | .10826 | - |
| - | .0177 | 0.45 | - | .01151 | - | .02302 | 11.5 | .0869 | - | .05648 | - | .11296 | - |
| 56 | .0178 | - | .01160 | - | .02320 | - | 11 | .0909 | - | .05905 | - | .11810 | - |
| - | .0197 | 0.5 | - | .01279 | - | .02558 | - | .0984 | 2.5 | - | .06393 | - | .12786 |
| 48 | .0208 | - | .01353 | - | .02706 | - | 10 | .1000 | - | .06495 | - | .12990 | - |
| 44 | .0227 | - | .01476 | - | .02952 | - | 9 | .1111 | - | .07217 | - | .14434 | - |
| - | .0236 | 0.6 | - | .01534 | - | .03068 | - | .1181 | 3.0 | - | .07672 | - | .15344 |
| 40 | .0250 | - | .01624 | - | .03248 | - | 8 | .1250 | - | .08119 | - | .16238 | - |
| - | .0275 | 0.7 | - | .01790 | - | .03580 | - | .1378 | 3.5 | - | .08950 | - | .17900 |
| 36 | .0278 | - | .01804 | - | .03608 | - | 7 | .1428 | - | .09279 | - | .18558 | - |
| - | .0295 | 0.75 | - | .01918 | - | .03836 | - | .1575 | 4.0 | - | .10229 | - | .20458 |
| 32 | .0312 | - | .02030 | - | .04060 | - | 6 | .1667 | - | .10825 | - | .21650 | - |
| - | .0315 | 0.8 | - | .02046 | - | .04092 | - | .1772 | 4.5 | - | .11507 | - | .23014 |
| 28 | .0357 | - | .02320 | - | .04640 | - | - | .1968 | 5.0 | - | .12786 | - | .25572 |
| 27 | .0370 | - | .02406 | - | .04812 | - | 5 | .2000 | - | .12990 | - | .25980 | - |
| - | .0394 | 1.0 | - | .02557 | - | .05114 | - | .2165 | 5.5 | - | .14064 | - | .28128 |
| 24 | .0417 | - | .02706 | - | .05412 | - | 4.5 | .2222 | - | .14434 | - | .28868 | - |
| - | .0492 | 1.25 | - | .03196 | - | .06392 | - | .2362 | 6.0 | - | .15343 | - | .30353 |
| | | | | | | | 4 | .2500 | - | .16238 | - | .32476 | - |

TECHNICAL
 High Speed Steel

continued on next page





Basic Thread Dimensions Unified & American National Form

Technical Information

USCTI Table 352 Fractional Sizes

TECHNICAL
High Speed Steel

| nominal size & TPI | | basic major diameter | basic pitch diameter | basic minor diameter | max minor diameter Class 3B internal thread | nominal size & TPI | | basic major diameter | basic pitch diameter | basic minor diameter | max minor diameter Class 3B internal thread |
|--------------------|----|----------------------|----------------------|----------------------|---|--------------------|----|----------------------|----------------------|----------------------|---|
| 1/16 | 64 | .0625 | .0524 | .0422 | .0518 | 13/16 | 12 | .8125 | .7584 | .7042 | .7329 |
| 3/32 | 48 | .0938 | .0803 | .0667 | .0793 | 13/16 | 16 | .8125 | .7719 | .7313 | .7533 |
| 1/8 | 40 | .1250 | .1088 | .0925 | .1062 | 13/16 | 20 | .8125 | .7800 | .7475 | .7662 |
| 5/32 | 32 | .1563 | .1360 | .1157 | .1311 | 7/8 | 9 | .8750 | .8028 | .7307 | .7681 |
| 5/32 | 36 | .1563 | .1382 | .1202 | .1339 | 7/8 | 12 | .8750 | .8209 | .7668 | .7952 |
| 3/16 | 24 | .1875 | .1604 | .1334 | .1530 | 7/8 | 14 | .8750 | .8286 | .7822 | .8068 |
| 3/16 | 32 | .1875 | .1672 | .1469 | .1616 | 7/8 | 16 | .8750 | .8344 | .7938 | .8158 |
| 7/32 | 24 | .2188 | .1917 | .1646 | .1834 | 7/8 | 18 | .8750 | .8389 | .8028 | .8230 |
| 7/32 | 32 | .2188 | .1985 | .1782 | .1922 | 7/8 | 20 | .8750 | .8425 | .8100 | .8287 |
| 1/4 | 20 | .2500 | .2175 | .1850 | .2067 | 15/16 | 12 | .9375 | .8834 | .8293 | .8575 |
| 1/4 | 24 | .2500 | .2229 | .1959 | .2139 | 15/16 | 16 | .9375 | .8969 | .8563 | .8783 |
| 1/4 | 28 | .2500 | .2268 | .2036 | .2190 | 15/16 | 20 | .9375 | .9050 | .8725 | .8912 |
| 1/4 | 32 | .2500 | .2297 | .2094 | .2229 | 1 | 8 | 1.0000 | .9188 | .8376 | .8797 |
| 5/16 | 18 | .3125 | .2764 | .2403 | .2630 | 1 | 12 | 1.0000 | .9459 | .8918 | .9198 |
| 5/16 | 20 | .3125 | .2800 | .2476 | .2680 | 1 | 14 | 1.0000 | .9536 | .9072 | .9315 |
| 5/16 | 24 | .3125 | .2854 | .2584 | .2754 | 1 | 16 | 1.0000 | .9594 | .9188 | .9408 |
| 5/16 | 32 | .3125 | .2922 | .2719 | .2847 | 1 | 20 | 1.0000 | .9675 | .9350 | .9537 |
| 3/8 | 16 | .3750 | .3344 | .2938 | .3182 | 1-1/16 | 12 | 1.0625 | 1.0084 | .9543 | .9823 |
| 3/8 | 20 | .3750 | .3425 | .3100 | .3297 | 1-1/16 | 16 | 1.0625 | 1.0219 | .9813 | 1.0033 |
| 3/8 | 24 | .3750 | .3479 | .3209 | .3372 | 1-1/16 | 18 | 1.0625 | 1.0264 | .9903 | 1.0105 |
| 3/8 | 32 | .3750 | .3547 | .3344 | .3469 | 1-1/8 | 7 | 1.1250 | 1.0322 | .9394 | .9875 |
| 7/16 | 14 | .4375 | .3911 | .3447 | .3717 | 1-1/8 | 8 | 1.1250 | 1.0438 | .9626 | 1.0047 |
| 7/16 | 20 | .4375 | .4050 | .3726 | .3916 | 1-1/8 | 12 | 1.1250 | 1.0709 | 1.0168 | 1.0448 |
| 7/16 | 24 | .4375 | .4104 | .3834 | .3994 | 1-1/8 | 16 | 1.1250 | 1.0844 | 1.0438 | 1.0658 |
| 7/16 | 28 | .4375 | .4143 | .3911 | .4051 | 1-1/8 | 18 | 1.1250 | 1.0889 | 1.0528 | 1.0730 |
| 1/2 | 12 | .5000 | .4459 | .3918 | .4223 | 1-3/16 | 12 | 1.1875 | 1.1334 | 1.0793 | 1.1073 |
| 1/2 | 13 | .5000 | .4500 | .4001 | .4284 | 1-3/16 | 16 | 1.1875 | 1.1469 | 1.1063 | 1.1283 |
| 1/2 | 20 | .5000 | .4675 | .4351 | .4537 | 1-3/16 | 18 | 1.1875 | 1.1514 | 1.1153 | 1.1355 |
| 1/2 | 24 | .5000 | .4729 | .4459 | .4619 | 1-1/4 | 7 | 1.2500 | 1.1572 | 1.0644 | 1.1125 |
| 1/2 | 28 | .5000 | .4768 | .4536 | .4676 | 1-1/4 | 8 | 1.2500 | 1.1688 | 1.0876 | 1.1297 |
| 9/16 | 12 | .5625 | .5084 | .4542 | .4843 | 1-1/4 | 12 | 1.2500 | 1.1959 | 1.1418 | 1.1698 |
| 9/16 | 18 | .5625 | .5264 | .4903 | .5106 | 1-1/4 | 16 | 1.2500 | 1.2094 | 1.1688 | 1.1908 |
| 9/16 | 24 | .5625 | .5354 | .5084 | .5244 | 1-1/4 | 18 | 1.2500 | 1.2139 | 1.1778 | 1.1980 |
| 5/8 | 11 | .6250 | .5660 | .5069 | .5391 | 1-5/16 | 12 | 1.3125 | 1.2584 | 1.2043 | 1.2323 |
| 5/8 | 12 | .6250 | .5709 | .5168 | .5463 | 1-5/16 | 16 | 1.3125 | 1.2719 | 1.2313 | 1.2533 |
| 5/8 | 18 | .6250 | .5889 | .5528 | .5730 | 1-5/16 | 18 | 1.3125 | 1.2764 | 1.2403 | 1.2605 |
| 5/8 | 24 | .6250 | .5979 | .5709 | .5869 | 1-3/8 | 6 | 1.3750 | 1.2667 | 1.1585 | 1.2146 |
| 11/16 | 11 | .6875 | .6285 | .5694 | .6012 | 1-3/8 | 8 | 1.3750 | 1.2938 | 1.2126 | 1.2547 |
| 11/16 | 12 | .6875 | .6334 | .5793 | .6085 | 1-3/8 | 12 | 1.3750 | 1.3209 | 1.2668 | 1.2948 |
| 11/16 | 16 | .6875 | .6469 | .6063 | .6284 | 1-3/8 | 16 | 1.3750 | 1.3344 | 1.2938 | 1.3158 |
| 11/16 | 24 | .6875 | .6604 | .6334 | .6494 | 1-3/8 | 18 | 1.3750 | 1.3389 | 1.3028 | 1.3230 |
| 3/4 | 10 | .7500 | .6850 | .6201 | .6545 | 1-7/16 | 12 | 1.4375 | 1.3834 | 1.3293 | 1.3573 |
| 3/4 | 12 | .7500 | .6959 | .6418 | .6707 | 1-7/16 | 16 | 1.4375 | 1.3969 | 1.3563 | 1.3783 |
| 3/4 | 16 | .7500 | .7094 | .6688 | .6908 | 1-7/16 | 18 | 1.4375 | 1.4014 | 1.3653 | 1.3855 |
| 3/4 | 20 | .7500 | .7175 | .6850 | .7037 | | | | | | |





Technical Information

Basic Thread Dimensions (cont'd)
USCTI Table 352
Fractional Sizes

| nominal size & TPI | | basic major diameter | basic pitch diameter | basic minor diameter | max minor diameter Class 3B internal thread | nominal size & TPI | | basic major diameter | basic pitch diameter | basic minor diameter | max minor diameter Class 3B internal thread |
|--------------------|-------|----------------------|----------------------|----------------------|---|--------------------|----|----------------------|----------------------|----------------------|---|
| 1-1/2 | 6 | 1.5000 | 1.3917 | 1.2835 | 1.3396 | 2-5/8 | 12 | 2.6250 | 2.5709 | 2.5168 | 2.5448 |
| 1-1/2 | 8 | 1.5000 | 1.4188 | 1.3376 | 1.3797 | 2-5/8 | 16 | 2.6250 | 2.5844 | 2.5438 | 2.5658 |
| 1-1/2 | 12 | 1.5000 | 1.4459 | 1.3918 | 1.4198 | 2-3/4 | 4 | 2.7500 | 2.5876 | 2.4252 | 2.5094 |
| 1-1/2 | 16 | 1.5000 | 1.4594 | 1.4188 | 1.4408 | 2-3/4 | 8 | 2.7500 | 2.6688 | 2.5876 | 2.6297 |
| 1-1/2 | 18 | 1.5000 | 1.4639 | 1.4278 | 1.4480 | 2-3/4 | 12 | 2.7500 | 2.6959 | 2.6418 | 2.6698 |
| 1-1/2 | 16 | 1.5625 | 1.5219 | 1.4813 | 1.5033 | 2-3/4 | 16 | 2.7500 | 2.7094 | 2.6688 | 2.6908 |
| 1-1/2 | 18 | 1.5625 | 1.5264 | 1.4903 | 1.5105 | 2-7/8 | 12 | 2.8750 | 2.8209 | 2.7668 | 2.7948 |
| 1-5/8 | 6 | 1.6250 | 1.5167 | 1.4085 | 1.4646 | 2-7/8 | 16 | 2.8750 | 2.8344 | 2.7938 | 2.8158 |
| 1-5/8 | 8 | 1.6250 | 1.5438 | 1.4626 | 1.5047 | 3 | 4 | 3.0000 | 2.8376 | 2.6752 | 2.7594 |
| 1-5/8 | 12 | 1.6250 | 1.5709 | 1.5168 | 1.5448 | 3 | 8 | 3.0000 | 2.9188 | 2.8376 | 2.8797 |
| 1-5/8 | 16 | 1.6250 | 1.5844 | 1.5438 | 1.5658 | 3 | 12 | 3.0000 | 2.9459 | 2.8918 | 2.9198 |
| 1-5/8 | 18 | 1.6250 | 1.5889 | 1.5528 | 1.5730 | 3 | 16 | 3.0000 | 2.9594 | 2.9188 | 2.9408 |
| 1-11/16 | 16 | 1.6875 | 1.6469 | 1.6063 | 1.6283 | 3-1/8 | 12 | 3.1250 | 3.0709 | 3.0168 | 3.0448 |
| 1-11/16 | 18 | 1.6875 | 1.6514 | 1.6153 | 1.6355 | 3-1/8 | 16 | 3.1250 | 3.0844 | 3.0438 | 3.0658 |
| 1-3/4 | 5 | 1.7500 | 1.6201 | 1.4902 | 1.5575 | 3-1/4 | 4 | 3.2500 | 3.0876 | 2.9252 | 3.0094 |
| 1-3/4 | 8 | 1.7500 | 1.6688 | 1.5876 | 1.6297 | 3-1/4 | 8 | 3.2500 | 3.1688 | 3.0876 | 3.1297 |
| 1-3/4 | 12 | 1.7500 | 1.6959 | 1.6418 | 1.6698 | 3-1/4 | 12 | 3.2500 | 3.1959 | 3.1418 | 3.1698 |
| 1-3/4 | 16 | 1.7500 | 1.7094 | 1.6688 | 1.6908 | 3-1/4 | 16 | 3.2500 | 3.2094 | 3.1688 | 3.1908 |
| 1-13/16 | 16 | 1.8125 | 1.7719 | 1.7313 | 1.7533 | 3-3/8 | 12 | 3.3750 | 3.3209 | 3.2668 | 3.2948 |
| 1-7/8 | 8 | 1.8750 | 1.7938 | 1.7126 | 1.7547 | 3-3/8 | 16 | 3.3750 | 3.3344 | 3.2938 | 3.3158 |
| 1-7/8 | 12 | 1.8750 | 1.8209 | 1.7668 | 1.7948 | 3-3/8 | 4 | 3.5000 | 3.3376 | 3.1752 | 3.2594 |
| 1-7/8 | 16 | 1.8750 | 1.8344 | 1.7938 | 1.8158 | 3-1/2 | 8 | 3.5000 | 3.4188 | 3.3376 | 3.3797 |
| 1-15/16 | 16 | 1.9375 | 1.8969 | 1.8563 | 1.8783 | 3-1/2 | 12 | 3.5000 | 3.4459 | 3.3918 | 3.4198 |
| 2 | 4-1/2 | 2.0000 | 1.8557 | 1.7113 | 1.7861 | 3-1/2 | 16 | 3.5000 | 3.4594 | 3.4188 | 3.4408 |
| 2 | 8 | 2.0000 | 1.9188 | 1.8376 | 1.8797 | 3-5/8 | 12 | 3.6250 | 3.5709 | 3.5168 | 3.5448 |
| 2 | 12 | 2.0000 | 1.9459 | 1.8918 | 1.9198 | 3-5/8 | 16 | 3.6250 | 3.5844 | 3.5438 | 3.5658 |
| 2 | 16 | 2.0000 | 1.9594 | 1.9188 | 1.9408 | 3-3/4 | 4 | 3.7500 | 3.5876 | 3.4252 | 3.5094 |
| 2-1/16 | 16 | 2.0625 | 2.0219 | 1.9813 | 2.0033 | 3-3/4 | 8 | 3.7500 | 3.6688 | 3.5876 | 3.6297 |
| 2-1/8 | 8 | 2.1250 | 2.0438 | 1.9626 | 2.0047 | 3-3/4 | 12 | 3.7500 | 3.6959 | 3.6418 | 3.6698 |
| 2-1/8 | 12 | 2.1250 | 2.0709 | 2.0168 | 2.0448 | 3-3/4 | 16 | 3.8750 | 3.7094 | 3.6686 | 3.6908 |
| 2-1/8 | 16 | 2.1250 | 2.0844 | 2.0438 | 2.0658 | 3-7/8 | 12 | 3.8750 | 3.8209 | 3.7669 | 3.7948 |
| 2-3/16 | 16 | 2.1875 | 2.1469 | 2.1063 | 2.1283 | 3-7/8 | 16 | 3.8750 | 3.8344 | 3.7938 | 3.8158 |
| 2-1/4 | 4-1/2 | 2.2500 | 2.1057 | 1.9613 | 2.0361 | 4 | 4 | 4.0000 | 3.8376 | 3.6752 | 3.7594 |
| 2-1/4 | 8 | 2.2500 | 2.1688 | 2.0876 | 2.1297 | 4 | 8 | 4.0000 | 3.9188 | 3.8376 | 3.8797 |
| 2-1/4 | 12 | 2.2500 | 2.1959 | 2.1418 | 2.1698 | 4 | 12 | 4.0000 | 3.9459 | 3.8918 | 3.9198 |
| 2-1/4 | 16 | 2.2500 | 2.2094 | 2.1688 | 2.1908 | 4 | 16 | 4.0000 | 3.9594 | 3.9188 | 3.9408 |
| 2-5/16 | 16 | 2.3125 | 2.2719 | 2.2313 | 2.2533 | 4 | 16 | 1.8125 | 1.7719 | 1.7313 | 1.7533 |
| 2-3/8 | 12 | 2.3750 | 2.3209 | 2.2668 | 2.2948 | | | | | | |
| 2-3/8 | 16 | 2.3750 | 2.3344 | 2.2938 | 2.3158 | | | | | | |
| 2-7/16 | 16 | 2.4375 | 2.3969 | 2.3563 | 2.3783 | | | | | | |
| 2-1/2 | 4 | 2.5000 | 2.3376 | 2.1752 | 2.2594 | | | | | | |
| 2-1/2 | 8 | 2.5000 | 2.4188 | 2.3376 | 2.3797 | | | | | | |
| 2-1/2 | 12 | 2.5000 | 2.4459 | 2.3918 | 2.4198 | | | | | | |
| 2-1/2 | 16 | 2.5000 | 2.4594 | 2.4188 | 2.4408 | | | | | | |

TECHNICAL High Speed Steel





Thread Mill Information / Helpful Information

Technical Information

Thread Mill Information

Features

- Helical flute design reduces thread chatter, improving product thread finish and quality
- Advanced TiAlN coating is standard for increasing speeds
- Ideal for internal and external threads
- Full range of sizes available
 - Internal threads #4 to 1" UNC and UNF
 - Pipe threads 1/16" to 1" NPT, NPTF and NPSM
 - Metric internal threads M4.5 x .75 through M20 x 3
- Specials program for nonstandard sizes and other coatings

Benefits

- Thread milling is a superior process for threading most materials
- More economical than using taps:
 - One thread mill can produce several diameters of threaded holes of the same pitch
 - Same tool makes right or left-hand threads
 - Avoid chip packing in blind holes, a primary cause of tap breakage
 - One tool for through and blind holes
 - Pitch diameter can be controlled by CNC offset

Applications

- Cleveland thread mills are the ideal choice when:
- Machine tool has helical interpolation capabilities
 - Thread specification calls for full threads close to bottom of hole
 - Thread specification requires a special tap
 - Small lot size is to be threaded
 - Need to cut large diameter threads on low horsepower machines
 - Workpiece is thin walled which can be milled more easily than tapped
 - CNC machine has a slower RPM capability below what is recommended for carbide thread mills

Calculating Thread Mill Feed Rate

For internal threads: $(D1 - d1) / D1 \times \text{RPM} \times \text{ipr}$

For external threads: $(D1 + d1) / D1 \times \text{RPM} \times \text{ipr}$

where:

D1 is the major diameter of the thread

d1 is the cutting diameter

RPM is the calculated speed rate = $(3.82 \times \text{SFM}) / \text{Diameter}$

ipr is the calculated feed rate = $\text{IPT (inches per tooth)} \times \text{number of flutes per cutter}$

Example: to cut an internal 7/8-14 thread using a four-flute, 1/2" diameter cutter in bronze, the programmed feed rate would be $((.875 - .500) / .875) \times (3438 \text{ RPM} \times .016)$ or 23.6 ipm

Operating Parameters for Helical Thread Mills

| material | surface feet per minute (SFM) | cutter diameter (inches) | | | | | |
|-----------------------|-------------------------------|--------------------------|--------|--------|--------|--------|--------|
| | | 0.125 | 0.250 | 0.375 | 0.500 | 0.750 | 1.000 |
| | | feed per tooth (inches) | | | | | |
| Al-Si Alloys | 600 | 0.0010 | 0.0020 | 0.0030 | 0.0040 | 0.0050 | 0.0060 |
| cast iron | 600 | 0.0008 | 0.0015 | 0.0020 | 0.0030 | 0.0040 | 0.0050 |
| brass or bronze | 450 | 0.0010 | 0.0020 | 0.0030 | 0.0040 | 0.0050 | 0.0060 |
| steel <200 Bhn | 600 | 0.0007 | 0.0015 | 0.0020 | 0.0030 | 0.0040 | 0.0050 |
| steel <325 Bhn | 575 | 0.0005 | 0.0010 | 0.0015 | 0.0020 | 0.0030 | 0.0040 |
| stainless steel | 525 | 0.0005 | 0.0008 | 0.0015 | 0.0020 | 0.0030 | 0.0040 |
| tool steels, annealed | 125 | 0.0005 | 0.0008 | 0.0012 | 0.0015 | 0.0020 | 0.0030 |

TECHNICAL

High Speed Steel



How to request Made-to-Order taps:

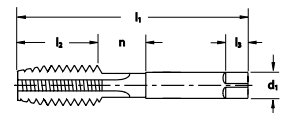
Information required for every order:

- quantity
- ordering number

Information required for some tool styles:

- exact tool size
- threads per inch
- pitch
- thread form
- right- or left-hand
- limit
- pitch diameter
- class of fit
- chamfer
- number of chamfered threads
- chamfer angle
- number of lube grooves
- short projections

Made To Order Taps Available



Other features available:

- surface treatment
- special hook
- male centers removed
- special back tape
- recessed neck
- shank flats
- special shank diameter
- special rake
- thread relief
- interrupted threads
- controlled root
- ETTCO notch
- shank grooves





TECHNICAL
High Speed Steel



TECH TIP

Ground Thread Tap Limits

All standard ground thread taps made to USCTI Tables 327 and 329 will be marked **G** to designate ground thread. **G** will be followed by **H** to designate above basic or **L** for below basic and a numeral to designate the pitch diameter limits. For example: **G H3** indicates a ground thread tap with pitch diameter limits .0010" to .0015" over basic. See table at right.

For taps over 1-1/2" diameter with H or L limit numbers, divide the the H or L limit number by 2 to get the amount (in thousandths of an inch) the maximum tap pitch diameter is over basic for the H series or under basic for the L series. In H series taps, the tolerance shown in USCTI Table 331, Column D, **subtracted** from the maximum pitch diameter will give the minimum pitch diameter. In L series taps the tolerance shown in Table 331, Column D, **added** to the minimum pitch diameter will give the maximum pitch diameter. These taps will be marked with the appropriate H or L limit number.



TECH TIP

The Proper Use of Lubricants in Tapping

Applying the proper lubricants in tapping operations can result in longer tap life, increased production, better workpiece size control, smoother and more accurate threads, less resharping, and more efficient chip removal. Generally, for best tap performance, straight cutting oil should be used. For non-ferrous and non-metallic materials, a coolant or a cutting fluid (light oil or soluble oil) is recommended.

Often, machining centers are equipped with a coolant or a cutting fluid that contains enough water and oil to provide adequate cooling and lubrication for a variety of tools and workpieces. However, most soluble blends are not suitable for tapping applications. Tapping, especially with thread-forming taps, requires more lubrication than cooling. A coolant or cutting fluid might lack the lubrication necessary to obtain acceptable tool life and part finish. Get recommendations from a coolant specialist.

After you select the proper lubricant, choose the right method of application and pressure. For tapping, use multiple nozzles around the tap. Nozzles should be as close to the surface of the part as possible, positioned at an angle close to the axis of the tool, and should point directly into the hole to flush chips from the flutes. For horizontal tapping, where the tap is stationary and the workpieces rotate, consider using two streams of lubricant, one on each side of the tap.

Whether you are tapping vertically, horizontally, or at an angle, make sure the lubricant reaches the cutting lands of the tap at all times, especially at the point or chamfered sections. Brushing or squirting oil or fluid onto the tap does not provide sufficient lubrication. In fact, heavy viscosity oil may cause the chips to stick or cling to a tap, increasing the chance of breakage. In addition,

if the lubricant is automatically applied only on the forward motion of the tap, time the application of the lubricant so that it will reach the hole before the tap starts to cut, particularly with machines on which the cutting fluid is automatically shut off when the tap reverses. For maximum effectiveness, it is better to force the lubricant into the hole under pressure, which will vary depending on the tapping method, hole depth, and tapping speed.

Keep tapping lubricants as clean as possible using a filtering system or other equipment. Dust and other foreign particles can contaminate oil and decrease its effectiveness. Thoroughly clean machines and oil tanks when adding new lubricant and at regular intervals to ensure optimum results.

Pitch Diameter Limits

for taps through 1" diameter

- L1 = basic to basic - .0005
- H1 = basic to basic + .0005
- H2 = basic + .0005 to basic + .0010
- H3 = basic + .0010 to basic + .0015
- H4 = basic + .0015 to basic + .0020
- H5 = basic + .0020 to basic + .0025
- H6 = basic + .0025 to basic + .0030

for taps over 1" diameter through 1-1/2" diameter

- H4 = basic + .0010 to basic + .0020

Call for a Quote

Special Taps

Call Customer Service at 800.348.2885 for your quote

Prices for special taps are available upon request. Special taps can be furnished in quantities to meet your specific requirements. All special metric taps will produce internal threads which conform to ISO, ISO modified, and the obsolete OMFS thread systems and are manufactured to USCTI standard blank dimensions to fit the tap holders and machine spindles now in use in the USA.



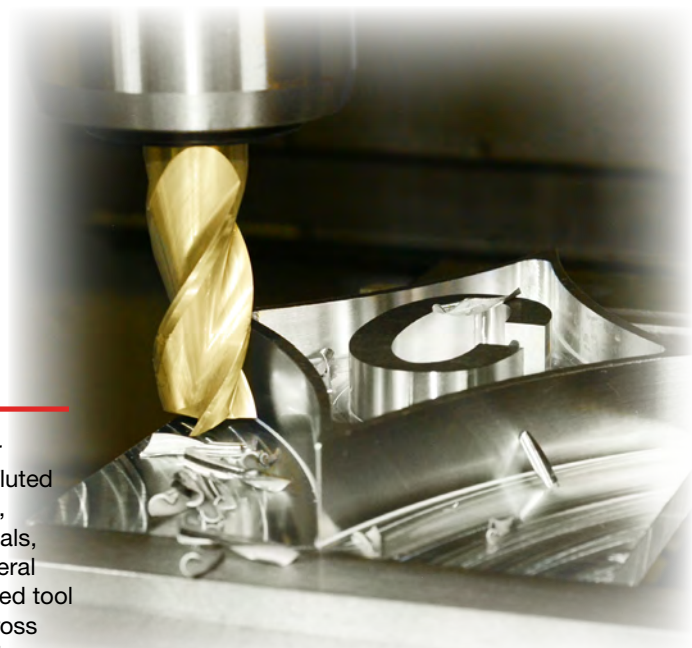
Important Update: All products in this catalog are Center Cutting (CC) End Mills.

In the past Greenfield has sold HSS End Mills in two brands, Cleveland and Putnam. In late 2016, most items sold in the Putnam Catalog were moved into the Cleveland Catalog, and the Putnam Brand will no longer be sold as a separate brand. A move was also made to manufacture all end mills as Center Cutting. However, Non-Center Cutting (NCC) End Mills, especially in the Putnam Brand, may still be available, while quantities last. Please inquire on purchasing if the product you are buying is available as a NCC End Mill. If the item you desire is not in this catalog, please inquire of our capability to make your item as a special.



Carbide End Mills

Our carbide end mills were included in our 2017 Cleveland™ Catalog. Our end mills are designed to machine a broad range of materials and are manufactured out of premium grade carbide material.



TECH TIP

Flute Selection: The selection of a tool with the proper number of flutes for any round tool is important. A two fluted tool will always have the greatest amount of chip space, and therefore should be the tool of choice in soft materials, or in situations where the tool will be run more than several diameters of itself deep. On the other hand, the two fluted tool will usually be the weaker tool because of the thinner cross section of web. Tools with more flutes (3,4,6,8, etc) will have a stronger backbone because those flutes are more shallow and provide much more cutting action. This will lead one to use a tool with more than two flutes in harder, tougher materials, or where stronger tools and less chip space are required.



TECH TIP

Understanding Chip Load per Tooth/Tool

1. Every material has an appropriate amount of stock that can be removed in milling. This rate of removal is defined as feed or chip load.
2. Chip load per tooth (CLT) is the selected maximum depth of cut for material removed by one cutting edge in one revolution of the tool.
3. This amount can vary per material, size of the end mill or number of flutes. Softer materials afford higher CLT compared to harder, tougher materials. Larger diameter tools afford higher CLT also.
4. Greenfield Industries' catalogs have charts to help determine chip load per tooth starting points. See the Speed & Feed data in the technical section.
5. Chip Load per Tool is simply the CLT per tooth X the number of cutting faces contained on the end mill. Increasing the number of cutting edges also increases inches per minute/production rate.

Here are a couple of examples: 1/4 diameter, 2 flute end mill in aluminum CLT is .0005 to .002 @200-600 SFM, 3056-9168 RPM Using .002 CLT x 2 flutes = .004 chip load per tool @6,000 RPM =24 Inches per minute
1/4 diameter, change to a 3 flute tool .002 CLT x 3 flutes = .006 chip load per tool @6,000 RPM = 36 Inches per minute.



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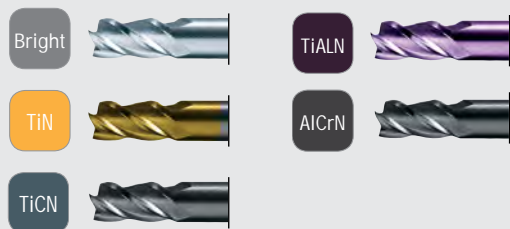
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Surface Treatment








Additional treatments available upon request.














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|------------------|---------------------|--|--------------------------|---------------|--------|------|--------------------|-----------------|-------|-----------|-----------|-------------|-----------------|----------------|------|-------------------|----------|---------|----------|---------|----------------|--------|-----|------|-------|
| Style | Page | | Type | No. of Flutes | Square | Ball | Chamfer | Radius/Rounding | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Slot | Profile | Plunging | Ramping | Drilling | Chamfer | Slot w/ Radius | Bright | TiN | TiCN | TiAlN |
| **HMD-2 | 232 | | Miniature | 2 | • | | | | • | • | • | • | | | • | • | • | • | | | | • | • | | |
| **HMD-2B | 233 | | Miniature | 2 | | • | | | • | • | • | • | | | • | • | • | • | | | • | • | | | |
| **HMD-4 | 234 | | Miniature | 4 | • | | | | • | • | • | • | | | | • | | • | | | | • | | | |
| **HMG-2 | 235 | | Miniature | 2 | • | | | | • | • | • | • | | | • | • | • | • | | | | • | | | |
| **HMG-2B | 236 | | Miniature | 2 | | • | | | • | • | • | • | | | • | • | • | • | | | • | • | | | |
| **HMG-4 | 237 | | Miniature | 4 | • | | | | • | • | • | • | | | | • | | • | | | | • | | | |
| **HD-2 | 238 | | Finisher | 2 | • | | | | • | • | • | • | | | • | • | • | • | | | | • | • | • | |
| **HD-2B | 240 | | Finisher | 2 | | • | | | • | • | • | • | | | • | • | • | • | | | • | • | • | | |
| **HD-3 | 241 | | Finisher | 3 | • | | | | • | • | • | • | | | • | • | • | • | | | | • | • | • | |
| **HD-4C | 242 | | Finisher | 4 | • | | | | • | • | • | • | | | | • | | • | | | | • | • | • | |
| **HG-2 | 243 | | Finisher | 2 | • | | | | • | • | • | • | | | • | • | • | • | | | | • | • | • | |
| **HG-2M | 246 | | Finisher | 2 | • | | | | • | • | • | • | | | • | • | • | • | | | | • | | | |
| **HG-2B | 247 | | Finisher | 2 | | • | | | • | • | • | • | | | • | • | • | • | | | • | • | • | | |
| **HG-2K | 248 | | Keyway | 2 | • | | | | • | • | • | • | | | • | • | • | • | | | | • | • | • | |
| **HG-2KS | 249 | | Keyway Cutter | 2 | • | | | | • | • | • | • | | | • | | | | | | | • | | | |
| **HGN-2 | 250 | | Finisher - Extended Neck | 2 | • | | | | • | • | • | • | | | • | • | • | • | | | | • | | | |
| **HGN-2B | 251 | | Finisher - Extended Neck | 2 | | • | | | • | • | • | • | | | • | • | • | • | | | • | • | | | |
| **HGA-2 | 252 | | Finisher - High Helix | 2 | • | | | | • | • | • | • | | | • | • | • | • | | | | • | • | • | |
| HPDM-2 | 253 | | Finisher - Drill Mill | 2 | | | <i>Pointed end</i> | | • | • | • | • | | | • | | • | • | | | | • | • | • | |
| **HG-3 | 254 | | General Purpose | 3 | • | | | | • | • | • | • | | | • | • | • | • | | | | • | • | • | |

Index

| High Speed Steel (continued) | | | | End Work | | | Application | | | | | Machining | | | | Surface Treatment | | | | | | | | | | |
|------------------------------|---------------------|---|--|-----------------------|---------------|--------|-------------|---------|-----------------|-------|-----------|-----------|-------------|-----------------|----------------|-------------------|---------|----------|---------|----------|---------|----------------|--------|-----|------|-------|
| Style | Page | Image | | Type | No. of Flutes | Square | Ball | Chamfer | Radius/Rounding | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Slot | Profile | Plunging | Ramping | Drilling | Chamfer | Slot w/ Radius | Bright | TiN | TiCN | TiAlN |
| **HG-4C | 255 |  | | General Purpose | M | • | | | | • | • | • | | | | • | | • | | | | | • | • | • | |
| HG-4MC | 258 |  | | General Purpose | 4 | • | | | | • | • | • | | | | | | • | | | | | • | | | |
| **HG-4B | 259 |  | | General Purpose | 4 | | • | | | • | • | • | | | | | | • | | | | | • | • | • | |
| **HG-4LL | 260 |  | | Left Hand Helix / Cut | 4 | • | | | | • | • | • | | | | | | • | | | | | • | • | • | |
| **CRE | 261 |  | | Corner Radius | 4 | | | | • | • | • | | | | | | | • | | | | | • | | | |

M = Multi Flute

| Cobalt | | | | End Work | | | Application | | | | | Machining | | | | Surface Treatment | | | | | | | | | | |
|----------|---------------------|---|--|------------------------------|---------------|--------|-------------|---------|--------|-------|-----------|-----------|-------------|-----------------|----------------|-------------------|---------|----------|---------|----------|---------|----------------|--------|-----|------|-------|
| Style | Page | Image | | Type | No. of Flutes | Square | Ball | Chamfer | Radius | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Slot | Profile | Plunging | Ramping | Drilling | Chamfer | Slot w/ Radius | Bright | TiN | TiCN | TiAlN |
| **HMDC-2 | 262 |  | | Miniature End Mill | 2 | • | | | | • | • | | • | | • | • | • | • | | | | | • | | • | |
| **HMDC-4 | 263 |  | | Miniature End Mill | 4 | • | | | | • | • | | • | | | | | • | | | | | • | | • | |
| **HDC-2 | 264 |  | | Finisher | 2 | • | | | | • | • | | • | | | | | • | | | | | • | • | • | |
| **HDC-4C | 265 |  | | Finisher | 4 | • | | | | • | • | | • | | | | | • | | | | | • | • | • | |
| **HGC-2 | 266 |  | | Finisher | 2 | • | | | | • | • | | • | | | | | • | | | | | • | • | • | |
| **HGC-2B | 268 |  | | Finisher | 2 | | • | | | • | • | | • | | | | | • | | | | | • | • | • | |
| **HGC-4C | 269 |  | | Finisher | M | • | | | | • | • | | • | | | | | • | | | | | • | • | • | |
| **HGC-4B | 271 |  | | Finisher | M | | • | | | • | • | | • | | | | | • | | | | | • | • | • | |
| **RG6 | 272 |  | | Rougher Fine Pitch | M | • | | | | • | • | | • | | | | | • | | | | | • | | • | • |
| **RG8 | 273 |  | | Rougher Coarse Pitch | M | | | • | | • | • | | • | | | | | • | | | | | • | | • | • |
| **RG9 | 275 |  | | Rougher - Extra Coarse Pitch | 3 | | | • | | • | • | | • | | | | | • | | | | | • | | • | • |

M = Multi Flute

Powdered Metal

| Style | Page | Image | Type | No. of Flutes | End Work | | | | Application | | | | | Machining | | | | Surface Treatment | | | | | |
|-----------|---------------------|-------|----------------------------------|---------------|----------|------|---------|--------|-------------|-----------|-----------|-------------|-----------------|----------------|------|---------|----------|-------------------|----------|---------|----------------|--------|-----|
| | | | | | Square | Ball | Chamfer | Radius | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Slot | Profile | Plunging | Ramping | Drilling | Chamfer | Slot w/ Radius | Bright | TiN |
| **PM-4DE | 276 | | Finisher | 4 | • | | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| **PM-2 | 277 | | Finisher | 2 | • | | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| **PM-3 | 278 | | Finisher | 3 | • | | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| **PM-4 | 279 | | Finisher | M | • | | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| **PM-4B | 281 | | Finisher | 4 | | • | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| **PM-539R | 282 | | Finisher High Helix | 3 | • | | | • | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| **PM-539L | 283 | | Finisher - Left - High Helix/Cut | 3 | • | | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| **PMRC-C | 284 | | Rougher Coarse Profile | M | • | | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| **PMRF-C | 285 | | Rougher Fine Profile | M | • | | | | • | • | • | • | • | | • | • | • | | • | • | • | • | • |
| **PM-538R | 286 | | Rougher Coarse Profile | 3 | • | | | • | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| **PM-538L | 287 | | Rougher - Left Low Helix/Cut | 3 | • | | | • | • | • | • | • | • | | • | • | • | | • | • | • | • | |

M = Multi Flute








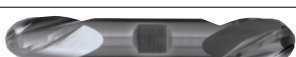


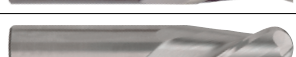


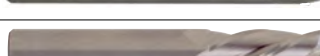
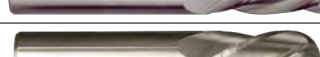
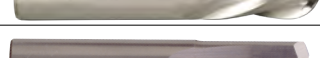
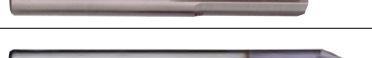
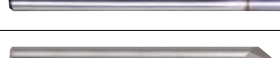
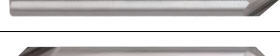
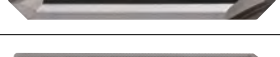

Carbide

Tolerances for Solid Carbide End Mills
Cutting Diameter: 1/32" through 1": +0.000 - 0.002
Shank Diameter: h6

| Style | Page | Image | Type | No. of Flutes | End Work | | | | Application | | | | | Machining | | | | Surface Treatment | | | | | |
|-------------|---------------------|-------|---------------------------------|---------------|----------|------|---------|--------|-------------|-----------|-----------|-------------|-----------------|----------------|------|---------|----------|-------------------|----------|---------|----------------|--------|------|
| | | | | | Square | Ball | Chamfer | Radius | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Slot | Profile | Plunging | Ramping | Drilling | Chamfer | Slot w/ Radius | Bright | TiCN |
| CEM-V-4R | 288 | | Variable Index Ferrous Material | 4 | • | | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| CEM-V-4B | 291 | | Variable Index Ferrous Material | 4 | | • | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| CEM-V2-5R | 292 | | Variable Index Ferrous Material | 5 | • | | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| CEM-V3-7R | 294 | | Steel Material | 7 | • | | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| CEM-V3-7RCB | 296 | | Steel Material | 7 | • | | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| CEM-HPDE-5 | 297 | | Steel Material | 5 | • | | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| CEM-EMS-3 | 298 | | Steel Material | 3 | • | | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |
| CEM-EMS-5 | 299 | | Steel Material | 5 | • | | | | • | • | • | • | • | | • | • | • | | • | • | • | • | |



Carbide (continued)

| Style | Page | Image | Type | No. of Flutes | End Work | | | | Application | | | | | Machining | | | | | Surface Treatment | | | | |
|--------------------|---------------------|---|-------------------|---------------|----------|------|---------|--------|-------------|-----------|-----------|-------------|-----------------|----------------|------|---------|----------|---------|-------------------|---------|----------------|--------|------|
| | | | | | Square | Ball | Chamfer | Radius | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Slot | Profile | Plunging | Ramping | Drilling | Chamfer | Slot w/ Radius | Bright | TiCN |
| CEM-AM2 | 300 |  | Aluminum Material | 2 | • | | | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-AM3 | 301 |  | Aluminum Material | 3 | • | | | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-RS | 303 |  | Rougher | 4 | • | | | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-RA | 304 |  | Rougher | 3 | • | | | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-DE2 | 305 |  | General Purpose | 2 | • | | | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-DE2B | 306 |  | General Purpose | 2 | | • | | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-DE4 | 307 |  | General Purpose | 4 | • | | | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-DE4B | 308 |  | General Purpose | 4 | | • | | | • | • | • | • | | | | | | • | • | | | | • |
| CMCE-2 CMCE-2AL | 309 |  | Miniature | 2 | • | | | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-SE2 | 311 |  | General Purpose | 2 | • | | • | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-SE2B | 313 |  | General Purpose | 2 | | • | | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-SE3 | 315 |  | General Purpose | 3 | • | | • | | • | • | • | • | | | | | | • | • | | | | • |
| CMCE-4 CMCE-4AL | 316 |  | Miniature | 4 | • | | | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-SE4 | 318 |  | General Purpose | 4 | • | | • | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-SE4B | 321 |  | General Purpose | 4 | | • | | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-SEST2 | 323 |  | Straight Flute | 2 | | | | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-EG2 | 323 |  | Engraving Tool | 2 | | • | | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-CH2 | 324 |  | Chamfer Tool | 2 | | | • | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-CH2D | 324 |  | Chamfer Tool | 2 | | | • | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-CH4 | 325 |  | Chamfer Tool | 4 | | | • | | • | • | • | • | | | | | | • | • | | | | • |
| CEM-CH4D | 325 |  | Chamfer Tool | 4 | | | • | | • | • | • | • | | | | | | • | • | | | | • |

M = Multi Flute

Index

Miniature

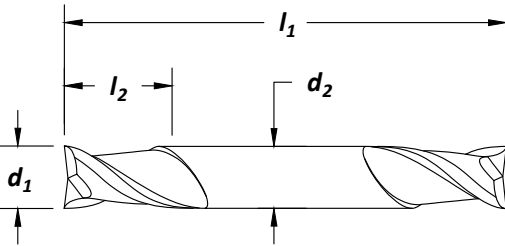
Style: **HMD-2 - Double End**



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



High Speed Steel

Center Cutting

| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number | |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|--------------|----------|
| | | | | | | HMD-2 | |
| | | | | | | Bright | TiCN |
| 1/32 | .0312 | .188 | .047 | 2.000 | 2 | C41001 | C39851 |
| 1/32 | .0312 | .188 | .094 | 2.250 | 2 | C41032 | C39883 |
| 3/64 | .0469 | .188 | .063 | 2.000 | 2 | C41003 | C39852 |
| 3/64 | .0469 | .188 | .141 | 2.250 | 2 | C41034 | C39884 |
| 1/16 | .0625 | .188 | .094 | 2.000 | 2 | C41005 | C39853 |
| 1/16 | .0625 | .188 | .188 | 2.250 | 2 | C41036 | C39885 |
| 1/16 | .0625 | .188 | .219 | 2.500 | 2 | C41070 | C39909 |
| 5/64 | .0781 | .188 | .125 | 2.000 | 2 | — | **C39854 |
| 3/32 | .0938 | .188 | .141 | 2.000 | 2 | C41008 | C39855 |
| 3/32 | .0938 | .188 | .281 | 2.250 | 2 | C41039 | C39887 |
| 3/32 | .0938 | .188 | .281 | 2.625 | 2 | **C41072 | — |
| 7/64 | .1094 | .188 | .156 | 2.000 | 2 | **C41010 | **C39856 |
| 7/64 | .1094 | .188 | .328 | 2.250 | 2 | **C41041 | **C39888 |
| 1/8 | .1250 | .188 | .188 | 2.000 | 2 | C41012 | C39857 |
| 1/8 | .1250 | .188 | .375 | 2.250 | 2 | C41043 | C39889 |
| 1/8 | .1250 | .188 | .750 | 3.125 | 2 | **C41075 | **C39911 |
| 9/64 | .1406 | .188 | .219 | 2.000 | 2 | **C41013 | **C39858 |
| 9/64 | .1406 | .188 | .406 | 2.250 | 2 | **C41044 | — |
| 5/32 | .1562 | .188 | .234 | 2.000 | 2 | **C41014 | — |
| 5/32 | .1562 | .188 | .438 | 2.250 | 2 | **C41045 | **C39891 |
| 5/32 | .1562 | .188 | .875 | 3.250 | 2 | **C41076 | **C39912 |
| 11/64 | .1719 | .188 | .500 | 2.250 | 2 | **C41047 | **C39892 |
| 3/16 | .1875 | .188 | .281 | 2.000 | 2 | C41017 | C39861 |
| 3/16 | .1875 | .188 | .500 | 2.250 | 2 | C41048 | C39893 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | | | | ◆ | | ◆ | | | |
| TiCN | ☆ | | ☆ | | | | | ☆ | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



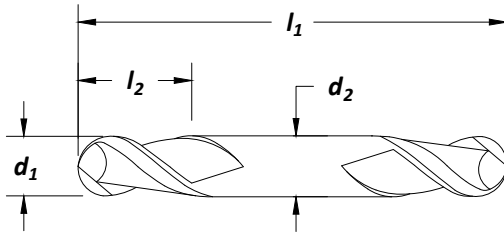
Style: **HMD-2B - Double End**

Miniature

HSS ANSI SIZES

Surface Treatment

****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number HMD-2B Bright |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|---|
| 1/32 | .0313 | .188 | .047 | 2.000 | 2 | **C75323 |
| 3/32 | .0938 | .188 | .281 | 2.250 | 2 | **C41056 |
| 1/8 | .1250 | .188 | .375 | 2.250 | 2 | **C41060 |
| 1/8 | .1250 | .188 | .750 | 3.125 | 2 | **C75326 |
| 3/16 | .1875 | .188 | .281 | 2.000 | 2 | **C41029 |
| 3/16 | .1875 | .188 | .500 | 2.250 | 2 | **C41063 |
| 3/16 | .1875 | .188 | 1.00 | 3.375 | 2 | **C75327 |

High Speed Steel

Center Cutting

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ☆ | | | | ☆ | | ☆ | | |

☆ = Best Performance ◆ = Acceptable

Miniature

 Style: **HMD-4 - Double End**

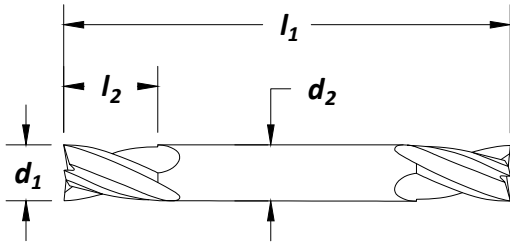
HSS

ANSI SIZES



Surface Treatment

Bright

****Items are being OBSOLETED, only available until inventory is depleted.**


| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number HMD-4 Bright |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|--|
| 1/8 | .1250 | .188 | .188 | 2.000 | 4 | **C41090 |
| 1/8 | .1250 | .188 | .375 | 2.250 | 4 | **C41104 |
| 5/32 | .1562 | .188 | .234 | 2.000 | 4 | **C41091 |
| 5/32 | .1562 | .188 | .875 | 3.250 | 4 | **C41119 |
| 3/16 | .1875 | .188 | .500 | 2.250 | 4 | **C41107 |

High Speed Steel

Center Cutting

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ★ | | ★ | | | | | ★ | | ★ | | | |

★ = Best Performance ◆ = Acceptable



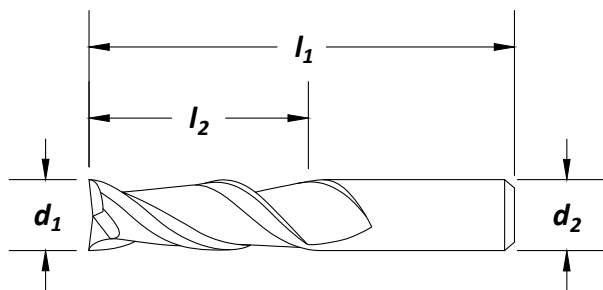
Style: **HMG-2 - Single End**

Miniature

HSS **ANSI SIZES** 2 Flute CC Helix 30° Square End

Surface Treatment **Bright**

****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number HMG-2 Bright |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|--|
| 1/32 | .0312 | .188 | .094 | 1.500 | 2 | **C40843 |
| 3/64 | .0469 | .188 | .062 | 1.500 | 2 | **C75329 |
| 3/64 | .0469 | .188 | .141 | 1.500 | 2 | **C40844 |
| 1/16 | .0625 | .188 | .094 | 1.500 | 2 | **C75330 |
| 1/16 | .0625 | .188 | .188 | 1.500 | 2 | **C40845 |
| 5/64 | .0781 | .188 | .234 | 1.500 | 2 | **C40846 |
| 3/32 | .0938 | .188 | .281 | 1.500 | 2 | **C40847 |
| 7/64 | .1094 | .188 | .328 | 1.500 | 2 | **C40848 |
| 1/8 | .1250 | .188 | .375 | 1.500 | 2 | **C40849 |
| 9/64 | .1406 | .188 | .250 | 1.500 | 2 | **C75332 |
| 9/64 | .1406 | .188 | .406 | 1.500 | 2 | **C40850 |
| 5/32 | .1562 | .188 | .250 | 1.500 | 2 | **C75333 |
| 5/32 | .1562 | .188 | .438 | 1.500 | 2 | **C40851 |
| 11/64 | .1719 | .188 | .500 | 1.500 | 2 | **C40852 |
| 3/16 | .1875 | .188 | .281 | 1.500 | 2 | **C75334 |
| 3/16 | .1875 | .188 | .500 | 1.500 | 2 | **C40853 |

High Speed Steel

Center Cutting

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ◆ | | | | ◆ | | | | |

☆ = Best Performance ◆ = Acceptable



Miniature
Styles: HMG-2B - Single End

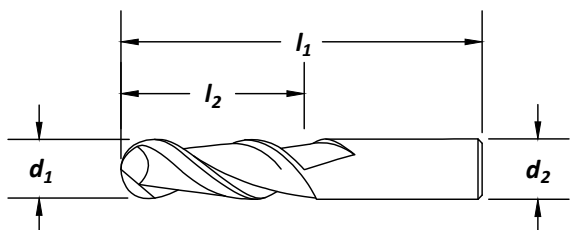
HSS

ANSI SIZES



Surface Treatment

Bright

****Items are being OBSOLETED, only available until inventory is depleted.**


| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number HMG-2B Bright |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|---|
| 1/32 | .0312 | .188 | .094 | 1.500 | 2 | **C75335 |
| 1/16 | .0625 | .188 | .094 | 1.500 | 2 | **C75336 |
| 1/16 | .0625 | .188 | .188 | 1.500 | 2 | **C75337 |
| 3/32 | .0938 | .188 | .281 | 1.500 | 2 | **C75339 |
| 1/8 | .1250 | .188 | .188 | 1.500 | 2 | **C75340 |
| 1/8 | .1250 | .188 | .375 | 1.500 | 2 | **C75341 |
| 5/32 | .1562 | .188 | .438 | 1.500 | 2 | **C75342 |
| 3/16 | .1875 | .188 | .563 | 1.500 | 2 | **C75343 |

High Speed Steel

Center Cutting

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Bright | ☆ | | ◆ | | | | | | | | | | |

☆ = Best Performance ◆ = Acceptable



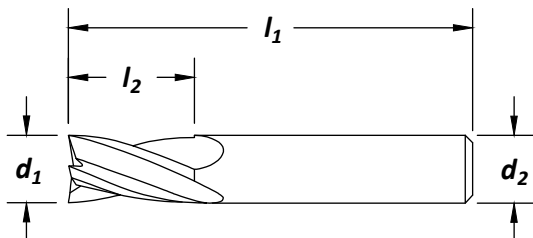
Style: **HMG-4 - Single End**

Miniature

HSS ANSI SIZES 4 Flute CC Helix 30° Square End

Surface Treatment: Bright

****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number HMG-4 Bright |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|--|
| 5/64 | .0781 | .188 | .234 | 1.500 | 4 | **C40877 |
| 7/64 | .1094 | .188 | .328 | 1.500 | 4 | **C40879 |
| 9/64 | .1406 | .188 | .406 | 1.500 | 4 | **C40881 |
| 5/32 | .1562 | .188 | .438 | 1.500 | 4 | **C40882 |
| 11/64 | .1719 | .188 | .500 | 1.500 | 4 | **C40883 |
| 3/16 | .1875 | .188 | .500 | 1.500 | 4 | **C40884 |

High Speed Steel

Center Cutting

| Material Reference | Steel (HRc) | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | 18-22 | 22-32 | | | >45 |
| Bright | ☆ | | ◆ | | | | ◆ | | | | |

☆ = Best Performance ◆ = Acceptable

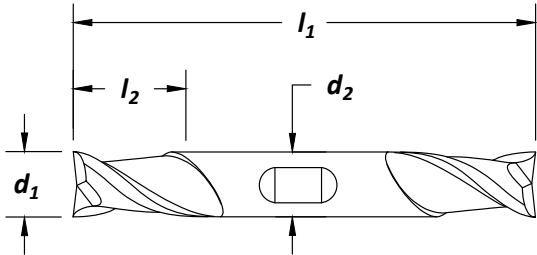


Finisher

Style: **HD-2 - Double End**

HSS
ANSI SIZES
2 Flute CC
Helix 30°
Square End
Surface Treatment
Bright
TiN
TiCN

****Items are being OBSOLETED, only available until inventory is depleted.**



High Speed Steel

Center Cutting

| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number | | |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|--------------|----------|----------|
| | | | | | | Bright | TiN | TiCN |
| 1/8 | .1250 | .375 | .188 | 2.750 | 2 | C42096 | C39044 | C39049 |
| 1/8 | .1250 | .375 | .375 | 3.063 | 2 | C42051 | C33648 | C33689 |
| 9/64 | .1406 | .375 | .438 | 3.125 | 2 | **C33626 | **C33649 | **C33690 |
| 5/32 | .1562 | .375 | .234 | 2.750 | 2 | **C42097 | — | **C39050 |
| 5/32 | .1562 | .375 | .438 | 3.125 | 2 | C42052 | C33650 | C33691 |
| 11/64 | .1719 | .375 | .438 | 3.250 | 2 | **C33627 | **C33651 | **C33692 |
| 3/16 | .1875 | .375 | .281 | 2.750 | 2 | C42099 | C39046 | C39051 |
| 3/16 | .1875 | .375 | .438 | 3.250 | 2 | C42054 | C33652 | C33693 |
| 13/64 | .2031 | .375 | .500 | 3.250 | 2 | **C42055 | — | **C33694 |
| 7/32 | .2188 | .375 | .328 | 2.875 | 2 | **C42101 | — | **C39052 |
| 7/32 | .2188 | .375 | .500 | 3.250 | 2 | C42056 | C33654 | C33695 |
| 15/64 | .2344 | .375 | .500 | 3.375 | 2 | **C33629 | **C33655 | **C33696 |
| 1/4 | .2500 | .375 | .375 | 2.875 | 2 | C42103 | C39048 | C39053 |
| 1/4 | .2500 | .375 | .500 | 3.375 | 2 | C42058 | C33656 | C33697 |
| 17/64 | .2656 | .375 | .563 | 3.375 | 2 | **C33630 | **C33657 | **C33698 |
| 9/32 | .2812 | .375 | .563 | 3.375 | 2 | C42060 | C33658 | C33699 |
| 19/64 | .2969 | .375 | .563 | 3.500 | 2 | **C33631 | — | **C33700 |
| 5/16 | .3125 | .375 | .563 | 3.500 | 2 | C42061 | C33660 | C33701 |
| 21/64 | .3281 | .375 | .563 | 3.500 | 2 | **C33632 | **C33661 | **C33702 |
| 11/32 | .3438 | .375 | .563 | 3.500 | 2 | C42063 | C33662 | C33703 |
| 23/64 | .3594 | .375 | .563 | 3.500 | 2 | **C33633 | **C33663 | **C33704 |
| 3/8 | .3750 | .375 | .563 | 3.500 | 2 | C42065 | C33664 | C33705 |
| 25/64 | .3906 | .500 | .813 | 4.125 | 2 | — | **C33665 | **C33706 |
| 13/32 | .4062 | .500 | .813 | 4.125 | 2 | C42067 | C33666 | C33707 |
| 27/64 | .4219 | .500 | .813 | 4.125 | 2 | **C33635 | — | — |
| 7/16 | .4375 | .500 | .813 | 4.125 | 2 | C42069 | C33668 | C33709 |
| 15/32 | .4688 | .500 | .813 | 4.125 | 2 | C42070 | C33670 | C33711 |
| 31/64 | .4844 | .500 | .813 | 4.125 | 2 | **C33637 | — | — |
| 1/2 | .5000 | .500 | .813 | 4.125 | 2 | C42072 | C33672 | C33713 |
| 17/32 | .5312 | .625 | 1.125 | 5.000 | 2 | **C33638 | — | **C33714 |
| 9/16 | .5625 | .625 | 1.125 | 5.000 | 2 | C42074 | C33674 | C33715 |

continued on next page



Style: HD-2 - Double End (continued)

Finisher

| diameter | decimal equiv. | shank dia d ₂ (in) | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | order number | | |
|----------|----------------|-------------------------------|-----------------------------------|------------------------------------|---------------|--------------|-----------------|----------|
| | | | | | | Bright | HD-2 TiN | TiCN |
| 19/32 | .5938 | .625 | 1.125 | 5.000 | 2 | — | — | **C33716 |
| 5/8 | .6250 | .625 | 1.125 | 5.000 | 2 | C42076 | C33676 | C33717 |
| 21/32 | .6562 | .750 | 1.313 | 5.625 | 2 | **C33640 | **C33677 | **C33718 |
| 11/16 | .6875 | .750 | 1.313 | 5.625 | 2 | C42078 | C33678 | C33719 |
| 23/32 | .7188 | .750 | 1.313 | 5.625 | 2 | **C33641 | **C33679 | — |
| 3/4 | .7500 | .750 | 1.313 | 5.625 | 2 | C42080 | C33680 | C33721 |
| 13/16 | .8125 | .875 | 1.563 | 6.125 | 2 | **C33643 | **C33682 | — |
| 7/8 | .8750 | .875 | 1.563 | 6.125 | 2 | C42084 | C33684 | C33725 |
| 15/16 | .9375 | 1.000 | 1.625 | 6.375 | 2 | **C33646 | — | — |
| 1 | 1.0000 | 1.000 | 1.625 | 6.375 | 2 | C42088 | C33688 | C33729 |

High Speed Steel

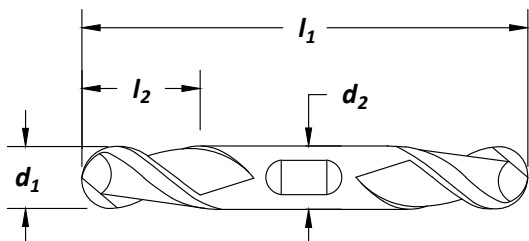
Center Cutting

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | ◆ | | ◆ | | | | | ◆ | | | | | |
| TiCN | ☆ | | ☆ | | | | | ☆ | | ◆ | | | |

☆ = Best Performance ◆ = Acceptable

Finisher
Style: HD-2B - Double End
HSS
ANSI SIZES

Surface Treatment

****Items are being OBSOLETED, only available until inventory is depleted.**

High Speed Steel
Center Cutting

| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number | | |
|--|----------------|--|--|---|---------------|--------------|---------------------|----------|
| | | | | | | Bright | HD-2B TiN | TiCN |
| 1/8 | .1250 | .375 | .1875 | 3.125 | 2 | C75117 | C75120 | C75123 |
| 1/8 | .1250 | .375 | .375 | 3.063 | 2 | C42184 | C39142 | C39158 |
| 5/32 | .1562 | .375 | .438 | 3.125 | 2 | C39136 | C39143 | C39159 |
| 3/16 | .1875 | .375 | .281 | 3.250 | 2 | **C75118 | — | — |
| 3/16 | .1875 | .375 | .438 | 3.250 | 2 | C42186 | C39144 | C39160 |
| 7/32 | .2188 | .375 | .500 | 3.250 | 2 | — | **C39145 | **C39161 |
| 1/4 | .2500 | .375 | .375 | 3.375 | 2 | C75119 | C75122 | C75125 |
| 1/4 | .2500 | .375 | .500 | 3.375 | 2 | C42189 | C39146 | C39162 |
| 9/32 | .2812 | .375 | .563 | 3.375 | 2 | **C39138 | **C39147 | **C39163 |
| 5/16 | .3125 | .375 | .563 | 3.500 | 2 | C42191 | C39148 | C39164 |
| 11/32 | .3438 | .375 | .563 | 3.500 | 2 | **C39139 | **C39149 | **C39165 |
| 3/8 | .3750 | .375 | .563 | 3.500 | 2 | C42194 | C39150 | C39166 |
| 13/32 | .4062 | .500 | .813 | 4.125 | 2 | — | **C39151 | — |
| 7/16 | .4375 | .500 | .813 | 4.125 | 2 | C42197 | C39152 | C39168 |
| 1/2 | .5000 | .500 | .813 | 4.125 | 2 | C42199 | C39153 | C39169 |
| 5/8 | .6250 | .625 | 1.125 | 5.000 | 2 | C42202 | C39154 | C39170 |
| 3/4 | .7500 | .750 | 1.313 | 5.625 | 2 | C42205 | C39155 | C39171 |
| 7/8 | .8750 | .875 | 1.563 | 6.125 | 2 | **C39141 | — | — |
| 1 | 1.0000 | 1.000 | 1.625 | 6.375 | 2 | **C42212 | **C39157 | — |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | >38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | ◆ | | ◆ | | | | | ◆ | | | | | |
| TiCN | ☆ | | ☆ | | | | | ☆ | ☆ | ◆ | | | |

☆ = Best Performance ◆ = Acceptable



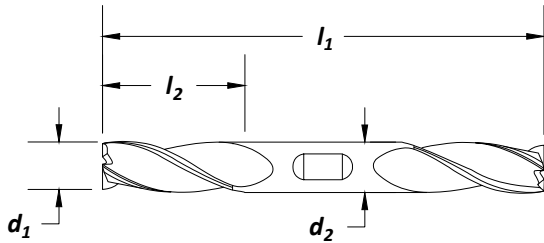
Style: **HD-3 - Double End**

Finisher

HSS ANSI SIZES 3 Flute CC Helix 30° Square End

Surface Treatment Bright TiN TiCN

****Items are being OBSOLETEd, only available until inventory is depleted.**



| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number | | |
|--|----------------|--|--|---|---------------|--------------|----------|----------|
| | | | | | | HD-3 | | |
| | | | | | | Bright | TiN | TiCN |
| 1/8 | .1250 | .375 | .375 | 3.063 | 3 | C39575 | C39596 | C39617 |
| 5/32 | .1562 | .375 | .438 | 3.125 | 3 | **C39576 | C39597 | **C39618 |
| 3/16 | .1875 | .375 | .500 | 3.250 | 3 | C39577 | C39598 | C39619 |
| 7/32 | .2188 | .375 | .563 | 3.250 | 3 | **C39578 | — | **C39620 |
| 1/4 | .2500 | .375 | .625 | 3.375 | 3 | C39579 | C39600 | C39621 |
| 9/32 | .2812 | .375 | .688 | 3.375 | 3 | **C39580 | — | — |
| 5/16 | .3125 | .375 | .750 | 3.500 | 3 | C39581 | C39602 | C39623 |
| 11/32 | .3438 | .375 | .750 | 3.500 | 3 | **C39582 | **C39603 | **C39624 |
| 3/8 | .3750 | .375 | .750 | 3.500 | 3 | C39583 | C39604 | C39625 |
| 13/32 | .4062 | .500 | 1.000 | 4.125 | 3 | **C39584 | — | **C39626 |
| 7/16 | .4375 | .500 | 1.000 | 4.125 | 3 | C39585 | C39606 | C39627 |
| 1/2 | .5000 | .500 | 1.000 | 4.125 | 3 | C39587 | C39608 | C39629 |
| 9/16 | .5625 | .625 | 1.375 | 5.000 | 3 | — | — | **C39630 |
| 5/8 | .6250 | .625 | 1.375 | 5.000 | 3 | **C39589 | **C39610 | **C39631 |
| 3/4 | .7500 | .750 | 1.625 | 5.625 | 3 | C39591 | C39612 | C39633 |
| 7/8 | .8750 | .875 | 1.875 | 6.125 | 3 | **C39593 | **C39614 | **C39635 |
| 1 | 1.0000 | 1.000 | 1.875 | 6.375 | 3 | — | — | **C39637 |

High Speed Steel

Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | |
| Hardness | | | | | | | | | | | | >45 | |
| TiN | ★ | | ★ | | | | | ★ | | | | | |
| TiCN | ☆ | | ☆ | | | | | ☆ | | ★ | | | |

☆ = Best Performance ★ = Acceptable



Finisher

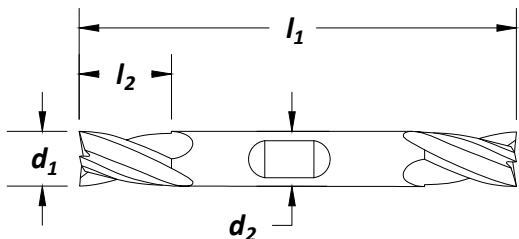
Style: **HD-4C - Double End**



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



High Speed Steel

Center Cutting

| cutting diameter | decimal | shank dia | length of cut | overall length | no. of flutes | order number | | |
|------------------|---------|---------------------|---------------------|---------------------|---------------|--------------|----------|----------|
| | | | | | | HD-4C | | |
| d ₁ | equiv. | d ₂ (in) | l ₂ (in) | l ₁ (in) | | Bright | TiN | TiCN |
| 1/8 | .1250 | .375 | .188 | 2.750 | 4 | **C74995 | — | **C75005 |
| 1/8 | .1250 | .375 | .375 | 3.063 | 4 | C41202 | C33059 | C33100 |
| 9/64 | .1406 | .375 | .438 | 3.125 | 4 | C33028 | C33060 | C33101 |
| 5/32 | .1562 | .375 | .234 | 2.750 | 4 | **C74996 | **C75001 | — |
| 5/32 | .1562 | .375 | .438 | 3.125 | 4 | C33029 | C33061 | C33102 |
| 11/64 | .1719 | .375 | .500 | 3.250 | 4 | C33030 | C33062 | C33103 |
| 3/16 | .1875 | .375 | .281 | 2.750 | 4 | **C74997 | **C75002 | **C75007 |
| 3/16 | .1875 | .375 | .500 | 3.250 | 4 | C41204 | C33063 | C33104 |
| 13/64 | .2031 | .375 | .563 | 3.250 | 4 | C33031 | C33064 | C33105 |
| 7/32 | .2188 | .375 | .328 | 2.875 | 4 | **C74998 | **C75003 | — |
| 7/32 | .2188 | .375 | .563 | 3.250 | 4 | C33032 | C33065 | C33106 |
| 15/64 | .2344 | .375 | .625 | 3.375 | 4 | C33033 | C33066 | C33107 |
| 1/4 | .2500 | .375 | .375 | 2.875 | 4 | C74999 | C75004 | C75009 |
| 1/4 | .2500 | .375 | .625 | 3.375 | 4 | C41207 | C33067 | C33108 |
| 17/64 | .2656 | .375 | .688 | 3.375 | 4 | C33034 | C33068 | C33109 |
| 9/32 | .2812 | .375 | .688 | 3.375 | 4 | C33035 | C33069 | C33110 |
| 19/64 | .2969 | .375 | .750 | 3.500 | 4 | C33036 | C33070 | C33111 |
| 5/16 | .3125 | .375 | .750 | 3.500 | 4 | C41209 | C33071 | C33112 |
| 21/64 | .3281 | .375 | .750 | 3.500 | 4 | C33037 | C33072 | C33113 |
| 11/32 | .3438 | .375 | .750 | 3.500 | 4 | C33038 | C33073 | C33114 |
| 23/64 | .3594 | .375 | .750 | 3.500 | 4 | **C33039 | — | **C33115 |
| 3/8 | .3750 | .375 | .750 | 3.500 | 4 | C41212 | C33075 | C33116 |
| 25/64 | .3906 | .500 | 1.000 | 4.125 | 4 | C33040 | C33076 | C33117 |
| 13/32 | .4062 | .500 | 1.000 | 4.125 | 4 | C33041 | C33077 | C33118 |
| 27/64 | .4219 | .500 | 1.000 | 4.125 | 4 | **C33042 | — | — |
| 7/16 | .4375 | .500 | 1.000 | 4.125 | 4 | C33043 | C33079 | C33120 |
| 29/64 | .4531 | .500 | 1.000 | 4.125 | 4 | — | **C33080 | — |
| 15/32 | .4688 | .500 | 1.000 | 4.125 | 4 | **C33045 | **C33081 | **C33122 |
| 31/64 | .4844 | .500 | 1.000 | 4.125 | 4 | **C33046 | **C33082 | — |
| 1/2 | .5000 | .500 | 1.000 | 4.125 | 4 | C41216 | C33083 | C33124 |
| 17/32 | .5312 | .625 | 1.375 | 5.000 | 4 | **C33047 | C33084 | C33125 |
| 9/16 | .5625 | .625 | 1.375 | 5.000 | 4 | C33048 | C33085 | C33126 |
| 19/32 | .5938 | .625 | 1.375 | 5.000 | 4 | C33049 | C33086 | C33127 |
| 5/8 | .6250 | .625 | 1.375 | 5.000 | 4 | C41219 | C33087 | C33128 |
| 11/16 | .6875 | .750 | 1.625 | 5.625 | 4 | C33051 | C33089 | C33130 |
| 3/4 | .7500 | .750 | 1.625 | 5.625 | 4 | C41223 | C33091 | C33132 |
| 13/16 | .8125 | .875 | 1.875 | 6.125 | 4 | C33054 | C33093 | C33134 |
| 7/8 | .8750 | .875 | 1.875 | 6.125 | 4 | C41227 | C33095 | C33136 |
| 15/16 | .9375 | 1.000 | 1.875 | 6.375 | 4 | C33057 | **C33097 | — |
| 1 | 1.0000 | 1.000 | 1.875 | 6.375 | 4 | C41231 | C33099 | C33140 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | + | | + | | | | | + | | | | | |
| TiCN | ☆ | | ☆ | | | | | ☆ | | + | | | |

☆ = Best Performance + = Acceptable

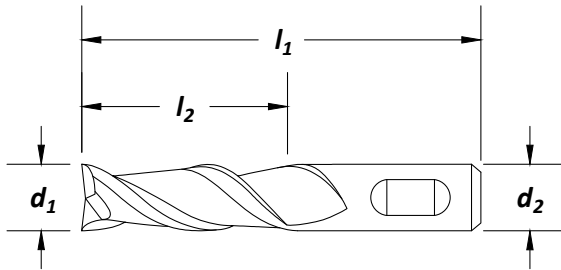


Style: **HG-2 - Single End**

Finisher



****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number | | |
|--|----------------|--|--|---|---------------|---------------|------------|-------------|
| | | | | | | Bright | TiN | TiCN |
| 1/8 | .1250 | .375 | .375 | 2.313 | 2 | C41602 | C41550 | C33803 |
| 5/32 | .1562 | .375 | .438 | 2.375 | 2 | C33730 | C33754 | C33804 |
| 3/16 | .1875 | .375 | .281 | 2.188 | 2 | **C75183 | **C75217 | **C75251 |
| 3/16 | .1875 | .375 | .438 | 2.375 | 2 | C41604 | C41551 | C33806 |
| 3/16 | .1875 | .375 | 1.250 | 3.063 | 2 | C39064 | C39078 | C39107 |
| 13/64 | .2031 | .375 | .500 | 2.438 | 2 | **C33732 | **C33756 | **C33807 |
| 7/32 | .2188 | .375 | .500 | 2.438 | 2 | C33733 | C33757 | C33808 |
| 7/32 | .2188 | .375 | 1.250 | 3.063 | 2 | C39065 | C39079 | C39108 |
| 15/64 | .2344 | .375 | .500 | 2.438 | 2 | **C33734 | — | — |
| 1/4 | .2500 | .375 | .500 | 2.438 | 2 | C41607 | C41552 | C33810 |
| 1/4 | .2500 | .375 | 1.250 | 3.063 | 2 | C39066 | C39080 | C39109 |
| 17/64 | .2656 | .375 | .563 | 2.500 | 2 | — | — | **C33811 |
| 9/32 | .2812 | .375 | .563 | 2.500 | 2 | C33736 | C33760 | C33812 |
| 9/32 | .2812 | .375 | 1.375 | 3.125 | 2 | C39067 | C39081 | C39110 |
| 19/64 | .2969 | .375 | .563 | 2.500 | 2 | **C33737 | **C33761 | **C33813 |
| 5/16 | .3125 | .375 | .563 | 2.500 | 2 | C41609 | C41553 | C33814 |
| 5/16 | .3125 | .375 | 1.375 | 3.125 | 2 | C39068 | C39082 | C39111 |
| 21/64 | .3281 | .375 | .563 | 2.500 | 2 | **C33738 | — | **C33815 |
| 11/32 | .3438 | .375 | .563 | 2.500 | 2 | C33739 | C33763 | C33816 |
| 11/32 | .3438 | .375 | 1.500 | 3.250 | 2 | **C39069 | — | — |
| 23/64 | .3594 | .375 | .563 | 2.500 | 2 | **C33740 | — | — |
| 3/8 | .3750 | .375 | .563 | 2.500 | 2 | C41612 | C41554 | C33818 |
| 3/8 | .3750 | .375 | 1.000 | 2.750 | 2 | **C75184 | — | — |
| 3/8 | .3750 | .375 | 1.500 | 3.250 | 2 | C41714 | C39084 | C39113 |
| 25/64 | .3906 | .375 | .813 | 2.688 | 2 | **C33741 | **C33765 | **C33819 |
| 13/32 | .4062 | .375 | .813 | 2.688 | 2 | C33742 | C33766 | C33820 |
| 13/32 | .4062 | .500 | 1.750 | 3.750 | 2 | — | — | **C39114 |
| 27/64 | .4219 | .375 | .813 | 2.688 | 2 | **C33743 | — | — |
| 7/16 | .4375 | .375 | .813 | 2.688 | 2 | C41615 | C33768 | C33822 |
| 7/16 | .4375 | .500 | 1.750 | 3.750 | 2 | C39071 | C39086 | C39115 |
| 29/64 | .4531 | .375 | .813 | 2.688 | 2 | — | — | **C75253 |
| 29/64 | .4531 | .500 | .813 | 3.250 | 2 | C33744 | C33769 | C33823 |
| 15/32 | .4688 | .375 | .813 | 2.688 | 2 | **C75186 | **C75220 | — |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | | | >45 | |
| TiN | ★ | | ★ | | | | | ★ | | | | | |
| TiCN | ★ | | ★ | | | | | ★ | | ★ | | | |

★ = Best Performance ◆ = Acceptable

Finisher

Style: HG-2 - Single End (continued)

| cutting diameter d ₁ | decimal equiv. | shank dia d ₂ (in) | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | order number | | |
|------------------------------------|----------------|----------------------------------|--------------------------------------|---------------------------------------|---------------|--------------|--------------------|----------|
| | | | | | | Bright | HG-2 TiN | TiCN |
| 15/32 | .4688 | .500 | .813 | 3.250 | 2 | **C33745 | — | **C33824 |
| 15/32 | .4688 | .500 | 2.000 | 4.000 | 2 | C39072 | C39087 | C39116 |
| 31/64 | .4844 | .375 | .813 | 2.688 | 2 | **C75187 | — | **C75255 |
| 31/64 | .4844 | .500 | .813 | 3.250 | 2 | C33746 | C33771 | C33825 |
| 1/2 | .5000 | .375 | .813 | 2.688 | 2 | C41617 | C33772 | C33826 |
| 1/2 | .5000 | .500 | 1.000 | 3.250 | 2 | C41618 | C41555 | C33827 |
| 1/2 | .5000 | .500 | 1.500 | 3.500 | 2 | C75188 | C75222 | C75256 |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 2 | C41718 | C39088 | C39117 |
| 33/64 | .5156 | .500 | 1.000 | 3.250 | 2 | **C75189 | **C75223 | **C75257 |
| 33/64 | .5156 | .500 | 1.125 | 3.375 | 2 | C33747 | C33773 | C33828 |
| 17/32 | .5312 | .500 | 1.125 | 3.375 | 2 | C33748 | C33774 | C33829 |
| 17/32 | .5312 | .625 | 2.000 | 4.125 | 2 | C39073 | C39089 | C39118 |
| 35/64 | .5469 | .500 | 1.125 | 3.375 | 2 | C33749 | C33775 | C33830 |
| 9/16 | .5625 | .500 | 1.125 | 3.375 | 2 | C41620 | C33776 | C33831 |
| 9/16 | .5625 | .625 | 2.000 | 4.125 | 2 | C39074 | C39090 | C39119 |
| 37/64 | .5781 | .500 | 1.125 | 3.375 | 2 | C33750 | C33777 | C33832 |
| 19/32 | .5938 | .500 | 1.125 | 3.375 | 2 | C33751 | C33778 | C33833 |
| 39/64 | .6094 | .500 | 1.125 | 3.375 | 2 | C33752 | C33779 | C33834 |
| 5/8 | .6250 | .500 | .625 | 2.750 | 2 | — | — | **C75258 |
| 5/8 | .6250 | .500 | 1.125 | 3.375 | 2 | C41622 | C33780 | C33835 |
| 5/8 | .6250 | .625 | 1.313 | 3.750 | 2 | C41623 | C41556 | C33836 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 2 | — | **C75225 | **C75259 |
| 5/8 | .6250 | .625 | 2.000 | 4.125 | 2 | C41721 | C39091 | C39120 |
| 41/64 | .6406 | .625 | 1.313 | 3.750 | 2 | **C75192 | — | **C75260 |
| 21/32 | .6563 | .625 | 1.313 | 3.750 | 2 | **C75193 | **C75227 | **C75261 |
| 11/16 | .6875 | .500 | 1.313 | 3.625 | 2 | C41625 | C33781 | C33837 |
| 11/16 | .6875 | .625 | 1.313 | 3.750 | 2 | C41626 | C33782 | C33838 |
| 11/16 | .6875 | .750 | 2.250 | 4.500 | 2 | C39075 | C39092 | C39121 |
| 23/32 | .7188 | .500 | 1.313 | 3.313 | 2 | **C75194 | — | — |
| 23/32 | .7188 | .750 | 1.313 | 3.875 | 2 | **C75195 | — | **C75263 |
| 47/64 | .7344 | .750 | 1.313 | 3.875 | 2 | — | **C75230 | **C75264 |
| 3/4 | .7500 | .500 | 1.313 | 3.625 | 2 | C41628 | C33783 | C33839 |
| 3/4 | .7500 | .625 | 1.313 | 3.750 | 2 | C41629 | C33784 | C33840 |
| 3/4 | .7500 | .750 | .750 | 3.000 | 2 | **C75197 | — | — |
| 3/4 | .7500 | .750 | 1.313 | 3.875 | 2 | C41630 | C41557 | C33841 |
| 3/4 | .7500 | .750 | 1.750 | 4.000 | 2 | C75198 | C75232 | C75266 |
| 3/4 | .7500 | .750 | 2.250 | 4.500 | 2 | C41724 | C39093 | C39122 |
| 25/32 | .7813 | .750 | 1.500 | 4.250 | 2 | — | **C75233 | **C75267 |
| 13/16 | .8125 | .625 | 1.500 | 4.000 | 2 | C41632 | C33785 | C38900 |
| 13/16 | .8125 | .750 | 1.500 | 4.125 | 2 | **C75200 | **C75234 | **C75268 |
| 13/16 | .8125 | .875 | 2.500 | 4.750 | 2 | C39076 | C39094 | C39123 |
| 27/32 | .8438 | .875 | 1.500 | 4.250 | 2 | **C75201 | — | — |
| 7/8 | .8750 | .625 | 1.500 | 4.000 | 2 | C41635 | C33786 | C38901 |
| 7/8 | .8750 | .750 | 1.500 | 4.125 | 2 | C41636 | C33787 | C38902 |
| 7/8 | .8750 | .875 | 1.500 | 4.125 | 2 | C41637 | C33788 | C38903 |
| 7/8 | .8750 | .875 | 2.500 | 4.750 | 2 | C41728 | C39095 | C39124 |
| 15/16 | .9375 | .625 | 1.500 | 4.000 | 2 | C75204 | C75238 | C75272 |
| 15/16 | .9375 | .875 | 1.500 | 4.125 | 2 | — | **C33789 | **C38904 |
| 15/16 | .9375 | 1.000 | 3.000 | 5.500 | 2 | C39077 | C39096 | C39125 |
| 1 | 1.0000 | .500 | 1.500 | 3.500 | 2 | **C75207 | — | **C75275 |
| 1 | 1.0000 | .625 | 1.500 | 4.000 | 2 | C41641 | C33790 | C38905 |
| 1 | 1.0000 | .750 | 1.500 | 4.125 | 2 | C41642 | C33791 | C38906 |
| 1 | 1.0000 | .875 | 1.500 | 4.125 | 2 | C41643 | C33792 | C38907 |
| 1 | 1.0000 | 1.000 | 1.625 | 4.500 | 2 | C41644 | C41558 | C38908 |

continued on next page

High Speed Steel

Center Cutting



Style: HG-2 - Single End (continued)

Finisher

| cutting diameter <u>d₁</u> | decimal equiv. | shank dia <u>d₂ (in)</u> | length of cut <u>l₂ (in)</u> | overall length <u>l₁ (in)</u> | no. of flutes | order number | | |
|--|----------------|--|--|---|---------------|--------------|--------------------|----------|
| | | | | | | Bright | HG-2 TiN | TiCN |
| 1 | 1.0000 | 1.000 | 2.250 | 4.750 | 2 | — | **C75242 | — |
| 1 | 1.0000 | 1.000 | 3.000 | 5.500 | 2 | C41732 | C39097 | C39126 |
| 1-1/8 | 1.1250 | .750 | 1.500 | 3.875 | 2 | C75209 | C75243 | C75277 |
| 1-1/8 | 1.1250 | .875 | 1.625 | 4.125 | 2 | C41647 | C33793 | C38909 |
| 1-1/8 | 1.1250 | 1.000 | 1.625 | 4.500 | 2 | C41648 | C33794 | C38910 |
| 1-1/8 | 1.1250 | 1.000 | 3.000 | 5.500 | 2 | **C41735 | — | — |
| 1-1/4 | 1.2500 | .875 | 1.625 | 4.125 | 2 | C41650 | C33795 | C38911 |
| 1-1/4 | 1.2500 | 1.000 | 1.625 | 4.500 | 2 | C41651 | C33796 | C38912 |
| 1-1/4 | 1.2500 | 1.250 | 1.625 | 4.500 | 2 | C41652 | C33797 | C38913 |
| 1-1/4 | 1.2500 | 1.000 | 3.000 | 5.500 | 2 | C41737 | C39099 | C39128 |
| 1-3/8 | 1.3750 | .750 | 1.500 | 3.875 | 2 | C75212 | C75246 | C75280 |
| 1-3/8 | 1.3750 | 1.000 | 1.625 | 4.500 | 2 | — | — | **C38914 |
| 1-3/8 | 1.3750 | 1.000 | 3.000 | 5.500 | 2 | **C41741 | **C39101 | — |
| 1-1/2 | 1.5000 | 1.000 | 1.625 | 4.500 | 2 | C41659 | C33799 | C38915 |
| 1-1/2 | 1.5000 | 1.250 | 1.625 | 4.500 | 2 | C41660 | C33800 | C38916 |
| 1-5/8 | 1.6250 | 1.250 | 3.000 | 5.500 | 2 | C41747 | C39103 | C39132 |
| 1-3/4 | 1.7500 | .750 | 1.500 | 3.875 | 2 | **C75214 | — | — |
| 1-3/4 | 1.7500 | 1.250 | 1.625 | 4.500 | 2 | C41662 | C33801 | C38917 |
| 1-7/8 | 1.8750 | 1.250 | 1.625 | 4.500 | 2 | **C75215 | — | — |
| 2 | 2.0000 | .750 | 1.500 | 3.875 | 2 | C75216 | C75250 | C75284 |
| 2 | 2.0000 | 1.250 | 1.625 | 4.500 | 2 | C41665 | C33802 | C38918 |

High Speed Steel

Center Cutting

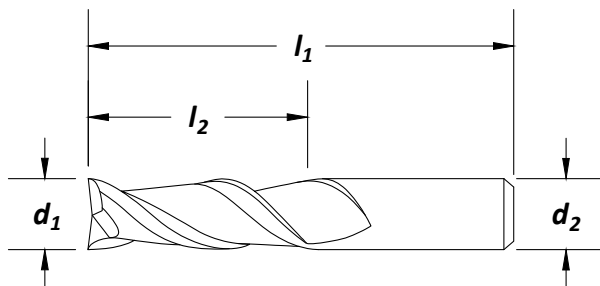
| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | ◆ | | ◆ | | | | | ◆ | | | | | |
| TiCN | ☆ | | ☆ | | | | | ☆ | | ◆ | | | |

☆ = Best Performance ◆ = Acceptable





Surface Treatment


****Items are being OBSOLETED, only available until inventory is depleted.**


| cutting diameter d_1 | decimal equiv. | shank dia d_2 (mm) | length of cut l_2 (mm) | overall length l_1 (mm) | no. of flutes | order number HG-2M Bright |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|--|
| 3 | .1181 | 9.52 | 9.52 | 58.74 | 2 | **C75285 |
| 5 | .1969 | 9.52 | 12.70 | 61.91 | 2 | **C75287 |
| 9 | .3543 | 9.52 | 14.29 | 63.50 | 2 | **C75291 |
| 11 | .4331 | 9.52 | 20.64 | 68.26 | 2 | **C75293 |
| 12 | .4724 | 12.70 | 20.64 | 82.55 | 2 | **C75294 |
| 14 | .5512 | 12.70 | 28.57 | 85.72 | 2 | **C75296 |
| 16 | .6299 | 15.88 | 33.34 | 95.25 | 2 | **C75298 |
| 18 | .7087 | 15.88 | 33.34 | 95.25 | 2 | **C75300 |
| 25 | .9843 | 25.40 | 41.27 | 114.30 | 2 | **C75304 |

High Speed Steel
Center Cutting

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable

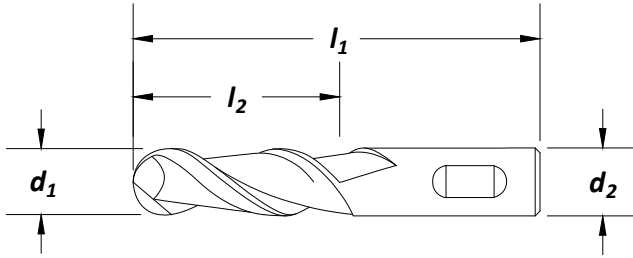


Style: **HG-2B** - Single End

Finisher



****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number | | |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|--------------|---------------------|----------|
| | | | | | | Bright | HG-2B TiN | TiCN |
| 1/8 | .1250 | .375 | .375 | 2.313 | 2 | C42109 | C39010 | C39027 |
| 3/16 | .1875 | .375 | .500 | 2.375 | 2 | C42111 | C39011 | C39028 |
| 1/4 | .2500 | .375 | .625 | 2.438 | 2 | C42114 | C39012 | C39029 |
| 5/16 | .3125 | .375 | .750 | 2.500 | 2 | C42116 | C39013 | C39030 |
| 3/8 | .3750 | .375 | .750 | 2.500 | 2 | C42119 | C39014 | C39031 |
| 7/16 | .4375 | .500 | 1.000 | 3.250 | 2 | C42122 | C39015 | C39032 |
| 1/2 | .5000 | .500 | 1.000 | 3.250 | 2 | C42124 | C39016 | C39033 |
| 9/16 | .5625 | .500 | 1.125 | 3.375 | 2 | C42126 | C39017 | C39034 |
| 5/8 | .6250 | .500 | 1.125 | 3.375 | 2 | C42128 | C39018 | C39035 |
| 5/8 | .6250 | .625 | 1.375 | 3.750 | 2 | C42129 | C39019 | C39036 |
| 3/4 | .7500 | .500 | 1.313 | 3.625 | 2 | C42132 | C39020 | C39037 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 2 | C42133 | C39021 | C39038 |
| 13/16 | .8125 | .750 | 2.000 | 4.250 | 2 | C75305 | C75311 | C75317 |
| 7/8 | .8750 | .875 | 2.000 | 4.250 | 2 | C42137 | C39022 | C39039 |
| 15/16 | .9375 | .750 | 2.250 | 4.500 | 2 | **C75306 | **C75312 | **C75318 |
| 1 | 1.0000 | .750 | 2.250 | 4.500 | 2 | C75307 | C75313 | C75319 |
| 1 | 1.0000 | 1.000 | 2.250 | 4.750 | 2 | C42141 | C39023 | C39040 |
| 1-1/4 | 1.2500 | .750 | 1.500 | 3.875 | 2 | C75309 | C75315 | C75321 |
| 1-1/4 | 1.2500 | 1.250 | 2.500 | 5.000 | 2 | C42146 | C39025 | C39042 |
| 1 3/8 | 1.3750 | 1.250 | 2.500 | 5.063 | 2 | **C75310 | **C75316 | — |
| 1-1/2 | 1.5000 | 1.250 | 2.500 | 5.000 | 2 | C42152 | C39026 | C39043 |

High Speed Steel

Center Cutting

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | | >45 |
| TiN | ✦ | | ✦ | | | | | ✦ | | | |
| TiCN | ✧ | | ✧ | | | | | ✧ | ✦ | | |

✧ = Best Performance ✦ = Acceptable

Keyway
Keyway Tolerance

Style: **HG-2K** - Single End

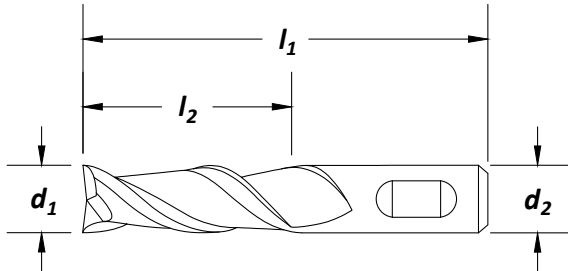
Note
+.00 /-.0015 tolerances for correct key stock fit.



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



High Speed Steel

Center Cutting

| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number | | |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|--------------|---------------------|----------|
| | | | | | | Bright | HG-2K TiN | TiCN |
| 1/8 | .1250 | .375 | .375 | 2.313 | 2 | C41671 | C38932 | C38957 |
| 3/16 | .1875 | .375 | .438 | 2.375 | 2 | C41673 | C38933 | C38958 |
| 7/32 | .2188 | .375 | .500 | 2.438 | 2 | **C38919 | **C38934 | — |
| 1/4 | .2500 | .375 | .500 | 2.438 | 2 | C41676 | C38935 | C38960 |
| 9/32 | .2812 | .375 | .563 | 2.500 | 2 | **C38920 | **C38936 | **C38961 |
| 5/16 | .3125 | .375 | .563 | 2.500 | 2 | C41678 | C38937 | C38962 |
| 11/32 | .3438 | .375 | .563 | 2.500 | 2 | **C38921 | **C38938 | **C38963 |
| 3/8 | .3750 | .375 | .563 | 2.500 | 2 | C41681 | C38939 | C38964 |
| 13/32 | .4062 | .375 | .813 | 2.688 | 2 | **C38922 | **C38940 | — |
| 7/16 | .4375 | .375 | .813 | 2.688 | 2 | C38923 | C38941 | C38966 |
| 15/32 | .4688 | .500 | 1.000 | 3.250 | 2 | **C38924 | — | **C38967 |
| 1/2 | .5000 | .500 | 1.000 | 3.250 | 2 | C41685 | C38943 | C38968 |
| 17/32 | .5312 | .500 | 1.125 | 3.375 | 2 | **C38925 | — | — |
| 9/16 | .5625 | .500 | 1.125 | 3.375 | 2 | C38926 | C38945 | C38970 |
| 5/8 | .6250 | .625 | 1.313 | 3.750 | 2 | C41688 | C38946 | C38971 |
| 11/16 | .6875 | .625 | 1.313 | 3.750 | 2 | **C38927 | — | **C38972 |
| 3/4 | .7500 | .750 | 1.313 | 3.875 | 2 | C41691 | C38948 | C38973 |
| 13/16 | .8125 | .625 | 1.500 | 4.000 | 2 | **C38928 | — | — |
| 7/8 | .8750 | .875 | 1.500 | 4.125 | 2 | C41695 | C38950 | C38975 |
| 15/16 | .9375 | .875 | 1.500 | 4.125 | 2 | **C38929 | **C38951 | — |
| 1 | 1.0000 | 1.000 | 1.625 | 4.500 | 2 | C41699 | C38952 | C38977 |
| 1-1/8 | 1.1250 | 1.000 | 1.625 | 4.500 | 2 | — | **C38953 | — |
| 1-1/4 | 1.2500 | 1.250 | 1.625 | 4.500 | 2 | C41703 | C38954 | C38979 |
| 1-3/8 | 1.3750 | 1.000 | 1.625 | 4.500 | 2 | **C38931 | **C38955 | **C38980 |
| 1-1/2 | 1.5000 | 1.250 | 1.625 | 4.500 | 2 | C41709 | C38956 | C38981 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | + | | + | | | | | + | | | | | |
| TiCN | ☆ | | ☆ | | | | | ☆ | | + | | | |

☆ = Best Performance + = Acceptable



Style: **HG-2KS - Single End**

Keyway Cutter

Note
+.00 /-.0015 tolerances for correct key stock fit.

Keyway Sizes

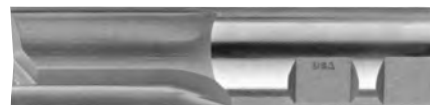
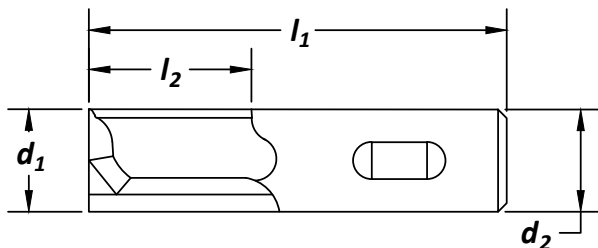
HSS



Surface Treatment

Bright

****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter | decimal equiv. | shank dia | length of cut | overall length | key slot width | no. of flutes | order number |
|------------------|----------------|------------|---------------|----------------|----------------|---------------|-------------------------|
| d_1 | | d_2 (in) | l_2 (in) | l_1 (in) | l_3 (in) | | HG-2KS Bright |
| 1/8 | .1230 | .375 | .375 | 2.313 | .125 | 2 | **C75363 |
| 1/4 | .2480 | .375 | .500 | 2.438 | .250 | 2 | **C75365 |
| 5/16 | .3105 | .375 | .563 | 2.500 | .313 | 2 | **C75366 |
| 3/8 | .3730 | .375 | .563 | 2.500 | .375 | 2 | **C75367 |
| 1/2 | .4980 | .500 | 1.000 | 3.250 | .500 | 2 | **C75368 |
| 5/8 | .6230 | .625 | 1.313 | 3.750 | .625 | 2 | **C75369 |
| 7/8 | .8730 | .8758 | 1.500 | 4.125 | .875 | 2 | **C75371 |

High Speed Steel

Center Cutting

| Material Reference | Steel (HRc) | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | | | | >45 |
| Bright | ☆ | | ☆ | | | | ☆ | ☆ | ◆ | | |

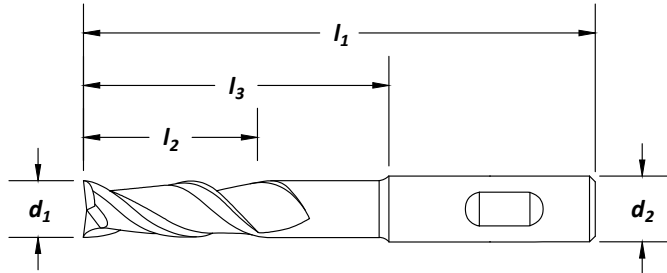
☆ = Best Performance ◆ = Acceptable

ANSI SIZES

HSS



Surface Treatment


****Items are being OBSOLETED, only available until inventory is depleted.**


| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | reach l_3 (in) | no. of flutes | order number HGN-2 Bright |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------------|---------------|--|
| 1/8 | .1250 | .375 | .375 | 2.375 | .813 | 2 | C38982 |
| 3/16 | .1875 | .375 | .500 | 2.688 | 1.125 | 2 | C38983 |
| 1/4 | .2500 | .375 | .625 | 3.063 | 1.500 | 2 | C41772 |
| 5/16 | .3125 | .375 | .750 | 3.313 | 1.750 | 2 | C41774 |
| 3/8 | .3750 | .375 | .750 | 3.313 | 1.750 | 2 | C41777 |
| 7/16 | .4375 | .500 | 1.000 | 3.750 | 1.875 | 2 | C38984 |
| 1/2 | .5000 | .500 | 1.000 | 4.000 | 2.250 | 2 | C41781 |
| 5/8 | .6250 | .625 | 1.375 | 4.625 | 2.750 | 2 | **C41784 |
| 3/4 | .7500 | .750 | 1.625 | 5.250 | 3.375 | 2 | **C41787 |
| 1 | 1.0000 | 1.000 | 2.500 | 7.250 | 5.000 | 2 | C41795 |

High Speed Steel

Center Cutting

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | | ◆ | | | |

☆ = Best Performance ◆ = Acceptable



Style: **HGN-2B - Single End**

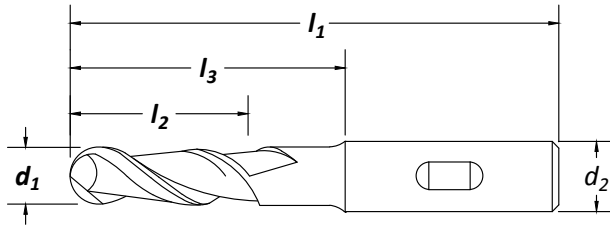
Finisher
Extended Neck

ANSI SIZES HSS

Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | reach l_3 (in) | no. of flutes | order number HGN-2B Bright |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------------|---------------|---|
| 1/8 | .1250 | .375 | .375 | 2.375 | .813 | 2 | **C42158 |
| 3/16 | .1875 | .375 | .500 | 2.688 | 1.125 | 2 | **C42160 |
| 5/16 | .3125 | .375 | .750 | 3.313 | 1.750 | 2 | **C42165 |
| 3/8 | .3750 | .375 | .750 | 3.313 | 1.750 | 2 | **C42168 |
| 7/16 | .4375 | .500 | 1.000 | 3.750 | 1.875 | 2 | **C42171 |
| 1/2 | .5000 | .500 | 1.000 | 4.000 | 2.250 | 2 | **C42173 |
| 5/8 | .6250 | .625 | 1.375 | 4.625 | 2.750 | 2 | **C42176 |
| 3/4 | .7500 | .750 | 1.625 | 5.375 | 3.375 | 2 | **C42179 |
| 7/8 | .8750 | .875 | 2.000 | 5.750 | 4.000 | 2 | **C39174 |
| 1 | 1.0000 | 1.000 | 2.500 | 7.250 | 5.000 | 2 | **C42181 |

High Speed Steel

Center Cutting

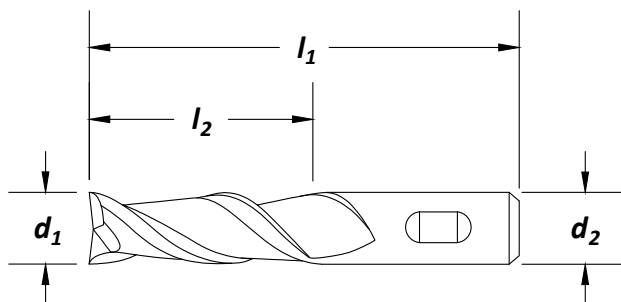
| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | | ◆ | |

☆ = Best Performance ◆ = Acceptable

ANSI
 SIZES

HSS


 Surface
 Treatment

****Items are being OBSOLETED, only available until inventory is depleted.**

High Speed Steel
Center Cutting

| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number | | |
|--|----------------|--|--|---|---------------|--------------|----------|----------|
| | | | | | | HGA-2 | Bright | TiN |
| 1/4 | .2500 | .375 | .625 | 2.437 | 2 | C41843 | C33476 | C33488 |
| 1/4 | .2500 | .375 | 1.250 | 3.063 | 2 | C41888 | C33500 | C33511 |
| 5/16 | .3125 | .375 | .750 | 2.500 | 2 | C41845 | — | C33489 |
| 5/16 | .3125 | .375 | 1.375 | 3.125 | 2 | C41890 | — | C33512 |
| 5/16 | .3125 | .375 | 2.000 | 3.750 | 2 | — | **C33525 | **C33536 |
| 3/8 | .3750 | .375 | .750 | 2.500 | 2 | C41848 | C33478 | C33490 |
| 3/8 | .3750 | .375 | 1.500 | 3.250 | 2 | C41893 | C33502 | C33513 |
| 3/8 | .3750 | .375 | 2.500 | 4.250 | 2 | **C41935 | — | **C33537 |
| 7/16 | .4375 | .375 | 1.000 | 2.688 | 2 | — | — | **C33491 |
| 7/16 | .4375 | .500 | 1.750 | 3.750 | 2 | — | — | **C33514 |
| 7/16 | .4375 | .375 | 2.750 | 4.500 | 2 | **C33522 | — | **C33538 |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 2 | C41853 | C33480 | C33492 |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 2 | C41898 | C33504 | C33515 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 2 | — | — | **C33493 |
| 5/8 | .6250 | .625 | 4.000 | 6.125 | 2 | — | — | **C33540 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 2 | C41859 | — | C33494 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 2 | C41904 | C33506 | C33517 |
| 3/4 | .7500 | .750 | 4.000 | 6.250 | 2 | C41945 | C33530 | C33541 |
| 7/8 | .8750 | .875 | 3.500 | 5.750 | 2 | C32066 | — | C33518 |
| 7/8 | .8750 | .875 | 5.000 | 7.250 | 2 | **C33523 | — | — |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 2 | C41867 | — | C33496 |
| 1 | 1.0000 | 1.000 | 4.000 | 6.500 | 2 | C41911 | — | C33519 |
| 1 | 1.0000 | 1.000 | 6.000 | 8.500 | 2 | **C41952 | — | — |

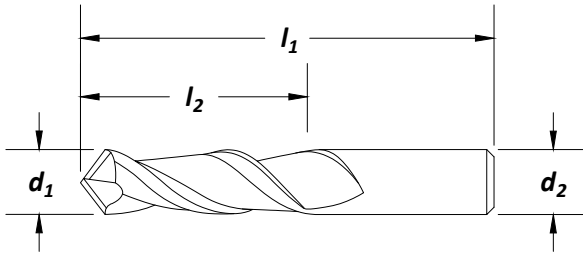
| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | ✦ | | | | | | | | | | | | |
| TiCN | ✦ | | | | | | | | | ✦ | | | |

✦ = Best Performance ✦ = Acceptable

Style: **HPDM-2 - Single End**

ANSI SIZES HSS

Surface Treatment



| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut | | no. of flutes | order number | | |
|--|----------------|--|---------------------------|---------------------------|---------------|---------------|--------|--------|
| | | | l₂ (in) | l₁ (in) | | HPDM-2 | Bright | TiN |
| 1/4 | .2500 | .375 | .500 | 2.313 | 2 | C32430 | C40506 | C40519 |
| 5/16 | .3125 | .375 | .563 | 2.313 | 2 | C32431 | C40507 | C40520 |
| 3/8 | .3750 | .375 | .563 | 2.313 | 2 | C32432 | C40508 | C40521 |
| 7/16 | .4375 | .375 | .813 | 2.500 | 2 | C32433 | C40509 | C40522 |
| 1/2 | .5000 | .500 | 1.000 | 3.000 | 2 | C32434 | C40510 | C40523 |
| 9/16 | .5625 | .500 | 1.125 | 3.125 | 2 | C32435 | C40511 | C40524 |
| 5/8 | .6250 | .625 | 1.313 | 3.438 | 2 | C32436 | C40512 | C40525 |
| 3/4 | .7500 | .750 | 1.313 | 3.563 | 2 | C32438 | C40514 | C40527 |
| 7/8 | .8750 | .750 | 1.500 | 3.750 | 2 | C32440 | C40516 | C40529 |
| 1 | 1.0000 | .750 | 1.500 | 3.750 | 2 | C40505 | C40518 | C40531 |

TECH TIP

Using Drill Mills

- 90° point allows for rapid plunge cuts.
- Also good for slotting applications.
- 2 flutes deliver enhanced chip ejection.

High Speed Steel
Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | | | | ◆ | | | | | |
| TiN | ◆ | | ◆ | | | | | ◆ | | | | | |
| TiCN | ☆ | | ☆ | | | | | ☆ | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable

General Purpose

Style: **HG-3 - Single End**

ANSI SIZES

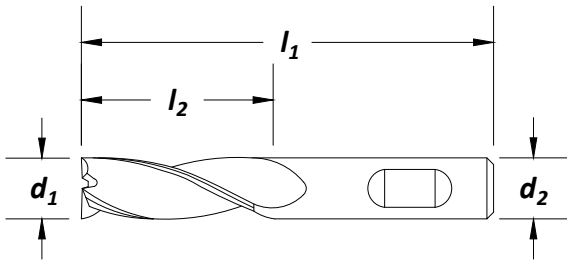
HSS



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



High Speed Steel

Center Cutting

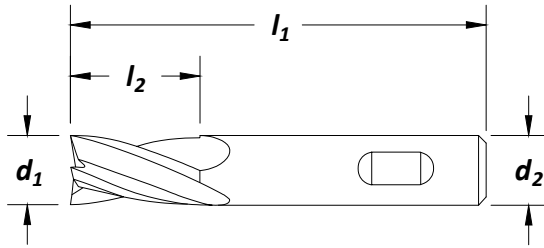
| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number | | |
|--|----------------|--|--|---|---------------|--------------|--------------------|----------|
| | | | | | | Bright | HG-3 TiN | TiCN |
| 1/8 | .1250 | .375 | .375 | 2.313 | 3 | C39638 | C39669 | C39700 |
| 5/32 | .1562 | .375 | .500 | 2.375 | 3 | **C39639 | **C39670 | **C39701 |
| 3/16 | .1875 | .375 | .500 | 2.375 | 3 | C39640 | C39671 | C39702 |
| 3/16 | .1875 | .375 | 1.250 | 3.063 | 3 | C39731 | C39753 | C39775 |
| 7/32 | .2188 | .375 | .625 | 2.438 | 3 | **C39641 | **C39672 | **C39703 |
| 7/32 | .2188 | .375 | 1.250 | 3.063 | 3 | **C39732 | — | **C39776 |
| 1/4 | .2500 | .375 | .625 | 2.438 | 3 | C39642 | C39673 | C39704 |
| 1/4 | .2500 | .375 | 1.250 | 3.063 | 3 | C39733 | C39755 | C39777 |
| 9/32 | .2812 | .375 | .750 | 2.500 | 3 | **C39643 | **C39674 | **C39705 |
| 9/32 | .2812 | .375 | 1.375 | 3.125 | 3 | **C39734 | — | **C39778 |
| 5/16 | .3125 | .375 | .750 | 2.500 | 3 | C39644 | C39675 | C39706 |
| 5/16 | .3125 | .375 | 1.375 | 3.125 | 3 | C39735 | C39757 | C39779 |
| 11/32 | .3438 | .375 | .750 | 2.500 | 3 | **C39645 | **C39676 | **C39707 |
| 11/32 | .3438 | .375 | 1.500 | 3.250 | 3 | **C39736 | — | — |
| 3/8 | .3750 | .375 | .750 | 2.500 | 3 | C39646 | C39677 | C39708 |
| 3/8 | .3750 | .375 | 1.500 | 3.250 | 3 | C39737 | C39759 | C39781 |
| 13/32 | .4062 | .375 | 1.000 | 2.688 | 3 | **C39647 | **C39678 | **C39709 |
| 13/32 | .4062 | .500 | 1.750 | 3.750 | 3 | **C39738 | — | **C39782 |
| 7/16 | .4375 | .375 | 1.000 | 2.688 | 3 | C39648 | C39679 | C39710 |
| 7/16 | .4375 | .500 | 1.750 | 3.750 | 3 | C39739 | C39761 | C39783 |
| 15/32 | .4688 | .500 | 1.250 | 3.250 | 3 | **C39649 | **C39680 | **C39711 |
| 15/32 | .4688 | .500 | 2.000 | 4.000 | 3 | **C39740 | — | — |
| 1/2 | .5000 | .375 | 1.000 | 2.688 | 3 | C39650 | C39681 | C39712 |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 3 | C39651 | C39682 | C39713 |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 3 | C39741 | C39763 | C39785 |
| 9/16 | .5625 | .500 | 1.375 | 3.375 | 3 | C39652 | C39683 | C39714 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 3 | C39653 | C39684 | C39715 |
| 5/8 | .6250 | .625 | 2.500 | 4.625 | 3 | C39742 | C39764 | C39786 |
| 11/16 | .6875 | .625 | 1.625 | 3.750 | 3 | C39654 | C39685 | C39716 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 3 | C39655 | C39686 | C39717 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 3 | C39743 | C39765 | C39787 |
| 13/16 | .8125 | .625 | 1.875 | 4.000 | 3 | C39656 | C39687 | C39718 |
| 7/8 | .8750 | .875 | 1.875 | 4.125 | 3 | C39657 | C39688 | C39719 |
| 7/8 | .8750 | .875 | 3.500 | 5.750 | 3 | C39744 | C39766 | C39788 |
| 15/16 | .9375 | .875 | 1.875 | 4.125 | 3 | **C39658 | **C39689 | **C39720 |
| 1 | 1.0000 | .750 | 1.875 | 4.125 | 3 | C39659 | C39690 | C39721 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 3 | C39660 | C39691 | C39722 |
| 1 | 1.0000 | 1.000 | 4.000 | 6.500 | 3 | C39745 | C39767 | C39789 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | + | | + | | | | | + | | | | | |
| TiCN | ☆ | | ☆ | | | | | ☆ | | + | | | |

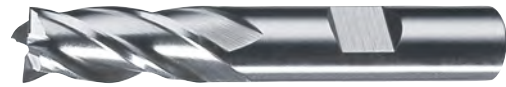
☆ = Best Performance + = Acceptable



Style: HG-4C - Single End



****Items are being OBSOLETED, only available until inventory is depleted.**



Feature:

Heavy cross-section for high rigidity.

| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number | | |
|--|----------------|--|--|---|---------------|--------------|---------------------|----------|
| | | | | | | Bright | HG-4C TiN | TiCN |
| 1/8 | .1250 | .375 | .375 | 2.313 | 4 | C41243 | C41520 | C33240 |
| 9/64 | .1406 | .375 | .500 | 2.375 | 4 | C33141 | C33188 | C33241 |
| 5/32 | .1562 | .375 | .500 | 2.375 | 4 | C33142 | C33189 | C33242 |
| 11/64 | .1719 | .375 | .500 | 2.375 | 4 | C33143 | C33190 | C33243 |
| 3/16 | .1875 | .375 | .500 | 2.375 | 4 | C41245 | C41521 | C33244 |
| 3/16 | .1875 | .375 | 1.250 | 3.063 | 4 | C33371 | C33384 | C33406 |
| 3/16 | .1875 | .375 | 1.750 | 3.563 | 4 | C33428 | C33438 | C33457 |
| 13/64 | .2031 | .375 | .625 | 2.438 | 4 | C33144 | C33191 | C33245 |
| 7/32 | .2188 | .375 | .625 | 2.438 | 4 | C33145 | C33192 | C33246 |
| 7/32 | .2188 | .375 | 1.250 | 3.063 | 4 | — | — | **C33407 |
| 7/32 | .2188 | .375 | 1.750 | 3.563 | 4 | C33429 | C33439 | C33458 |
| 15/64 | .2344 | .375 | .625 | 2.438 | 4 | C33146 | C33193 | C33247 |
| 1/4 | .2500 | .375 | .625 | 2.438 | 4 | C41248 | C41522 | C33248 |
| 1/4 | .2500 | .375 | 1.250 | 3.063 | 4 | C41326 | C33386 | C33408 |
| 1/4 | .2500 | .375 | 1.750 | 3.563 | 4 | C41381 | C33440 | C33459 |
| 17/64 | .2656 | .375 | .750 | 2.500 | 4 | C33147 | C33194 | C33249 |
| 9/32 | .2812 | .375 | .750 | 2.500 | 4 | C33148 | C33195 | C33250 |
| 9/32 | .2812 | .375 | 1.375 | 3.125 | 4 | C33373 | C33387 | C33409 |
| 9/32 | .2812 | .375 | 2.000 | 3.750 | 4 | C33430 | C33441 | C33460 |
| 19/64 | .2969 | .375 | .750 | 2.500 | 4 | **C33149 | — | **C33251 |
| 5/16 | .3125 | .375 | .750 | 2.500 | 4 | C41250 | C41523 | C33252 |
| 5/16 | .3125 | .375 | 1.375 | 3.125 | 4 | C41328 | C33388 | C33410 |
| 5/16 | .3125 | .375 | 2.000 | 3.750 | 4 | C41383 | C33442 | C33461 |
| 11/32 | .3438 | .375 | .750 | 2.500 | 4 | C33151 | C33198 | C33254 |
| 11/32 | .3438 | .375 | 1.500 | 3.250 | 4 | C33374 | C33389 | C33411 |
| 11/32 | .3438 | .375 | 2.500 | 4.250 | 4 | **C33431 | — | — |
| 23/64 | .3594 | .375 | .750 | 2.500 | 4 | **C33152 | **C33199 | — |
| 3/8 | .3750 | .375 | .750 | 2.500 | 4 | C41253 | C41524 | C33256 |
| 3/8 | .3750 | .375 | 1.500 | 3.250 | 4 | C41331 | C33390 | C33412 |
| 3/8 | .3750 | .375 | 2.500 | 4.250 | 4 | C41386 | C33444 | C33463 |
| 25/64 | .3906 | .375 | 1.000 | 2.688 | 4 | **C33153 | — | — |
| 13/32 | .4062 | .375 | 1.000 | 2.688 | 4 | C33154 | C33201 | C33258 |
| 13/32 | .4062 | .375 | 2.750 | 4.500 | 4 | C33432 | C33445 | C33464 |
| 13/32 | .4062 | .500 | 1.750 | 3.750 | 4 | C33375 | C33391 | C33413 |
| 27/64 | .4219 | .375 | 1.000 | 2.688 | 4 | **C33155 | **C33202 | — |

continued on next page

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------|-----------------|------------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | >45 |
| TiN | ★ | | ★ | | | | | ★ | | | |
| TiCN | ★ | | ★ | | | | | ★ | | | |

★ = Best Performance ★ = Acceptable

High Speed Steel

Center Cutting

General Purpose
Multi Flute

Style: HG-4C - Single End (continued)

| cutting diameter d ₁ | decimal equiv. | shank dia d ₂ (in) | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | order number | | |
|------------------------------------|----------------|----------------------------------|--------------------------------------|---------------------------------------|---------------|--------------|---------------------|----------|
| | | | | | | Bright | HG-4C TiN | TiCN |
| 7/16 | .4375 | .375 | 1.000 | 2.688 | 4 | C41254 | C33203 | C33260 |
| 7/16 | .4375 | .375 | 2.750 | 4.500 | 4 | C33433 | C33446 | C33465 |
| 7/16 | .4375 | .500 | 1.750 | 3.750 | 4 | C33376 | C33392 | C33414 |
| 29/64 | .4531 | .500 | 1.250 | 3.250 | 4 | — | **C33204 | **C33261 |
| 15/32 | .4688 | .500 | 1.250 | 3.250 | 4 | C33158 | C33205 | C33262 |
| 15/32 | .4688 | .500 | 2.000 | 4.000 | 4 | **C33377 | — | — |
| 31/64 | .4844 | .500 | 1.250 | 3.250 | 4 | — | — | **C33263 |
| 1/2 | .5000 | .375 | 1.000 | 2.688 | 4 | C33160 | C33207 | C33264 |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 4 | C41257 | C41525 | C33265 |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 4 | C41335 | C33394 | C33416 |
| 1/2 | .5000 | .500 | 3.000 | 5.000 | 4 | C41390 | C33448 | C33467 |
| 17/32 | .5312 | .500 | 1.375 | 3.375 | 4 | C33161 | C33208 | C33266 |
| 9/16 | .5625 | .500 | 1.375 | 3.375 | 4 | C33162 | C33209 | C33267 |
| 19/32 | .5938 | .500 | 1.375 | 3.375 | 4 | C33163 | C33210 | C33268 |
| 5/8 | .6250 | .500 | 1.375 | 3.375 | 4 | C33164 | C33211 | C33269 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 4 | C41260 | C41526 | C33270 |
| 5/8 | .6250 | .625 | 2.500 | 4.625 | 4 | C41338 | C33395 | C33417 |
| 5/8 | .6250 | .625 | 4.000 | 6.125 | 4 | C41393 | C33449 | C33468 |
| 21/32 | .6562 | .625 | 1.625 | 3.750 | 4 | C33165 | C33212 | C33271 |
| 11/16 | .6875 | .500 | 1.625 | 3.625 | 4 | C33166 | C33213 | C33272 |
| 11/16 | .6875 | .625 | 1.625 | 3.750 | 4 | C41262 | C33214 | C33273 |
| 23/32 | .7188 | .750 | 1.625 | 3.875 | 4 | C33167 | C33215 | C33274 |
| 3/4 | .7500 | .500 | .875 | 2.875 | 4 | **C75017 | **C75042 | **C75067 |
| 3/4 | .7500 | .500 | 1.625 | 3.625 | 4 | C33168 | C33216 | C33275 |
| 3/4 | .7500 | .625 | 1.625 | 3.750 | 4 | C33169 | C33217 | C33276 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 4 | C41264 | C41527 | C33277 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 4 | C41341 | C33396 | C33418 |
| 3/4 | .7500 | .750 | 4.000 | 6.250 | 4 | C41396 | C33450 | C33469 |
| 25/32 | .7812 | .750 | 1.875 | 4.125 | 4 | C33170 | C33218 | C33278 |
| 13/16 | .8125 | .625 | 1.875 | 4.000 | 4 | C33171 | C33219 | C33279 |
| 13/16 | .8125 | .750 | 1.875 | 4.125 | 4 | C75019 | C75044 | C75069 |
| 7/8 | .8750 | .625 | 1.875 | 4.000 | 4 | C33173 | C33221 | C33281 |
| 7/8 | .8750 | .625 | 1.875 | 4.000 | 6 | C75020 | C75045 | C75070 |
| 7/8 | .8750 | .750 | 1.000 | 3.250 | 4 | C75021 | C75046 | C75071 |
| 7/8 | .8750 | .750 | 1.875 | 4.125 | 4 | C33174 | C33222 | C33282 |
| 7/8 | .8750 | .875 | 1.875 | 4.125 | 4 | C41268 | C33223 | C33283 |
| 7/8 | .8750 | .875 | 3.500 | 5.750 | 4 | C41345 | C33397 | C33419 |
| 7/8 | .8750 | .875 | 5.000 | 7.250 | 4 | C41400 | C33451 | C33470 |
| 15/16 | .9375 | .875 | 1.875 | 4.125 | 4 | C33176 | C33225 | C33285 |
| 31/32 | .9688 | 1.000 | 2.000 | 4.500 | 4 | C33177 | C33226 | C33286 |
| 1 | 1.0000 | .625 | 1.875 | 4.000 | 4 | C33178 | C33227 | C33287 |
| 1 | 1.0000 | .625 | 1.875 | 4.000 | 6 | C75023 | C75048 | C75073 |
| 1 | 1.0000 | .750 | 1.000 | 3.250 | 6 | — | — | **C75074 |
| 1 | 1.0000 | .750 | 1.875 | 4.125 | 4 | C33179 | C33228 | C33288 |
| 1 | 1.0000 | .875 | 1.875 | 4.125 | 4 | C33180 | C33229 | C33289 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 4 | C41272 | C41528 | C33290 |
| 1 | 1.0000 | 1.000 | 3.000 | 5.500 | 4 | C75025 | C75050 | C75075 |
| 1 | 1.0000 | 1.000 | 4.000 | 6.500 | 4 | C41349 | C33398 | C33420 |
| 1 | 1.0000 | 1.000 | 6.000 | 8.500 | 4 | C41404 | C33452 | C33471 |
| 1-1/8 | 1.1250 | .750 | 1.375 | 3.625 | 6 | C75026 | C75051 | C75076 |
| 1-1/8 | 1.1250 | .875 | 2.000 | 4.500 | 4 | C33181 | C33230 | C33291 |
| 1-1/8 | 1.1250 | 1.000 | 2.000 | 4.500 | 4 | C41275 | C33231 | C33292 |
| 1-1/8 | 1.1250 | 1.000 | 2.000 | 4.500 | 6 | **C75027 | **C75052 | — |
| 1-1/8 | 1.1250 | 1.000 | 4.000 | 6.500 | 4 | C33378 | C33399 | C33421 |
| 1-1/8 | 1.1250 | 1.000 | 4.000 | 6.500 | 6 | **C75028 | — | — |

continued on next page

High Speed Steel

Center Cutting



Style: HG-4C - Single End (continued)

| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number | | |
|--|----------------|--|--|---|---------------|--------------|---------------------|----------|
| | | | | | | Bright | HG-4C TiN | TiCN |
| 1-1/4 | 1.2500 | .750 | 1.375 | 3.625 | 6 | C75029 | C75054 | C75079 |
| 1 1/4 | 1.2500 | .875 | 2.000 | 4.250 | 6 | C75030 | C75055 | C75080 |
| 1-1/4 | 1.2500 | 1.000 | 2.000 | 4.500 | 4 | C33183 | C33233 | C33294 |
| 1-1/4 | 1.2500 | 1.000 | 2.000 | 4.500 | 6 | — | — | **C75081 |
| 1-1/4 | 1.2500 | 1.000 | 4.000 | 6.500 | 4 | C33379 | C33400 | C33422 |
| 1-1/4 | 1.2500 | 1.250 | 2.000 | 4.500 | 4 | C41277 | C33234 | C33295 |
| 1-1/4 | 1.2500 | 1.250 | 2.000 | 4.500 | 6 | — | — | **C75082 |
| 1-1/4 | 1.1250 | 1.250 | 4.000 | 6.500 | 4 | C41353 | C33401 | C33423 |
| 1-1/4 | 1.2500 | 1.250 | 6.000 | 8.500 | 4 | **C41408 | **C33453 | — |
| 1-3/8 | 1.3750 | .750 | 1.375 | 3.625 | 6 | C75034 | C75059 | C75084 |
| 1-3/8 | 1.3750 | 1.000 | 2.000 | 4.500 | 4 | C33184 | C33235 | C33296 |
| 1-3/8 | 1.3750 | 1.000 | 2.000 | 4.500 | 6 | C75035 | C75060 | C75085 |
| 1-1/2 | 1.5000 | .750 | 1.375 | 3.625 | 6 | C75036 | C75061 | C75086 |
| 1-1/2 | 1.5000 | 1.000 | 2.000 | 4.500 | 6 | C33185 | C33236 | C33297 |
| 1-1/2 | 1.5000 | 1.250 | 2.000 | 4.500 | 4 | C41283 | C33237 | C33298 |
| 1-1/2 | 1.5000 | 1.250 | 2.000 | 4.500 | 6 | **C75038 | — | — |
| 1-1/2 | 1.5000 | 1.250 | 4.000 | 6.500 | 6 | C75039 | C75064 | **C75088 |
| 1-1/2 | 1.5000 | 1.250 | 8.000 | 10.500 | 4 | **C33436 | **C33455 | — |
| 1-3/4 | 1.7500 | .750 | 1.375 | 3.625 | 6 | C75040 | C75065 | C75089 |
| 1-3/4 | 1.7500 | 1.250 | 4.000 | 6.500 | 4 | **C33382 | — | — |
| 1-3/4 | 1.7500 | 1.250 | 4.000 | 6.500 | 6 | **C75041 | — | — |
| 2 | 2.0000 | 1.250 | 2.000 | 4.500 | 8 | C33187 | C33239 | C33300 |

High Speed Steel

Center Cutting

TECH TIP

Benefits of Multi Flute End Mills

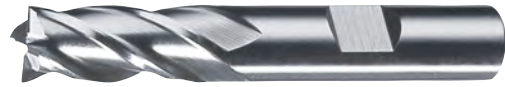
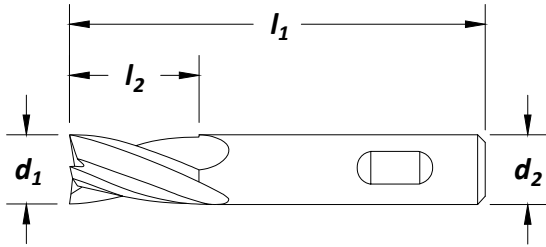
- Generally, multi flute end mills give smoother finishes than 2 flute end mills.
- Increased number of flutes mean more cutting edges, providing more cutting action.

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | | >45 |
| TiN | ◆ | | ◆ | | | | | ◆ | | | |
| TiCN | ☆ | | ☆ | | | | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Surface Treatment



High Speed Steel

Center Cutting

| cutting diameter | decimal | shank dia | length of cut | overall length | no. of flutes | order number |
|------------------|---------|------------|---------------|----------------|---------------|-------------------------|
| d_1 | equiv. | d_2 (mm) | l_2 (mm) | l_1 (mm) | | HG-4MC Bright |
| 3 | .1181 | 9.52 | 9.52 | 58.74 | 4 | C75091 |
| 4 | .1575 | 9.52 | 12.70 | 60.32 | 4 | C75092 |
| 5 | .1969 | 9.52 | 15.88 | 61.91 | 4 | C75093 |
| 6 | .2362 | 9.52 | 15.88 | 61.91 | 4 | C75094 |
| 7 | .2756 | 9.52 | 19.05 | 63.50 | 4 | C75095 |
| 8 | .3150 | 9.52 | 19.05 | 63.50 | 4 | C75096 |
| 9 | .3543 | 9.52 | 19.05 | 63.50 | 4 | C75097 |
| 10 | .3937 | 9.52 | 25.40 | 68.26 | 4 | C75098 |
| 11 | .4331 | 9.52 | 25.40 | 68.26 | 4 | C75099 |
| 12 | .4724 | 12.70 | 31.75 | 82.55 | 4 | C75100 |
| 13 | .5118 | 12.70 | 34.92 | 85.72 | 4 | C75101 |
| 14 | .5512 | 12.70 | 34.92 | 85.72 | 4 | C75102 |
| 15 | .5906 | 12.70 | 34.92 | 85.72 | 4 | C75103 |
| 16 | .6299 | 15.88 | 41.27 | 95.25 | 4 | C75104 |
| 18 | .7087 | 15.88 | 41.27 | 95.25 | 4 | C75106 |
| 20 | .7874 | 15.88 | 47.63 | 101.60 | 4 | C75108 |
| 25 | .9843 | 25.40 | 50.80 | 114.30 | 4 | C75113 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | ◆ | | | | |

☆ = Best Performance ◆ = Acceptable

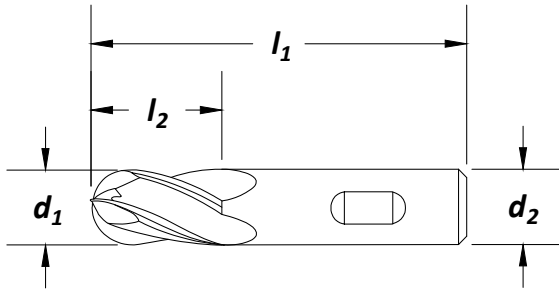


Style: **HG-4B - Single End**

General Purpose



****Items are being OBSOLETEd, only available until inventory is depleted.**



Feature:

Heavy cross-section for high rigidity.

| cutting diameter | decimal | shank dia | length of cut | overall length | no. of flutes | order number | | |
|------------------|---------|-----------|---------------|----------------|---------------|--------------|---------------------|----------|
| | | | | | | Bright | HG-4B TiN | TiCN |
| 1/4 | .2500 | .375 | .625 | 2.438 | 4 | C33301 | C33303 | C33313 |
| 1/4 | .2500 | .375 | 1.250 | 3.063 | 4 | C33323 | C33326 | C33335 |
| 1/4 | .2500 | .375 | 1.750 | 3.563 | 4 | C33344 | C33353 | C33362 |
| 5/16 | .3125 | .375 | .750 | 2.500 | 4 | C33302 | C33304 | C33314 |
| 5/16 | .3125 | .375 | 2.000 | 3.750 | 4 | C33345 | C33354 | C33363 |
| 3/8 | .3750 | .375 | .750 | 2.500 | 4 | C41289 | C33305 | C33315 |
| 3/8 | .3750 | .375 | 1.500 | 3.250 | 4 | C33325 | C33328 | C33337 |
| 3/8 | .3750 | .375 | 2.500 | 4.250 | 4 | C33346 | C33355 | C33364 |
| 1/2 | .5000 | .500 | 1.000 | 3.000 | 4 | — | — | **C75116 |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 4 | C41293 | C33306 | C33316 |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 4 | C41358 | C33329 | C33338 |
| 1/2 | .5000 | .500 | 3.000 | 5.000 | 4 | C33347 | C33356 | C33365 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 4 | C41297 | C33307 | C33317 |
| 5/8 | .6250 | .625 | 2.500 | 4.625 | 4 | C41361 | C33330 | C33339 |
| 5/8 | .6250 | .625 | 4.000 | 6.125 | 4 | C33348 | C33357 | C33366 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 4 | C41300 | C33308 | C33318 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 4 | C41364 | C33331 | C33340 |
| 3/4 | .7500 | .750 | 4.000 | 6.250 | 4 | C33349 | C33358 | C33367 |
| 7/8 | .8750 | .875 | 1.875 | 4.125 | 4 | — | **C33309 | **C33319 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 4 | C41308 | C33310 | C33320 |
| 1 | 1.0000 | 1.000 | 4.000 | 6.500 | 4 | C41371 | C33332 | C33341 |
| 1 | 1.0000 | 1.000 | 6.000 | 8.500 | 4 | C33350 | C33359 | C33368 |
| 1-1/4 | 1.2500 | 1.250 | 2.000 | 4.500 | 4 | C41312 | C33311 | C33321 |
| 1-1/4 | 1.2500 | 1.250 | 4.000 | 6.500 | 4 | — | — | **C33342 |

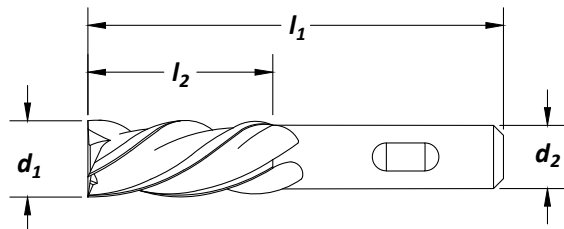
High Speed Steel

Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | ✦ | | ✦ | | | | | ✦ | | | | | |
| TiCN | ✦ | | ✦ | | | | | ✦ | ✦ | | | | |

✦ = Best Performance ✦ = Acceptable


Surface Treatment

****Items are being OBSOLETED, only available until inventory is depleted.**

Feature:

Heavy cross-section for high rigidity.

| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number | | |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|--------------|----------------------|----------|
| | | | | | | Bright | HG-4LL TiN | TiCN |
| 3/16 | .1875 | .375 | .500 | 2.375 | 4 | **C42294 | — | **C33618 |
| 1/4 | .2500 | .375 | .625 | 2.438 | 4 | C42297 | C33611 | C33619 |
| 5/16 | .3125 | .375 | .750 | 2.500 | 4 | **C42299 | — | — |
| 3/8 | .3750 | .375 | .750 | 2.500 | 4 | C42302 | C33613 | C33621 |
| 7/16 | .4375 | .375 | 1.000 | 2.688 | 4 | **C33609 | **C33614 | **C33622 |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 4 | C42306 | C33615 | C33623 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 4 | **C42309 | — | **C33624 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 4 | C42312 | C33617 | C33625 |

High Speed Steel

Center Cutting

TECH TIP
Using Style HG-4LL End Mills

- 32° left-hand helix for reverse spindle operation.
- 4 flute design delivers smoother finish.

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | | ☆ | | | | | ☆ | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Styles: **CRE**

Corner Radius

ANSI SIZES

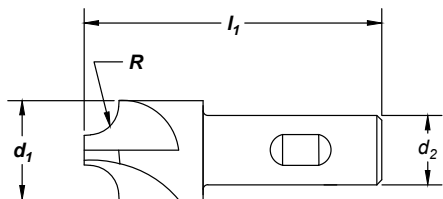
HSS

Corner Round

Surface Treatment

Bright

****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter | decimal | shank dia | overall length | no. of | radius | order number |
|------------------|---------|------------|----------------|--------|--------|----------------------|
| d_1 | equiv. | d_2 (in) | l_1 (in) | flutes | R (in) | CRE Bright |
| 7/16 | .4375 | .375 | 2.500 | 4 | .0625 | C75373 |
| 1/2 | .500 | .375 | 2.500 | 4 | .0938 | C75374 |
| 5/8 | .625 | .500 | 3.000 | 4 | .1250 | C75375 |
| 3/4 | .750 | .500 | 3.000 | 4 | .1562 | C75376 |
| 7/8 | .875 | .500 | 2.938 | 4 | .1875 | C75377 |
| 7/8 | .875 | .750 | 3.125 | 4 | .1875 | C75378 |
| 1 | 1.000 | .500 | 3.000 | 4 | .2500 | C75379 |
| 1 | 1.000 | .750 | 3.250 | 4 | .2500 | **C75380 |
| 1-1/8 | 1.125 | .500 | 3.250 | 4 | .3125 | C75381 |
| 1-1/8 | 1.125 | .875 | 3.500 | 4 | .3125 | **C75382 |
| 1-1/4 | 1.250 | .500 | 3.500 | 4 | .3750 | C75383 |
| 1-1/4 | 1.250 | .875 | 3.750 | 4 | .3750 | C75384 |
| 1-1/2 | 1.500 | 1.000 | 4.125 | 4 | .5000 | C75386 |

High Speed Steel

Center Cutting

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | | | | >45 |
| Bright | ☆ | | ☆ | | | | ☆ | ◆ | | | |

☆ = Best Performance ◆ = Acceptable



Miniature

Style: **HMDC-2 - Double End**

Note
Operating parameters begin on page 310.

M42 Cobalt

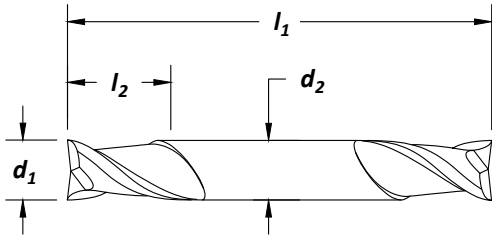
ANSI SIZES



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



Feature:

High red hardness for high heat conditions.

Cobalt

Center Cutting

| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number HMDC-2 | |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|-------------------------------|----------|
| | | | | | | Bright | TiCN |
| 1/32 | .0312 | .188 | .047 | 2.000 | 2 | — | — |
| 1/32 | .0312 | .188 | .094 | 2.250 | 2 | **C40903 | **C40925 |
| 3/64 | .0469 | .188 | .063 | 2.000 | 2 | **C40937 | **C40959 |
| 3/64 | .0469 | .188 | .141 | 2.250 | 2 | **C40904 | — |
| 1/16 | .0625 | .188 | .094 | 2.000 | 2 | **C40938 | **C40960 |
| 1/16 | .0625 | .188 | .188 | 2.250 | 2 | — | **C40927 |
| 5/64 | .0781 | .188 | .125 | 2.000 | 2 | **C40939 | **C40961 |
| 5/64 | .0781 | .188 | .234 | 2.250 | 2 | — | **C40928 |
| 3/32 | .0938 | .188 | .141 | 2.000 | 2 | **C40940 | **C40962 |
| 3/32 | .0938 | .188 | .281 | 2.250 | 2 | **C40907 | **C40929 |
| 7/64 | .1094 | .188 | .156 | 2.000 | 2 | **C40941 | — |
| 7/64 | .1094 | .188 | .328 | 2.250 | 2 | **C40908 | — |
| 1/8 | .1250 | .188 | .188 | 2.000 | 2 | — | **C40964 |
| 1/8 | .1250 | .188 | .375 | 2.250 | 2 | — | **C40931 |
| 9/64 | .1406 | .188 | .219 | 2.000 | 2 | **C40943 | — |
| 9/64 | .1406 | .188 | .406 | 2.250 | 2 | **C40910 | **C40932 |
| 11/64 | .1719 | .188 | .250 | 2.000 | 2 | **C40945 | **C40967 |
| 11/64 | .1719 | .188 | .500 | 2.250 | 2 | **C40912 | — |
| 3/16 | .1875 | .188 | .281 | 2.000 | 2 | **C40946 | **C40968 |
| 3/16 | .1875 | .188 | .500 | 2.250 | 2 | — | **C40935 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | | | | ◆ | | | | | |
| TiCN | ☆ | | ☆ | | ◆ | ◆ | | ☆ | | | ◆ | | |

☆ = Best Performance ◆ = Acceptable



Style: **HMDC-4 - Double End**

Miniature

Note
Operating parameters begin on page 310.

M42
Cobalt

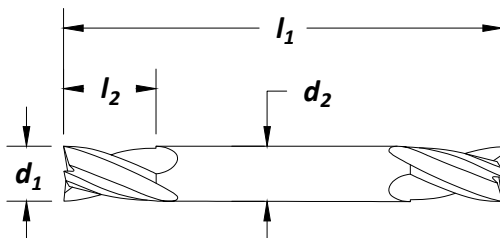
ANSI
SIZES



Surface
Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number HMDC-4 | |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|-------------------------------|----------|
| | | | | | | Bright | TiCN |
| 1/16 | .0625 | .188 | .094 | 2.000 | 4 | **C40984 | **C40994 |
| 1/16 | .0625 | .188 | .188 | 2.250 | 4 | **C40969 | **C40979 |
| 3/32 | .0938 | .188 | .141 | 2.000 | 4 | **C40985 | **C40995 |
| 1/8 | .1250 | .188 | .188 | 2.000 | 4 | **C40986 | **C40996 |
| 1/8 | .1250 | .188 | .375 | 2.250 | 4 | — | **C40981 |
| 5/32 | .1562 | .188 | .234 | 2.000 | 4 | **C40987 | **C40997 |
| 3/16 | .1875 | .188 | .281 | 2.000 | 4 | **C40988 | **C40998 |
| 3/16 | .1875 | .188 | .500 | 2.250 | 4 | — | **C40983 |

TECH TIP

Miniature End Mill Features

- All miniature end mills feature 3/16" shanks.
- Only one holder size needed for all cutting diameters.
- Double end mills are available in multiple lengths.
- Double end mills have two cutting ends to reduce tool costs.

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | | | | ◆ | | | | | |
| TiCN | ☆ | | ☆ | | ◆ | ◆ | | ☆ | | | ◆ | ◆ | |

☆ = Best Performance ◆ = Acceptable

Finisher
Style: HDC-2 - Double End

Note
Operating parameters begin on page 310.

M42
Cobalt

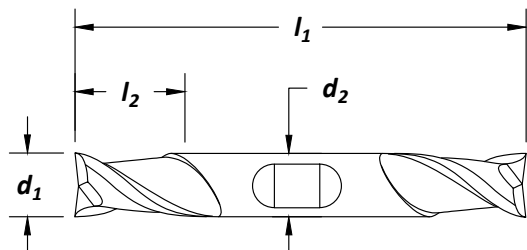
ANSI
SIZES



Surface
Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**


Feature:

High red hardness for high heat conditions.

Cobalt

Center Cutting

| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number | | |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|--------------|----------|----------|
| | | | | | | Bright | TiN | TiCN |
| 1/8 | .1250 | .375 | .375 | 3.063 | 2 | C52151 | — | C32880 |
| 9/64 | .1406 | .375 | .438 | 3.125 | 2 | **C32833 | — | — |
| 5/32 | .1562 | .375 | .438 | 3.125 | 2 | C52152 | — | C32882 |
| 11/64 | .1719 | .375 | .438 | 3.250 | 2 | **C32834 | — | — |
| 3/16 | .1875 | .375 | .438 | 3.250 | 2 | C52153 | — | C32884 |
| 13/64 | .2031 | .375 | .500 | 3.250 | 2 | **C32835 | — | — |
| 7/32 | .2188 | .375 | .500 | 3.250 | 2 | C52154 | — | C32886 |
| 15/64 | .2344 | .375 | .500 | 3.375 | 2 | **C32836 | — | **C32887 |
| 1/4 | .2500 | .375 | .500 | 3.375 | 2 | C52155 | — | C32888 |
| 17/64 | .2656 | .375 | .563 | 3.375 | 2 | — | — | **C32889 |
| 9/32 | .2812 | .375 | .563 | 3.375 | 2 | C52156 | — | C32890 |
| 5/16 | .3125 | .375 | .563 | 3.500 | 2 | C52157 | — | C32892 |
| 21/64 | .3281 | .375 | .563 | 3.500 | 2 | **C32839 | — | — |
| 11/32 | .3438 | .375 | .563 | 3.500 | 2 | C52158 | — | C32894 |
| 23/64 | .3594 | .375 | .563 | 3.500 | 2 | **C32840 | — | — |
| 3/8 | .3750 | .375 | .563 | 3.500 | 2 | C52159 | — | C32896 |
| 25/64 | .3906 | .500 | .813 | 4.125 | 2 | **C32841 | — | — |
| 13/32 | .4062 | .500 | .813 | 4.125 | 2 | — | — | **C32898 |
| 7/16 | .4375 | .500 | .813 | 4.125 | 2 | C52161 | — | C32900 |
| 15/32 | .4688 | .500 | .813 | 4.125 | 2 | **C52162 | — | — |
| 31/64 | .4844 | .500 | .813 | 4.125 | 2 | **C32844 | — | — |
| 1/2 | .5000 | .500 | .813 | 4.125 | 2 | C52163 | — | C32904 |
| 9/16 | .5625 | .625 | 1.125 | 5.000 | 2 | C52164 | **C32872 | C32905 |
| 5/8 | .6250 | .625 | 1.125 | 5.000 | 2 | C52165 | — | C32906 |
| 11/16 | .6875 | .750 | 1.313 | 5.625 | 2 | — | — | **C32907 |
| 3/4 | .7500 | .750 | 1.313 | 5.625 | 2 | C52167 | — | C32908 |
| 13/16 | .8125 | .875 | 1.563 | 6.125 | 2 | **C32845 | — | **C32909 |
| 7/8 | .8750 | .875 | 1.563 | 6.125 | 2 | C52168 | — | C32910 |
| 15/16 | .9375 | 1.000 | 1.625 | 6.375 | 2 | **C32846 | **C32878 | **C32911 |
| 1 | 1.0000 | 1.000 | 1.625 | 6.375 | 2 | C52169 | — | C32912 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | + | | + | | + | + | | | | | | | |
| TiCN | ☆ | | ☆ | | ☆ | ☆ | + | | | | + | + | |

☆ = Best Performance + = Acceptable



Style: **HDC-4C - Double End**

Finisher

Note
Operating parameters begin on page 310.

M42 Cobalt

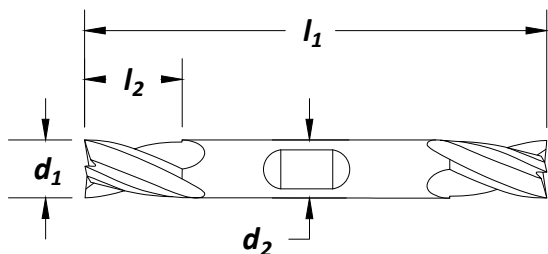
ANSI SIZES



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



Feature:

High red hardness for high heat conditions.

| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number HDC-4C | | |
|--|----------------|--|--|---|---------------|-------------------------------|--------|----------|
| | | | | | | Bright | TiN | TiCN |
| 1/8 | .1250 | .375 | .375 | 3.063 | 4 | C52170 | C32941 | C32974 |
| 9/64 | .1406 | .375 | .438 | 3.125 | 4 | **C32927 | — | **C32975 |
| 5/32 | .1562 | .375 | .438 | 3.125 | 4 | C52171 | — | C32976 |
| 11/64 | .1719 | .375 | .500 | 3.250 | 4 | **C32928 | — | — |
| 3/16 | .1875 | .375 | .500 | 3.250 | 4 | C52172 | C32945 | C32978 |
| 13/64 | .2031 | .375 | .563 | 3.250 | 4 | **C32929 | — | **C32979 |
| 7/32 | .2188 | .375 | .563 | 3.250 | 4 | C52173 | — | C32980 |
| 15/64 | .2344 | .375 | .625 | 3.375 | 4 | **C32930 | — | **C32981 |
| 1/4 | .2500 | .375 | .625 | 3.375 | 4 | C52174 | C32949 | C32982 |
| 17/64 | .2656 | .375 | .688 | 3.375 | 4 | **C32931 | — | — |
| 9/32 | .2812 | .375 | .688 | 3.375 | 4 | C52175 | — | C32984 |
| 19/64 | .2969 | .375 | .750 | 3.500 | 4 | **C32932 | — | **C32985 |
| 5/16 | .3125 | .375 | .750 | 3.500 | 4 | C52176 | C32953 | C32986 |
| 21/64 | .3281 | .375 | .750 | 3.500 | 4 | **C32933 | — | — |
| 11/32 | .3438 | .375 | .750 | 3.500 | 4 | **C52177 | — | **C32988 |
| 23/64 | .3594 | .375 | .750 | 3.500 | 4 | **C32934 | — | — |
| 3/8 | .3750 | .375 | .750 | 3.500 | 4 | C52178 | C32957 | C32990 |
| 25/64 | .3906 | .500 | 1.000 | 4.125 | 4 | **C32935 | — | — |
| 13/32 | .4062 | .500 | 1.000 | 4.125 | 4 | **C52179 | — | — |
| 27/64 | .4219 | .500 | 1.000 | 4.125 | 4 | **C32936 | — | **C32993 |
| 7/16 | .4375 | .500 | 1.000 | 4.125 | 4 | C52180 | C32961 | C32994 |
| 15/32 | .4688 | .500 | 1.000 | 4.125 | 4 | **C52181 | — | **C32996 |
| 31/64 | .4844 | .500 | 1.000 | 4.125 | 4 | **C32938 | — | **C32997 |
| 1/2 | .5000 | .500 | 1.000 | 4.125 | 4 | C52182 | C32965 | C32998 |
| 9/16 | .5625 | .625 | 1.375 | 5.000 | 4 | C52183 | C32966 | C32999 |
| 5/8 | .6250 | .625 | 1.375 | 5.000 | 4 | C52184 | C32967 | C33000 |
| 11/16 | .6875 | .750 | 1.625 | 5.625 | 4 | **C52185 | — | **C33001 |
| 3/4 | .7500 | .750 | 1.625 | 5.625 | 4 | C52186 | C32969 | C33002 |
| 13/16 | .8125 | .875 | 1.875 | 6.125 | 4 | **C32939 | — | **C33003 |
| 7/8 | .8750 | .875 | 1.875 | 6.125 | 4 | C52187 | C32971 | C33004 |
| 15/16 | .9375 | 1.000 | 1.875 | 6.375 | 4 | **C32940 | — | — |
| 1 | 1.0000 | 1.000 | 1.875 | 6.375 | 4 | C52188 | — | C33006 |

Cobalt
Center Cutting

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------|-----------------|------------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | |
| TiN | ★ | | ★ | | ★ | ★ | | | | | |
| TiCN | ★ | | ★ | | ★ | ★ | ★ | | | ★ | ★ |

★ = Best Performance ◆ = Acceptable



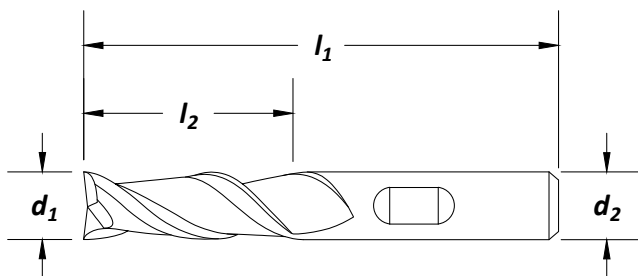
Finisher

Style: HGC-2 - Single End

Note
Operating parameters begin on page 310.



****Items are being OBSOLETED, only available until inventory is depleted.**



Feature:

High red hardness for high heat conditions.

Cobalt
Center Cutting

| cutting diameter | decimal equiv. | shank dia d ₂ (in) | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | order number | | |
|------------------|----------------|-------------------------------|-----------------------------------|------------------------------------|---------------|--------------|---------------------|----------|
| | | | | | | Bright | HGC-2 TiN | TiCN |
| 1/8 | .1250 | .375 | .188 | 2.125 | 2 | — | **C75136 | **C75146 |
| 1/8 | .1250 | .375 | .375 | 2.313 | 2 | C42602 | C32498 | C32527 |
| 1/8 | .1250 | .375 | .750 | 2.625 | 2 | — | — | **C75147 |
| 5/32 | .1562 | .375 | .438 | 2.375 | 2 | **C32480 | **C32499 | — |
| 11/64 | .1719 | .375 | .438 | 2.375 | 2 | **C32481 | **C32500 | **C32529 |
| 3/16 | .1875 | .375 | .438 | 2.375 | 2 | C42604 | C32501 | C32530 |
| 13/64 | .2031 | .375 | .500 | 2.438 | 2 | **C32482 | **C32502 | — |
| 7/32 | .2188 | .375 | .500 | 2.438 | 2 | **C32483 | **C32503 | **C32532 |
| 15/64 | .2344 | .375 | .500 | 2.438 | 2 | **C32484 | **C32504 | **C32533 |
| 1/4 | .2500 | .375 | .500 | 2.438 | 2 | C42607 | C32505 | C32534 |
| 17/64 | .2656 | .375 | .563 | 2.500 | 2 | **C32485 | **C32506 | **C32535 |
| 9/32 | .2812 | .375 | .563 | 2.500 | 2 | **C32486 | **C32507 | **C32536 |
| 19/64 | .2969 | .375 | .563 | 2.500 | 2 | **C32487 | **C32508 | — |
| 5/16 | .3125 | .375 | .563 | 2.500 | 2 | C42609 | C32509 | C32538 |
| 21/64 | .3281 | .375 | .563 | 2.500 | 2 | **C32488 | — | — |
| 11/32 | .3438 | .375 | .563 | 2.500 | 2 | **C32489 | **C32511 | **C32540 |
| 23/64 | .3594 | .375 | .563 | 2.500 | 2 | **C32490 | — | — |
| 3/8 | .3750 | .375 | .563 | 2.500 | 2 | C42612 | C32513 | C32542 |
| 3/8 | .3750 | .375 | 1.000 | 2.750 | 2 | C75128 | C75138 | C75148 |
| 3/8 | .3750 | .375 | 1.500 | 3.250 | 2 | **C75129 | **C75139 | **C75149 |
| 25/64 | .3906 | .375 | .813 | 2.688 | 2 | **C32491 | — | **C32543 |
| 13/32 | .4062 | .375 | .813 | 2.688 | 2 | — | **C32515 | — |
| 27/64 | .4219 | .375 | .813 | 2.688 | 2 | **C32493 | **C32516 | — |
| 7/16 | .4375 | .375 | .813 | 2.688 | 2 | C32494 | C32517 | C32546 |
| 29/64 | .4531 | .500 | 1.000 | 3.250 | 2 | **C32495 | **C32518 | **C32547 |
| 15/32 | .4688 | .500 | .813 | 3.250 | 2 | **C32496 | **C32519 | — |
| 31/64 | .4844 | .500 | 1.000 | 3.250 | 2 | **C32497 | — | — |
| 1/2 | .5000 | .375 | .813 | 2.688 | 2 | **C75130 | **C75140 | **C75150 |
| 1/2 | .5000 | .500 | 1.000 | 3.250 | 2 | C42616 | C32521 | C32550 |
| 1/2 | .5000 | .500 | 1.500 | 3.500 | 2 | C75131 | C75141 | C75151 |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 2 | **C75132 | — | **C75152 |
| 9/16 | .5625 | .500 | 1.125 | 3.375 | 2 | — | **C75143 | **C75153 |
| 5/8 | .6250 | .500 | 1.125 | 3.375 | 2 | **C75134 | **C75144 | **C75154 |
| 5/8 | .6250 | .625 | 1.313 | 3.750 | 2 | C42619 | C32522 | C32551 |

continued on next page



Style: HGC-2 - Single End (continued)

Finisher

| cutting diameter | decimal equiv. | shank dia d ₂ (in) | length of cut | | overall length l ₁ (in) | no. of flutes | order number | | |
|------------------|----------------|-------------------------------|---------------------|--|------------------------------------|---------------|--------------|-----------|----------|
| | | | l ₂ (in) | | | | Bright | HGC-2 TiN | TiCN |
| 3/4 | .7500 | .500 | 1.313 | | 3.625 | 2 | C75135 | C75145 | C75155 |
| 3/4 | .7500 | .750 | 1.313 | | 3.875 | 2 | C42622 | C32523 | C32552 |
| 3/4 | .7500 | .750 | 1.750 | | 4.000 | 2 | C75156 | C75165 | C75174 |
| 3/4 | .7500 | .750 | 2.250 | | 4.500 | 2 | **C75157 | **C75166 | — |
| 7/8 | .8750 | .625 | 1.500 | | 4.000 | 2 | C75158 | C75167 | C75176 |
| 7/8 | .8750 | .750 | 1.500 | | 4.125 | 2 | C75159 | C75168 | C75177 |
| 1 | 1.0000 | .625 | 1.500 | | 4.000 | 2 | **C75160 | — | **C75178 |
| 1 | 1.0000 | .750 | 1.500 | | 4.125 | 2 | C75161 | C75170 | C75179 |
| 1 | 1.0000 | 1.000 | 1.625 | | 4.500 | 2 | C42629 | C32524 | C32553 |
| 1 | 1.0000 | 1.000 | 2.250 | | 4.750 | 2 | — | **C75171 | — |
| 1 | 1.0000 | 1.000 | 3.000 | | 5.500 | 2 | C75163 | C75172 | C75181 |
| 1-1/4 | 1.2500 | .7500 | 1.625 | | 3.875 | 2 | C75164 | C75173 | C75182 |
| 1-1/4 | 1.2500 | 1.250 | 1.625 | | 4.500 | 2 | — | — | **C32554 |

Cobalt

Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| TiN | ◆ | | ◆ | | ◆ | ◆ | | | | | | | |
| TiCN | ☆ | | ☆ | | ☆ | ☆ | ◆ | | | | ◆ | ◆ | |

☆ = Best Performance ◆ = Acceptable



Finisher
Style: HGC-2B - Single End

Note
Operating parameters begin on page 310.

ANSI SIZES

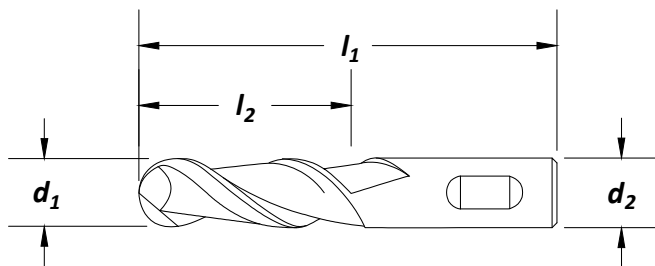
M42 Cobalt



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**


Feature:

High red hardness for high heat conditions.

| cutting diameter | decimal equiv. | shank dia d ₂ (in) | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | order number | | |
|------------------|----------------|-------------------------------|-----------------------------------|------------------------------------|---------------|---------------|----------|----------|
| | | | | | | HGC-2B | | |
| d ₁ | | | | | | Bright | TiN | TiCN |
| 1/8 | .1250 | .375 | .375 | 2.313 | 2 | C42643 | — | C32749 |
| 3/16 | .1875 | .375 | .500 | 2.375 | 2 | C42645 | **C32738 | C32750 |
| 1/4 | .2500 | .375 | .625 | 2.438 | 2 | C42648 | **C32739 | C32751 |
| 5/16 | .3125 | .375 | .750 | 2.500 | 2 | C42650 | **C32740 | C32752 |
| 3/8 | .3750 | .375 | .750 | 2.500 | 2 | C42653 | — | C32753 |
| 1/2 | .5000 | .500 | 1.000 | 3.250 | 2 | C42657 | — | C32754 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 2 | **C42660 | — | — |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 2 | C42663 | — | C32756 |
| 7/8 | .8750 | .875 | 1.875 | 4.125 | 2 | **C32736 | **C32745 | **C32757 |
| 1 | 1.0000 | 1.000 | 2.250 | 4.750 | 2 | C42670 | — | C32758 |

Cobalt

Center Cutting

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|--|-------|--|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | | | | 300 Series | 400 series | | 18-22 | 22-32 | | | | |
| TiN | + | | + | | + | + | | | | | | | |
| TiCN | ☆ | | ☆ | | ☆ | ☆ | + | | | | + | + | |

☆ = Best Performance + = Acceptable



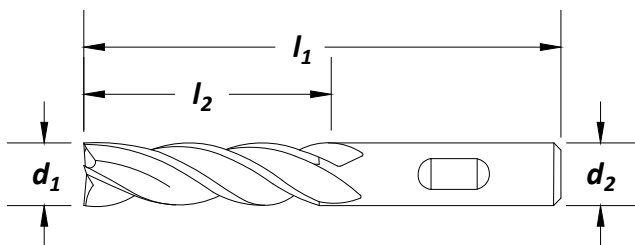
Style: **HGC-4C - Single End**

Finisher

Note
Operating parameters begin on page 310.



****Items are being OBSOLETED, only available until inventory is depleted.**



Feature:

High red hardness for high heat conditions. Heavy cross-section for high rigidity.

| cutting diameter | decimal equiv. | shank dia d ₂ (in) | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | order number | | |
|------------------|----------------|-------------------------------|-----------------------------------|------------------------------------|---------------|--------------|-------------------|----------|
| | | | | | | Bright | HGC-4C TiN | TiCN |
| 1/8 | .1250 | .375 | .375 | 2.313 | 4 | C42684 | C32574 | C32610 |
| 5/32 | .1562 | .375 | .500 | 2.375 | 4 | C32556 | C32575 | C32611 |
| 3/16 | .1875 | .375 | .500 | 2.375 | 4 | C42686 | C32577 | C32613 |
| 13/64 | .2031 | .375 | .625 | 2.438 | 4 | **C32558 | — | — |
| 7/32 | .2188 | .375 | .625 | 2.438 | 4 | C32559 | C32579 | C32615 |
| 15/64 | .2344 | .375 | .625 | 2.438 | 4 | **C32560 | **C32580 | **C32616 |
| 1/4 | .2500 | .375 | .625 | 2.438 | 4 | C42689 | C32581 | C32617 |
| 1/4 | .2500 | .375 | 1.250 | 3.063 | 4 | C32646 | C32655 | C32673 |
| 1/4 | .2500 | .375 | 1.750 | 3.563 | 4 | C32691 | C32700 | C32718 |
| 17/64 | .2656 | .375 | .750 | 2.500 | 4 | C32561 | C32582 | C32618 |
| 9/32 | .2812 | .375 | .750 | 2.500 | 4 | C32562 | C32583 | C32619 |
| 9/32 | .2812 | .375 | 1.375 | 3.125 | 4 | C32647 | C32656 | C32674 |
| 9/32 | .2812 | .375 | 2.000 | 3.750 | 4 | **C32692 | — | **C32719 |
| 19/64 | .2969 | .375 | .750 | 2.500 | 4 | C32563 | C32584 | C32620 |
| 5/16 | .3125 | .375 | .750 | 2.500 | 4 | C42691 | C32585 | C32621 |
| 5/16 | .3125 | .375 | 1.375 | 3.125 | 4 | C32648 | C32657 | C32675 |
| 5/16 | .3125 | .375 | 2.000 | 3.750 | 4 | C32693 | C32702 | C32720 |
| 21/64 | .3281 | .375 | .750 | 2.500 | 4 | **C32564 | **C32586 | **C32622 |
| 11/32 | .3438 | .375 | .750 | 2.500 | 4 | **C32565 | **C32587 | — |
| 11/32 | .3438 | .375 | 1.500 | 3.250 | 4 | **C32649 | **C32658 | **C32676 |
| 11/32 | .3438 | .375 | 2.500 | 4.250 | 4 | C32694 | C32703 | C32721 |
| 23/64 | .3594 | .375 | .750 | 2.500 | 4 | — | **C32588 | — |
| 3/8 | .3750 | .375 | .750 | 2.500 | 4 | C42694 | C32589 | C32625 |
| 3/8 | .3750 | .375 | 1.500 | 3.250 | 4 | C42857 | C32659 | C32677 |
| 3/8 | .3750 | .375 | 2.500 | 4.250 | 4 | C42913 | C32704 | C32722 |
| 25/64 | .3906 | .375 | 1.000 | 2.688 | 4 | — | **C32590 | **C32626 |
| 13/32 | .4062 | .375 | 1.000 | 2.688 | 4 | C32568 | C32591 | C32627 |
| 13/32 | .4062 | .375 | 1.750 | 3.750 | 4 | C32650 | C32660 | C32678 |
| 13/32 | .4062 | .375 | 2.750 | 4.500 | 4 | **C32695 | **C32705 | — |
| 27/64 | .4219 | .375 | 1.000 | 2.688 | 4 | — | — | **C32628 |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | ★ | | ★ | | ★ | ★ | | | | | | | |
| TiCN | ★ | | ★ | | ★ | ★ | ★ | | | | ★ | ★ | |

★ = Best Performance ★ = Acceptable

| cutting diameter d ₁ | decimal equiv. | shank dia d ₂ (in) | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | order number HGC-4C | | |
|------------------------------------|----------------|----------------------------------|--------------------------------------|---------------------------------------|---------------|-------------------------------|----------|----------|
| | | | | | | Bright | TiN | TiCN |
| 7/16 | .4375 | .375 | 1.000 | 2.688 | 4 | C32570 | C32593 | C32629 |
| 7/16 | .4375 | .375 | 1.750 | 3.750 | 4 | C32651 | C32661 | C32679 |
| 7/16 | .4375 | .375 | 2.750 | 4.500 | 4 | C32696 | C32706 | C32724 |
| 29/64 | .4531 | .500 | 1.250 | 3.250 | 4 | **C32571 | **C32594 | **C32630 |
| 15/32 | .4688 | .500 | 1.250 | 3.250 | 4 | C32572 | C32595 | C32631 |
| 15/32 | .4688 | .500 | 2.000 | 4.000 | 4 | **C32652 | C32662 | — |
| 15/32 | .4688 | .500 | 3.000 | 5.000 | 4 | **C32697 | — | — |
| 31/64 | .4844 | .500 | 1.250 | 3.250 | 4 | C32573 | C32596 | C32632 |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 4 | C42699 | C32597 | C32633 |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 6 | C42698 | C32598 | C32634 |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 4 | C42861 | C32663 | C32681 |
| 1/2 | .5000 | .500 | 3.000 | 5.000 | 4 | C42917 | C32708 | C32726 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 4 | C42703 | C32599 | C32635 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 6 | **C42702 | — | **C32636 |
| 5/8 | .6250 | .625 | 2.500 | 4.625 | 4 | C42864 | C32664 | C32682 |
| 5/8 | .6250 | .625 | 4.000 | 6.125 | 4 | C42920 | C32709 | C32727 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 4 | C42707 | C32601 | C32637 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 6 | — | — | **C32638 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 4 | C42868 | C32665 | C32683 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 6 | C42867 | C32666 | C32684 |
| 3/4 | .7500 | .750 | 4.000 | 6.250 | 4 | C42924 | C32710 | C32728 |
| 3/4 | .7500 | .750 | 4.000 | 6.250 | 6 | — | **C32711 | **C32729 |
| 7/8 | .8750 | .875 | 3.500 | 5.750 | 4 | C32653 | C32667 | C32685 |
| 7/8 | .8750 | .875 | 3.500 | 5.750 | 6 | C32654 | C32668 | C32686 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 4 | C42715 | C32603 | C32639 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 6 | **C42714 | **C32604 | — |
| 1 | 1.0000 | 1.000 | 4.000 | 6.500 | 4 | C42876 | C32669 | C32687 |
| 1 | 1.0000 | 1.000 | 4.000 | 6.500 | 6 | C42875 | C32670 | C32688 |
| 1 | 1.0000 | 1.000 | 6.000 | 8.500 | 4 | C42932 | C32712 | C32730 |
| 1 | 1.0000 | 1.000 | 6.000 | 8.500 | 6 | **C42931 | — | **C32731 |
| 1-1/4 | 1.2500 | 1.250 | 2.000 | 4.500 | 4 | C42720 | C32605 | C32641 |
| 1-1/4 | 1.2500 | 1.250 | 2.000 | 4.500 | 6 | **C42719 | **C32606 | **C32642 |
| 1-1/4 | 1.2500 | 1.250 | 4.000 | 6.500 | 6 | C42880 | C32672 | C32690 |
| 1-1/4 | 1.2500 | 1.250 | 6.000 | 8.500 | 4 | C42937 | C32714 | C32732 |
| 1-1/4 | 1.2500 | 1.250 | 6.000 | 8.500 | 6 | **C42936 | — | — |
| 1-1/2 | 1.5000 | 1.250 | 2.000 | 4.500 | 4 | C42727 | C32607 | C32643 |
| 1-1/2 | 1.5000 | 1.250 | 2.000 | 4.500 | 6 | **C42726 | — | — |
| 1-1/2 | 1.5000 | 1.250 | 8.000 | 10.500 | 4 | **C32698 | **C32716 | — |
| 1-1/2 | 1.5000 | 1.250 | 8.000 | 10.500 | 6 | C32699 | C32717 | C32735 |
| 2 | 2.0000 | 2.000 | 4.000 | 7.750 | 6 | C42731 | C32609 | C32645 |

Cobalt

Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | ◆ | | ◆ | | ◆ | ◆ | | | | | | | |
| TiCN | ☆ | | ☆ | | ☆ | ☆ | ◆ | | | | ◆ | ◆ | |

☆ = Best Performance ◆ = Acceptable

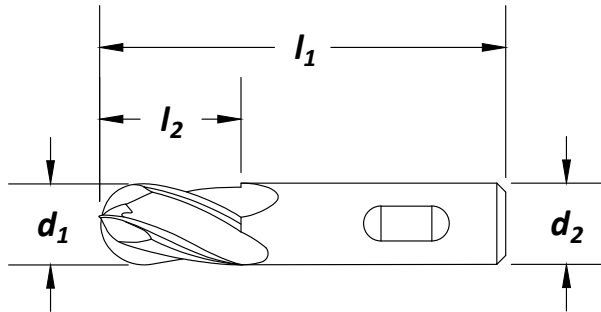


Style: HGC-4B - Single End

Note
Operating parameters begin on page 310.



****Items are being OBSOLETED, only available until inventory is depleted.**



Feature:

High red hardness for high heat conditions. Heavy cross-section for high rigidity.

| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut | | no. of flutes | order number | | |
|---------------------------|----------------|-------------------------|---------------|------------|---------------|---------------|----------|----------|
| | | | l_2 (in) | l_1 (in) | | HGC-4B | | |
| | | | | | | Bright | TiN | TiCN |
| 1/8 | .1250 | .375 | .375 | 2.313 | 4 | C42778 | — | C32776 |
| 3/16 | .1875 | .375 | .500 | 2.375 | 4 | C42780 | **C32764 | C32777 |
| 1/4 | .2500 | .375 | .625 | 2.438 | 4 | C42783 | — | C32778 |
| 1/4 | .2500 | .375 | 1.750 | 3.563 | 4 | **C75011 | **C75013 | — |
| 5/16 | .3125 | .375 | .750 | 2.500 | 4 | **C42785 | **C32766 | — |
| 3/8 | .3750 | .375 | .750 | 2.500 | 4 | C42788 | — | C32780 |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 4 | C42792 | — | C32781 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 4 | **C42795 | **C32769 | **C32782 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 4 | C42799 | **C32770 | C32783 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 6 | **C42798 | **C32771 | **C32784 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 4 | **C75012 | — | **C75016 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 4 | C42807 | **C32772 | C32785 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 6 | **C42806 | — | **C32786 |
| 1-1/4 | 1.2500 | 1.250 | 2.000 | 4.500 | 6 | — | **C32774 | **C32787 |
| 1-1/2 | 1.5000 | 1.250 | 2.000 | 4.500 | 6 | **C32762 | — | **C32788 |

Cobalt

Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Hardness | | | | | | | | | | | | | |
| Bright | | | | | | | | | | | | | |
| TiN | ◆ | | ◆ | | ◆ | ◆ | | | | | | | |
| TiCN | ☆ | | ☆ | | ☆ | ☆ | ◆ | | | ◆ | ◆ | | |

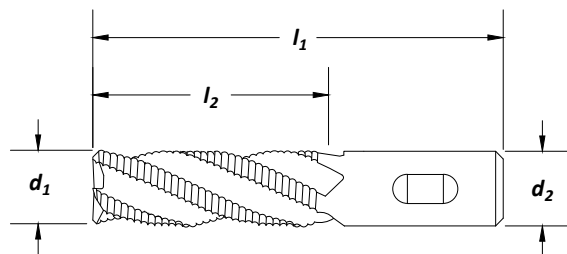
☆ = Best Performance ◆ = Acceptable



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



Feature:

Center cutting design for rapid plunge cutting. Heavy cross-section for high rigidity. High red hardness for high heat conditions.

Cobalt
Center Cutting

| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number | | |
|--|----------------|--|--|---|---------------|----------------------|-----------------------|------------------------|
| | | | | | | RG6 Bright | RG6-TC TiCN | RG6-TA TiAlN |
| 3/16 | .1875 | .375 | .500 | 2.375 | 4 | C30733 | — | — |
| 1/4 | .2500 | .375 | .250 | 2.063 | 4 | **C31160 | **C31279 | — |
| 1/4 | .2500 | .375 | .625 | 2.438 | 4 | C30826 | C30976 | — |
| 1/4 | .2500 | .375 | 1.250 | 3.125 | 4 | C30827 | — | — |
| 5/16 | .3125 | .375 | .750 | 2.500 | 4 | C30828 | C30977 | — |
| 3/8 | .3750 | .375 | .375 | 2.156 | 4 | — | **C31280 | — |
| 3/8 | .3750 | .375 | .750 | 2.500 | 4 | C30829 | C30978 | C31054 |
| 3/8 | .3750 | .375 | 1.500 | 3.250 | 4 | C30830 | C30979 | C31060 |
| 7/16 | .4375 | .500 | 1.250 | 3.250 | 4 | C30734 | — | — |
| 1/2 | .5000 | .500 | .500 | 2.500 | 4 | C31162 | C31281 | C31056 |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 4 | C30831 | C30980 | C31055 |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 4 | C30832 | C30981 | — |
| 5/8 | .6250 | .625 | .625 | 2.750 | 4 | C31163 | C31282 | C31053 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 4 | C30833 | C30982 | C31044 |
| 5/8 | .6250 | .625 | 2.500 | 4.625 | 4 | C30834 | C30983 | — |
| 3/4 | .7500 | .750 | .750 | 2.875 | 4 | C30837 | C30986 | C31058 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 4 | C30835 | C30984 | C31057 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 4 | C30836 | C30985 | — |
| 7/8 | .8750 | .875 | .875 | 3.125 | 5 | **C31164 | **C31283 | — |
| 7/8 | .8750 | .875 | 1.875 | 4.125 | 5 | C31165 | — | — |
| 1 | 1.0000 | 1.000 | 1.000 | 3.500 | 5 | C31166 | C31284 | C31063 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 5 | C30838 | C30987 | C31059 |
| 1 | 1.0000 | 1.000 | 3.000 | 5.500 | 5 | C30839 | C30988 | C31087 |
| 1 | 1.0000 | 1.000 | 4.000 | 6.500 | 5 | C30840 | C30989 | — |
| 1-1/4 | 1.2500 | 1.250 | 2.000 | 4.500 | 6 | C31167 | C31285 | C31064 |
| 1-1/4 | 1.2500 | 1.250 | 3.000 | 5.500 | 6 | — | **C31286 | **C31098 |
| 1-1/4 | 1.2500 | 1.250 | 4.000 | 6.500 | 6 | C31169 | C31287 | — |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | | | | | ◆ | ☆ | |
| TiAlN | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ◆ | | | | | | |

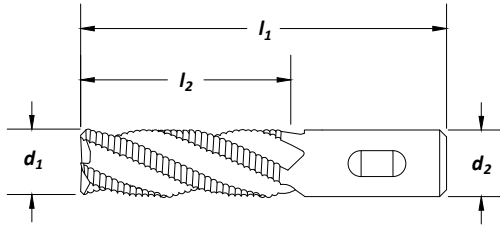
☆ = Best Performance ◆ = Acceptable



Styles: **RG8, RG8-TC, RG8-TA**



****Items are being OBSOLETED, only available until inventory is depleted.**



Feature:

Center cutting design for rapid plunge cutting. Heavy cross-section for high rigidity. High red hardness for high heat conditions.

| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number | | |
|--|----------------|--|--|---|---------------|----------------------|-----------------------|------------------------|
| | | | | | | RG8 Bright | RG8-TC TiCN | RG8-TA TiAlN |
| 3/16 | .1875 | .375 | .500 | 2.375 | 4 | C30709 | — | — |
| 1/4 | .2500 | .375 | .250 | 2.063 | 3 | **C31173 | **C31291 | — |
| 1/4 | .2500 | .375 | .625 | 2.438 | 4 | C31174 | C31292 | — |
| 1/4 | .2500 | .375 | 1.250 | 3.125 | 4 | C31175 | — | — |
| 5/16 | .3125 | .375 | .750 | 2.500 | 4 | C31176 | C31293 | — |
| 3/8 | .3750 | .375 | .375 | 2.156 | 4 | **C31177 | **C31294 | **C31065 |
| 3/8 | .3750 | .375 | .750 | 2.500 | 4 | C31178 | C31295 | C31067 |
| 3/8 | .3750 | .375 | 1.500 | 3.250 | 4 | C31179 | C31296 | — |
| 7/16 | .4375 | .500 | 1.250 | 3.250 | 4 | C30710 | — | — |
| 1/2 | .5000 | .500 | .500 | 2.500 | 4 | C31180 | C31297 | C31069 |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 4 | C31181 | C31298 | C31070 |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 4 | C31182 | C31299 | C31109 |
| 1/2 | .5000 | .500 | 3.000 | 5.000 | 4 | C30732 | — | — |
| 5/8 | .6250 | .625 | .625 | 2.750 | 4 | C31183 | C31300 | C31071 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 4 | C31184 | C31301 | C31072 |
| 5/8 | .6250 | .625 | 2.500 | 4.625 | 4 | C31190 | C31302 | — |
| 3/4 | .7500 | .750 | .750 | 2.875 | 4 | C31193 | C31303 | C31074 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 4 | C31194 | C31304 | C31075 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 4 | C31195 | C31305 | — |
| 3/4 | .7500 | 3/4 | 4.000 | 6.250 | 4 | **C75344 | — | — |
| 7/8 | .8750 | 3/4 | 1.875 | 4.125 | 5 | **C75345 | **C75358 | — |
| 7/8 | .8750 | 7/8 | 1.875 | 4.125 | 5 | — | C75359 | — |
| 1 | 1.0000 | .750 | 2.000 | 4.250 | 5 | C75347 | — | — |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 5 | C31197 | C31306 | C31076 |
| 1 | 1.0000 | 1.000 | 3.000 | 5.500 | 5 | C31198 | C31307 | C31111 |
| 1 | 1.0000 | 1.000 | 4.000 | 6.500 | 5 | C31199 | C31308 | — |
| 1-1/8 | 1.1250 | .750 | 2.000 | 4.250 | 6 | **C75348 | — | — |
| 1-1/4 | 1.2500 | 1.250 | 4.000 | 6.500 | 6 | C31205 | — | — |
| 1-1/2 | 1.5000 | 1.250 | 2.000 | 4.250 | 6 | C75350 | — | — |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiN | ◆ | | ◆ | | ◆ | ◆ | | | | | | | |
| TiAlN | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | | | | | | |

☆ = Best Performance ◆ = Acceptable

| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number | | |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|----------------------|-----------------------|------------------------|
| | | | | | | RG8 Bright | RG8-TC TiCN | RG8-TA TiAlN |
| 1-1/2 | 1.5000 | 1.250 | 2.000 | 4.500 | 6 | C75351 | C75360 | — |
| 2 | 2.0000 | .750 | 2.000 | 4.250 | 8 | C75354 | — | — |
| 2 | 2.0000 | 1.250 | 2.000 | 4.500 | 8 | C75355 | C75361 | — |
| 2 | 2.0000 | 2.000 | 4.000 | 7.750 | 6 | C31208 | C31313 | — |
| 2 | 2.0000 | 2.000 | 6.000 | 9.750 | 6 | **C31209 | — | — |
| 2 | 2.0000 | 2.000 | 6.000 | 9.750 | 8 | **C75390 | — | — |
| 2 | 2.0000 | 2.000 | 8.000 | 11.750 | 8 | C75391 | — | — |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| TiN | ◆ | | ◆ | | ◆ | ◆ | | | | | | | |
| TiAlN | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | | | | | | |

☆ = Best Performance ◆ = Acceptable

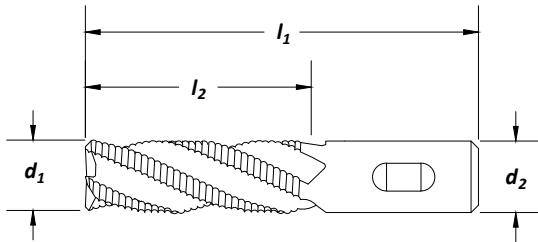


Styles: **RG9, RG9-TC**

ANSI SIZES **M42 Cobalt**

Surface Treatment

****Items are being OBSOLETED, only available until inventory is depleted.**



Feature:

Center cutting design for rapid plunge cutting. Heavy cross-section for high rigidity. High red hardness for high heat conditions.

| cutting diameter | decimal | shank dia | length of cut | overall length | no. of flutes | order number |
|------------------|---------|------------|---------------|----------------|---------------|----------------------|
| d_1 | equiv. | d_2 (in) | l_2 (in) | l_1 (in) | | RG9 Bright |
| 3/8 | .3750 | .375 | 1.500 | 3.250 | 3 | **C30720 |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 3 | **C30782 |
| 1/2 | .5000 | .500 | 3.000 | 5.000 | 3 | **C30721 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 3 | **C30783 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 3 | **C30785 |
| 3/4 | .7500 | .750 | 2.250 | 4.500 | 3 | **C30786 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 3 | **C30722 |
| 3/4 | .7500 | .750 | 4.000 | 6.250 | 3 | **C30723 |
| 7/8 | .8750 | .750 | 1.500 | 3.750 | 3 | **C30788 |
| 7/8 | .8750 | .875 | 1.875 | 4.125 | 3 | **C30787 |
| 1 | 1.0000 | .750 | 1.500 | 3.750 | 3 | **C30791 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 3 | **C30789 |
| 1 | 1.0000 | 1.000 | 3.000 | 5.500 | 3 | **C30790 |

Cobalt

Center Cutting

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | | >45 |
| Bright | | | | | | | | | | ◆ | |
| TiCN | | | | | | | | | | ☆ | |

☆ = Best Performance ◆ = Acceptable

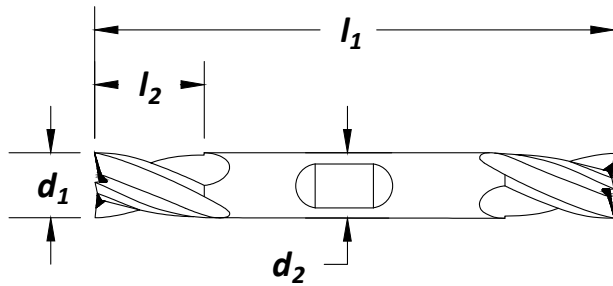
Note
 Operating parameters
 begin on page 310.



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**


Feature:

Double productivity with double ended end mills.

| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number PM-4DE | |
|--|----------------|--|--|---|---------------|-------------------------------|----------|
| | | | | | | Bright | TiCN |
| 5/32 | .1562 | .375 | .438 | 3.250 | 4 | — | **C31904 |
| 7/32 | .2188 | .375 | .563 | 3.250 | 4 | — | **C31906 |
| 5/16 | .3125 | .375 | .750 | 3.500 | 4 | — | **C31909 |
| 3/8 | .3750 | .375 | .750 | 3.500 | 4 | — | **C31911 |
| 13/32 | .4062 | .500 | 1.000 | 4.125 | 4 | — | **C31912 |
| 7/16 | .4375 | .500 | 1.000 | 4.125 | 4 | — | **C31913 |
| 1/2 | .5000 | .500 | 1.000 | 4.125 | 4 | — | **C31915 |
| 9/16 | .5625 | .625 | 1.375 | 5.000 | 4 | **C39974 | — |
| 5/8 | .6250 | .625 | 1.375 | 5.000 | 4 | — | **C31896 |
| 3/4 | .7500 | .750 | 1.625 | 5.625 | 4 | **C52197 | **C31919 |
| 7/8 | .8750 | .875 | 1.875 | 6.125 | 4 | **C52198 | **C31921 |
| 1 | 1.0000 | 1.000 | 1.875 | 6.375 | 4 | — | **C31923 |

Powered Metal

Center Cutting

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|-----|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | 13-38 | >38 | 16-38 | >38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | |
| Hardness | | | | | | | | | | | | | |
| Bright | ☆ | | ☆ | | | | | | | | | | |
| TiCN | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | ☆ | ◆ | | ◆ | ◆ | ◆ |

☆ = Best Performance ◆ = Acceptable



Style: PM-2 - Single End

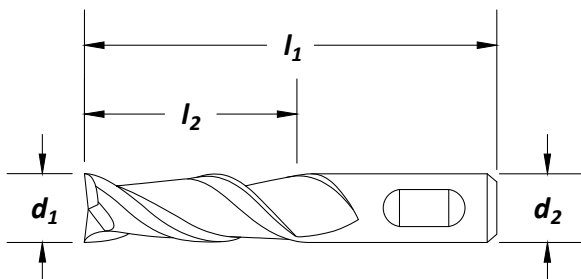
Note
Operating parameters begin on page 310.



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number | | |
|--|----------------|--|--|---|---------------|-----------------------|----------|----------|
| | | | | | | PM-2 Bright | TiN | TiCN |
| 1/8 | .1250 | .375 | .375 | 2.313 | 2 | — | — | **C40826 |
| 3/16 | .1875 | .375 | .500 | 2.375 | 2 | **C40793 | **C40810 | — |
| 1/4 | .2500 | .375 | .625 | 2.438 | 2 | **C40794 | **C40811 | **C40828 |
| 5/16 | .3125 | .375 | .750 | 2.500 | 2 | **C40795 | **C40812 | **C40829 |
| 3/8 | .3750 | .375 | .750 | 2.500 | 2 | **C40796 | **C40813 | **C40830 |
| 7/16 | .4375 | .500 | 1.000 | 2.688 | 2 | **C40797 | — | — |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 2 | — | — | **C40832 |
| 9/16 | .5625 | .500 | 1.375 | 3.375 | 2 | **C40799 | — | — |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 2 | **C40800 | **C40817 | **C40834 |
| 11/16 | .6875 | .625 | 1.625 | 3.750 | 2 | **C40801 | — | — |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 2 | **C40802 | **C40819 | **C40836 |
| 7/8 | .8750 | .875 | 1.875 | 4.125 | 2 | — | **C40820 | **C40837 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 2 | **C40804 | **C40821 | **C40838 |

TECH TIP

PM Plus High-Performance End Mills Deliver Superior Performance

- 8% cobalt substrate.
- High vanadium for high red hardness means exceptional toughness and high shock resistance.
- Runs at higher feeds than conventional HSS or cobalt end mills.
- Provide excellent heat and wear resistance.
- Freer cutting minimizes heat build up.
- Gives excellent finish

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------|-----------------|------------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | >45 |
| Bright | ★ | | ◆ | | | | | | ◆ | | |
| TiN | ★ | | ★ | | | | | | ◆ | | |
| TiCN | ★ | ◆ | ★ | ◆ | ◆ | ◆ | ◆ | | ★ | ◆ | ◆ |

★ = Best Performance ◆ = Acceptable



Powdered Metal
Center Cutting

Style: **PM-3 - Single End**

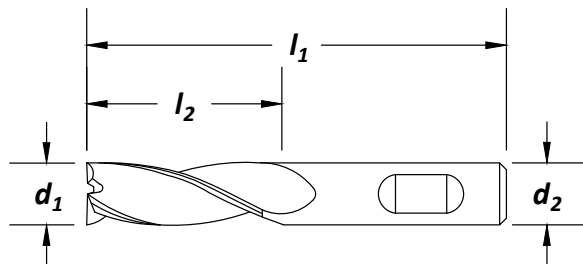
Note
Operating parameters begin on page 310.



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number | |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|--------------|----------|
| | | | | | | Bright | TiCN |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 3 | — | **C39950 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 3 | — | **C39951 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 3 | **C49277 | **C39952 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 3 | — | **C39962 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 3 | — | **C39953 |
| 1 | 1.0000 | 1.000 | 3.000 | 5.500 | 3 | — | **C39963 |

Powered Metal

Center Cutting

| Material Reference | Steel (HRc) | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | | | | >45 |
| Bright | | | | | | | | | | | |
| TiCN | | | | | | | | | | | |

= Best Performance = Acceptable

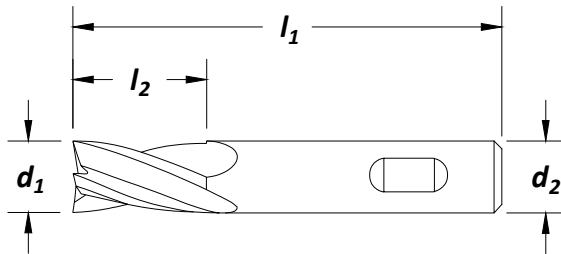
Style: **PM-4 - Single End**

Finisher
PM Plus™, Multi Flute

Note
Operating parameters begin on page 310.



****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number | | |
|--|----------------|--|--|---|---------------|-----------------------|----------|----------|
| | | | | | | PM-4 Bright | TiN | TiCN |
| 1/8 | .1250 | .375 | .250 | 2.188 | 4 | C43208 | C31924 | C31939 |
| 1/8 | .1250 | .375 | .375 | 2.313 | 4 | **C42500 | **C31960 | **C31987 |
| 5/32 | .1562 | .375 | .500 | 2.375 | 4 | **C43280 | **C31961 | **C31988 |
| 3/16 | .1875 | .375 | .250 | 2.125 | 4 | C43209 | C31925 | C31940 |
| 3/16 | .1875 | .375 | .500 | 2.375 | 4 | **C42502 | — | **C31989 |
| 7/32 | .2188 | .375 | .625 | 2.438 | 4 | **C43281 | **C31963 | **C31990 |
| 1/4 | .2500 | .375 | .250 | 2.063 | 4 | C43210 | C31926 | C31941 |
| 1/4 | .2500 | .375 | .625 | 2.438 | 4 | C42504 | C31964 | C31991 |
| 1/4 | .2500 | .375 | 1.250 | 3.063 | 4 | C43290 | C32016 | C32032 |
| 9/32 | .2812 | .375 | .750 | 2.500 | 4 | **C43282 | **C31965 | **C31992 |
| 5/16 | .3125 | .375 | .375 | 2.125 | 4 | **C43211 | **C31927 | — |
| 5/16 | .3125 | .375 | .750 | 2.500 | 4 | C42506 | C31966 | C31993 |
| 5/16 | .3125 | .375 | 1.375 | 3.125 | 4 | — | **C32017 | — |
| 11/32 | .3438 | .375 | .750 | 2.500 | 4 | **C43283 | — | **C31994 |
| 3/8 | .3750 | .375 | .375 | 2.125 | 4 | C43212 | C31928 | C31943 |
| 3/8 | .3750 | .375 | .750 | 2.500 | 4 | C42508 | C31968 | C31995 |
| 3/8 | .3750 | .375 | 1.500 | 3.250 | 4 | **C43292 | **C32018 | **C32034 |
| 13/32 | .4062 | .500 | 1.000 | 2.688 | 4 | **C43284 | — | **C31996 |
| 7/16 | .4375 | .375 | 1.750 | 3.750 | 4 | **C32014 | **C32019 | — |
| 7/16 | .4375 | .500 | .500 | 2.188 | 4 | C43213 | C31929 | C31944 |
| 7/16 | .4375 | .500 | 1.000 | 2.688 | 4 | C43285 | C31970 | C31997 |

continued on next page

TECH TIP

Benefits of Multi Flute End Mills

- Generally, multi flute end mills give smoother finishes than 2 Flute end mills.
- Increased number of flutes mean more cutting edges, providing more cutting action.

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | | >45 |
| Bright | ☆ | | ☆ | | | | | | | | |
| TiN | ☆ | | ☆ | | | | | | | | |
| TiCN | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | ☆ | ◆ | ◆ | ◆ |

☆ = Best Performance ◆ = Acceptable

| cutting diameter | decimal | shank dia | length of cut | overall length | no. of flutes | order number | | |
|----------------------|---------|---------------------------|---------------------------|---------------------------|---------------|--------------|----------|----------|
| | | | | | | PM-4 | | |
| d₁ | equiv. | d₂ (in) | l₂ (in) | l₁ (in) | | Bright | TiN | TiCN |
| 1/2 | .5000 | .500 | .500 | 2.500 | 4 | C43214 | C31930 | C31945 |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 4 | C42510 | C31972 | C31999 |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 4 | — | **C32020 | **C32036 |
| 9/16 | .5625 | .500 | 1.375 | 3.375 | 4 | C31955 | C31973 | C32000 |
| 5/8 | .6250 | .625 | .625 | 2.750 | 4 | C43215 | C31931 | C31946 |
| 5/8 | .6250 | .625 | .625 | 2.750 | 6 | **C43216 | — | — |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 4 | C42512 | C31974 | C32001 |
| 5/8 | .6250 | .625 | 2.500 | 4.625 | 4 | **C43294 | **C32021 | — |
| 11/16 | .6875 | .625 | 1.625 | 3.750 | 4 | C31956 | C31975 | C32002 |
| 3/4 | .7500 | .750 | .750 | 3.000 | 4 | C43217 | C31933 | C31948 |
| 3/4 | .7500 | .750 | .750 | 3.000 | 6 | C43218 | C31934 | C31949 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 4 | C42514 | C31976 | C32003 |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 6 | **C42516 | **C31977 | **C32004 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 4 | C43295 | C32022 | C32038 |
| 7/8 | .8750 | .875 | .875 | 3.125 | 4 | C43219 | C31936 | C31951 |
| 7/8 | .8750 | .875 | 1.250 | 3.500 | 4 | **C43220 | **C31935 | **C31950 |
| 7/8 | .8750 | .875 | 1.875 | 4.125 | 4 | C31958 | C31979 | C32006 |
| 7/8 | .8750 | .875 | 3.500 | 5.750 | 4 | **C32015 | — | **C32039 |
| 15/16 | .9375 | 1.000 | 1.875 | 4.500 | 4 | **C31959 | **C31980 | — |
| 1 | 1.0000 | 1.000 | 1.000 | 3.500 | 4 | C43221 | C31938 | C31953 |
| 1 | 1.0000 | 1.000 | 1.000 | 3.500 | 6 | **C43222 | **C31937 | **C31952 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 4 | C42518 | C31981 | C32008 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 6 | — | **C31982 | — |
| 1 | 1.0000 | 1.000 | 3.000 | 5.500 | 4 | C43286 | C32024 | C32040 |
| 1 | 1.0000 | 1.000 | 4.000 | 6.500 | 4 | C43296 | C32025 | C32041 |
| 1-1/8 | 1.1250 | 1.000 | 2.000 | 4.500 | 6 | **C43223 | — | **C32010 |
| 1-1/4 | 1.2500 | 1.250 | 2.000 | 4.500 | 6 | **C43224 | **C31984 | **C32011 |
| 1-1/4 | 1.2500 | 1.250 | 4.000 | 6.500 | 6 | **C43297 | **C32027 | — |

Powered Metal

Center Cutting

| Material Reference | Steel (HRc) | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | | >45 |
| Bright | | | | | | | | | | | |
| TiN | | | | | | | | | | | |
| TiCN | | | | | | | | | | | |

= Best Performance = Acceptable

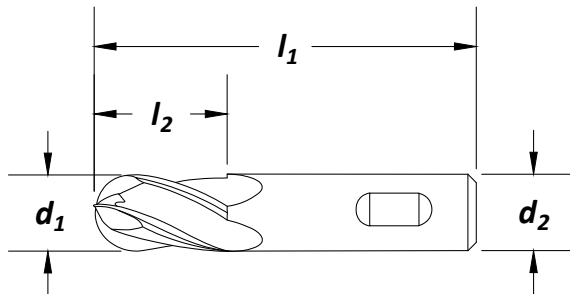


Style: PM-4B - Single End

Note
Operating parameters begin on page 310.



****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number | |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|--------------|----------|
| | | | | | | Bright | TiCN |
| 3/16 | .1875 | .375 | .500 | 2.375 | 4 | — | **C32058 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 4 | — | **C32063 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 4 | — | **C32065 |

Powdered Metal
Center Cutting

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | | >45 |
| Bright | ☆ | | ☆ | | | | | | | | |
| TiCN | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | ☆ | ◆ | ◆ | ◆ |

☆ = Best Performance ◆ = Acceptable

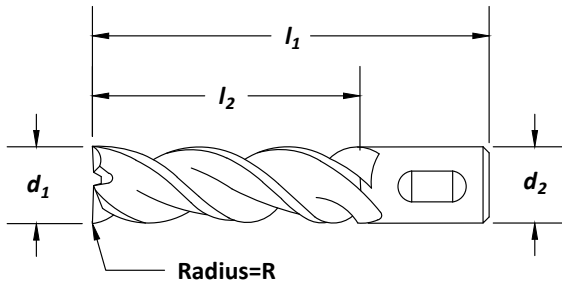
Note
Operating parameters begin on page 310.



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



Powered Metal

Center Cutting

order number

PM-539R

| cutting diameter | decimal | shank dia | length of cut | overall length | no. of flutes | Bright R = 0° | TiCN R = 0° | TiCN R = .060° | TiCN R = .090° | TiCN R = .120° |
|------------------|---------|---------------------|---------------------|---------------------|---------------|---------------|-------------|----------------|----------------|----------------|
| d ₁ | equiv. | d ₂ (in) | l ₂ (in) | l ₁ (in) | | | | | | |
| 3/8 | .3750 | .375 | .750 | 2.500 | 3 | C40072 | C40073 | - | - | - |
| 3/8 | .3750 | .375 | 1.500 | 3.250 | 3 | C40074 | C40075 | - | - | - |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 3 | C40076 | C40077 | - | - | - |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 3 | C40078 | C40079 | - | - | - |
| 1/2 | .5000 | .500 | 3.000 | 5.000 | 3 | C40080 | C40081 | - | - | - |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 3 | C40082 | C40083 | - | - | - |
| 5/8 | .6250 | .625 | 2.500 | 4.625 | 3 | **C40084 | **C40085 | - | - | - |
| 5/8 | .6225 | .625 | 3.000 | 5.125 | 3 | C40086 | C40087 | - | - | - |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 3 | C40345 | C40346 | C40347 | C40348 | C40349 |
| 3/4 | .7500 | .750 | 2.250 | 4.500 | 3 | C40390 | C40391 | C40392 | C40393 | C40394 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 3 | C40350 | C40351 | C40352 | C40353 | C40354 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 3 | C40355 | C40356 | C40357 | C40358 | C40359 |
| 1 | 1.0000 | 1.000 | 3.000 | 5.500 | 3 | C40360 | C40361 | C40362 | C40363 | C40364 |
| 1 | 1.0000 | 1.000 | 4.000 | 6.500 | 3 | C40365 | C40366 | C40367 | C40368 | C40369 |
| 1-1/4 | 1.2500 | 1.250 | 2.000 | 4.500 | 3 | **C40370 | - | - | - | **C40374 |
| 1-1/4 | 1.2500 | 1.250 | 3.000 | 5.500 | 3 | C40375 | - | - | - | C40379 |
| 1-1/4 | 1.2500 | 1.250 | 4.000 | 6.500 | 3 | **C40380 | - | - | - | **C40384 |
| 1-1/4 | 1.2500 | 1.250 | 6.000 | 8.500 | 3 | C40385 | - | - | - | - |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | | | | | | | | | | ☆ | | | |
| TiCN | | | | | | | | | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



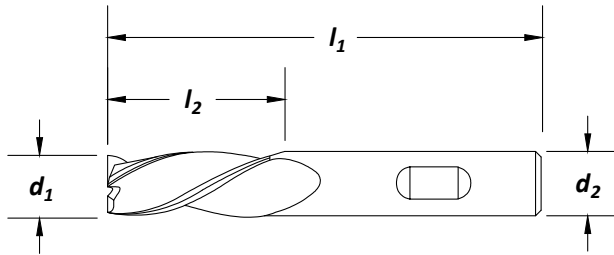
Style: **PM-539L - Single End**

Finisher
PM Plus™, Left, High Helix

Note
Left hand spiral.
Left hand cut.
Operating parameters
begin on page 310.



****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number PM-539L | |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|--------------------------------|----------|
| | | | | | | Bright | TiCN |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 3 | C40295 | - |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 3 | C40296 | - |
| 1/2 | .5000 | .500 | 3.000 | 5.000 | 3 | **C40297 | - |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 3 | **C40298 | - |
| 5/8 | .6250 | .625 | 2.500 | 4.625 | 3 | **C40299 | - |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 3 | C40300 | C40301 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 3 | C40305 | C40306 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 3 | C40310 | C40311 |
| 1 | 1.0000 | 1.000 | 3.000 | 5.500 | 3 | **C40315 | **C40316 |
| 1 | 1.0000 | 1.000 | 4.000 | 6.500 | 3 | C40320 | C40321 |

TECH TIP

The PM-539 Advantage

- Exceptional speeds in aluminum.
- Quiet, chatter-free machining and high shear cutting.

Powdered Metal

Center Cutting

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | | >45 |
| Bright | | | | | | | | | | ☆ | |
| TiCN | | | | | | | | | | ☆ | |

☆ = Best Performance ◆ = Acceptable

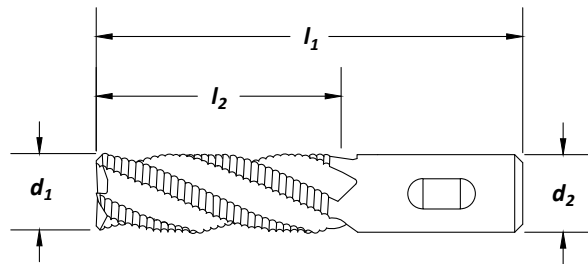
Rougher
PM Plus™, Multi Flute, Coarse Pitch

Style: **PMRC-C - Single End**

Note
Operating parameters begin on page 310.



****Items are being OBSOLETED, only available until inventory is depleted.**



Center Cutting Powered Metal

| cutting diameter <u>d₁</u> | decimal equiv. | shank dia <u>d₂</u> (in) | length of cut | | overall length <u>l₁</u> (in) | no. of flutes | order number PMRC-C | | |
|--|-------------------|--|---------------------------|--|---|------------------|-------------------------------|----------|----------|
| | | | <u>l₂</u> (in) | | | | Bright | TiN | TiCN |
| 1/4 | .2500 | .375 | .625 | | 2.438 | 3 | C43229 | C32214 | C32243 |
| 3/8 | .3750 | .375 | .375 | | 2.125 | 4 | **C43230 | **C32215 | **C32244 |
| 3/8 | .3750 | .375 | .750 | | 2.500 | 4 | C43299 | C32216 | C32245 |
| 3/8 | .3750 | .375 | 1.500 | | 3.250 | 4 | C32210 | C32217 | C32246 |
| 1/2 | .5000 | .500 | .500 | | 2.500 | 4 | C43231 | C32218 | C32247 |
| 1/2 | .5000 | .500 | 1.250 | | 3.250 | 4 | C43300 | C32219 | C32248 |
| 1/2 | .5000 | .500 | 2.000 | | 4.000 | 4 | C32211 | C32220 | C32249 |
| 5/8 | .6250 | .625 | .625 | | 2.750 | 4 | C43232 | C32221 | C32250 |
| 5/8 | .6250 | .625 | 1.625 | | 3.750 | 4 | C43301 | C32222 | C32251 |
| 5/8 | .6250 | .625 | 2.500 | | 4.625 | 4 | C32212 | C32223 | C32252 |
| 3/4 | .7500 | .750 | .750 | | 3.000 | 4 | C43233 | C32224 | C32253 |
| 3/4 | .7500 | .750 | 1.625 | | 3.875 | 4 | C43302 | C32225 | C32254 |
| 3/4 | .7500 | .750 | 3.000 | | 5.250 | 4 | C43303 | C32226 | C32255 |
| 7/8 | .8750 | .875 | .875 | | 3.125 | 5 | C43234 | C32227 | C32256 |
| 1 | 1.0000 | 1.000 | 1.000 | | 3.500 | 5 | C43235 | C32228 | C32257 |
| 1 | 1.0000 | 1.000 | 2.000 | | 4.500 | 5 | C43236 | C32229 | C32258 |
| 1 | 1.0000 | 1.000 | 3.000 | | 5.500 | 5 | C43304 | C32230 | C32259 |
| 1 | 1.0000 | 1.000 | 4.000 | | 6.500 | 5 | C43305 | C32231 | C32260 |
| 1-1/8 | 1.1250 | 1.125 | 2.000 | | 4.500 | 5 | **C43237 | — | — |
| 1-1/4 | 1.2500 | 1.250 | 2.000 | | 4.500 | 5 | **C43238 | **C32233 | **C32262 |
| 1-1/4 | 1.2500 | 1.250 | 3.000 | | 5.500 | 5 | **C43239 | **C32234 | — |
| 1-1/4 | 1.2500 | 1.250 | 4.000 | | 6.500 | 5 | C43306 | C32235 | C32264 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | | | | | | | | ◆ | | | |
| TiN | ◆ | | | | | | | | | ☆ | | | |
| TiCN | ◆ | | ◆ | | ◆ | ◆ | | | | ☆ | ◆ | ◆ | |

☆ = Best Performance ◆ = Acceptable



Style: **PMRF-C - Single End**

PM Plus™, Multi Flute, Fine Pitch

Rougher

Note

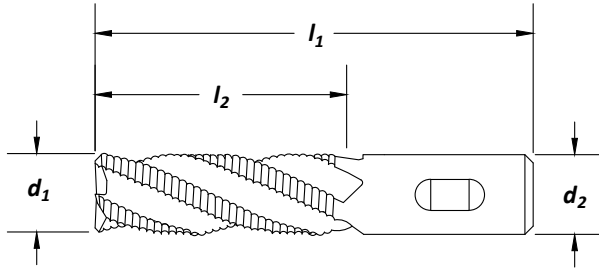
Operating parameters begin on page 310.



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



| cutting diameter d₁ | decimal equiv. | shank dia d₂ (in) | length of cut | | no. of flutes | order number | | |
|--|----------------|--|---------------------------|---------------------------|---------------|---------------|----------|----------|
| | | | l₂ (in) | l₁ (in) | | PMRF-C | | |
| | | | | | | Bright | TiCN | TiAlN |
| 3/8 | .3750 | .375 | .750 | 2.500 | 4 | **C41122 | **C41145 | — |
| 3/8 | .3750 | .375 | 1.500 | 3.250 | 4 | **C41134 | **C41157 | — |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 4 | C41123 | — | **C41169 |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 4 | C41135 | **C41158 | **C41181 |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 4 | **C41124 | — | — |
| 5/8 | .6250 | .625 | 2.500 | 4.625 | 4 | **C41136 | **C41159 | — |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 4 | C41125 | **C41148 | **C41171 |
| 3/4 | .7500 | .750 | 2.250 | 4.500 | 4 | C41130 | — | — |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 4 | **C41137 | **C41160 | — |
| 7/8 | .8750 | .875 | 1.875 | 4.125 | 5 | **C41126 | — | — |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 5 | C41127 | **C41150 | — |
| 1 | 1.0000 | 1.000 | 3.000 | 5.500 | 5 | **C41131 | **C41154 | **C41177 |
| 1 | 1.0000 | 1.000 | 4.000 | 6.500 | 5 | C41139 | — | **C41185 |
| 1-1/4 | 1.2500 | 1.250 | 2.000 | 4.500 | 6 | **C41128 | — | — |
| 1-1/4 | 1.2500 | 1.250 | 3.000 | 5.500 | 6 | **C41132 | **C41155 | — |
| 1-1/4 | 1.2500 | 1.250 | 4.000 | 6.500 | 6 | — | **C41163 | **C41186 |
| 1-1/2 | 1.5000 | 1.250 | 3.000 | 5.500 | 6 | C41133 | **C41156 | — |

Powdered Metal

Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | | | | | | | | | |
| TiN | ☆ | | ☆ | | | | | | | | | | |
| TiCN | ☆ | ◆ | ☆ | ◆ | ◆ | ◆ | | | | | ◆ | ◆ | |

☆ = Best Performance ◆ = Acceptable

Rougher
PM Plus™, Coarse Pitch

Styles: **PM-538R - Single End**

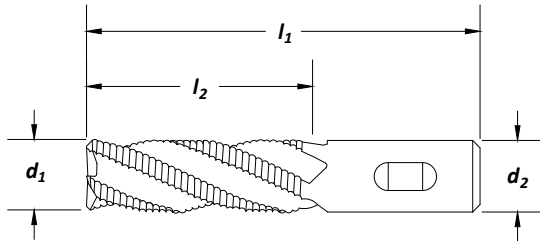
Note
Operating parameters begin on page 310.



Surface Treatment



****Items are being OBSOLETED, only available until inventory is depleted.**



Feature:

For HIGH VOLUME aluminum roughing.

Powered Metal

Center Cutting

| cutting diameter d ₁ | decimal equiv. | shank dia d ₂ (in) | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | order number PM-538R | | | |
|------------------------------------|----------------|----------------------------------|--------------------------------------|---------------------------------------|---------------|--------------------------------|--------------|-----------------|---------------|
| | | | | | | Bright 0° R | TiCN 0° R | TiCN .060° R | TiCN .120° |
| 1/2 | .5000 | .500 | 1.250 | 3.250 | 3 | C40003 | C40015 | - | - |
| 1/2 | .5000 | .500 | 2.000 | 4.000 | 3 | C40004 | C40016 | - | - |
| 5/8 | .6250 | .625 | 1.625 | 3.750 | 3 | C40005 | C40017 | - | - |
| 5/8 | .6250 | .625 | 2.500 | 4.625 | 3 | C40006 | C40018 | - | - |
| 3/4 | .7500 | .750 | 1.625 | 3.875 | 3 | C40007 | C40019 | C40033 | C40035 |
| 3/4 | .7500 | .750 | 2.250 | 4.500 | 3 | C40062 | C40063 | C40064 | C40066 |
| 3/4 | .7500 | .750 | 3.000 | 5.250 | 3 | C40008 | C40020 | C40036 | C40038 |
| 1 | 1.0000 | 1.000 | 2.000 | 4.500 | 3 | C40009 | C40021 | C40039 | C40041 |
| 1 | 1.0000 | 1.000 | 3.000 | 5.500 | 3 | C40010 | C40022 | C40042 | C40044 |
| 1 | 1.0000 | 1.000 | 4.000 | 6.500 | 3 | C40011 | C40023 | C40045 | C40047 |
| 1-1/4 | 1.2500 | 1.250 | 2.000 | 4.500 | 3 | **C40048 | - | **C40050 | **C40052 |
| 1-1/4 | 1.2500 | 1.250 | 3.000 | 5.500 | 3 | - | - | - | **C40055 |
| 1-1/4 | 1.2500 | 1.250 | 4.000 | 6.500 | 3 | C40013 | C40025 | C40056 | C40058 |
| 1-1/4 | 1.2500 | 1.250 | 6.000 | 8.500 | 3 | C40014 | C40026 | C40059 | C40061 |
| 1-1/2 | 1.5000 | 1.250 | 2.000 | 4.500 | 3 | **C43244 | - | - | - |
| 1-1/2 | 1.5000 | 1.250 | 3.000 | 5.500 | 3 | **C43247 | **C43249 | - | - |
| 1-1/2 | 1.5000 | 1.250 | 4.000 | 6.500 | 3 | **C43250 | **C43252 | - | - |
| 1-1/2 | 1.5000 | 1.250 | 6.000 | 8.500 | 3 | C43253 | C43255 | - | - |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | | | | | | | | | | ★ | | | |
| TiCN | | | | | | | | | | ★ | | | |

★ = Best Performance ◆ = Acceptable



Styles: **PM-538L - Left, Single End**

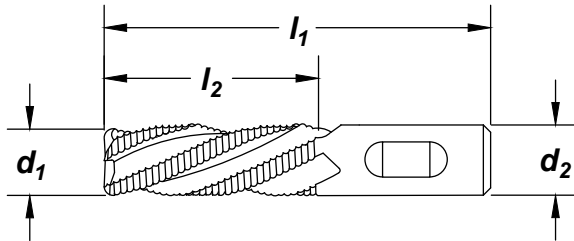
Note
Left Hand Spiral.
Left Hand Cut.



Surface Treatment



****Items are being OBSOLETEd, only available until inventory is depleted.**



| cutting diameter d_1 | decimal equiv. | shank dia d_2 (in) | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | order number PM-538L Bright 0° R **C40435 |
|---------------------------|----------------|-------------------------|-----------------------------|------------------------------|---------------|---|
| 1-1/4 | 1.2500 | 1.250 | 4.000 | 6.500 | 3 | |

Powdered Metal

Center Cutting

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) | |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|-----|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | | | >45 |
| Bright | | | | | | | | | | ☆ | | |

☆ = Best Performance ◆ = Acceptable

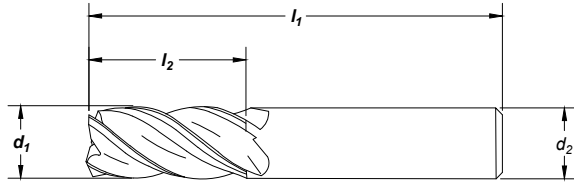
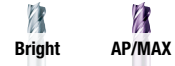
Variable Index
Ferrous Materials

Style: CEM-V-4R

Note
*Weldon flats available
1/2" and larger.



Surface Treatment



Carbide

Center Cutting

| cutting diameter d₁ | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | corner radius | order number CEM-V-4R | | |
|--|---------|--|--|---|---------------|---------------|---------------------------------|--------|--------|
| fractional | decimal | | | | | | bright | AP/MAX | T-Max® |
| 1/8 | .1250 | 1/8 | 1/4 | 1-1/2 | 4 | 0.000 | C60001 | C80001 | — |
| 1/8 | .1250 | 1/8 | 1/4 | 1-1/2 | 4 | 0.010 | C60002 | C80002 | — |
| 1/8 | .1250 | 1/8 | 3/8 | 1-1/2 | 4 | 0.000 | C60003 | C80003 | — |
| 1/8 | .1250 | 1/8 | 3/8 | 1-1/2 | 4 | 0.010 | C60004 | C80004 | — |
| 1/8 | .1250 | 1/8 | 1/2 | 1-1/2 | 4 | 0.000 | C60005 | C80005 | — |
| 1/8 | .1250 | 1/8 | 1/2 | 1-1/2 | 4 | 0.010 | C60006 | C80006 | — |
| 3/16 | .1875 | 3/16 | 3/8 | 2 | 4 | 0.000 | C60007 | C80007 | — |
| 3/16 | .1875 | 3/16 | 3/8 | 2 | 4 | 0.010 | C60008 | C80008 | — |
| 3/16 | .1875 | 3/16 | 7/16 | 2 | 4 | 0.000 | C60009 | C80009 | — |
| 3/16 | .1875 | 3/16 | 7/16 | 2 | 4 | 0.010 | C60010 | C80010 | C70810 |
| 3/16 | .1875 | 3/16 | 3/4 | 2-1/2 | 4 | 0.000 | C60011 | C80011 | C70811 |
| 3/16 | .1875 | 3/16 | 3/4 | 2-1/2 | 4 | 0.010 | C60012 | C80012 | C70812 |
| 1/4 | .2500 | 1/4 | 1/2 | 2 | 4 | 0.000 | C60013 | C80013 | C70813 |
| 1/4 | .2500 | 1/4 | 1/2 | 2 | 4 | 0.020 | C60014 | C80014 | C70814 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 4 | 0.000 | C60015 | C80015 | C70815 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 4 | 0.020 | C60016 | C80016 | C70816 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 4 | 0.045 | C60017 | C80017 | C70817 |
| 1/4 | .2500 | 1/4 | 1-1/8 | 3 | 4 | 0.000 | C60018 | C80018 | C70818 |
| 1/4 | .2500 | 1/4 | 1-1/8 | 3 | 4 | 0.020 | C60019 | C80019 | C70819 |
| 1/4 | .2500 | 1/4 | 1-1/4 | 3 | 4 | 0.000 | C60020 | C80020 | C70820 |
| 5/16 | .3125 | 5/16 | 1/2 | 2 | 4 | 0.000 | C60021 | C80021 | C70821 |
| 5/16 | .3125 | 5/16 | 1/2 | 2 | 4 | 0.020 | C60022 | C80022 | C70822 |
| 5/16 | .3125 | 5/16 | 13/16 | 2-1/2 | 4 | 0.000 | C60023 | C80023 | C70823 |
| 5/16 | .3125 | 5/16 | 13/16 | 2-1/2 | 4 | 0.020 | C60024 | C80024 | C70824 |
| 5/16 | .3125 | 5/16 | 1-1/4 | 3 | 4 | 0.000 | C60025 | C80025 | C70825 |
| 5/16 | .3125 | 5/16 | 1-1/4 | 3 | 4 | 0.020 | C60026 | C80026 | C70826 |
| 3/8 | .3750 | 3/8 | 5/8 | 2 | 4 | 0.000 | C60027 | C80027 | C70827 |
| 3/8 | .3750 | 3/8 | 5/8 | 2 | 4 | 0.020 | C60028 | C80028 | C70828 |
| 3/8 | .3750 | 3/8 | 7/8 | 2-1/2 | 4 | 0.000 | C60029 | C80029 | C70829 |
| 3/8 | .3750 | 3/8 | 7/8 | 2-1/2 | 4 | 0.020 | C60030 | C80030 | C70830 |
| 3/8 | .3750 | 3/8 | 1-1/8 | 3 | 4 | 0.000 | C60031 | C80031 | C70831 |
| 3/8 | .3750 | 3/8 | 1-1/8 | 3 | 4 | 0.020 | C60032 | C80032 | C70832 |
| 3/8 | .3750 | 3/8 | 2 | 4 | 4 | 0.000 | C60033 | C80033 | C70833 |
| 3/8 | .3750 | 3/8 | 2 | 4 | 4 | 0.020 | C60034 | C80034 | C70834 |

continued on next page



Style: **CEM-V-4R** (continued)

| cutting diameter d ₁ | | shank diameter d ₂ | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | corner radius | order number CEM-V-4R | | |
|------------------------------------|---------|----------------------------------|--------------------------------------|---------------------------------------|---------------|---------------|---------------------------------|--------|--------|
| fractional | decimal | | | | | | bright | AP/MAX | T-Max® |
| 7/16 | .4375 | 7/16 | 5/8 | 2-1/2 | 4 | 0.000 | C60035 | C80035 | C70835 |
| 7/16 | .4375 | 7/16 | 5/8 | 2-1/2 | 4 | 0.020 | C60036 | C80036 | C70836 |
| 7/16 | .4375 | 7/16 | 1 | 3 | 4 | 0.000 | C60037 | C80037 | C70837 |
| 7/16 | .4375 | 7/16 | 1 | 3 | 4 | 0.020 | C60038 | C80038 | C70838 |
| 7/16 | .4375 | 7/16 | 2 | 4 | 4 | 0.000 | C60039 | C80039 | C70839 |
| 1/2* | .5000 | 1/2 | 5/8 | 2-1/2 | 4 | 0.000 | C60040 | C80040 | C70840 |
| 1/2* | .5000 | 1/2 | 5/8 | 2-1/2 | 4 | 0.020 | C60041 | C80041 | C70841 |
| 1/2* | .5000 | 1/2 | 5/8 | 2-1/2 | 4 | 0.030 | C60042 | C80042 | C70842 |
| 1/2* | .5000 | 1/2 | 1 | 3 | 4 | 0.000 | C60043 | C80043 | C70843 |
| 1/2* | .5000 | 1/2 | 1 | 3 | 4 | 0.030 | C60044 | C80044 | C70844 |
| 1/2* | .5000 | 1/2 | 1 | 3 | 4 | 0.060 | C60045 | C80045 | C70845 |
| 1/2* | .5000 | 1/2 | 1 | 3 | 4 | 0.090 | C60046 | C80046 | C70846 |
| 1/2* | .5000 | 1/2 | 1 | 3 | 4 | 0.125 | C60047 | C80047 | C70847 |
| 1/2* | .5000 | 1/2 | 1-1/4 | 3 | 4 | 0.000 | C60048 | C80048 | C70848 |
| 1/2* | .5000 | 1/2 | 1-1/4 | 3 | 4 | 0.020 | C60049 | C80049 | C70849 |
| 1/2* | .5000 | 1/2 | 1-1/4 | 3 | 4 | 0.030 | C60050 | C80050 | C70850 |
| 1/2* | .5000 | 1/2 | 1-1/4 | 3 | 4 | 0.060 | C60051 | C80051 | C70851 |
| 1/2* | .5000 | 1/2 | 1-1/4 | 3 | 4 | 0.090 | C60052 | C80052 | C70852 |
| 1/2* | .5000 | 1/2 | 1-1/4 | 3 | 4 | 0.125 | C60053 | C80053 | C70853 |
| 1/2* | .5000 | 1/2 | 2 | 4 | 4 | 0.000 | C60054 | C80054 | C70854 |
| 1/2* | .5000 | 1/2 | 2 | 4 | 4 | 0.030 | C60055 | C80055 | C70855 |
| 1/2* | .5000 | 1/2 | 2 | 4 | 4 | 0.060 | C60056 | C80056 | C70856 |
| 1/2* | .5000 | 1/2 | 2 | 4 | 4 | 0.090 | C60057 | C80057 | C70857 |
| 1/2* | .5000 | 1/2 | 2 | 4 | 4 | 0.125 | C60058 | C80058 | C70858 |
| 5/8* | .6250 | 5/8 | 3/4 | 3 | 4 | 0.000 | C60059 | C80059 | C70859 |
| 5/8* | .6250 | 5/8 | 3/4 | 3 | 4 | 0.030 | C60060 | C80060 | C70860 |
| 5/8* | .6250 | 5/8 | 1-1/4 | 3-1/2 | 4 | 0.000 | C60061 | C80061 | C70861 |
| 5/8* | .6250 | 5/8 | 1-1/4 | 3-1/2 | 4 | 0.030 | C60062 | C80062 | C70862 |
| 5/8* | .6250 | 5/8 | 1-1/4 | 3-1/2 | 4 | 0.060 | C60063 | C80063 | C70863 |
| 5/8* | .6250 | 5/8 | 1-1/4 | 3-1/2 | 4 | 0.090 | C60064 | C80064 | C70864 |
| 5/8* | .6250 | 5/8 | 1-1/4 | 3-1/2 | 4 | 0.125 | C60065 | C80065 | C70865 |
| 5/8* | .6250 | 5/8 | 2-1/4 | 5 | 4 | 0.000 | C60066 | C80066 | C70866 |
| 5/8* | .6250 | 5/8 | 2-1/4 | 5 | 4 | 0.030 | C60067 | C80067 | C70867 |
| 5/8* | .6250 | 5/8 | 2-1/4 | 5 | 4 | 0.060 | C60068 | C80068 | C70868 |
| 5/8* | .6250 | 5/8 | 2-1/4 | 5 | 4 | 0.090 | C60069 | C80069 | C70869 |
| 5/8* | .6250 | 5/8 | 2-1/4 | 5 | 4 | 0.125 | C60070 | C80070 | C70870 |

* Weldon flats available on 1/2" and over, please specify when ordering and call customer service for pricing.

continued on next page

Carbide

Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Hardness | | | | | | | | | | | | | |
| AP/MAX | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | | | | ◆ | ◆ | ◆ |
| T-Max | | ☆ | | ☆ | | | | | | | ☆ | ☆ | |

☆ = Best Performance ◆ = Acceptable



Variable Index
Ferrous Materials

Style: CEM-V-4R (continued)

| cutting diameter d ₁ | | shank diameter d ₂ | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | corner radius | order number CEM-V-4R | | |
|------------------------------------|---------|----------------------------------|--------------------------------------|---------------------------------------|---------------|---------------|---------------------------------|--------|--------|
| fractional | decimal | | | | | | bright | AP/MAX | T-Max® |
| 3/4* | .7500 | 3/4 | 7/8 | 3 | 4 | 0.030 | C60071 | C80071 | C70871 |
| 3/4* | .7500 | 3/4 | 1 | 3 | 4 | 0.000 | C60072 | C80072 | C70872 |
| 3/4* | .7500 | 3/4 | 1 | 3 | 4 | 0.030 | C60073 | C80073 | C70873 |
| 3/4* | .7500 | 3/4 | 1-1/2 | 4 | 4 | 0.000 | C60074 | C80074 | C70874 |
| 3/4* | .7500 | 3/4 | 1-1/2 | 4 | 4 | 0.030 | C60075 | C80075 | C70875 |
| 3/4* | .7500 | 3/4 | 1-1/2 | 4 | 4 | 0.060 | C60076 | C80076 | C70876 |
| 3/4* | .7500 | 3/4 | 1-1/2 | 4 | 4 | 0.090 | C60077 | C80077 | C70877 |
| 3/4* | .7500 | 3/4 | 1-1/2 | 4 | 4 | 0.125 | C60078 | C80078 | C70878 |
| 3/4* | .7500 | 3/4 | 2-1/4 | 5 | 4 | 0.000 | C60079 | C80079 | C70879 |
| 3/4* | .7500 | 3/4 | 2-1/4 | 5 | 4 | 0.030 | C60080 | C80080 | C70880 |
| 3/4* | .7500 | 3/4 | 2-1/4 | 5 | 4 | 0.060 | C60081 | C80081 | C70881 |
| 3/4* | .7500 | 3/4 | 2-1/4 | 5 | 4 | 0.090 | C60082 | C80082 | C70882 |
| 3/4* | .7500 | 3/4 | 2-1/4 | 5 | 4 | 0.125 | C60083 | C80083 | C70883 |
| 1* | 1.0000 | 1 | 1-1/2 | 4 | 4 | 0.000 | C60084 | C80084 | C70884 |
| 1* | 1.0000 | 1 | 1-1/2 | 4 | 4 | 0.030 | C60085 | C80085 | C70885 |
| 1* | 1.0000 | 1 | 1-1/2 | 4 | 4 | 0.060 | C60086 | C80086 | C70886 |
| 1* | 1.0000 | 1 | 1-1/2 | 4 | 4 | 0.090 | C60087 | C80087 | C70887 |
| 1* | 1.0000 | 1 | 1-1/2 | 4 | 4 | 0.125 | C60088 | C80088 | C70888 |
| 1* | 1.0000 | 1 | 2-1/4 | 5 | 4 | 0.000 | C60089 | C80089 | C70889 |
| 1* | 1.0000 | 1 | 2-1/4 | 5 | 4 | 0.030 | C60090 | C80090 | C70890 |
| 1* | 1.0000 | 1 | 2-1/4 | 5 | 4 | 0.060 | C60091 | C80091 | C70891 |
| 1* | 1.0000 | 1 | 2-1/4 | 5 | 4 | 0.090 | C60092 | C80092 | C70892 |
| 1* | 1.0000 | 1 | 2-1/4 | 5 | 4 | 0.125 | C60093 | C80093 | C70893 |
| 1* | 1.0000 | 1 | 3 | 6 | 4 | 0.000 | C60094 | C80094 | C70894 |
| 1* | 1.0000 | 1 | 3 | 6 | 4 | 0.030 | C60095 | C80095 | C70895 |
| 1* | 1.0000 | 1 | 3 | 6 | 4 | 0.060 | C60096 | C80096 | C70896 |
| 1* | 1.0000 | 1 | 3 | 6 | 4 | 0.090 | C60097 | C80097 | C70897 |
| 1* | 1.0000 | 1 | 3 | 6 | 4 | 0.125 | C60098 | C80098 | C70898 |

* Weldon flats available on 1/2" and over, please specify when ordering and call customer service for pricing.

Carbide

Center Cutting

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| AP/MAX | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | | | | ◆ | ◆ | ◆ |
| T-Max | | ☆ | | ☆ | | | | | | | ☆ | ☆ | |

☆ = Best Performance ◆ = Acceptable



Styles: CEM-V-4B

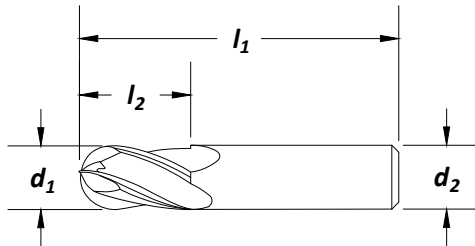
Variable Index
Ferrous Materials

Note

*Weldon flats available 1/2" and larger.



Surface Treatment



| cutting diameter | | shank diameter | length of cut | overall length | no. of flutes | order number | | |
|------------------|---------|----------------|---------------|----------------|---------------|-----------------|--------|--------|
| fractional | decimal | | | | | CEM-V-4B | bright | T-Max® |
| 1/8 | .1250 | 1/8 | 3/8 | 1-1/2 | 4 | C60108 | C80108 | C70908 |
| 3/16 | .1875 | 3/16 | 7/16 | 2 | 4 | C60109 | C80109 | C70909 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 4 | C60110 | C80110 | C70910 |
| 5/16 | .3125 | 5/16 | 13/16 | 2-1/2 | 4 | C60111 | C80111 | C70911 |
| 3/8 | .3750 | 3/8 | 7/8 | 2-1/2 | 4 | C60112 | C80112 | C70912 |
| 7/16 | .4375 | 7/16 | 1 | 3 | 4 | C60113 | C80113 | C70913 |
| 1/2 | .5000 | 1/2 | 5/8 | 2-1/2 | 4 | C60114 | C60118 | C70914 |
| 1/2* | .5000 | 1/2 | 1 | 3 | 4 | C60115 | C80115 | C70915 |
| 5/8* | .6250 | 5/8 | 1-1/4 | 3-1/2 | 4 | C60116 | C80116 | C70916 |
| 3/4* | .7500 | 3/4 | 1-1/2 | 4 | 4 | C60117 | C80117 | C70917 |
| 1* | 1.0000 | 1 | 2-1/4 | 5 | 4 | C60118 | C80118 | C70918 |

* Weldon flats available on 1/2" and over, please specify when ordering and call customer service for pricing.

Carbide

Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| AP/MAX | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | | | | ◆ | ◆ | ◆ |
| T-Max | | ☆ | | ☆ | | | | | | | ☆ | ☆ | |

☆ = Best Performance ◆ = Acceptable

Variable Index
Ferrous Materials

Styles: **CEM-V2-5R**

Note

For slotting up to 1 x D.

Minimized chatter from unequal flute spacing.

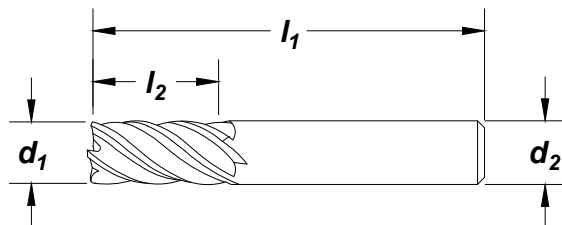
*Weldon flats available 1/2" and larger.



Surface Treatment

Bright

AP/MAX



Feature

Use one tool for roughing and finishing operations. **Improved Geometry**

Carbide

Center Cutting

| cutting diameter | | shank diameter | length of cut | overall length | no. of flutes | corner radius | order number | | |
|------------------|---------|----------------|---------------|----------------|---------------|---------------|----------------|---------------------|---------------------|
| fractional | decimal | | | | | | d ₂ | l ₂ (in) | l ₁ (in) |
| 3/16 | .1875 | 3/16 | 3/8 | 2 | 5 | 0.000 | C60525 | C80525 | C70525 |
| 3/16 | .1875 | 3/16 | 3/8 | 2 | 5 | 0.010 | C60526 | C80526 | C70526 |
| 3/16 | .1875 | 3/16 | 7/16 | 2 | 5 | 0.000 | C60527 | C80527 | C70527 |
| 3/16 | .1875 | 3/16 | 7/16 | 2 | 5 | 0.010 | C60528 | C80528 | C70528 |
| 3/16 | .1875 | 3/16 | 3/4 | 2-1/2 | 5 | 0.000 | C60529 | C80529 | C70529 |
| 3/16 | .1875 | 3/16 | 3/4 | 2-1/2 | 5 | 0.010 | C60530 | C80530 | C70530 |
| 1/4 | .2500 | 1/4 | 1/2 | 2 | 5 | 0.000 | C60531 | C80531 | C70531 |
| 1/4 | .2500 | 1/4 | 1/2 | 2 | 5 | 0.020 | C60532 | C80532 | C70532 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 5 | 0.000 | C60533 | C80533 | C70533 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 5 | 0.020 | C60534 | C80534 | C70534 |
| 1/4 | .2500 | 1/4 | 1-1/8 | 3 | 5 | 0.010 | C60535 | C80535 | C70535 |
| 1/4 | .2500 | 1/4 | 1-1/8 | 3 | 5 | 0.020 | C60536 | C80536 | C70536 |
| 1/4 | .2500 | 1/4 | 1-1/4 | 3 | 5 | 0.000 | C60537 | C80537 | C70537 |
| 5/16 | .3125 | 5/16 | 1/2 | 2 | 5 | 0.000 | C60538 | C80538 | C70538 |
| 5/16 | .3125 | 5/16 | 1/2 | 2 | 5 | 0.020 | C60539 | C80539 | C70539 |
| 5/16 | .3125 | 5/16 | 13/16 | 2-1/2 | 5 | 0.000 | C60540 | C80540 | C70540 |
| 5/16 | .3125 | 5/16 | 13/16 | 2-1/2 | 5 | 0.020 | C60541 | C80541 | C70541 |
| 5/16 | .3125 | 5/16 | 1-1/4 | 3 | 5 | 0.000 | C60542 | C80542 | C70542 |
| 5/16 | .3125 | 5/16 | 1-1/4 | 3 | 5 | 0.020 | C60543 | C80543 | C70543 |
| 3/8 | .3750 | 3/8 | 1/2 | 2 | 5 | 0.030 | C60544 | C80544 | C70544 |
| 3/8 | .3750 | 3/8 | 5/8 | 2 | 5 | 0.000 | C60545 | C80545 | C70545 |
| 3/8 | .3750 | 3/8 | 5/8 | 2 | 5 | 0.020 | C60546 | C80546 | C70546 |
| 3/8 | .3750 | 3/8 | 7/8 | 2-1/2 | 5 | 0.000 | C60547 | C80547 | C70547 |
| 3/8 | .3750 | 3/8 | 7/8 | 2-1/2 | 5 | 0.020 | C60548 | C80548 | C70548 |
| 3/8 | .3750 | 3/8 | 1-1/8 | 3 | 5 | 0.000 | C60549 | C80549 | C70549 |
| 3/8 | .3750 | 3/8 | 1-1/8 | 3 | 5 | 0.020 | C60550 | C80550 | C70550 |
| 3/8 | .3750 | 3/8 | 2 | 4 | 5 | 0.000 | C60551 | C80551 | C70551 |
| 3/8 | .3750 | 3/8 | 2 | 4 | 5 | 0.020 | C60552 | C80552 | C70552 |
| 7/16 | .4375 | 7/16 | 5/8 | 2-1/2 | 5 | 0.000 | C60553 | C80553 | C70553 |
| 7/16 | .4375 | 7/16 | 5/8 | 2-1/2 | 5 | 0.020 | C60554 | C80554 | C70554 |
| 7/16 | .4375 | 7/16 | 1 | 3 | 5 | 0.000 | C60555 | C80555 | C70555 |
| 7/16 | .4375 | 7/16 | 1 | 3 | 5 | 0.020 | C60556 | C80556 | C70556 |
| 7/16 | .4375 | 7/16 | 2 | 4 | 5 | 0.000 | C60557 | C80557 | C70557 |
| 1/2* | .5000 | 1/2 | 5/8 | 2-1/2 | 5 | 0.000 | C60558 | C80558 | C70558 |
| 1/2* | .5000 | 1/2 | 5/8 | 2-1/2 | 5 | 0.030 | C60559 | C80559 | C70559 |
| 1/2* | .5000 | 1/2 | 1 | 3 | 5 | 0.000 | C60560 | C80560 | C70560 |
| 1/2* | .5000 | 1/2 | 1 | 3 | 5 | 0.030 | C60561 | C80561 | C70561 |
| 1/2* | .5000 | 1/2 | 1 | 3 | 5 | 0.060 | C60562 | C80562 | C70562 |
| 1/2* | .5000 | 1/2 | 1 | 3 | 5 | 0.090 | C60563 | C80563 | C70563 |
| 1/2* | .5000 | 1/2 | 1 | 3 | 5 | 0.125 | C60564 | C80564 | C70564 |
| 1/2* | .5000 | 1/2 | 1-1/4 | 3 | 5 | 0.000 | C60565 | C80565 | C70565 |
| 1/2* | .5000 | 1/2 | 1-1/4 | 3 | 5 | 0.020 | C60566 | C80566 | C70566 |
| 1/2* | .5000 | 1/2 | 1-1/4 | 3 | 5 | 0.030 | C60567 | C80567 | C70567 |
| 1/2* | .5000 | 1/2 | 1-1/4 | 3 | 5 | 0.060 | C60568 | C80568 | C70568 |
| 1/2* | .5000 | 1/2 | 1-1/4 | 3 | 5 | 0.090 | C60569 | C80569 | C70569 |

* Weldon flats available on 1/2" and over, please specify when ordering and call customer service for pricing.

continued on next page



Variable Index
Ferrous Materials

Style: CEM-V2-5R (continued)

| cutting diameter d ₁ | | shank diameter d ₂ | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | corner radius | order number CEM-V2-5R | | |
|------------------------------------|---------|----------------------------------|---|--|------------------|------------------|----------------------------------|--------|--------|
| fractional | decimal | | | | | | bright | AP/MAX | T-Max |
| 1/2* | .5000 | 1/2 | 1-1/4 | 3 | 5 | 0.125 | C60570 | C80570 | C70570 |
| 1/2* | .5000 | 1/2 | 2 | 4 | 5 | 0.000 | C60571 | C80571 | C70571 |
| 1/2* | .5000 | 1/2 | 2 | 4 | 5 | 0.030 | C60572 | C80572 | C70572 |
| 1/2* | .5000 | 1/2 | 2 | 4 | 5 | 0.060 | C60573 | C80573 | C70573 |
| 1/2* | .5000 | 1/2 | 2 | 4 | 5 | 0.090 | C60574 | C80574 | C70574 |
| 1/2* | .5000 | 1/2 | 2 | 4 | 5 | 0.125 | C60575 | C80575 | C70575 |
| 5/8* | .6250 | 5/8 | 3/4 | 3 | 5 | 0.000 | C60576 | C80576 | C70576 |
| 5/8* | .6250 | 5/8 | 3/4 | 3 | 5 | 0.030 | C60577 | C80577 | C70577 |
| 5/8* | .6250 | 5/8 | 1-1/4 | 3-1/2 | 5 | 0.000 | C60578 | C80578 | C70578 |
| 5/8* | .6250 | 5/8 | 1-1/4 | 3-1/2 | 5 | 0.030 | C60579 | C80579 | C70579 |
| 5/8* | .6250 | 5/8 | 1-1/4 | 3-1/2 | 5 | 0.060 | C60580 | C80580 | C70580 |
| 5/8* | .6250 | 5/8 | 1-1/4 | 3-1/2 | 5 | 0.090 | C60581 | C80581 | C70581 |
| 5/8* | .6250 | 5/8 | 1-1/4 | 3-1/2 | 5 | 0.125 | C60582 | C80582 | C70582 |
| 5/8* | .6250 | 5/8 | 2-1/4 | 5 | 5 | 0.000 | C60583 | C80583 | C70583 |
| 5/8* | .6250 | 5/8 | 2-1/4 | 5 | 5 | 0.030 | C60584 | C80584 | C70584 |
| 5/8* | .6250 | 5/8 | 2-1/4 | 5 | 5 | 0.060 | C60585 | C80585 | C70585 |
| 5/8* | .6250 | 5/8 | 2-1/4 | 5 | 5 | 0.090 | C60586 | C80586 | C70586 |
| 5/8* | .6250 | 5/8 | 2-1/4 | 5 | 5 | 0.125 | C60587 | C80587 | C70587 |
| 3/4* | .7500 | 3/4 | 1 | 3 | 5 | 0.000 | C60588 | C80588 | C70588 |
| 3/4* | .7500 | 3/4 | 1 | 3 | 5 | 0.015 | C60511 | C80511 | C70511 |
| 3/4* | .7500 | 3/4 | 1 | 3 | 5 | 0.030 | C60589 | C80589 | C70589 |
| 3/4* | .7500 | 3/4 | 1-1/2 | 4 | 5 | 0.000 | C60590 | C80590 | C70590 |
| 3/4* | .7500 | 3/4 | 1-1/2 | 4 | 5 | 0.015 | C60512 | C80512 | — |
| 3/4* | .7500 | 3/4 | 1-1/2 | 4 | 5 | 0.030 | C60591 | C80591 | C70591 |
| 3/4* | .7500 | 3/4 | 1-1/2 | 4 | 5 | 0.060 | C60592 | C80592 | C70592 |
| 3/4* | .7500 | 3/4 | 1-1/2 | 4 | 5 | 0.090 | C60593 | C80593 | C70593 |
| 3/4* | .7500 | 3/4 | 1-1/2 | 4 | 5 | 0.125 | C60594 | C80594 | C70594 |
| 3/4* | .7500 | 3/4 | 2-1/4 | 5 | 5 | 0.000 | C60595 | C80595 | C70595 |
| 3/4* | .7500 | 3/4 | 2-1/4 | 5 | 5 | 0.015 | C60513 | C80513 | — |
| 3/4* | .7500 | 3/4 | 2-1/4 | 5 | 5 | 0.030 | C60596 | C80596 | C70596 |
| 3/4* | .7500 | 3/4 | 2-1/4 | 5 | 5 | 0.060 | C60597 | C80597 | C70597 |
| 3/4* | .7500 | 3/4 | 2-1/4 | 5 | 5 | 0.090 | C60598 | C80598 | C70598 |
| 3/4* | .7500 | 3/4 | 2-1/4 | 5 | 5 | 0.125 | C60599 | C80599 | C70599 |
| 1* | 1.0000 | 1 | 1-1/2 | 4 | 5 | 0.000 | C60600 | C80600 | C70600 |
| 1* | 1.0000 | 1 | 1-1/2 | 4 | 5 | 0.015 | C60514 | C80514 | — |
| 1* | 1.0000 | 1 | 1-1/2 | 4 | 5 | 0.030 | C60601 | C80601 | C70601 |
| 1* | 1.0000 | 1 | 1-1/2 | 4 | 5 | 0.060 | C60602 | C80602 | C70602 |
| 1* | 1.0000 | 1 | 1-1/2 | 4 | 5 | 0.090 | C60603 | C80603 | C70603 |
| 1* | 1.0000 | 1 | 1-1/2 | 4 | 5 | 0.125 | C60604 | C80604 | C70604 |
| 1* | 1.0000 | 1 | 2-1/4 | 5 | 5 | 0.000 | C60605 | C80605 | C70605 |
| 1* | 1.0000 | 1 | 2-1/4 | 5 | 5 | 0.015 | C60515 | C80515 | — |
| 1* | 1.0000 | 1 | 2-1/4 | 5 | 5 | 0.030 | C60606 | C80606 | C70606 |
| 1* | 1.0000 | 1 | 2-1/4 | 5 | 5 | 0.060 | C60607 | C80607 | C70607 |
| 1* | 1.0000 | 1 | 2-1/4 | 5 | 5 | 0.090 | C60608 | C80608 | C70608 |
| 1* | 1.0000 | 1 | 2-1/4 | 5 | 5 | 0.125 | C60609 | C80609 | C70609 |
| 1* | 1.0000 | 1 | 3 | 6 | 5 | 0.000 | C60610 | C80610 | C70610 |
| 1* | 1.0000 | 1 | 3 | 6 | 5 | 0.015 | C60516 | C80516 | — |
| 1* | 1.0000 | 1 | 3 | 6 | 5 | 0.030 | C60611 | C80611 | C70611 |
| 1* | 1.0000 | 1 | 3 | 6 | 5 | 0.060 | C60612 | C80612 | C70612 |
| 1* | 1.0000 | 1 | 3 | 6 | 5 | 0.090 | C60613 | C80613 | C70613 |
| 1* | 1.0000 | 1 | 3 | 6 | 5 | 0.125 | C60614 | C80614 | C70614 |

* Weldon flats available on 1/2" and over, please specify when ordering and call customer service for pricing.

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | | | | |
| AP/MAX | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | | | | ◆ | ◆ | ◆ |
| T-Max | | ☆ | | ☆ | | | | | | | ☆ | ☆ | |

☆ = Best Performance ◆ = Acceptable

Carbide

Center Cutting



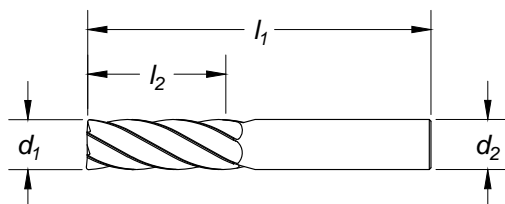
Variable Index
Ferrous Materials

Styles: CEM-V3-7R

Note
Ideal for High Efficiency Machining (HEM)
Minimized chatter from unequal flute spacing.
*Weldon flats available 1/2" and larger.



Surface Treatment
AP/MAX



Feature

Use one tool for roughing and finishing operations.

| cutting diameter d₁ | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | corner radius | order number CEM-V3-7R | |
|--|---------|--|--|---|---------------|---------------|----------------------------------|--------|
| fractional | decimal | | | | | | AP/MAX | T-Max® |
| 3/8 | 0.375 | 3/8 | 3/4 | 2-1/2 | 7 | 0.000 | C76270 | — |
| 3/8 | 0.375 | 3/8 | 3/4 | 2-1/2 | 7 | 0.015 | C76271 | — |
| 3/8 | 0.375 | 3/8 | 3/4 | 2-1/2 | 7 | 0.030 | C76272 | — |
| 3/8 | 0.375 | 3/8 | 15/16 | 2-1/2 | 7 | 0.000 | C76273 | — |
| 3/8 | 0.375 | 3/8 | 15/16 | 2-1/2 | 7 | 0.015 | C76274 | — |
| 3/8 | 0.375 | 3/8 | 15/16 | 2-1/2 | 7 | 0.030 | C76275 | — |
| 3/8 | 0.375 | 3/8 | 1-1/8 | 3 | 7 | 0.000 | C76276 | — |
| 3/8 | 0.375 | 3/8 | 1-1/8 | 3 | 7 | 0.015 | C76277 | — |
| 3/8 | 0.375 | 3/8 | 1-1/8 | 3 | 7 | 0.030 | C76278 | C86278 |
| 3/8 | 0.375 | 3/8 | 1-1/2 | 3-1/2 | 7 | 0.000 | C76279 | — |
| 3/8 | 0.375 | 3/8 | 1-1/2 | 3-1/2 | 7 | 0.015 | C76280 | — |
| 3/8 | 0.375 | 3/8 | 1-1/2 | 3-1/2 | 7 | 0.030 | C76281 | — |
| 1/2 | 0.500 | 1/2 | 5/8 | 2-1/2 | 7 | 0.000 | C76372 | — |
| 1/2 | 0.500 | 1/2 | 5/8 | 2-1/2 | 7 | 0.015 | C76373 | — |
| 1/2 | 0.500 | 1/2 | 5/8 | 2-1/2 | 7 | 0.030 | C76374 | — |
| 1/2 | 0.500 | 1/2 | 1 | 3 | 7 | 0.000 | C76282 | — |
| 1/2 | 0.500 | 1/2 | 1 | 3 | 7 | 0.030 | C76283 | — |
| 1/2 | 0.500 | 1/2 | 1 | 3 | 7 | 0.060 | C76284 | — |
| 1/2 | 0.500 | 1/2 | 1 | 3 | 7 | 0.090 | C76285 | — |
| 1/2 | 0.500 | 1/2 | 1-1/4 | 3 | 7 | 0.000 | C76286 | — |
| 1/2 | 0.500 | 1/2 | 1-1/4 | 3 | 7 | 0.015 | C80114 | — |
| 1/2 | 0.500 | 1/2 | 1-1/4 | 3 | 7 | 0.030 | C76287 | — |
| 1/2 | 0.500 | 1/2 | 1-1/4 | 3 | 7 | 0.060 | C76288 | — |
| 1/2 | 0.500 | 1/2 | 1-1/4 | 3 | 7 | 0.090 | C76289 | — |
| 1/2 | 0.500 | 1/2 | 1-1/2 | 3-1/2 | 7 | 0.000 | C76290 | — |
| 1/2 | 0.500 | 1/2 | 1-1/2 | 3-1/2 | 7 | 0.030 | C76291 | — |
| 1/2 | 0.500 | 1/2 | 1-1/2 | 3-1/2 | 7 | 0.060 | C76292 | — |
| 1/2 | 0.500 | 1/2 | 1-1/2 | 3-1/2 | 7 | 0.090 | C76293 | — |
| 1/2 | 0.500 | 1/2 | 2 | 4 | 7 | 0.000 | C76294 | — |
| 1/2 | 0.500 | 1/2 | 2 | 4 | 7 | 0.030 | C76295 | C86295 |
| 1/2 | 0.500 | 1/2 | 2 | 4 | 7 | 0.060 | C76296 | C86296 |
| 1/2 | 0.500 | 1/2 | 2 | 4 | 7 | 0.090 | C76297 | C86297 |
| 1/2 | 0.500 | 1/2 | 2-1/4 | 4 | 7 | 0.000 | C76298 | — |
| 1/2 | 0.500 | 1/2 | 2-1/4 | 4 | 7 | 0.030 | C76299 | — |
| 1/2 | 0.500 | 1/2 | 2-1/4 | 4 | 7 | 0.060 | C76300 | — |
| 1/2 | 0.500 | 1/2 | 2-1/4 | 4 | 7 | 0.090 | C76301 | — |
| 5/8 | 0.625 | 5/8 | 1-7/8 | 4 | 7 | 0.000 | C76302 | — |
| 5/8 | 0.625 | 5/8 | 1-7/8 | 4 | 7 | 0.030 | C76303 | — |
| 5/8 | 0.625 | 5/8 | 1-7/8 | 4 | 7 | 0.060 | C76304 | — |
| 5/8 | 0.625 | 5/8 | 1-7/8 | 4 | 7 | 0.090 | C76305 | — |
| 5/8 | 0.625 | 5/8 | 2-1/4 | 4 | 7 | 0.000 | C76306 | — |
| 5/8 | 0.625 | 5/8 | 2-1/4 | 4 | 7 | 0.030 | C76307 | C86307 |
| 5/8 | 0.625 | 5/8 | 2-1/4 | 4 | 7 | 0.060 | C76308 | C86308 |

continued on next page

Carbide

Center Cutting



Styles: **CEM-V3-7R**

| cutting diameter d ₁ | | shank diameter d ₂ | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | corner radius | order number CEM-V3-7R | |
|------------------------------------|---------|----------------------------------|--------------------------------------|---------------------------------------|---------------|---------------|----------------------------------|--------|
| fractional | decimal | | | | | | AP/MAX | T-Max® |
| 5/8 | 0.625 | 5/8 | 2-1/4 | 4 | 7 | 0.090 | C76309 | C86309 |
| 5/8 | 0.625 | 5/8 | 3 | 6 | 7 | 0.000 | C76310 | — |
| 5/8 | 0.625 | 5/8 | 3 | 6 | 7 | 0.030 | C76311 | — |
| 5/8 | 0.625 | 5/8 | 3 | 6 | 7 | 0.060 | C76312 | — |
| 3/4 | 0.750 | 3/4 | 1-1/2 | 4 | 7 | 0.000 | C76313 | — |
| 3/4 | 0.750 | 3/4 | 1-1/2 | 4 | 7 | 0.030 | C76314 | — |
| 3/4 | 0.750 | 3/4 | 1-1/2 | 4 | 7 | 0.060 | C76315 | — |
| 3/4 | 0.750 | 3/4 | 1-1/2 | 4 | 7 | 0.125 | C76316 | — |
| 3/4 | 0.750 | 3/4 | 1-7/8 | 4 | 7 | 0.000 | C76317 | — |
| 3/4 | 0.750 | 3/4 | 1-7/8 | 4 | 7 | 0.030 | C76318 | — |
| 3/4 | 0.750 | 3/4 | 1-7/8 | 4 | 7 | 0.060 | C76319 | — |
| 3/4 | 0.750 | 3/4 | 1-7/8 | 4 | 7 | 0.090 | C76320 | — |
| 3/4 | 0.750 | 3/4 | 1-7/8 | 4 | 7 | 0.125 | C76321 | — |
| 3/4 | 0.750 | 3/4 | 2-1/4 | 5 | 7 | 0.000 | C76322 | — |
| 3/4 | 0.750 | 3/4 | 2-1/4 | 5 | 7 | 0.030 | C76323 | — |
| 3/4 | 0.750 | 3/4 | 2-1/4 | 5 | 7 | 0.060 | C76324 | — |
| 3/4 | 0.750 | 3/4 | 2-1/4 | 5 | 7 | 0.090 | C76325 | — |
| 3/4 | 0.750 | 3/4 | 2-1/4 | 5 | 7 | 0.125 | C76326 | — |
| 3/4 | 0.750 | 3/4 | 2-5/8 | 5 | 7 | 0.000 | C76327 | — |
| 3/4 | 0.750 | 3/4 | 2-5/8 | 5 | 7 | 0.030 | C76328 | C86328 |
| 3/4 | 0.750 | 3/4 | 2-5/8 | 5 | 7 | 0.060 | C76329 | C86329 |
| 3/4 | 0.750 | 3/4 | 2-5/8 | 5 | 7 | 0.090 | C76330 | C86330 |
| 3/4 | 0.750 | 3/4 | 2-5/8 | 5 | 7 | 0.125 | C76331 | — |
| 3/4 | 0.750 | 3/4 | 3 | 6 | 7 | 0.000 | C76332 | — |
| 3/4 | 0.750 | 3/4 | 3 | 6 | 7 | 0.030 | C76333 | — |
| 3/4 | 0.750 | 3/4 | 3 | 6 | 7 | 0.060 | C76334 | — |
| 3/4 | 0.750 | 3/4 | 3 | 6 | 7 | 0.125 | C76335 | — |
| 1 | 1.000 | 1 | 3 | 6 | 7 | 0.000 | C76341 | — |
| 1 | 1.000 | 1 | 3 | 6 | 7 | 0.030 | C76342 | — |
| 1 | 1.000 | 1 | 3 | 6 | 7 | 0.060 | C76343 | — |
| 1 | 1.000 | 1 | 3 | 6 | 7 | 0.125 | C76344 | — |
| 1 | 1.000 | 1 | 3-1/2 | 6 | 7 | 0.000 | C76345 | — |
| 1 | 1.000 | 1 | 3-1/2 | 6 | 7 | 0.030 | C76346 | — |
| 1 | 1.000 | 1 | 3-1/2 | 6 | 7 | 0.060 | C76347 | — |
| 1 | 1.000 | 1 | 3-1/2 | 6 | 7 | 0.125 | C76348 | — |

Carbide

Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| AP/MAX | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | ◆ | ◆ | | ◆ | ◆ | ◆ |
| T-Max | | ☆ | | ☆ | | | | | | | ☆ | ☆ | |

☆ = Best Performance ◆ = Acceptable



Variable Index
Ferrous Materials

Styles: CEM-V3-7RCB

Note

Chip breaking geometry for improved High Efficiency Machining (HEM)

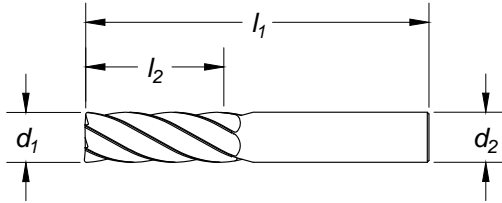
For slotting up to 1 x D.

Minimized chatter from unequal flute spacing.

*Weldon flats available 1/2" and larger.



Surface Treatment



Feature

Use one tool for roughing and finishing operations.

| cutting diameter d₁ | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | corner radius | order number |
|--|---------|--|--|---|---------------|---------------|--------------------|
| fractional | decimal | | | | | | CEM-V3-7RCB |
| 3/8 | 0.375 | 3/8 | 1-1/8 | 3 | 7 | 0.030 | C76350 |
| 3/8 | 0.375 | 3/8 | 1-1/2 | 3-1/2 | 7 | 0.030 | C76351 |
| 1/2 | 0.500 | 1/2 | 1-1/2 | 3-1/2 | 7 | 0.030 | C76352 |
| 1/2 | 0.500 | 1/2 | 1-1/2 | 3-1/2 | 7 | 0.060 | C76353 |
| 1/2 | 0.500 | 1/2 | 2 | 4 | 7 | 0.030 | C76354 |
| 1/2 | 0.500 | 1/2 | 2 | 4 | 7 | 0.060 | C76355 |
| 5/8 | 0.625 | 5/8 | 1-7/8 | 4 | 7 | 0.030 | C76356 |
| 5/8 | 0.625 | 5/8 | 1-7/8 | 4 | 7 | 0.060 | C76357 |
| 5/8 | 0.625 | 5/8 | 3 | 6 | 7 | 0.030 | C76358 |
| 5/8 | 0.625 | 5/8 | 3 | 6 | 7 | 0.060 | C76359 |
| 3/4 | 0.750 | 3/4 | 1-1/2 | 4 | 7 | 0.030 | C76360 |
| 3/4 | 0.750 | 3/4 | 1-1/2 | 4 | 7 | 0.060 | C76361 |
| 3/4 | 0.750 | 3/4 | 2-1/4 | 5 | 7 | 0.030 | C76364 |
| 3/4 | 0.750 | 3/4 | 2-1/4 | 5 | 7 | 0.060 | C76365 |
| 3/4 | 0.750 | 3/4 | 2-5/8 | 5 | 7 | 0.030 | C76366 |
| 3/4 | 0.750 | 3/4 | 2-5/8 | 5 | 7 | 0.060 | C76367 |
| 3/4 | 0.750 | 3/4 | 3 | 6 | 7 | 0.030 | C76368 |
| 3/4 | 0.750 | 3/4 | 3 | 6 | 7 | 0.060 | C76369 |
| 1 | 1.000 | 1 | 3 | 6 | 7 | 0.030 | C76370 |
| 1 | 1.000 | 1 | 3 | 6 | 7 | 0.060 | C76371 |

Carbide

Center Cutting

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | |
| Hardness | | | | | | | | | | | | | |
| AP/MAX | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | ◆ | ◆ | | ☆ | ☆ | ◆ |

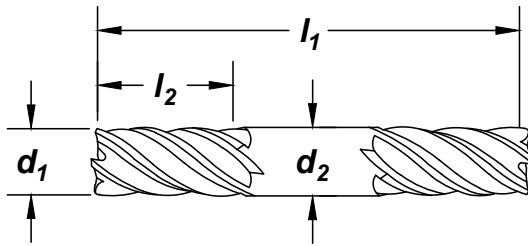
☆ = Best Performance ◆ = Acceptable

Styles: **CEM-HPDE-5**

Steel Materials



Surface Treatment



| cutting diameter | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | corner radius | order number | |
|------------------------------------|---------|--|--|---|---------------|---------------|-----------------------------|--------|
| d₁ fractional | decimal | | | | | | CEM-HPDE-5 bright | TiAlN |
| 1/8 | .1250 | 1/8 | 1/4 | 1-1/2 | 5 | 0.000 | C60100 | C80100 |
| 3/16 | .1875 | 3/16 | 5/16 | 2 | 5 | 0.000 | C60101 | C80101 |
| 1/4 | .2500 | 1/4 | 3/8 | 2-1/2 | 5 | 0.000 | C60102 | C80102 |
| 5/16 | .3125 | 5/16 | 7/16 | 2-1/2 | 5 | 0.000 | C60103 | C80103 |
| 3/8 | .3750 | 3/8 | 1/2 | 2-1/2 | 5 | 0.000 | C60104 | C80104 |
| 7/16 | .4375 | 7/16 | 9/16 | 3 | 5 | 0.000 | C60105 | C80105 |
| 1/2* | .5000 | 1/2 | 5/8 | 3 | 5 | 0.000 | C60106 | C80106 |

*Weldon shank; all others plain shank

Carbide

Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | | | | | ◆ | ☆ | |
| TiAlN | ☆ | ☆ | ☆ | ☆ | ☆ | ☆ | ◆ | | | | | | |

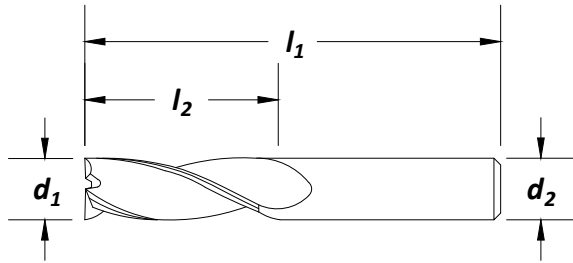
☆ = Best Performance ◆ = Acceptable

Steel Materials

Styles: **CEM-EMS-3**



Surface Treatment



Carbide

Center Cutting

| cutting diameter | | shank diameter | length of cut | overall length | no. of flutes | corner radius | order number | |
|------------------|---------|----------------|---------------|------------------|---------------|---------------|--------------|--------|
| d_1 | d_2 | l_2 (in) | l_1 (in) | CEM-EMS-3 | | | | |
| fractional | decimal | | | | | bright | TiAlN | |
| 1/8 | .1250 | 1/8 | 1/4 | 1-1/2 | 3 | 0.010 | C60365 | C80365 |
| 1/8 | .1250 | 1/8 | 1/2 | 1-1/2 | 3 | 0.010 | C60366 | C80366 |
| 5/32 | .1562 | 3/16 | 5/16 | 1-1/2 | 3 | 0.010 | C60367 | C80367 |
| 5/32 | .1562 | 3/16 | 9/16 | 2 | 3 | 0.010 | C60368 | C80368 |
| 3/16 | .1875 | 3/16 | 5/16 | 2 | 3 | 0.010 | C60369 | C80369 |
| 3/16 | .1875 | 3/16 | 5/8 | 2 | 3 | 0.010 | C60370 | C80370 |
| 7/32 | .2188 | 1/4 | 1/2 | 2 | 3 | 0.020 | C60371 | C80371 |
| 7/32 | .2188 | 1/4 | 3/4 | 2-1/2 | 3 | 0.020 | C60372 | C80372 |
| 1/4 | .2500 | 1/4 | 3/8 | 2 | 3 | 0.020 | C60373 | C80373 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 3 | 0.020 | C60374 | C80374 |
| 9/32 | .2812 | 5/16 | 7/16 | 2 | 3 | 0.020 | C60375 | C80375 |
| 9/32 | .2812 | 5/16 | 13/16 | 2-1/2 | 3 | 0.020 | C60376 | C80376 |
| 5/16 | .3125 | 5/16 | 7/16 | 2 | 3 | 0.020 | C60377 | C80377 |
| 5/16 | .3125 | 5/16 | 13/16 | 2-1/2 | 3 | 0.020 | C60378 | C80378 |
| 11/32 | .3438 | 3/8 | 1/2 | 2 | 3 | 0.020 | C60379 | C80379 |
| 11/32 | .3438 | 3/8 | 7/8 | 2-1/2 | 3 | 0.020 | C60380 | C80380 |
| 3/8 | .3750 | 3/8 | 1/2 | 2 | 3 | 0.020 | C60381 | C80381 |
| 3/8 | .3750 | 3/8 | 7/8 | 2-1/2 | 3 | 0.020 | C60382 | C80382 |
| 13/32 | .4062 | 7/16 | 9/16 | 2-1/2 | 3 | 0.020 | C60383 | C80383 |
| 13/32 | .4062 | 7/16 | 1 | 2-1/2 | 3 | 0.020 | C60384 | C80384 |
| 7/16 | .4375 | 7/16 | 9/16 | 2-1/2 | 3 | 0.020 | C60385 | C80385 |
| 7/16 | .4375 | 7/16 | 1 | 2-1/2 | 3 | 0.020 | C60386 | C80386 |
| 15/32* | .4688 | 1/2 | 5/8 | 2-1/2 | 3 | 0.020 | C60387 | C80387 |
| 15/32* | .4688 | 1/2 | 1-1/4 | 3 | 3 | 0.020 | C60388 | C80388 |
| 1/2* | .5000 | 1/2 | 5/8 | 2-1/2 | 3 | 0.030 | C60389 | C80389 |
| 1/2* | .5000 | 1/2 | 1-1/4 | 3 | 3 | 0.030 | C60390 | C80390 |
| 5/8* | .6250 | 5/8 | 3/4 | 3 | 3 | 0.030 | C60391 | C80391 |
| 5/8* | .6250 | 5/8 | 1-5/8 | 4 | 3 | 0.030 | C60392 | C80392 |
| 3/4* | .7500 | 3/4 | 7/8 | 3 | 3 | 0.030 | C60393 | C80393 |
| 3/4* | .7500 | 3/4 | 1-5/8 | 4 | 3 | 0.030 | C60394 | C80394 |
| 1* | 1.0000 | 1 | 1-1/8 | 3 | 3 | 0.030 | C60395 | C80395 |
| 1* | 1.0000 | 1 | 2 | 4 | 3 | 0.030 | C60396 | C80396 |

*Weldon shank; all others plain shank

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | |
| Hardness | | | | | | | | | | | | | >45 |
| TiAlN | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | | | | | | ◆ |

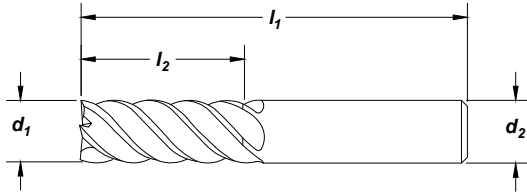
☆ = Best Performance ◆ = Acceptable



Styles: **CEM-EMS-5**

Steel Materials

Solid Carbide
 5 Flute CC
 Helix 47°
 Square End
 Surface Treatment: Bright TiAlN



| cutting diameter | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | corner radius | order number | |
|------------------------------------|---------|--|--|---|---------------|---------------|------------------|--------|
| d₁ fractional | decimal | | | | | | CEM-EMS-5 | |
| | | | | | | bright | TiAlN | |
| 1/8 | .1250 | 1/8 | 1/4 | 1-1/2 | 5 | 0.000 | C60417 | C80417 |
| 1/8 | .1250 | 1/8 | 1/2 | 1-1/2 | 5 | 0.000 | C60418 | C80418 |
| 1/8 | .1250 | 1/8 | 1/2 | 2 | 5 | 0.000 | C60419 | C80419 |
| 5/32 | .1562 | 3/16 | 5/16 | 2 | 5 | 0.000 | C60420 | C80420 |
| 5/32 | .1562 | 3/16 | 9/16 | 2 | 5 | 0.000 | C60421 | C80421 |
| 3/16 | .1875 | 3/16 | 5/16 | 2 | 5 | 0.000 | C60422 | C80422 |
| 3/16 | .1875 | 3/16 | 9/16 | 2 | 5 | 0.000 | C60423 | C80423 |
| 7/32 | .2188 | 1/4 | 3/8 | 2 | 5 | 0.000 | C60424 | C80424 |
| 7/32 | .2188 | 1/4 | 3/4 | 2-1/2 | 5 | 0.000 | C60425 | C80425 |
| 1/4 | .2500 | 1/4 | 3/8 | 2 | 5 | 0.000 | C60426 | C80426 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 5 | 0.000 | C60427 | C80427 |
| 1/4 | .2500 | 1/4 | 1-1/4 | 4 | 5 | 0.000 | C60428 | C80428 |
| 9/32 | .2812 | 5/16 | 7/16 | 2 | 5 | 0.000 | C60429 | C80429 |
| 9/32 | .2812 | 5/16 | 13/16 | 2-1/2 | 5 | 0.000 | C60430 | C80430 |
| 5/16 | .3125 | 5/16 | 7/16 | 2 | 5 | 0.000 | C60431 | C80431 |
| 5/16 | .3125 | 5/16 | 13/16 | 2-1/2 | 5 | 0.000 | C60432 | C80432 |
| 5/16 | .3125 | 5/16 | 1-1/4 | 4 | 5 | 0.000 | C60433 | C80433 |
| 3/8 | .3750 | 3/8 | 1/2 | 2 | 5 | 0.000 | C60434 | C80434 |
| 3/8 | .3750 | 3/8 | 7/8 | 2-1/2 | 5 | 0.000 | C60435 | C80435 |
| 3/8 | .3750 | 3/8 | 1-1/2 | 4 | 5 | 0.000 | C60436 | C80436 |
| 7/16 | .4375 | 7/16 | 9/16 | 2-1/2 | 5 | 0.000 | C60437 | C80437 |
| 7/16 | .4375 | 7/16 | 1 | 2-1/2 | 5 | 0.000 | C60438 | C80438 |
| 7/16 | .4375 | 7/16 | 2 | 4 | 5 | 0.000 | C60439 | C80439 |
| 1/2* | .5000 | 1/2 | 5/8 | 2-1/2 | 5 | 0.000 | C60440 | C80440 |
| 1/2* | .5000 | 1/2 | 1-1/4 | 3 | 5 | 0.000 | C60441 | C80441 |
| 1/2* | .5000 | 1/2 | 2 | 4 | 5 | 0.000 | C60442 | C80442 |
| 9/16* | .5625 | 9/16 | 1-1/2 | 3 1/2 | 5 | 0.000 | C60443 | C80443 |
| 5/8* | .6250 | 5/8 | 3/4 | 3 | 5 | 0.000 | C60444 | C80444 |
| 5/8* | .6250 | 5/8 | 1-5/8 | 4 | 5 | 0.000 | C60445 | C80445 |
| 5/8* | .6250 | 5/8 | 2-1/2 | 5 | 5 | 0.000 | C60446 | C80446 |
| 3/4* | .7500 | 3/4 | 7/8 | 3 | 5 | 0.000 | C60447 | C80447 |
| 3/4* | .7500 | 3/4 | 1-5/8 | 4 | 5 | 0.000 | C60448 | C80448 |
| 3/4* | .7500 | 3/4 | 3 1/4 | 6 | 5 | 0.000 | C60449 | C80449 |
| 7/8* | .8750 | 7/8 | 2 | 4 | 5 | 0.000 | C60450 | C80450 |
| 1* | 1.0000 | 1 | 1-1/8 | 3 | 5 | 0.000 | C60451 | C80451 |
| 1* | 1.0000 | 1 | 2 | 4 | 5 | 0.000 | C60452 | C80452 |
| 1* | 1.0000 | 1 | 3 1/4 | 6 | 5 | 0.000 | C60453 | C80453 |

*Weldon shank; all others plain shank

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiAlN | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | | | | | | ◆ |

☆ = Best Performance ◆ = Acceptable

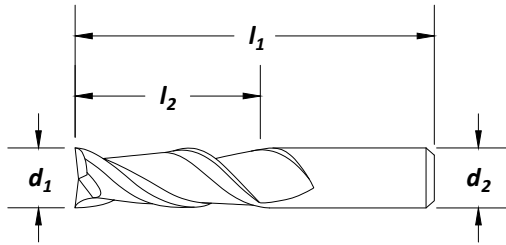
Carbide Center Cutting

Aluminum Materials

Style: **CEM-AM2**



Surface Treatment



Carbide
Center Cutting

| cutting diameter | | shank diameter | length of cut | overall length | no. of flutes | order number | |
|------------------|---------|----------------|---------------------|---------------------|---------------|----------------|--------|
| fractional | decimal | d ₂ | l ₂ (in) | l ₁ (in) | | CEM-AM2 | |
| d ₁ | | | | | | bright | ZrN |
| 1/8 | .1250 | 1/8 | 1/4 | 1-1/2 | 2 | C60477 | C84000 |
| 1/8 | .1250 | 1/8 | 3/8 | 1-1/2 | 2 | C60478 | C84001 |
| 3/16 | .1875 | 3/16 | 5/16 | 2 | 2 | C60479 | C84002 |
| 3/16 | .1875 | 3/16 | 9/16 | 2 | 2 | C60480 | C84003 |
| 1/4 | .2500 | 1/4 | 3/8 | 2-1/2 | 2 | C60481 | C84004 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 2 | C60482 | C84005 |
| 1/4 | .2500 | 1/4 | 1-1/4 | 3 | 2 | C60483 | C84006 |
| 5/16 | .3125 | 5/16 | 7/16 | 2-1/2 | 2 | C60484 | C84007 |
| 5/16 | .3125 | 5/16 | 13/16 | 2-1/2 | 2 | C60485 | C84008 |
| 5/16 | .3125 | 5/16 | 1-1/4 | 3-3/4 | 2 | C60486 | C84009 |
| 5/16 | .3125 | 5/16 | 2-1/8 | 4 | 2 | C60487 | C84010 |
| 3/8 | .3750 | 3/8 | 1/2 | 2-1/2 | 2 | C60488 | C84011 |
| 3/8 | .3750 | 3/8 | 1 | 2-1/2 | 2 | C60489 | C84012 |
| 3/8 | .3750 | 3/8 | 1-1/2 | 4 | 2 | C60490 | C84013 |
| 3/8 | .3750 | 3/8 | 2-1/2 | 6 | 2 | C60491 | C84014 |
| 7/16 | .4375 | 7/16 | 9/16 | 2-1/2 | 2 | C60492 | C84015 |
| 7/16 | .4375 | 7/16 | 1 | 2-1/2 | 2 | C60493 | C84016 |
| 7/16 | .4375 | 7/16 | 2 | 4 | 2 | C60494 | C84017 |
| 1/2 | .5000 | 1/2 | 5/8 | 3 | 2 | C60495 | C84018 |
| 1/2 | .5000 | 1/2 | 1-1/4 | 3 | 2 | C60496 | C84019 |
| 1/2 | .5000 | 1/2 | 2 | 4 | 2 | C60497 | C84020 |
| 1/2 | .5000 | 1/2 | 3-1/8 | 6 | 2 | C60498 | C84021 |
| 5/8 | .6250 | 5/8 | 3/4 | 3-1/2 | 2 | C60499 | C84022 |
| 5/8 | .6250 | 5/8 | 1-5/8 | 4 | 2 | C60500 | C84023 |
| 5/8 | .6250 | 5/8 | 2-1/2 | 5 | 2 | C60501 | C84024 |
| 5/8 | .6250 | 5/8 | 3-3/4 | 6 | 2 | C60502 | C84025 |
| 3/4 | .7500 | 3/4 | 1 | 4 | 2 | C60503 | C84026 |
| 3/4 | .7500 | 3/4 | 1-5/8 | 4 | 2 | C60504 | C84027 |
| 3/4 | .7500 | 3/4 | 3-1/4 | 6 | 2 | C60505 | C84028 |
| 1 | 1.0000 | 1 | 1-1/4 | 5 | 2 | C60507 | C84029 |
| 1 | 1.0000 | 1 | 2 | 5 | 2 | C60508 | C84030 |
| 1 | 1.0000 | 1 | 3-1/4 | 6 | 2 | C60509 | C84031 |
| 1 | 1.0000 | 1 | 4-1/8 | 7 | 2 | C60510 | C84032 |

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | | | | | | | | | | ◆ | | | |
| ZrN | | | | | | | | | | ☆ | | | |

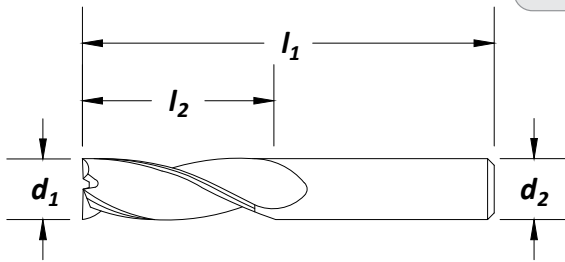
☆ = Best Performance ◆ = Acceptable

Style: **CEM-AM3**

Aluminum Materials



Surface Treatment



| cutting diameter | | shank diameter d_2 | length of cut l_2 (in) | overall length l_1 (in) | no. of flutes | corner radius | order number | |
|------------------|---------|-------------------------|-----------------------------|------------------------------|---------------|---------------|----------------|--------|
| fractional | decimal | | | | | | CEM-AM3 | |
| d_1 | | | | | | | bright | ZrN |
| 1/8 | .1250 | 1/8 | 1/4 | 1-1/2 | 3 | .000 | C60616 | C72340 |
| 1/8 | .1250 | 1/8 | 3/8 | 1-1/2 | 3 | .000 | C60617 | C72341 |
| 1/8 | .1250 | 1/8 | 3/8 | 1-1/2 | 3 | .015 | C72375 | C84150 |
| 3/16 | .1875 | 3/16 | 5/16 | 2 | 3 | .000 | C60618 | C72342 |
| 3/16 | .1875 | 3/16 | 9/16 | 2 | 3 | .000 | C60619 | C72343 |
| 3/16 | .1875 | 3/16 | 9/16 | 2 | 3 | .015 | C72376 | C84151 |
| 1/4 | .2500 | 1/4 | 3/8 | 2 | 3 | .000 | C60620 | C72344 |
| 1/4 | .2500 | 1/4 | 3/8 | 2 | 3 | .015 | C72377 | C84152 |
| 1/4 | .2500 | 1/4 | 3/8 | 2 | 3 | .030 | C72378 | C84153 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 3 | .000 | C60621 | C72345 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 3 | .015 | C72379 | C84154 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 3 | .030 | C72380 | C84155 |
| 1/4 | .2500 | 1/4 | 1-1/4 | 3 | 3 | .000 | C60622 | C72346 |
| 1/4 | .2500 | 1/4 | 1-1/4 | 3 | 3 | .015 | C72381 | C84156 |
| 1/4 | .2500 | 1/4 | 1-1/4 | 3 | 3 | .030 | C72382 | C84157 |
| 5/16 | .3125 | 5/16 | 7/16 | 2 | 3 | .000 | C60623 | C72347 |
| 5/16 | .3125 | 5/16 | 5/8 | 2-1/2 | 3 | .000 | C60624 | C72348 |
| 5/16 | .3125 | 5/16 | 1-1/4 | 3-3/4 | 3 | .000 | C60625 | C72349 |
| 5/16 | .3125 | 5/16 | 1-1/4 | 3-3/4 | 3 | .015 | C72383 | C84158 |
| 5/16 | .3125 | 5/16 | 1-1/4 | 3-3/4 | 3 | .030 | C72384 | C84159 |
| 5/16 | .3125 | 5/16 | 2-1/8 | 4 | 3 | .000 | C60626 | C72350 |
| 3/8 | .3750 | 3/8 | 1/2 | 2 | 3 | .000 | C60627 | C72351 |
| 3/8 | .3750 | 3/8 | 1/2 | 2 | 3 | .015 | C72385 | C84160 |
| 3/8 | .3750 | 3/8 | 1 | 2-1/2 | 3 | .000 | C60628 | C72352 |
| 3/8 | .3750 | 3/8 | 1 | 2-1/2 | 3 | .015 | C72386 | C84161 |
| 3/8 | .3750 | 3/8 | 1 | 2-1/2 | 3 | .030 | C72387 | C84162 |
| 3/8 | .3750 | 3/8 | 1 | 2-1/2 | 3 | .060 | C72388 | C84163 |
| 3/8 | .3750 | 3/8 | 1-1/2 | 3-1/2 | 3 | .000 | C60629 | C72353 |
| 3/8 | .3750 | 3/8 | 1-1/2 | 3-1/2 | 3 | .015 | C72389 | C84164 |
| 3/8 | .3750 | 3/8 | 1-1/2 | 3-1/2 | 3 | .030 | C72390 | C84165 |
| 3/8 | .3750 | 3/8 | 1-1/2 | 3-1/2 | 3 | .060 | C72391 | C84166 |
| 3/8 | .3750 | 3/8 | 2-1/2 | 6 | 3 | .000 | C60630 | C72354 |
| 7/16 | .4375 | 7/16 | 9/16 | 2-1/2 | 3 | .000 | C60631 | C72355 |
| 7/16 | .4375 | 7/16 | 9/16 | 2-1/2 | 3 | .015 | C72392 | C84167 |
| 7/16 | .4375 | 7/16 | 9/16 | 2-1/2 | 3 | .030 | C72393 | C84168 |
| 7/16 | .4375 | 7/16 | 9/16 | 2-1/2 | 3 | .060 | C72394 | C84169 |
| 7/16 | .4375 | 7/16 | 1 | 2-1/2 | 3 | .000 | C60632 | C72356 |
| 7/16 | .4375 | 7/16 | 2 | 4 | 3 | .000 | C60633 | C72357 |

continued on next page

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) | |
|--------------------|-------------|-------|-----------------|-------------|------|-----------------|------------|--------------------------|------------------------------|----------|----------------------|-----|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | >45 |
| Bright | | | | | | | | | | | | |
| ZrN | | | | | | | | | | | | |

☆ = Best Performance ◆ = Acceptable

Aluminum Materials

Style: CEM-AM3

Carbide
Center Cutting

| cutting diameter | | shank diameter d ₂ | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | corner radius | order number | |
|------------------------------|---------------------------|----------------------------------|--------------------------------------|---------------------------------------|---------------|---------------|--------------|--------|
| d ₁ fractional | d ₁ decimal | | | | | | CEM-AM3 | |
| | | | | | | | bright | ZrN |
| 1/2 | .5000 | 1/2 | 5/8 | 2-1/2 | 3 | .000 | C60634 | C72358 |
| 1/2 | .5000 | 1/2 | 5/8 | 2-1/2 | 3 | .060 | C72395 | C84170 |
| 1/2 | .5000 | 1/2 | 1-1/4 | 3 | 3 | .000 | C60635 | C72359 |
| 1/2 | .5000 | 1/2 | 1-1/4 | 3 | 3 | .015 | C72396 | C84171 |
| 1/2 | .5000 | 1/2 | 1-1/4 | 3 | 3 | .030 | C72397 | C84172 |
| 1/2 | .5000 | 1/2 | 1-1/4 | 3 | 3 | .060 | C72398 | C84173 |
| 1/2 | .5000 | 1/2 | 1-1/4 | 3 | 3 | .125 | C72399 | C84174 |
| 1/2 | .5000 | 1/2 | 2 | 4 | 3 | .000 | C60636 | C72360 |
| 1/2 | .5000 | 1/2 | 2 | 4 | 3 | .015 | C72400 | C84175 |
| 1/2 | .5000 | 1/2 | 2 | 4 | 3 | .030 | C72401 | C84176 |
| 1/2 | .5000 | 1/2 | 2 | 4 | 3 | .060 | C72402 | C84177 |
| 1/2 | .5000 | 1/2 | 2 | 4 | 3 | .125 | C72403 | C84178 |
| 1/2 | .5000 | 1/2 | 2-1/2 | 4 | 3 | .000 | C72404 | C84179 |
| 1/2 | .5000 | 1/2 | 2-1/2 | 4 | 3 | .015 | C72405 | C84180 |
| 1/2 | .5000 | 1/2 | 2-1/2 | 4 | 3 | .030 | C72406 | C84181 |
| 1/2 | .5000 | 1/2 | 2-1/2 | 4 | 3 | .060 | C72407 | C84182 |
| 1/2 | .5000 | 1/2 | 2-1/2 | 4 | 3 | .125 | C72408 | C84183 |
| 1/2 | .5000 | 1/2 | 3-1/8 | 6 | 3 | .000 | C60637 | C72361 |
| 1/2 | .5000 | 1/2 | 3-1/8 | 6 | 3 | .030 | C72409 | C84184 |
| 5/8 | .6250 | 5/8 | 3/4 | 3 | 3 | .000 | C60638 | C72362 |
| 5/8 | .6250 | 5/8 | 3/4 | 3 | 3 | .030 | C72410 | C84185 |
| 5/8 | .6250 | 5/8 | 1-5/8 | 4 | 3 | .000 | C60639 | C72363 |
| 5/8 | .6250 | 5/8 | 1-5/8 | 4 | 3 | .030 | C72411 | C84186 |
| 5/8 | .6250 | 5/8 | 1-5/8 | 4 | 3 | .125 | C72412 | C84187 |
| 5/8 | .6250 | 5/8 | 2-1/2 | 5 | 3 | .000 | C60640 | C72364 |
| 5/8 | .6250 | 5/8 | 2-1/2 | 5 | 3 | .030 | C72413 | C84188 |
| 5/8 | .6250 | 5/8 | 2-1/2 | 5 | 3 | .125 | C72414 | C84189 |
| 5/8 | .6250 | 5/8 | 3-3/4 | 6 | 3 | .000 | C60641 | C72365 |
| 5/8 | .6250 | 5/8 | 3-3/4 | 6 | 3 | .030 | C72415 | C84190 |
| 3/4 | .7500 | 3/4 | 1 | 3 | 3 | .000 | C60642 | C72366 |
| 3/4 | .7500 | 3/4 | 1 | 3 | 3 | .030 | C72416 | C84191 |
| 3/4 | .7500 | 3/4 | 1 | 3 | 3 | .060 | C72417 | C84192 |
| 3/4 | .7500 | 3/4 | 1 | 3 | 3 | .125 | C72418 | C84193 |
| 3/4 | .7500 | 3/4 | 1-5/8 | 4 | 3 | .000 | C60643 | C72367 |
| 3/4 | .7500 | 3/4 | 1-5/8 | 4 | 3 | .030 | C72419 | C84194 |
| 3/4 | .7500 | 3/4 | 1-5/8 | 4 | 3 | .060 | C72420 | C84195 |
| 3/4 | .7500 | 3/4 | 1-5/8 | 4 | 3 | .125 | C72421 | C84196 |
| 3/4 | .7500 | 3/4 | 2-1/2 | 5 | 3 | .000 | C72422 | C84197 |
| 3/4 | .7500 | 3/4 | 2-1/2 | 5 | 3 | .030 | C72423 | C84198 |
| 3/4 | .7500 | 3/4 | 2-1/2 | 5 | 3 | .060 | C72424 | C84199 |
| 3/4 | .7500 | 3/4 | 2-1/2 | 5 | 3 | .125 | C72425 | C84200 |
| 3/4 | .7500 | 3/4 | 3-1/4 | 6 | 3 | .000 | C60644 | C72368 |
| 3/4 | .7500 | 3/4 | 3-1/4 | 6 | 3 | .030 | C72426 | C84201 |
| 3/4 | .7500 | 3/4 | 3-1/4 | 6 | 3 | .125 | C72427 | C84202 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 3 | .000 | C60645 | C72369 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 3 | .030 | C72428 | C84203 |
| 1 | 1.0000 | 1 | 2 | 5 | 3 | .000 | C60646 | C72370 |
| 1 | 1.0000 | 1 | 2 | 5 | 3 | .030 | C72429 | C84204 |
| 1 | 1.0000 | 1 | 2-1/2 | 5 | 3 | .000 | C72430 | C84205 |
| 1 | 1.0000 | 1 | 2-1/2 | 5 | 3 | .030 | C72431 | C84206 |
| 1 | 1.0000 | 1 | 3-1/2 | 6 | 3 | .000 | C60647 | C72371 |
| 1 | 1.0000 | 1 | 3-1/2 | 6 | 3 | .030 | C72432 | C84207 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | | | | | | | | | | ◆ | | | |
| ZrN | | | | | | | | | | ☆ | | | |

☆ = Best Performance ◆ = Acceptable



Style: **CEM-RS**

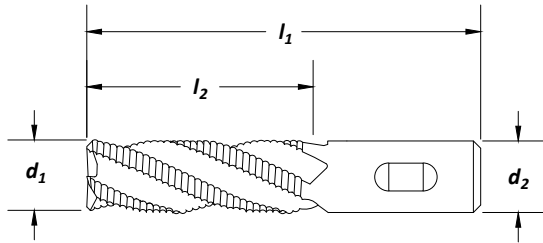
Rougher

Note
Has a Weldon shank




Surface Treatment





| cutting diameter | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | corner radius | order number | |
|------------------------------------|---------|--|--|---|---------------|---------------|---------------|--------|
| d₁ fractional | decimal | | | | | | CEM-RS | |
| | | | | | | bright | TiAlN | |
| 1/4 | .2500 | 1/4 | 1/4 | 2 | 4 | 0.000 | C60148 | C80148 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 4 | 0.000 | C60149 | C80149 |
| 3/8 | .3750 | 3/8 | 3/8 | 2 | 4 | 0.000 | C60150 | C80150 |
| 3/8 | .3750 | 3/8 | 7/8 | 2-1/2 | 4 | 0.000 | C60151 | C80151 |
| 1/2 | .5000 | 1/2 | 1/2 | 2-1/2 | 4 | 0.000 | C60152 | C80152 |
| 1/2 | .5000 | 1/2 | 1 | 3 | 4 | 0.000 | C60153 | C80153 |
| 5/8 | .6250 | 5/8 | 3/4 | 3 | 4 | 0.000 | C60154 | C80154 |
| 5/8 | .6250 | 5/8 | 1-1/4 | 3 1/2 | 4 | 0.000 | C60155 | C80155 |
| 3/4 | .7500 | 3/4 | 7/8 | 3 1/2 | 4 | 0.000 | C60156 | C80156 |
| 3/4 | .7500 | 3/4 | 1-1/2 | 4 | 4 | 0.000 | C60157 | C80157 |
| 1 | 1.0000 | 1 | 1 | 3 1/2 | 4 | 0.000 | C60158 | C80158 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 4 | 0.000 | C60159 | C80159 |

Carbide

Center Cutting

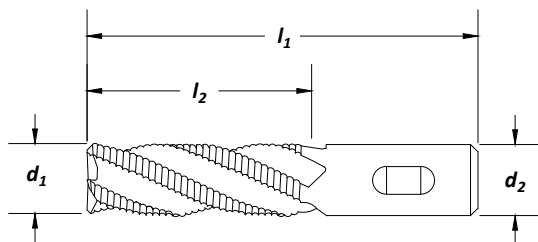
| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiAlN | ◆ | | ◆ | | ☆ | ☆ | ◆ | | | | | ☆ | |

☆ = Best Performance ◆ = Acceptable

Rougher
Style: CEM-RA

Note
Has a Weldon shank

| | | | | | | |
|---------------|------------|-----------|------------|-------------------|--------|------|
| Solid Carbide | 3 Flute CC | Helix 38° | Square End | Surface Treatment | Bright | TiCN |
|---------------|------------|-----------|------------|-------------------|--------|------|



| cutting diameter | | shank diameter | length of cut | overall length | no. of flutes | order number | |
|------------------|---------|----------------|---------------|----------------|---------------|--------------|--------|
| d_1 | d_2 | | | | | CEM-RA | |
| fractional | decimal | | l_2 (in) | l_1 (in) | | bright | TiCN |
| 1/4 | .2500 | 1/4 | 3/8 | 2 | 3 | C60455 | C70455 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 3 | C60456 | C70456 |
| 3/8 | .3750 | 3/8 | 1/2 | 2 | 3 | C60457 | C70457 |
| 3/8 | .3750 | 3/8 | 7/8 | 2-1/2 | 3 | C60458 | C70458 |
| 1/2 | .5000 | 1/2 | 5/8 | 2-1/2 | 3 | C60459 | C70459 |
| 1/2 | .5000 | 1/2 | 1 | 3 | 3 | C60460 | C70460 |
| 1/2 | .5000 | 1/2 | 2 | 4-1/2 | 3 | C60461 | C70461 |
| 5/8 | .6250 | 5/8 | 3/4 | 3 | 3 | C60462 | C70462 |
| 5/8 | .6250 | 5/8 | 1-1/4 | 3-1/2 | 3 | C60463 | C70463 |
| 5/8 | .6250 | 5/8 | 2-1/4 | 5 | 3 | C60464 | C70464 |
| 3/4 | .7500 | 3/4 | 1 | 3-1/2 | 3 | C60465 | C70465 |
| 3/4 | .7500 | 3/4 | 1-1/2 | 4 | 3 | C60466 | C70466 |
| 3/4 | .7500 | 3/4 | 2-1/4 | 5 | 3 | C60467 | C70467 |
| 1 | 1.0000 | 1 | 1-1/8 | 3-1/2 | 3 | C60468 | C70468 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 3 | C60469 | C70469 |
| 1 | 1.0000 | 1 | 2-1/4 | 5 | 3 | C60470 | C70470 |

Carbide
Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiCN | | | | | | | | | | ☆ | | | |

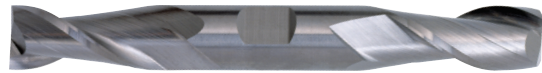
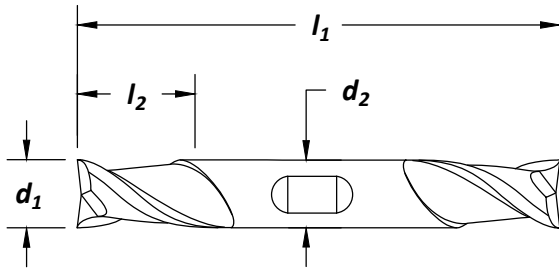
☆ = Best Performance ◆ = Acceptable

Style: **CEM-DE2**

General Purpose



Surface Treatment



| cutting diameter d₁ | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number CEM-DE2 | |
|--|---------|--|--|---|---------------|--------------------------------|--------|
| fractional | decimal | | | | | bright | TiAlN |
| 1/16 | .0625 | 1/8 | 1/8 | 1-1/2 | 2 | C60169 | C80169 |
| 3/32 | .0938 | 1/8 | 3/16 | 1-1/2 | 2 | C60170 | C80170 |
| 1/8 | .1250 | 1/8 | 1/4 | 1-1/2 | 2 | C60171 | C80171 |
| 1/8* | .1250 | 3/8 | 3/8 | 3 | 2 | C60172 | C80172 |
| 5/32 | .1562 | 3/16 | 5/16 | 2 | 2 | C60173 | C80173 |
| 5/32* | .1562 | 3/8 | 7/16 | 3 | 2 | C60174 | C80174 |
| 3/16 | .1875 | 3/16 | 3/8 | 2 | 2 | C60175 | C80175 |
| 3/16* | .1875 | 3/8 | 1/2 | 3 | 2 | C60176 | C80176 |
| 7/32* | .2188 | 3/8 | 9/16 | 3 1/2 | 2 | C60177 | C80177 |
| 1/4 | .2500 | 1/4 | 1/2 | 2-1/2 | 2 | C60178 | C80178 |
| 1/4* | .2500 | 3/8 | 5/8 | 3 1/2 | 2 | C60179 | C80179 |
| 9/32* | .2812 | 3/8 | 11/16 | 3 1/2 | 2 | C60180 | C80180 |
| 5/16* | .3125 | 3/8 | 3/4 | 3 1/2 | 2 | C60181 | C80181 |
| 3/8 | .3750 | 3/8 | 9/16 | 3 | 2 | C60182 | C80182 |
| 3/8* | .3750 | 3/8 | 3/4 | 3 1/2 | 2 | C60183 | C80183 |
| 7/16* | .4375 | 7/8 | 7/8 | 4 | 2 | C60184 | C80184 |
| 1/2 | .5000 | 1/2 | 5/8 | 3 | 2 | C60185 | C80185 |
| 1/2* | .5000 | 1/2 | 1 | 4 | 2 | C60186 | C80186 |

*Weldon shank; all others plain shank

Carbide

Center Cutting

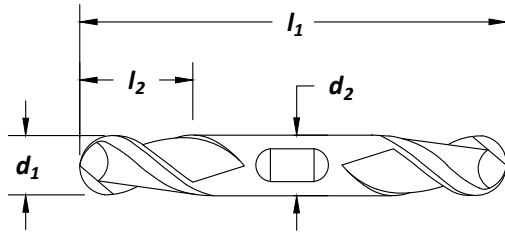
| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------|-----------------|------------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | |
| Bright | ◆ | | ◆ | | | | | ◆ | ◆ | ☆ | |
| TiAlN | ☆ | | ☆ | | ◆ | ◆ | | ☆ | ☆ | | |

☆ = Best Performance ◆ = Acceptable

General Purpose

Style: **CEM-DE2B**

Solid Carbide
 2 Flute CC
 Helix 35°
 Ball End
 Surface Treatment: Bright TiAlN



| cutting diameter | | shank diameter | length of cut | overall length | no. of flutes | order number | |
|------------------|------------|----------------|---------------|----------------|---------------|--------------|---------|
| d1 fractional | d1 decimal | | | | | d2 | l2 (in) |
| | | | | | | bright | TiAlN |
| 1/16 | .0625 | 1/8 | 1/8 | 1-1/2 | 2 | C60205 | C80205 |
| 3/32 | .0938 | 1/8 | 3/16 | 1-1/2 | 2 | C60206 | C80206 |
| 1/8* | .1250 | 3/8 | 3/8 | 3 | 2 | C60207 | C80207 |
| 5/32* | .1562 | 3/8 | 7/16 | 3 | 2 | C60208 | C80208 |
| 3/16* | .1875 | 3/8 | 1/2 | 3 | 2 | C60209 | C80209 |
| 7/32* | .2188 | 3/8 | 9/16 | 3 1/2 | 2 | C60210 | C80210 |
| 1/4* | .2500 | 3/8 | 5/8 | 3 1/2 | 2 | C60211 | C80211 |
| 9/32* | .2812 | 3/8 | 11/16 | 3 1/2 | 2 | C60212 | C80212 |
| 5/16* | .3125 | 3/8 | 3/4 | 3 1/2 | 2 | C60213 | C80213 |
| 3/8* | .3750 | 3/8 | 3/4 | 3 1/2 | 2 | C60214 | C80214 |
| 7/16* | .4375 | 1/2 | 7/8 | 4 | 2 | C60215 | C80215 |
| 1/2* | .5000 | 1/2 | 1 | 4 | 2 | C60216 | C80216 |

*Weldon shank; all others plain shank

Carbide

Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | | | | ◆ | ◆ | ☆ | | | |
| TiAlN | ☆ | | ☆ | | ◆ | ◆ | | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable

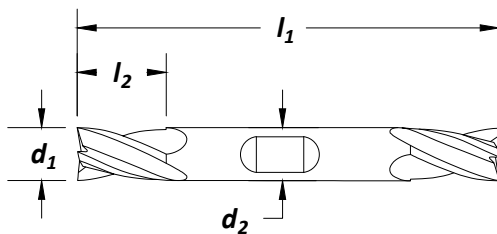


Style: **CEM-DE4**

General Purpose



Surface Treatment



| cutting diameter | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number | |
|------------------------------------|---------|--|--|---|---------------|----------------|--------|
| d₁ fractional | decimal | | | | | CEM-DE4 | |
| | | | | | | bright | TiAlN |
| 1/16 | .0625 | 1/8 | 1/8 | 1-1/2 | 4 | C60269 | C80269 |
| 3/32 | .0938 | 1/8 | 3/16 | 1-1/2 | 4 | C60270 | C80270 |
| 1/8 | .1250 | 1/8 | 1/4 | 1-1/2 | 4 | C60271 | C80271 |
| 1/8 | .1250 | 3/16 | 1/4 | 2 | 4 | C60272 | C80272 |
| 1/8* | .1250 | 3/8 | 7/16 | 3 | 4 | C60273 | C80273 |
| 5/32 | .1562 | 3/16 | 5/16 | 2 | 4 | C60274 | C80274 |
| 5/32* | .1562 | 3/8 | 7/16 | 3 | 4 | C60275 | C80275 |
| 3/16 | .1875 | 3/16 | 3/8 | 2 | 4 | C60276 | C80276 |
| 3/16* | .1875 | 3/8 | 1/2 | 3 | 4 | C60277 | C80277 |
| 7/32* | .2188 | 3/8 | 9/16 | 3 1/2 | 4 | C60278 | C80278 |
| 1/4 | .2500 | 1/4 | 1/2 | 2-1/2 | 4 | C60279 | C80279 |
| 1/4* | .2500 | 3/8 | 5/8 | 3 1/2 | 4 | C60280 | C80280 |
| 9/32* | .2812 | 3/8 | 11/16 | 3 1/2 | 4 | C60281 | C80281 |
| 5/16 | .3125 | 5/16 | 1/2 | 2-1/2 | 4 | C60282 | C80282 |
| 5/16* | .3125 | 3/8 | 3/4 | 3 1/2 | 4 | C60283 | C80283 |
| 3/8 | .3750 | 3/8 | 9/16 | 3 | 4 | C60284 | C80284 |
| 3/8* | .3750 | 3/8 | 3/4 | 3 1/2 | 4 | C60285 | C80285 |
| 7/16* | .4375 | 1/2 | 7/8 | 4 | 4 | C60286 | C80286 |
| 1/2 | .5000 | 1/2 | 5/8 | 3 | 4 | C60287 | C80287 |
| 1/2* | .5000 | 1/2 | 1 | 4 | 4 | C60288 | C80288 |

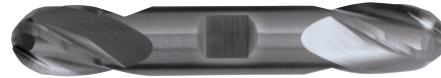
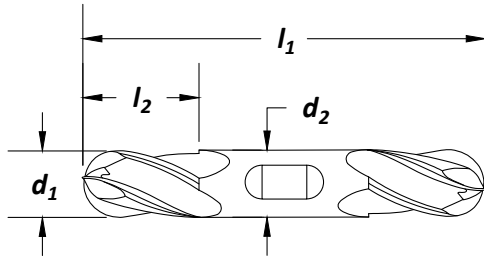
*Weldon shank; all others plain shank

Carbide
Center Cutting

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------|-----------------|------------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | |
| Bright | ◆ | | ◆ | | | | | ◆ | ◆ | ☆ | |
| TiAlN | ☆ | | ☆ | | ◆ | ◆ | | ☆ | ☆ | | ◆ |

☆ = Best Performance ◆ = Acceptable

General Purpose
Style: CEM-DE4B

Surface Treatment


| cutting diameter | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number | |
|------------------------------------|---------|--|--|---|---------------|------------------------------------|--------|
| d₁ fractional | decimal | | | | | CEM-DE4B bright TiAlN | |
| 1/16 | .0625 | 1/8 | 1/8 | 1-1/2 | 4 | C60305 | C80305 |
| 3/32 | .0938 | 1/8 | 3/16 | 1-1/2 | 4 | C60306 | C80306 |
| 1/8* | .1250 | 3/8 | 3/8 | 3 | 4 | C60307 | C80307 |
| 5/32* | .1562 | 3/8 | 7/16 | 3 | 4 | C60308 | C80308 |
| 3/16* | .1875 | 3/8 | 1/2 | 3 | 4 | C60309 | C80309 |
| 7/32* | .2188 | 3/8 | 9/16 | 3 1/2 | 4 | C60310 | C80310 |
| 1/4* | .2500 | 3/8 | 5/8 | 3 1/2 | 4 | C60311 | C80311 |
| 9/32* | .2812 | 3/8 | 11/16 | 3 1/2 | 4 | C60312 | C80312 |
| 5/16* | .3125 | 3/8 | 3/4 | 3 1/2 | 4 | C60313 | C80313 |
| 3/8* | .3750 | 3/8 | 3/4 | 3 1/2 | 4 | C60314 | C80314 |
| 7/16* | .4375 | 1/2 | 7/8 | 4 | 4 | C60315 | C80315 |
| 1/2* | .5000 | 1/2 | 1 | 4 | 4 | C60316 | C80316 |

*Weldon shank; all others plain shank

Carbide
Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | | | | ◆ | ◆ | ☆ | | | |
| TiAlN | ☆ | | ☆ | | ◆ | ◆ | | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable

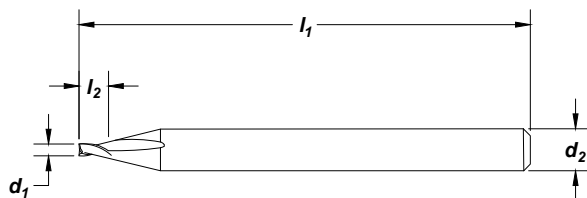
Style: **CMCE-2 / CMCE-2AL**

Note

General purpose applications.
30° right hand spiral-right hand cut
Diameter tolerance: ±0.0005"



Surface Treatment



| cutting diameter d₁ | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | description | order number | |
|--|--|--|---|----------------------|-------------------------|--------------------------|
| | | | | | CMCE-2 Bright | CMCE-2AL AlCrN |
| 0.005 | 1/8 | 0.0150 | 1-1/2 | 0.005 x 1/8 x 1-1/2 | C76001 | — |
| 0.006 | 1/8 | 0.0180 | 1-1/2 | 0.006 x 1/8 x 1-1/2 | C76002 | — |
| 0.007 | 1/8 | 0.0210 | 1-1/2 | 0.007 x 1/8 x 1-1/2 | C76003 | — |
| 0.008 | 1/8 | 0.0240 | 1-1/2 | 0.008 x 1/8 x 1-1/2 | C76004 | — |
| 0.009 | 1/8 | 0.0270 | 1-1/2 | 0.009 x 1/8 x 1-1/2 | C76005 | — |
| 0.010 | 1/8 | 0.0300 | 1-1/2 | 0.010 x 1/8 x 1-1/2 | C76006 | — |
| 0.011 | 1/8 | 0.0330 | 1-1/2 | 0.011 x 1/8 x 1-1/2 | C76007 | — |
| 0.012 | 1/8 | 0.0360 | 1-1/2 | 0.012 x 1/8 x 1-1/2 | C76008 | — |
| 0.013 | 1/8 | 0.0390 | 1-1/2 | 0.013 x 1/8 x 1-1/2 | C76009 | — |
| 0.014 | 1/8 | 0.0420 | 1-1/2 | 0.014 x 1/8 x 1-1/2 | C76010 | — |
| 0.015 | 1/8 | 0.0450 | 1-1/2 | 0.015 x 1/8 x 1-1/2 | C76011 | — |
| 0.0156 | 1/8 | 0.0468 | 1-1/2 | 0.0156 x 1/8 x 1-1/2 | C76012 | — |
| 0.018 | 1/8 | 0.0540 | 1-1/2 | 0.018 x 1/8 x 1-1/2 | C76013 | — |
| 0.020 | 1/8 | 0.0600 | 1-1/2 | 0.020 x 1/8 x 1-1/2 | C76014 | — |
| 0.023 | 1/8 | 0.0690 | 1-1/2 | 0.023 x 1/8 x 1-1/2 | C76015 | — |
| 0.024 | 1/8 | 0.0720 | 1-1/2 | 0.024 x 1/8 x 1-1/2 | C76016 | — |
| 0.025 | 1/8 | 0.0750 | 1-1/2 | 0.025 x 1/8 x 1-1/2 | C76017 | — |
| 0.026 | 1/8 | 0.0780 | 1-1/2 | 0.026 x 1/8 x 1-1/2 | C76018 | — |
| 0.029 | 1/8 | 0.0870 | 1-1/2 | 0.029 x 1/8 x 1-1/2 | C76019 | — |
| 0.030 | 1/8 | 0.0900 | 1-1/2 | 0.030 x 1/8 x 1-1/2 | C76020 | — |
| 0.031 | 1/8 | 0.0930 | 1-1/2 | 0.031 x 1/8 x 1-1/2 | C76021 | C76200 |
| 0.033 | 1/8 | 0.0990 | 1-1/2 | 0.033 x 1/8 x 1-1/2 | C76022 | C76201 |
| 0.035 | 1/8 | 0.1050 | 1-1/2 | 0.035 x 1/8 x 1-1/2 | C76023 | C76202 |
| 0.040 | 1/8 | 0.1200 | 1-1/2 | 0.040 x 1/8 x 1-1/2 | C76024 | C76203 |
| 0.045 | 1/8 | 0.1350 | 1-1/2 | 0.045 x 1/8 x 1-1/2 | C76025 | C76204 |
| 0.047 | 1/8 | 0.1410 | 1-1/2 | 0.047 x 1/8 x 1-1/2 | C76026 | C76205 |
| 0.050 | 1/8 | 0.1500 | 1-1/2 | 0.050 x 1/8 x 1-1/2 | C76027 | C76206 |
| 0.055 | 1/8 | 0.1650 | 1-1/2 | 0.055 x 1/8 x 1-1/2 | C76028 | C76207 |
| 0.060 | 1/8 | 0.1800 | 1-1/2 | 0.060 x 1/8 x 1-1/2 | C76029 | C76208 |
| 0.062 | 1/8 | 0.1875 | 1-1/2 | 0.062 x 1/8 x 1-1/2 | C76030 | C76209 |
| 0.064 | 1/8 | 0.1920 | 1-1/2 | 0.064 x 1/8 x 1-1/2 | C76031 | C76210 |
| 0.065 | 1/8 | 0.1950 | 1-1/2 | 0.065 x 1/8 x 1-1/2 | C76032 | C76211 |
| 0.070 | 1/8 | 0.2100 | 1-1/2 | 0.070 x 1/8 x 1-1/2 | C76033 | C76212 |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | ◆ | ◆ | | ◆ | ◆ | | | | |
| AlCrN | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | ☆ | ☆ | ☆ | ◆ | ◆ | ◆ |

☆ = Best Performance ◆ = Acceptable

Carbide Center Cutting

Miniature
Inch

Style: CMCE-2 / CMCE-2AL (continued)

| cutting diameter d₁ | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | description | order number | |
|--|--|--|---|---------------------|-------------------------|--------------------------|
| | | | | | CMCE-2 Bright | CMCE-2AL AlCrN |
| 0.075 | 1/8 | 0.2250 | 1-1/2 | 0.075 x 1/8 x 1-1/2 | C76034 | C76213 |
| 0.078 | 1/8 | 0.2243 | 1-1/2 | 0.078 x 1/8 x 1-1/2 | C76035 | C76214 |
| 0.080 | 1/8 | 0.2400 | 1-1/2 | 0.080 x 1/8 x 1-1/2 | C76036 | C76215 |
| 0.085 | 1/8 | 0.2550 | 1-1/2 | 0.085 x 1/8 x 1-1/2 | C76037 | C76216 |
| 0.090 | 1/8 | 0.2700 | 1-1/2 | 0.090 x 1/8 x 1-1/2 | C76038 | C76217 |
| 0.093 | 1/8 | 0.2814 | 1-1/2 | 0.093 x 1/8 x 1-1/2 | C76039 | C76218 |
| 0.095 | 1/8 | 0.2850 | 1-1/2 | 0.095 x 1/8 x 1-1/2 | C76040 | C76219 |
| 0.100 | 1/8 | 0.3000 | 1-1/2 | 0.100 x 1/8 x 1-1/2 | C76041 | C76220 |
| 0.103 | 1/8 | 0.3090 | 1-1/2 | 0.103 x 1/8 x 1-1/2 | C76042 | C76221 |
| 0.120 | 1/8 | 0.3600 | 1-1/2 | 0.120 x 1/8 x 1-1/2 | C76043 | C76222 |

Miniature
Metric

Style: CMCE-2 / CMCE-2AL

| cutting diameter d₁ | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | description | order number | |
|--|--------|--|--|---|----------------------|-------------------------|--------------------------|
| (mm) | (in) | | | | | CMCE-2 Bright | CMCE-2AL AlCrN |
| .5mm | 0.0197 | 1/8 | 0.0591 | 1-1/2 | .5mm x 1/8 x 1-1/2 | C76044 | — |
| 1.0mm | 0.0394 | 1/8 | 0.1182 | 1-1/2 | 1.0mm x 1/8 x 1-1/2 | C76045 | C76223 |
| 1.25mm | 0.0492 | 1/8 | 0.1476 | 1-1/2 | 1.25mm x 1/8 x 1-1/2 | C76046 | C76224 |
| 1.5mm | 0.0591 | 1/8 | 0.1773 | 1-1/2 | 1.5mm x 1/8 x 1-1/2 | C76047 | C76225 |
| 1.6mm | 0.0630 | 1/8 | 0.1890 | 1-1/2 | 1.6mm x 1/8 x 1-1/2 | C76048 | C76226 |
| 1.8mm | 0.0709 | 1/8 | 0.2127 | 1-1/2 | 1.8mm x 1/8 x 1-1/2 | C76049 | C76227 |
| 2.0mm | 0.0787 | 1/8 | 0.2361 | 1-1/2 | 2.0mm x 1/8 x 1-1/2 | C76050 | C76228 |
| 2.2mm | 0.0866 | 1/8 | 0.2598 | 1-1/2 | 2.2mm x 1/8 x 1-1/2 | C76051 | C76229 |
| 2.5mm | 0.0984 | 1/8 | 0.2952 | 1-1/2 | 2.5mm x 1/8 x 1-1/2 | C76052 | C76230 |
| 2.8mm | 0.1102 | 1/8 | 0.3306 | 1-1/2 | 2.8mm x 1/8 x 1-1/2 | C76053 | C76231 |
| 3.0mm | 0.1181 | 1/8 | 0.3543 | 1-1/2 | 3.0mm x 1/8 x 1-1/2 | C76054 | C76232 |
| 3.5mm | 0.1378 | 3/16 | 0.4134 | 2 | 3.5mm x 3/16 x 2 | C76055 | C76233 |
| 4.5mm | 0.1772 | 3/16 | 0.5316 | 2 | 4.5mm x 3/16 x 2 | C76056 | C76234 |

Carbide

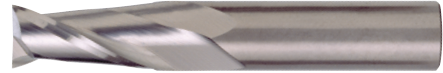
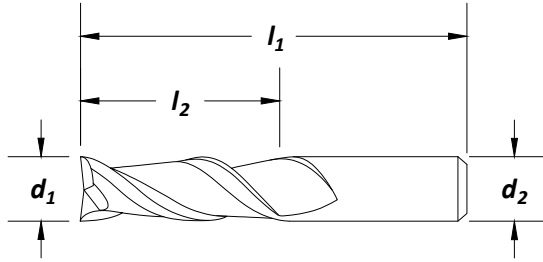
Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | ◆ | ◆ | | ◆ | ◆ | | | | |
| AlCrN | ☆ | ◆ | ☆ | ◆ | ☆ | ☆ | ◆ | ☆ | ☆ | ☆ | ◆ | ◆ | ◆ |

☆ = Best Performance ◆ = Acceptable

Style: **CEM-SE2**

General Purpose



| cutting diameter | | shank diameter | length of cut | overall length | no. of flutes | corner radius | order number | |
|----------------------|---------|----------------------|---------------------------|---------------------------|---------------|---------------|----------------|--------|
| d₁ | | d₂ | l₂ (in) | l₁ (in) | | | CEM-SE2 | |
| fractional | decimal | | | | | | bright | TiAlN |
| 1/32 | .0312 | 1/8 | 1/8 | 1-1/2 | 2 | 0.000 | C61001 | C81001 |
| 3/64 | .0469 | 1/8 | 1/8 | 1-1/2 | 2 | 0.000 | C61002 | C81002 |
| 1/16 | .0625 | 1/8 | 1/8 | 1-1/2 | 2 | 0.000 | C61003 | C81003 |
| 1/16 | .0625 | 1/8 | 3/16 | 1-1/2 | 2 | 0.000 | C61004 | C81004 |
| 5/64 | .0781 | 1/8 | 3/16 | 1-1/2 | 2 | 0.000 | C61005 | C81005 |
| 3/32 | .0938 | 1/8 | 3/16 | 1-1/2 | 2 | 0.000 | C61006 | C81006 |
| 3/32 | .0938 | 1/8 | 3/8 | 1-1/2 | 2 | 0.000 | C61007 | C81007 |
| 7/64 | .1094 | 1/8 | 3/8 | 1-1/2 | 2 | 0.000 | C61008 | C81008 |
| 1/8 | .1250 | 1/8 | 1/4 | 1-1/2 | 2 | 0.000 | C61009 | C81009 |
| 1/8 | .1250 | 1/8 | 1/2 | 1-1/2 | 2 | 0.000 | C61010 | C81010 |
| 1/8 | .1250 | 1/8 | 1/2 | 1-1/2 | 2 | 0.010 | C61011 | C81011 |
| 1/8 | .1250 | 1/8 | 3/4 | 2-1/4 | 2 | 0.000 | C61012 | C81012 |
| 1/8 | .1250 | 1/8 | 1 | 3 | 2 | 0.000 | C61013 | C81013 |
| 9/64 | .1406 | 3/16 | 9/16 | 2 | 2 | 0.000 | C61014 | C81014 |
| 5/32 | .1562 | 3/16 | 9/16 | 2 | 2 | 0.000 | C61015 | C81015 |
| 11/64 | .1719 | 3/16 | 5/8 | 2 | 2 | 0.000 | C61016 | C81016 |
| 3/16 | .1875 | 3/16 | 5/16 | 2 | 2 | 0.000 | C61017 | C81017 |
| 3/16 | .1875 | 3/16 | 5/8 | 2 | 2 | 0.000 | C61018 | C81018 |
| 3/16 | .1875 | 3/16 | 5/8 | 2 | 2 | 0.010 | C61019 | C81019 |
| 3/16 | .1875 | 3/16 | 3/4 | 2-1/2 | 2 | 0.000 | C61020 | C81020 |
| 3/16 | .1875 | 3/16 | 1-1/8 | 3 | 2 | 0.000 | C61021 | C81021 |
| 13/64 | .2031 | 1/4 | 5/8 | 2-1/2 | 2 | 0.000 | C61022 | C81022 |
| 7/32 | .2188 | 1/4 | 5/8 | 2-1/2 | 2 | 0.000 | C61023 | C81023 |
| 15/64 | .2344 | 1/4 | 3/4 | 2-1/2 | 2 | 0.000 | C61024 | C81024 |
| 1/4 | .2500 | 1/4 | 1/2 | 2 | 2 | 0.000 | C61025 | C81025 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 2 | 0.000 | C61026 | C81026 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 2 | 0.020 | C61027 | C81027 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 2 | 0.030 | C61028 | C81028 |
| 1/4 | .2500 | 1/4 | 1-1/8 | 3 | 2 | 0.000 | C61029 | C81029 |
| 1/4 | .2500 | 1/4 | 1-1/2 | 4 | 2 | 0.000 | C61030 | C81030 |
| 1/4 | .2500 | 1/4 | 1-1/2 | 6 | 2 | 0.000 | C61031 | C81031 |
| 17/64 | .2656 | 5/16 | 7/8 | 2-1/2 | 2 | 0.000 | C61032 | C81032 |
| 9/32 | .2812 | 5/16 | 7/8 | 2-1/2 | 2 | 0.000 | C61033 | C81033 |
| 5/16 | .3125 | 5/16 | 1/2 | 2 | 2 | 0.000 | C61034 | C81034 |
| 5/16 | .3125 | 5/16 | 7/8 | 2-1/2 | 2 | 0.000 | C61035 | C81035 |

continued on next page

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) | |
|--------------------|-------------|-------|-----------------|-------------|------|-----------------|------------|--------------------------|------------------------------|----------|----------------------|-----|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | >45 |
| Bright | ◆ | | ◆ | | | | | ◆ | ◆ | ☆ | | |
| TiAlN | ☆ | | ☆ | | ◆ | ◆ | | ☆ | ☆ | | | |

☆ = Best Performance ◆ = Acceptable

General Purpose
Style: CEM-SE2 (continued)

| cutting diameter d ₁ | | shank diameter d ₂ | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | corner radius | order number CEM-SE2 | |
|------------------------------------|---------|----------------------------------|--------------------------------------|---------------------------------------|---------------|---------------|--------------------------------|--------|
| fractional | decimal | | | | | | bright | TiAlN |
| 5/16 | .3125 | 5/16 | 13/16 | 2-1/2 | 2 | 0.020 | C61036 | C81036 |
| 5/16 | .3125 | 5/16 | 13/16 | 2-1/2 | 2 | 0.030 | C61037 | C81037 |
| 5/16 | .3125 | 5/16 | 1-1/8 | 3 | 2 | 0.000 | C61038 | C81038 |
| 5/16 | .3125 | 5/16 | 1-5/8 | 4 | 2 | 0.000 | C61039 | C81039 |
| 3/8 | .3750 | 3/8 | 5/8 | 2 | 2 | 0.000 | C61040 | C81040 |
| 3/8 | .3750 | 3/8 | 1 | 2-1/2 | 2 | 0.000 | C61041 | C81041 |
| 3/8 | .3750 | 3/8 | 1 | 2-1/2 | 2 | 0.020 | C61042 | C81042 |
| 3/8 | .3750 | 3/8 | 1 | 2-1/2 | 2 | 0.030 | C61043 | C81043 |
| 3/8 | .3750 | 3/8 | 1 | 2-1/2 | 2 | 0.045 | C61044 | C81044 |
| 3/8 | .3750 | 3/8 | 1-1/8 | 3 | 2 | 0.000 | C61045 | C81045 |
| 3/8 | .3750 | 3/8 | 1 3/4 | 4 | 2 | 0.000 | C61046 | C81046 |
| 3/8 | .3750 | 3/8 | 1-1/2 | 6 | 2 | 0.000 | C61047 | C81047 |
| 7/16 | .4375 | 7/16 | 5/8 | 2-1/2 | 2 | 0.000 | C61048 | C81048 |
| 7/16 | .4375 | 7/16 | 1 | 2-1/2 | 2 | 0.000 | C61049 | C81049 |
| 7/16 | .4375 | 7/16 | 2 | 4 | 2 | 0.000 | C61050 | C81050 |
| 7/16 | .4375 | 7/16 | 3 | 6 | 2 | 0.000 | C61051 | C81051 |
| 1/2 | .5000 | 1/2 | 5/8 | 2-1/2 | 2 | 0.000 | C61052 | C81052 |
| 1/2 | .5000 | 1/2 | 1 | 3 | 2 | 0.000 | C61053 | C81053 |
| 1/2 | .5000 | 1/2 | 1 | 3 | 2 | 0.030 | C61054 | C81054 |
| 1/2 | .5000 | 1/2 | 1 | 3 | 2 | 0.060 | C61055 | C81055 |
| 1/2 | .5000 | 1/2 | 1 | 3 | 2 | 0.090 | C61056 | C81056 |
| 1/2 | .5000 | 1/2 | 2 | 4 | 2 | 0.000 | C61057 | C81057 |
| 1/2 | .5000 | 1/2 | 1-1/2 | 6 | 2 | 0.000 | C61058 | C81058 |
| 1/2 | .5000 | 1/2 | 3 | 6 | 2 | 0.000 | C61059 | C81059 |
| 9/16 | .5625 | 9/16 | 1-1/4 | 3 1/2 | 2 | 0.000 | C61060 | C81060 |
| 5/8 | .6250 | 5/8 | 3/4 | 3 | 2 | 0.000 | C61061 | C81061 |
| 5/8 | .6250 | 5/8 | 1-1/4 | 3 1/2 | 2 | 0.000 | C61062 | C81062 |
| 5/8 | .6250 | 5/8 | 1-1/4 | 3 1/2 | 2 | 0.030 | C61063 | C81063 |
| 5/8 | .6250 | 5/8 | 1-1/4 | 3 1/2 | 2 | 0.060 | C61064 | C81064 |
| 5/8 | .6250 | 5/8 | 1-1/4 | 3 1/2 | 2 | 0.090 | C61065 | C81065 |
| 5/8 | .6250 | 5/8 | 2-1/4 | 5 | 2 | 0.000 | C61066 | C81066 |
| 5/8 | .6250 | 5/8 | 3 | 6 | 2 | 0.000 | C61067 | C81067 |
| 3/4 | .7500 | 3/4 | 1 | 3 | 2 | 0.000 | C61068 | C81068 |
| 3/4 | .7500 | 3/4 | 1-1/2 | 4 | 2 | 0.000 | C61069 | C81069 |
| 3/4 | .7500 | 3/4 | 1-1/2 | 4 | 2 | 0.030 | C61070 | C81070 |
| 3/4 | .7500 | 3/4 | 1-1/2 | 4 | 2 | 0.060 | C61071 | C81071 |
| 3/4 | .7500 | 3/4 | 1-1/2 | 4 | 2 | 0.090 | C61072 | C81072 |
| 3/4 | .7500 | 3/4 | 2-1/4 | 5 | 2 | 0.000 | C61073 | C81073 |
| 3/4 | .7500 | 3/4 | 3 | 6 | 2 | 0.000 | C61074 | C81074 |
| 7/8 | .8750 | 7/8 | 1-1/2 | 4 | 2 | 0.000 | C61075 | C81075 |
| 7/8 | .8750 | 7/8 | 2-1/4 | 5 | 2 | 0.000 | C61076 | C81076 |
| 7/8 | .8750 | 7/8 | 3 | 6 | 2 | 0.000 | C61077 | C81077 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 2 | 0.000 | C61078 | C81078 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 2 | 0.030 | C61079 | C81079 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 2 | 0.060 | C61080 | C81080 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 2 | 0.090 | C61081 | C81081 |
| 1 | 1.0000 | 1 | 2-1/4 | 5 | 2 | 0.000 | C61082 | C81082 |
| 1 | 1.0000 | 1 | 3 | 6 | 2 | 0.000 | C61083 | C81083 |

Carbide
Center Cutting

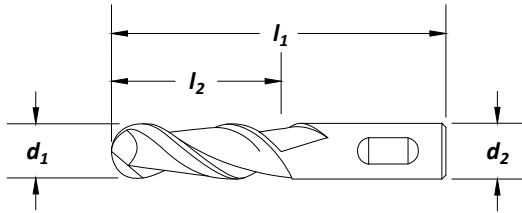
| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | ◆ | ◆ | | ◆ | ◆ | ☆ | | | |
| TiAlN | ☆ | | ☆ | | ◆ | ◆ | | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable

Style: **CEM-SE2B**

General Purpose

Solid Carbide
 2 Flute CC
 Helix 30°
 Ball End
 Surface Treatment: Bright TiAlN



| cutting diameter | | shank diameter | length of cut | overall length | no. of flutes | order number | |
|------------------|---------|----------------|---------------|----------------|---------------|--------------|------------|
| d_1 | d_1 | | | | | d_2 | l_2 (in) |
| fractional | decimal | | | | | bright | TiAlN |
| 1/32 | .0312 | 1/8 | 1/8 | 1-1/2 | 2 | C60914 | C80914 |
| 3/64 | .0469 | 1/8 | 1/8 | 1-1/2 | 2 | C60915 | C80915 |
| 1/16 | .0625 | 1/8 | 1/8 | 1-1/2 | 2 | C60916 | C80916 |
| 1/16 | .0625 | 1/8 | 3/16 | 1-1/2 | 2 | C60917 | C80917 |
| 5/64 | .0781 | 1/8 | 3/16 | 1-1/2 | 2 | C60918 | C80918 |
| 3/32 | .0938 | 1/8 | 3/8 | 1-1/2 | 2 | C60919 | C80919 |
| 7/64 | .1094 | 1/8 | 3/8 | 1-1/2 | 2 | C60920 | C80920 |
| 1/8 | .1250 | 1/8 | 1/4 | 1-1/2 | 2 | C60921 | C80921 |
| 1/8 | .1250 | 1/8 | 1/2 | 1-1/2 | 2 | C60922 | C80922 |
| 1/8 | .1250 | 1/8 | 3/4 | 2-1/4 | 2 | C60923 | C80923 |
| 1/8 | .1250 | 1/8 | 1 | 3 | 2 | C60924 | C80924 |
| 9/64 | .1406 | 3/16 | 9/16 | 2 | 2 | C60925 | C80925 |
| 5/32 | .1562 | 3/16 | 9/16 | 2 | 2 | C60926 | C80926 |
| 11/64 | .1719 | 3/16 | 5/8 | 2 | 2 | C60927 | C80927 |
| 3/16 | .1875 | 3/16 | 5/16 | 2 | 2 | C60928 | C80928 |
| 3/16 | .1875 | 3/16 | 5/8 | 2 | 2 | C60929 | C80929 |
| 3/16 | .1875 | 3/16 | 3/4 | 2-1/2 | 2 | C60930 | C80930 |
| 3/16 | .1875 | 3/16 | 1-1/8 | 3 | 2 | C60931 | C80931 |
| 13/64 | .2031 | 1/4 | 5/8 | 2-1/2 | 2 | C60932 | C80932 |
| 7/32 | .2188 | 1/4 | 5/8 | 2-1/2 | 2 | C60933 | C80933 |
| 15/64 | .2344 | 1/4 | 3/4 | 2-1/2 | 2 | C60934 | C80934 |
| 1/4 | .2500 | 1/4 | 1/2 | 2 | 2 | C60935 | C80935 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 2 | C60936 | C80936 |
| 1/4 | .2500 | 1/4 | 1-1/8 | 3 | 2 | C60937 | C80937 |
| 1/4 | .2500 | 1/4 | 1-1/2 | 4 | 2 | C60938 | C80938 |
| 1/4 | .2500 | 1/4 | 1-1/2 | 6 | 2 | C60939 | C80939 |
| 17/64 | .2656 | 5/16 | 7/8 | 2-1/2 | 2 | C60940 | C80940 |
| 9/32 | .2812 | 5/16 | 7/8 | 2-1/2 | 2 | C60941 | C80941 |
| 5/16 | .3125 | 5/16 | 1/2 | 2 | 2 | C60942 | C80942 |
| 5/16 | .3125 | 5/16 | 7/8 | 2-1/2 | 2 | C60943 | C80943 |
| 5/16 | .3125 | 5/16 | 1-1/8 | 3 | 2 | C60944 | C80944 |
| 5/16 | .3125 | 5/16 | 1-5/8 | 4 | 2 | C60945 | C80945 |
| 3/8 | .3750 | 3/8 | 5/8 | 2 | 2 | C60946 | C80946 |
| 3/8 | .3750 | 3/8 | 1 | 2-1/2 | 2 | C60947 | C80947 |
| 3/8 | .3750 | 3/8 | 1-1/8 | 3 | 2 | C60948 | C80948 |
| 3/8 | .3750 | 3/8 | 1 3/4 | 4 | 2 | C60949 | C80949 |
| 3/8 | .3750 | 3/8 | 1-1/2 | 6 | 2 | C60950 | C80950 |

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ★ | | ★ | | | | | ★ | ★ | ★ | | | |
| TiAlN | ★ | | ★ | | ★ | ★ | | ★ | ★ | | | | |

★ = Best Performance ★ = Acceptable

General Purpose

Style: CEM-SE2B (continued)

| cutting diameter d₁ | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number CEM-SE2B | |
|--|---------|--|--|---|---------------|---------------------------------|--------|
| fractional | decimal | | | | | bright | TiAlN |
| 7/16 | .4375 | 7/16 | 5/8 | 2-1/2 | 2 | C60951 | C80951 |
| 7/16 | .4375 | 7/16 | 1 | 2-1/2 | 2 | C60952 | C80952 |
| 7/16 | .4375 | 7/16 | 2 | 4 | 2 | C60953 | C80953 |
| 7/16 | .4375 | 7/16 | 3 | 6 | 2 | C60954 | C80954 |
| 1/2 | .5000 | 1/2 | 5/8 | 2-1/2 | 2 | C60955 | C80955 |
| 1/2 | .5000 | 1/2 | 1 | 3 | 2 | C60956 | C80956 |
| 1/2 | .5000 | 1/2 | 2 | 4 | 2 | C60957 | C80957 |
| 1/2 | .5000 | 1/2 | 3 | 6 | 2 | C60958 | C80958 |
| 1/2 | .5000 | 1/2 | 1-1/2 | 6 | 2 | C60959 | C80959 |
| 9/16 | .5625 | 9/16 | 1-1/4 | 3 1/2 | 2 | C60960 | C80960 |
| 5/8 | .6250 | 5/8 | 3/4 | 3 | 2 | C60961 | C80961 |
| 5/8 | .6250 | 5/8 | 1-1/4 | 3 1/2 | 2 | C60962 | C80962 |
| 5/8 | .6250 | 5/8 | 2-1/4 | 5 | 2 | C60963 | C80963 |
| 5/8 | .6250 | 5/8 | 3 | 6 | 2 | C60964 | C80964 |
| 3/4 | .7500 | 3/4 | 1 | 3 | 2 | C60965 | C80965 |
| 3/4 | .7500 | 3/4 | 1-1/2 | 4 | 2 | C60966 | C80966 |
| 3/4 | .7500 | 3/4 | 2-1/4 | 5 | 2 | C60967 | C80967 |
| 3/4 | .7500 | 3/4 | 3 | 6 | 2 | C60968 | C80968 |
| 7/8 | .8750 | 7/8 | 1-1/2 | 4 | 2 | C60969 | C80969 |
| 7/8 | .8750 | 7/8 | 2-1/4 | 5 | 2 | C60970 | C80970 |
| 7/8 | .8750 | 7/8 | 3 | 6 | 2 | C60971 | C80971 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 2 | C60972 | C80972 |
| 1 | 1.0000 | 1 | 2-1/4 | 5 | 2 | C60973 | C80973 |
| 1 | 1.0000 | 1 | 3 | 6 | 2 | C60974 | C80974 |

Carbide

Center Cutting

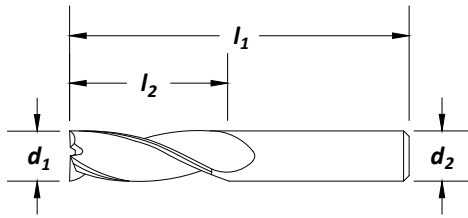
| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Bright | ◆ | | ◆ | | | | | ◆ | ◆ | ☆ | | | |
| TiAlN | ☆ | | ☆ | | ◆ | ◆ | | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable



Style: **CEM-SE3**

General Purpose



| cutting diameter d₁ | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | corner radius | order number CEM-SE3 | |
|--|---------|--|--|---|---------------|---------------|--------------------------------|--------|
| fractional | decimal | | | | | | bright | TiAIN |
| 1/16 | .0625 | 1/8 | 3/16 | 1-1/2 | 3 | 0.000 | C61657 | C81657 |
| 5/64 | .0781 | 1/8 | 3/16 | 1-1/2 | 3 | 0.000 | C61658 | C81658 |
| 3/32 | .0938 | 1/8 | 3/8 | 1-1/2 | 3 | 0.000 | C61659 | C81659 |
| 7/64 | .1094 | 1/8 | 3/8 | 1-1/2 | 3 | 0.000 | C61660 | C81660 |
| 1/8 | .1250 | 1/8 | 1/2 | 1-1/2 | 3 | 0.000 | C61661 | C81661 |
| 1/8 | .1250 | 1/8 | 1/2 | 1-1/2 | 3 | 0.010 | C61662 | C81662 |
| 9/64 | .1406 | 3/16 | 9/16 | 2 | 3 | 0.000 | C61663 | C81663 |
| 5/32 | .1562 | 3/16 | 9/16 | 2 | 3 | 0.000 | C61664 | C81664 |
| 11/64 | .1719 | 3/16 | 5/8 | 2 | 3 | 0.000 | C61665 | C81665 |
| 3/16 | .1875 | 3/16 | 5/8 | 2 | 3 | 0.000 | C61666 | C81666 |
| 3/16 | .1875 | 3/16 | 5/8 | 2 | 3 | 0.010 | C61667 | C81667 |
| 13/64 | .2031 | 1/4 | 5/8 | 2-1/2 | 3 | 0.000 | C61668 | C81668 |
| 7/32 | .2188 | 1/4 | 5/8 | 2-1/2 | 3 | 0.000 | C61669 | C81669 |
| 15/64 | .2344 | 1/4 | 3/4 | 2-1/2 | 3 | 0.000 | C61670 | C81670 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 3 | 0.000 | C61671 | C81671 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 3 | 0.020 | C61672 | C81672 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 3 | 0.030 | C61673 | C81673 |
| 17/64 | .2656 | 5/16 | 7/8 | 2-1/2 | 3 | 0.000 | C61674 | C81674 |
| 9/32 | .2812 | 5/16 | 7/8 | 2-1/2 | 3 | 0.000 | C61675 | C81675 |
| 5/16 | .3125 | 5/16 | 13/16 | 2-1/2 | 3 | 0.000 | C61676 | C81676 |
| 5/16 | .3125 | 5/16 | 13/16 | 2-1/2 | 3 | 0.020 | C61677 | C81677 |
| 5/16 | .3125 | 5/16 | 13/16 | 2-1/2 | 3 | 0.030 | C61678 | C81678 |
| 3/8 | .3750 | 3/8 | 7/8 | 2-1/2 | 3 | 0.000 | C61679 | C81679 |
| 3/8 | .3750 | 3/8 | 7/8 | 2-1/2 | 3 | 0.020 | C61680 | C81680 |
| 3/8 | .3750 | 3/8 | 7/8 | 2-1/2 | 3 | 0.030 | C61681 | C81681 |
| 3/8 | .3750 | 3/8 | 7/8 | 2-1/2 | 3 | 0.045 | C61682 | C81682 |
| 7/16 | .4375 | 7/16 | 7/8 | 2-1/2 | 3 | 0.000 | C61683 | C81683 |
| 1/2 | .5000 | 1/2 | 1 | 3 | 3 | 0.000 | C61684 | C81684 |
| 1/2 | .5000 | 1/2 | 1 | 3 | 3 | 0.030 | C61685 | C81685 |
| 1/2 | .5000 | 1/2 | 1 | 3 | 3 | 0.060 | C61686 | C81686 |
| 1/2 | .5000 | 1/2 | 1 | 3 | 3 | 0.090 | C61687 | C81687 |
| 9/16 | .5625 | 9/16 | 1-1/4 | 3 1/2 | 3 | 0.000 | C61688 | C81688 |
| 5/8 | .6250 | 5/8 | 1-1/4 | 3 1/2 | 3 | 0.000 | C61689 | C81689 |
| 5/8 | .6250 | 5/8 | 1-1/4 | 3 1/2 | 3 | 0.030 | C61690 | C81690 |
| 5/8 | .6250 | 5/8 | 1-1/4 | 3 1/2 | 3 | 0.060 | C61691 | C81691 |
| 5/8 | .6250 | 5/8 | 1-1/4 | 3 1/2 | 3 | 0.090 | C61692 | C81692 |
| 3/4 | .7500 | 3/4 | 1-1/2 | 4 | 3 | 0.000 | C61693 | C81693 |
| 3/4 | .7500 | 3/4 | 1-1/2 | 4 | 3 | 0.030 | C61694 | C81694 |
| 3/4 | .7500 | 3/4 | 1-1/2 | 4 | 3 | 0.060 | C61695 | C81695 |
| 3/4 | .7500 | 3/4 | 1-1/2 | 4 | 3 | 0.090 | C61696 | C81696 |
| 7/8 | .8750 | 7/8 | 1-1/2 | 4 | 3 | 0.000 | C61697 | C81697 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 3 | 0.000 | C61698 | C81698 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 3 | 0.030 | C61699 | C81699 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 3 | 0.060 | C61700 | C81700 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 3 | 0.090 | C61701 | C81701 |

Carbide
Center Cutting

| Material Reference | Steel (HRc) | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) | |
|--------------------|-------------|-------|-----------------|------------|-------------|-----------------|------------|--------------------------|---------------|------------------------------|----------------------|----------|
| | Low Carbon | | Alloy | Austenitic | Martensitic | PH | Gray | | Nodular | Ni, Co, Fe Based Super Alloy | | Titanium |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | | | | >45 |
| Bright | ★ | | ★ | | | | | ★ | ★ | ★ | | |
| TiAIN | ★ | | ★ | | ★ | ★ | | ★ | ★ | | | |

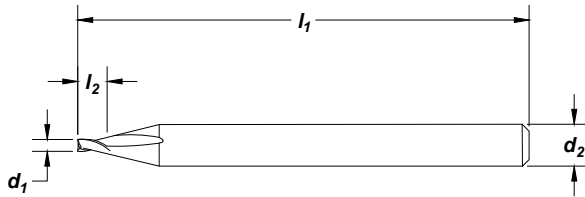
★ = Best Performance ★ = Acceptable



Note
General purpose applications.
30° right hand spiral-right hand cut
Diameter tolerance: ± 0.0005 "



Surface Treatment



| cutting diameter d₁ | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | description | order number | |
|--|--|--|---|------------------|-------------------------|--------------------------|
| | | | | | CMCE-4 Bright | CMCE-4AL AlCrN |
| 0.0100 | 1/8 | 0.0300 | 1-1/2 | 0.0100x1/8x1-1/2 | C76057 | — |
| 0.0110 | 1/8 | 0.0330 | 1-1/2 | 0.0110x1/8x1-1/2 | C76058 | — |
| 0.0120 | 1/8 | 0.0360 | 1-1/2 | 0.0120x1/8x1-1/2 | C76059 | — |
| 0.0130 | 1/8 | 0.0390 | 1-1/2 | 0.0130x1/8x1-1/2 | C76060 | — |
| 0.0140 | 1/8 | 0.0420 | 1-1/2 | 0.0140x1/8x1-1/2 | C76061 | — |
| 0.0150 | 1/8 | 0.0450 | 1-1/2 | 0.0150x1/8x1-1/2 | C76062 | — |
| 0.0200 | 1/8 | 0.0600 | 1-1/2 | 0.0200x1/8x1-1/2 | C76063 | — |
| 0.0250 | 1/8 | 0.0750 | 1-1/2 | 0.0250x1/8x1-1/2 | C76064 | — |
| 0.0260 | 1/8 | 0.0780 | 1-1/2 | 0.0260x1/8x1-1/2 | C76065 | — |
| 0.0300 | 1/8 | 0.0900 | 1-1/2 | 0.0300x1/8x1-1/2 | C76066 | — |
| 0.0312 | 1/8 | 0.0930 | 1-1/2 | 0.0312x1/8x1-1/2 | C76067 | C76235 |
| 0.0330 | 1/8 | 0.0990 | 1-1/2 | 0.0330x1/8x1-1/2 | C76068 | C76236 |
| 0.0350 | 1/8 | 0.1050 | 1-1/2 | 0.0350x1/8x1-1/2 | C76069 | C76237 |
| 0.0400 | 1/8 | 0.1200 | 1-1/2 | 0.0400x1/8x1-1/2 | C76070 | C76238 |
| 0.0450 | 1/8 | 0.1350 | 1-1/2 | 0.0450x1/8x1-1/2 | C76071 | C76239 |
| 0.0470 | 1/8 | 0.1410 | 1-1/2 | 0.0470x1/8x1-1/2 | C76072 | C76240 |
| 0.0500 | 1/8 | 0.1500 | 1-1/2 | 0.0500x1/8x1-1/2 | C76073 | C76241 |
| 0.0550 | 1/8 | 0.1650 | 1-1/2 | 0.0550x1/8x1-1/2 | C76074 | C76242 |
| 0.0600 | 1/8 | 0.180 | 1-1/2 | 0.0600x1/8x1-1/2 | C76075 | C76243 |
| 0.0625 | 1/8 | 0.1875 | 1-1/2 | 0.0625x1/8x1-1/2 | C76076 | C76244 |
| 0.0640 | 1/8 | 0.1920 | 1-1/2 | 0.0640x1/8x1-1/2 | C76077 | C76245 |
| 0.0650 | 1/8 | 0.1950 | 1-1/2 | 0.0650x1/8x1-1/2 | C76078 | C76246 |
| 0.0700 | 1/8 | 0.2100 | 1-1/2 | 0.0700x1/8x1-1/2 | C76079 | C76247 |
| 0.0750 | 1/8 | 0.2250 | 1-1/2 | 0.0750x1/8x1-1/2 | C76080 | C76248 |
| 0.0780 | 1/8 | 0.2343 | 1-1/2 | 0.0780x1/8x1-1/2 | C76081 | C76249 |
| 0.0800 | 1/8 | 0.2400 | 1-1/2 | 0.0800x1/8x1-1/2 | C76082 | C76250 |
| 0.0850 | 1/8 | 0.2550 | 1-1/2 | 0.0850x1/8x1-1/2 | C76083 | C76251 |
| 0.0900 | 1/8 | 0.2700 | 1-1/2 | 0.0900x1/8x1-1/2 | C76084 | C76252 |
| 0.0938 | 1/8 | 0.2814 | 1-1/2 | 0.0938x1/8x1-1/2 | C76085 | C76253 |
| 0.0950 | 1/8 | 0.2850 | 1-1/2 | 0.0950x1/8x1-1/2 | C76086 | C76254 |
| 0.1000 | 1/8 | 0.3000 | 1-1/2 | 0.1000x1/8x1-1/2 | C76087 | C76255 |
| 0.1030 | 1/8 | 0.3090 | 1-1/2 | 0.1030x1/8x1-1/2 | C76088 | C76256 |
| 0.1200 | 1/8 | 0.3600 | 1-1/2 | 0.1200x1/8x1-1/2 | C76089 | C76257 |

continued on next page



**Miniature
Metric**

Style: CMCE-4 / CMCE-4AL (continued)

| cutting diameter | | shank diameter | length of cut | overall length | description | order number | |
|--------------------------------|------------------------|----------------|---------------|----------------|------------------|------------------|-------------------|
| d ₁ (mm) (in) | d ₂ (in) | | | | | CMCE-4 Bright | CMCE-4AL AlCrN |
| .5mm | 0.0197 | 1/8 | 0.0591 | 1-1/2 | .5mmx1/8x1-1/2 | C76090 | — |
| 1.0mm | 0.0394 | 1/8 | 0.1182 | 1-1/2 | 1.0mmx1/8x1-1/2 | C76091 | C76258 |
| 1.25mm | 0.0492 | 1/8 | 0.1476 | 1-1/2 | 1.25mmx1/8x1-1/2 | C76092 | C76259 |
| 1.5mm | 0.0591 | 1/8 | 0.1773 | 1-1/2 | 1.5mmx1/8x1-1/2 | C76093 | C76260 |
| 1.6mm | 0.0630 | 1/8 | 0.1890 | 1-1/2 | 1.6mmx1/8x1-1/2 | C76094 | C76261 |
| 1.8mm | 0.0709 | 1/8 | 0.2127 | 1-1/2 | 1.8mmx1/8x1-1/2 | C76095 | C76262 |
| 2.0mm | 0.0787 | 1/8 | 0.2361 | 1-1/2 | 2.0mmx1/8x1-1/2 | C76096 | C76263 |
| 2.2mm | 0.0866 | 1/8 | 0.2598 | 1-1/2 | 2.2mmx1/8x1-1/2 | C76097 | C76264 |
| 2.5mm | 0.0984 | 1/8 | 0.2952 | 1-1/2 | 2.5mmx1/8x1-1/2 | C76098 | C76265 |
| 2.8mm | 0.1102 | 1/8 | 0.3306 | 1-1/2 | 2.8mmx1/8x1-1/2 | C76099 | C76266 |
| 3.0mm | 0.1181 | 1/8 | 0.3543 | 1-1/2 | 3.0mmx1/8x1-1/2 | C76100 | C76267 |
| 3.5mm | 0.1378 | 3/16 | 0.1875 | 2 | 3.5mmx3/16x2 | C76101 | C76268 |
| 4.5mm | 0.1772 | 3/16 | 0.5316 | 2 | 4.5mmx3/16x2 | C76102 | C76269 |

Carbide

Center Cutting

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | ◆ | ◆ | | ◆ | ◆ | | | | |
| AlCrN | ★ | ◆ | ★ | ◆ | ★ | ★ | ◆ | ★ | ★ | ★ | ◆ | ◆ | |

★ = Best Performance ◆ = Acceptable

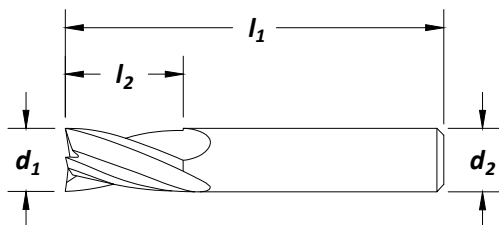


General Purpose

Style: **CEM-SE4**



Surface Treatment



| cutting diameter | | mm | shank diameter | length of cut | overall length | no. of flutes | corner radius | order number | |
|------------------|---------|------|----------------|---------------------|---------------------|---------------|---------------|--------------|--------|
| fractional | decimal | | d ₂ | l ₂ (in) | l ₁ (in) | | | CEM-SE4 | |
| | | | | | | | | bright | TiAlN |
| 1/32 | .0312 | | 1/8 | 1/16 | 1-1/2 | 4 | 0.000 | C61805 | C81805 |
| 1/32 | .0312 | | 1/8 | 1/8 | 1-1/2 | 4 | 0.000 | C61806 | C81806 |
| | .0394 | 1.00 | 3 | 3.0 | 38 | 4 | 0.000 | C98215 | C98240 |
| 3/64 | .0469 | | 1/8 | 1/8 | 1-1/2 | 4 | 0.000 | C61807 | C81807 |
| | .0591 | 1.50 | 3 | 5.0 | 38 | 4 | 0.000 | C98216 | C98241 |
| 1/16 | .0625 | | 1/8 | 1/8 | 1-1/2 | 4 | 0.000 | C61808 | C81808 |
| 1/16 | .0625 | | 1/8 | 3/16 | 1-1/2 | 4 | 0.000 | C61809 | C81809 |
| 1/16 | .0625 | | 1/8 | 1/4 | 1-1/2 | 4 | 0.010 | C61810 | C81810 |
| 5/64 | .0781 | | 1/8 | 1/4 | 1-1/2 | 4 | 0.000 | C61811 | C81811 |
| | .0788 | 2.00 | 3 | 6.0 | 38 | 4 | 0.000 | C98217 | C98242 |
| 3/32 | .0938 | | 1/8 | 3/16 | 1-1/2 | 4 | 0.000 | C61812 | C81812 |
| 3/32 | .0938 | | 1/8 | 3/8 | 1-1/2 | 4 | 0.000 | C61813 | C81813 |
| 3/32 | .0938 | | 1/8 | 3/8 | 1-1/2 | 4 | 0.010 | C61814 | C81814 |
| 3/32 | .0938 | | 1/8 | 3/8 | 1-1/2 | 4 | 0.020 | C61815 | C81815 |
| | .0985 | 2.50 | 3 | 7.0 | 38 | 4 | 0.000 | C98218 | C98243 |
| 7/64 | .1094 | | 1/8 | 1/4 | 1-1/2 | 4 | 0.000 | C61816 | C81816 |
| 7/64 | .1094 | | 1/8 | 3/8 | 1-1/2 | 4 | 0.000 | C61817 | C81817 |
| | .1182 | 3.00 | 3 | 12.0 | 38 | 4 | 0.000 | C98219 | C98244 |
| 1/8 | .1250 | | 1/8 | 1/4 | 1-1/2 | 4 | 0.000 | C61818 | C81818 |
| 1/8 | .1250 | | 1/8 | 1/2 | 1-1/2 | 4 | 0.000 | C61819 | C81819 |
| 1/8 | .1250 | | 1/8 | 1/2 | 1-1/2 | 4 | 0.010 | C61820 | C81820 |
| 1/8 | .1250 | | 1/8 | 1/2 | 1-1/2 | 4 | 0.015 | C61821 | C81821 |
| 1/8 | .1250 | | 1/8 | 1/2 | 1-1/2 | 4 | 0.020 | C61822 | C81822 |
| 1/8 | .1250 | | 1/8 | 3/4 | 2-1/4 | 4 | 0.000 | C61824 | C81824 |
| 1/8 | .1250 | | 1/8 | 1 | 3 | 4 | 0.000 | C61825 | C81825 |
| | .1378 | 3.50 | 4 | 12.0 | 50 | 4 | 0.000 | C98220 | C98245 |
| 9/64 | .1406 | | 3/16 | 9/16 | 2 | 4 | 0.000 | C61827 | C81827 |
| 5/32 | .1562 | | 3/16 | 5/16 | 2 | 4 | 0.000 | C61828 | C81828 |
| 5/32 | .1562 | | 3/16 | 9/16 | 2 | 4 | 0.000 | C61829 | C81829 |
| | .1575 | 4.00 | 4 | 14.0 | 50 | 4 | 0.000 | C98221 | C98246 |
| 11/64 | .1719 | | 3/16 | 5/8 | 2 | 4 | 0.000 | C61830 | C81830 |
| | .1772 | 4.50 | 5 | 14.0 | 50 | 4 | 0.000 | C98222 | C98247 |
| 3/16 | .1875 | | 3/16 | 5/16 | 2 | 4 | 0.000 | C61831 | C81831 |
| 3/16 | .1875 | | 3/16 | 5/8 | 2 | 4 | 0.000 | C61832 | C81832 |
| 3/16 | .1875 | | 3/16 | 5/8 | 2 | 4 | 0.010 | C61833 | C81833 |
| 3/16 | .1875 | | 3/16 | 5/8 | 2 | 4 | 0.015 | C61834 | C81834 |
| 3/16 | .1875 | | 3/16 | 5/8 | 2 | 4 | 0.020 | C61835 | C81835 |
| 3/16 | .1875 | | 3/16 | 5/8 | 2 | 4 | 0.030 | C61836 | C81836 |
| 3/16 | .1875 | | 3/16 | 3/4 | 2-1/2 | 4 | 0.000 | C61837 | C81837 |
| 3/16 | .1875 | | 3/16 | 1 | 3 | 4 | 0.000 | C61838 | C81838 |
| 3/16 | .1875 | | 3/16 | 1 | 3 | 4 | 0.045 | C61839 | C81839 |
| 3/16 | .1875 | | 3/16 | 1-1/8 | 3 | 4 | 0.000 | C61840 | C81840 |
| 3/16 | .1875 | | 3/16 | 1 | 4 | 4 | 0.000 | C61841 | C81841 |
| 3/16 | .1875 | | 3/16 | 1 | 4 | 4 | 0.045 | C61842 | C81842 |
| | .1969 | 5.00 | 5 | 16.0 | 50 | 4 | 0.000 | C98223 | C98248 |
| 13/64 | .2031 | | 1/4 | 5/8 | 2-1/2 | 4 | 0.000 | C61843 | C81843 |
| | .2166 | 5.50 | 6 | 16.0 | 50 | 4 | 0.000 | C98224 | C98249 |

Carbide

Center Cutting

continued on next page



Style: **CEM-SE4** (continued)

General Purpose

| | cutting diameter | | | shank diameter | length of cut | overall length | no. of flutes | corner radius | order number | |
|-------|------------------|---------|----|----------------|---------------|----------------|---------------|---------------|----------------|--------|
| | fractional | decimal | mm | | | | | | CEM-SE4 | |
| | d_1 | | | d_2 | l_2 (in) | l_1 (in) | | | bright | TiAlN |
| 7/32 | .2188 | | | 1/4 | 5/8 | 2-1/2 | 4 | 0.000 | C61844 | C81844 |
| 15/64 | .2344 | | | 1/4 | 3/4 | 2-1/2 | 4 | 0.000 | C61845 | C81845 |
| | .2363 | 6.00 | | 6 | 19.0 | 50 | 4 | 0.000 | C98225 | C98250 |
| 1/4 | .2500 | | | 1/4 | 1/2 | 2 | 4 | 0.000 | C61846 | C81846 |
| 1/4 | .2500 | | | 1/4 | 3/4 | 2-1/2 | 4 | 0.000 | C61847 | C81847 |
| 1/4 | .2500 | | | 1/4 | 3/4 | 2-1/2 | 4 | 0.010 | C61848 | C81848 |
| 1/4 | .2500 | | | 1/4 | 3/4 | 2-1/2 | 4 | 0.015 | C61849 | C81849 |
| 1/4 | .2500 | | | 1/4 | 3/4 | 2-1/2 | 4 | 0.020 | C61850 | C81850 |
| 1/4 | .2500 | | | 1/4 | 3/4 | 2-1/2 | 4 | 0.030 | C61851 | C81851 |
| 1/4 | .2500 | | | 1/4 | 3/4 | 2-1/2 | 4 | 0.045 | C61852 | C81852 |
| 1/4 | .2500 | | | 1/4 | 3/4 | 2-1/2 | 4 | 0.060 | C61853 | C81853 |
| 1/4 | .2500 | | | 1/4 | 1-1/8 | 3 | 4 | 0.000 | C61854 | C81854 |
| 1/4 | .2500 | | | 1/4 | 1-1/2 | 4 | 4 | 0.000 | C61855 | C81855 |
| 1/4 | .2500 | | | 1/4 | 1-1/2 | 6 | 4 | 0.000 | C61856 | C81856 |
| | .2560 | 6.50 | | 8 | 19.0 | 63 | 4 | 0.000 | C98226 | C98251 |
| 17/64 | .2656 | | | 5/16 | 7/8 | 2-1/2 | 4 | 0.000 | C61857 | C81857 |
| | .2756 | 7.00 | | 8 | 19.0 | 63 | 4 | 0.000 | C98227 | C98252 |
| 9/32 | .2812 | | | 5/16 | 7/8 | 2-1/2 | 4 | 0.000 | C61858 | C81858 |
| | .2953 | 7.50 | | 8 | 19.0 | 63 | 4 | 0.000 | C98228 | C98253 |
| 19/64 | .2969 | | | 5/16 | 7/8 | 2-1/2 | 4 | 0.000 | C61859 | C81859 |
| 5/16 | .3125 | | | 5/16 | 1/2 | 2 | 4 | 0.000 | C61860 | C81860 |
| 5/16 | .3125 | | | 5/16 | 7/8 | 2-1/2 | 4 | 0.000 | C61861 | C81861 |
| 5/16 | .3125 | | | 5/16 | 13/16 | 2-1/2 | 4 | 0.020 | C61862 | C81862 |
| 5/16 | .3125 | | | 5/16 | 13/16 | 2-1/2 | 4 | 0.030 | C61863 | C81863 |
| 5/16 | .3125 | | | 5/16 | 1 | 4 | 4 | 0.000 | C61864 | C81864 |
| 5/16 | .3125 | | | 5/16 | 1-1/8 | 3 | 4 | 0.000 | C61865 | C81865 |
| 5/16 | .3125 | | | 5/16 | 1-5/8 | 4 | 4 | 0.000 | C61866 | C81866 |
| | .3150 | 8.00 | | 8 | 19.0 | 63 | 4 | 0.000 | C98229 | C98254 |
| 21/64 | .3281 | | | 3/8 | 7/8 | 2-1/2 | 4 | 0.000 | C61867 | C81867 |
| 11/32 | .3438 | | | 3/8 | 7/8 | 2-1/2 | 4 | 0.000 | C61868 | C81868 |
| | .3544 | 9.00 | | 10 | 22.0 | 70 | 4 | 0.000 | C98230 | C98255 |
| 23/64 | .3594 | | | 3/8 | 7/8 | 2-1/2 | 4 | 0.000 | C61869 | C81869 |
| 3/8 | .3750 | | | 3/8 | 5/8 | 2 | 4 | 0.000 | C61870 | C81870 |
| 3/8 | .3750 | | | 3/8 | 1 | 2-1/2 | 4 | 0.000 | C61871 | C81871 |
| 3/8 | .3750 | | | 3/8 | 1 | 2-1/2 | 4 | 0.010 | C61872 | C81872 |
| 3/8 | .3750 | | | 3/8 | 1 | 2-1/2 | 4 | 0.015 | C61873 | C81873 |
| 3/8 | .3750 | | | 3/8 | 1 | 2-1/2 | 4 | 0.020 | C61874 | C81874 |
| 3/8 | .3750 | | | 3/8 | 1 | 2-1/2 | 4 | 0.030 | C61875 | C81875 |
| 3/8 | .3750 | | | 3/8 | 1 | 2-1/2 | 4 | 0.045 | C61876 | C81876 |
| 3/8 | .3750 | | | 3/8 | 1 | 2-1/2 | 4 | 0.060 | C61877 | C81877 |
| 3/8 | .3750 | | | 3/8 | 1 | 4 | 4 | 0.000 | C61879 | C81879 |
| 3/8 | .3750 | | | 3/8 | 1 | 4 | 4 | 0.020 | C61880 | C81880 |
| 3/8 | .3750 | | | 3/8 | 1-1/8 | 3 | 4 | 0.000 | C61878 | C81878 |
| 3/8 | .3750 | | | 3/8 | 1 3/4 | 4 | 4 | 0.000 | C61881 | C81881 |
| 3/8 | .3750 | | | 3/8 | 1-1/2 | 6 | 4 | 0.000 | C61882 | C81882 |
| 25/64 | .3906 | | | 7/16 | 7/8 | 2-1/2 | 4 | 0.000 | C61883 | C81883 |
| | .3938 | 10.00 | | 10 | 22.0 | 70 | 4 | 0.000 | C98231 | C98256 |
| 13/32 | .4062 | | | 7/16 | 7/8 | 2-1/2 | 4 | 0.000 | C61884 | C81884 |
| 27/64 | .4218 | | | 7/16 | 7/8 | 2-1/2 | 4 | 0.000 | C61885 | C81885 |

Carbide
Center Cutting

continued on next page

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ★ | | ★ | | | | | ★ | ★ | ★ | | | |
| TiAlN | ★ | | ★ | | ★ | ★ | | ★ | ★ | | | | |

★ = Best Performance ◆ = Acceptable



General Purpose

Style: CEM-SE4 (continued)

| cutting diameter | | shank diameter d ₂ | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | corner radius | order number | | |
|------------------|----------------|----------------------------------|--------------------------------------|---------------------------------------|---------------|---------------|--------------|--------|--------|
| d ₁ | d ₁ | | | | | | CEM-SE4 | | |
| fractional | decimal | mm | | | | | bright | TiAlN | |
| | .4331 | 11.00 | 11 | 25.0 | 70 | 4 | 0.000 | C98232 | C98257 |
| 7/16 | .4375 | | 7/16 | 5/8 | 2-1/2 | 4 | 0.000 | C61886 | C81886 |
| 7/16 | .4375 | | 7/16 | 1 | 2-1/2 | 4 | 0.000 | C61887 | C81887 |
| 7/16 | .4375 | | 7/16 | 2 | 4 | 4 | 0.000 | C61888 | C81888 |
| 7/16 | .4375 | | 7/16 | 3 | 6 | 4 | 0.000 | C61889 | C81889 |
| 29/64 | .4531 | | 1/2 | 1 | 3 | 4 | 0.000 | C61890 | C81890 |
| 15/32 | .4688 | | 1/2 | 1 | 3 | 4 | 0.000 | C61891 | C81891 |
| | .4725 | 12.00 | 12 | 25.0 | 75 | 4 | 0.000 | C98233 | C98258 |
| 31/64 | .4844 | | 1/2 | 1 | 3 | 4 | 0.000 | C61892 | C81892 |
| 1/2 | .5000 | | 1/2 | 5/8 | 2-1/2 | 4 | 0.000 | C61893 | C81893 |
| 1/2 | .5000 | | 1/2 | 1 | 3 | 4 | 0.000 | C61894 | C81894 |
| 1/2 | .5000 | | 1/2 | 1 | 3 | 4 | 0.015 | C61895 | C81895 |
| 1/2 | .5000 | | 1/2 | 1 | 3 | 4 | 0.020 | C61896 | C81896 |
| 1/2 | .5000 | | 1/2 | 1 | 3 | 4 | 0.030 | C61897 | C81897 |
| 1/2 | .5000 | | 1/2 | 1 | 3 | 4 | 0.045 | C61898 | C81898 |
| 1/2 | .5000 | | 1/2 | 1 | 3 | 4 | 0.060 | C61899 | C81899 |
| 1/2 | .5000 | | 1/2 | 1 | 3 | 4 | 0.090 | C61900 | C81900 |
| 1/2 | .5000 | | 1/2 | 1 | 3 | 4 | 0.125 | C61901 | C81901 |
| 1/2 | .5000 | | 1/2 | 2 | 4 | 4 | 0.000 | C61902 | C81902 |
| 1/2 | .5000 | | 1/2 | 3 | 6 | 4 | 0.000 | C61903 | C81903 |
| 1/2 | .5000 | | 1/2 | 1-1/2 | 6 | 4 | 0.000 | C61904 | C81904 |
| | .5512 | 14.00 | 14 | 30.0 | 88 | 4 | 0.000 | C98234 | C98259 |
| 9/16 | .5625 | | 9/16 | 1-1/4 | 3 1/2 | 4 | 0.000 | C61905 | C81905 |
| 5/8 | .6250 | | 5/8 | 3/4 | 3 | 4 | 0.000 | C61906 | C81906 |
| 5/8 | .6250 | | 5/8 | 1-1/4 | 3 1/2 | 4 | 0.000 | C61907 | C81907 |
| 5/8 | .6250 | | 5/8 | 1-1/4 | 3 1/2 | 4 | 0.030 | C61908 | C81908 |
| 5/8 | .6250 | | 5/8 | 1-1/4 | 3 1/2 | 4 | 0.060 | C61909 | C81909 |
| 5/8 | .6250 | | 5/8 | 1-1/4 | 3 1/2 | 4 | 0.090 | C61910 | C81910 |
| 5/8 | .6250 | | 5/8 | 2-1/4 | 5 | 4 | 0.000 | C61911 | C81911 |
| 5/8 | .6250 | | 5/8 | 3 | 6 | 4 | 0.000 | C61912 | C81912 |
| | .6300 | 16.00 | 16 | 32.0 | 88 | 4 | 0.000 | C98235 | C98260 |
| | .7087 | 18.00 | 18 | 36.0 | 100 | 4 | 0.000 | C98236 | C98261 |
| 3/4 | .7500 | | 3/4 | 1 | 3 | 4 | 0.000 | C61913 | C81913 |
| 3/4 | .7500 | | 3/4 | 1-1/2 | 4 | 4 | 0.000 | C61914 | C81914 |
| 3/4 | .7500 | | 3/4 | 1-1/2 | 4 | 4 | 0.030 | C61915 | C81915 |
| 3/4 | .7500 | | 3/4 | 1-1/2 | 4 | 4 | 0.060 | C61916 | C81916 |
| 3/4 | .7500 | | 3/4 | 1-1/2 | 4 | 4 | 0.090 | C61917 | C81917 |
| 3/4 | .7500 | | 3/4 | 2-1/4 | 5 | 4 | 0.000 | C61918 | C81918 |
| 3/4 | .7500 | | 3/4 | 3 | 6 | 4 | 0.000 | C61919 | C81919 |
| | .7875 | 20.00 | 20 | 38.0 | 100 | 4 | 0.000 | C98237 | C98262 |
| 7/8 | .8750 | | 7/8 | 1-1/2 | 4 | 4 | 0.000 | C61920 | C81920 |
| 7/8 | .8750 | | 7/8 | 2-1/4 | 5 | 4 | 0.000 | C61921 | C81921 |
| 7/8 | .8750 | | 7/8 | 3 | 6 | 4 | 0.000 | C61922 | C81922 |
| | .9843 | 25.00 | 25 | 38.0 | 100 | 4 | 0.000 | C98238 | C98263 |
| 1 | 1.0000 | | 1 | 1-1/2 | 4 | 4 | 0.000 | C61923 | C81923 |
| 1 | 1.0000 | | 1 | 1-1/2 | 4 | 4 | 0.030 | C61924 | C81924 |
| 1 | 1.0000 | | 1 | 1-1/2 | 4 | 4 | 0.060 | C61925 | C81925 |
| 1 | 1.0000 | | 1 | 1-1/2 | 4 | 4 | 0.090 | C61926 | C81926 |
| 1 | 1.0000 | | 1 | 2-1/4 | 5 | 4 | 0.000 | C61927 | C81927 |
| 1 | 1.0000 | | 1 | 3 | 6 | 4 | 0.000 | C61928 | C81928 |

Carbide

Center Cutting

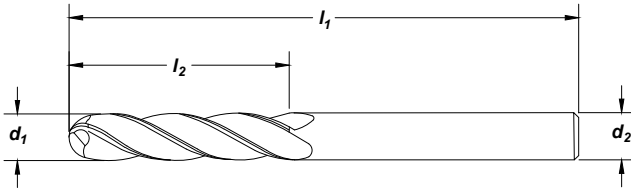
| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | | | | ◆ | ◆ | ☆ | | | |
| TiAlN | ☆ | | ☆ | | ◆ | ◆ | | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable

Style: **CEM-SE4B**

General Purpose

Solid Carbide
 4 Flute CC
 Helix 30°
 Ball End
 Surface Treatment: Bright TiAlN



| cutting diameter d₁ | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | no. of flutes | order number CEM-SE4B | |
|--|---------|--|--|---|---------------|---------------------------------|--------|
| fractional | decimal | | | | | bright | TiAlN |
| 1/32 | .0312 | 1/8 | 1/16 | 1-1/2 | 4 | C63509 | C83509 |
| 1/32 | .0312 | 1/8 | 1/8 | 1-1/2 | 4 | C63510 | C83510 |
| 1/32 | .0312 | 1/8 | 3/32 | 1-1/2 | 4 | C63511 | C83511 |
| 3/64 | .0469 | 1/8 | 1/8 | 1-1/2 | 4 | C63512 | C83512 |
| 1/16 | .0625 | 1/8 | 3/32 | 1-1/2 | 4 | C63508 | — |
| 1/16 | .0625 | 1/8 | 1/8 | 1-1/2 | 4 | C63513 | C83513 |
| 1/16 | .0625 | 1/8 | 3/16 | 1-1/2 | 4 | C63514 | C83514 |
| 5/64 | .0781 | 1/8 | 3/16 | 1-1/2 | 4 | C63515 | C83515 |
| 3/32 | .0938 | 1/8 | 3/8 | 1-1/2 | 4 | C63516 | C83516 |
| 3/32 | .0938 | 1/8 | 3/16 | 1-1/2 | 4 | C63517 | C83517 |
| 7/64 | .1094 | 1/8 | 3/8 | 1-1/2 | 4 | C63518 | C83518 |
| 1/8 | .1250 | 1/8 | 1/4 | 1-1/2 | 4 | C63519 | C83519 |
| 1/8 | .1250 | 1/8 | 1/2 | 1-1/2 | 4 | C63520 | C83520 |
| 1/8 | .1250 | 1/8 | 5/8 | 2 | 4 | C63521 | C83521 |
| 1/8 | .1250 | 1/8 | 3/4 | 2-1/4 | 4 | C63522 | C83522 |
| 1/8 | .1250 | 1/8 | 1 | 3 | 4 | C63523 | C83523 |
| 9/64 | .1406 | 3/16 | 9/16 | 2 | 4 | C63524 | C83524 |
| 5/32 | .1562 | 3/16 | 5/16 | 2 | 4 | C63525 | C83525 |
| 5/32 | .1562 | 3/16 | 9/16 | 2 | 4 | C63526 | C83526 |
| 11/64 | .1719 | 3/16 | 5/8 | 2 | 4 | C63527 | C83527 |
| 3/16 | .1875 | 3/16 | 5/16 | 2 | 4 | C63528 | C83528 |
| 3/16 | .1875 | 3/16 | 5/8 | 2 | 4 | C63529 | C83529 |
| 3/16 | .1875 | 3/16 | 3/4 | 2-1/2 | 4 | C63530 | C83530 |
| 3/16 | .1875 | 3/16 | 1-1/8 | 3 | 4 | C63531 | C83531 |
| 13/64 | .2031 | 1/4 | 5/8 | 2-1/2 | 4 | C63532 | C83532 |
| 7/32 | .2188 | 1/4 | 5/8 | 2-1/2 | 4 | C63533 | C83533 |
| 15/64 | .2344 | 1/4 | 3/4 | 2-1/2 | 4 | C63534 | C83534 |
| 1/4 | .2500 | 1/4 | 1/2 | 2 | 4 | C63535 | C83535 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 4 | C63536 | C83536 |
| 1/4 | .2500 | 1/4 | 1 | 4 | 4 | C63537 | C83537 |
| 1/4 | .2500 | 1/4 | 1-1/8 | 3 | 4 | C63538 | C83538 |
| 1/4 | .2500 | 1/4 | 1-1/2 | 4 | 4 | C63539 | C83539 |
| 1/4 | .2500 | 1/4 | 1-1/2 | 6 | 4 | C63540 | C83540 |

Carbide Center Cutting

continued on next page

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | PH | 18-22 | 22-32 | | | >45 | |
| Bright | ★ | | ★ | | | | | ★ | ★ | ★ | | | |
| TiAlN | ★ | | ★ | | ★ | ★ | | ★ | ★ | | | | |

★ = Best Performance ★ = Acceptable

General Purpose
Style: CEM-SE4B (continued)

| cutting diameter | | shank diameter d ₂ | length of cut l ₂ (in) | overall length l ₁ (in) | no. of flutes | order number | |
|------------------------------|---------|----------------------------------|--------------------------------------|---------------------------------------|---------------|--------------|--------|
| d ₁ fractional | decimal | | | | | CEM-SE4B | |
| | | | | | | bright | TiAlN |
| 17/64 | .2656 | 5/16 | 7/8 | 2-1/2 | 4 | C63541 | C83541 |
| 9/32 | .2812 | 5/16 | 7/8 | 2-1/2 | 4 | C63542 | C83542 |
| 5/16 | .3125 | 5/16 | 1/2 | 2 | 4 | C63543 | C83543 |
| 5/16 | .3125 | 5/16 | 7/8 | 2-1/2 | 4 | C63544 | C83544 |
| 5/16 | .3125 | 5/16 | 1-1/8 | 3 | 4 | C63545 | C83545 |
| 5/16 | .3125 | 5/16 | 1-5/8 | 4 | 4 | C63546 | C83546 |
| 23/64 | .3594 | 3/8 | 7/8 | 2-1/2 | 4 | C63547 | C83547 |
| 3/8 | .3750 | 3/8 | 5/8 | 2 | 4 | C63548 | C83548 |
| 3/8 | .3750 | 3/8 | 1 | 2-1/2 | 4 | C63549 | C83549 |
| 3/8 | .3750 | 3/8 | 1-1/8 | 3 | 4 | C63550 | C83550 |
| 3/8 | .3750 | 3/8 | 1-1/2 | 6 | 4 | C63551 | C83551 |
| 3/8 | .3750 | 3/8 | 1 3/4 | 4 | 4 | C63552 | C83552 |
| 25/64 | .3906 | 7/16 | 7/8 | 2-1/2 | 4 | C63553 | C83553 |
| 27/64 | .4219 | 7/16 | 7/8 | 2-1/2 | 4 | C63554 | C83554 |
| 7/16 | .4375 | 7/16 | 5/8 | 2-1/2 | 4 | C63555 | C83555 |
| 7/16 | .4375 | 7/16 | 1 | 2-1/2 | 4 | C63556 | C83556 |
| 7/16 | .4375 | 7/16 | 2 | 4 | 4 | C63557 | C83557 |
| 7/16 | .4375 | 7/16 | 3 | 6 | 4 | C63558 | C83558 |
| 31/64 | .4844 | 1/2 | 1 | 3 | 4 | C63559 | C83559 |
| 1/2 | .5000 | 1/2 | 5/8 | 2-1/2 | 4 | C63560 | C83560 |
| 1/2 | .5000 | 1/2 | 1 | 3 | 4 | C63561 | C83561 |
| 1/2 | .5000 | 1/2 | 2 | 4 | 4 | C63562 | C83562 |
| 1/2 | .5000 | 1/2 | 1-1/2 | 6 | 4 | C63563 | C83563 |
| 1/2 | .5000 | 1/2 | 3 | 6 | 4 | C63564 | C83564 |
| 9/16 | .5625 | 9/16 | 1-1/4 | 3 1/2 | 4 | C63565 | C83565 |
| 5/8 | .6250 | 5/8 | 3/4 | 3 | 4 | C63566 | C83566 |
| 5/8 | .6250 | 5/8 | 1-1/4 | 3 1/2 | 4 | C63567 | C83567 |
| 5/8 | .6250 | 5/8 | 2-1/4 | 5 | 4 | C63568 | C83568 |
| 5/8 | .6250 | 5/8 | 3 | 6 | 4 | C63569 | C83569 |
| 3/4 | .7500 | 3/4 | 1 | 3 | 4 | C63570 | C83570 |
| 3/4 | .7500 | 3/4 | 1-1/2 | 4 | 4 | C63571 | C83571 |
| 3/4 | .7500 | 3/4 | 2-1/4 | 5 | 4 | C63572 | C83572 |
| 3/4 | .7500 | 3/4 | 3 | 6 | 4 | C63573 | C83573 |
| 7/8 | .8750 | 7/8 | 1-1/2 | 4 | 4 | C63574 | C83574 |
| 7/8 | .8750 | 7/8 | 2-1/4 | 5 | 4 | C63575 | C83575 |
| 7/8 | .8750 | 7/8 | 3 | 6 | 4 | C63576 | C83576 |
| 1 | 1.0000 | 1 | 1-1/2 | 4 | 4 | C63577 | C83577 |
| 1 | 1.0000 | 1 | 2-1/4 | 5 | 4 | C63578 | C83578 |
| 1 | 1.0000 | 1 | 3 | 6 | 4 | C63579 | C83579 |

Carbide
Center Cutting

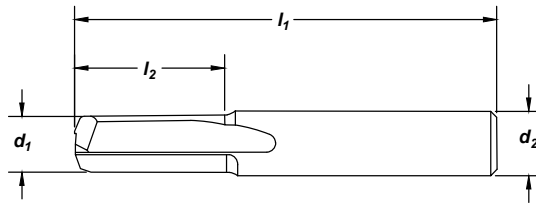
| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ◆ | | ◆ | | | | | ◆ | ◆ | ☆ | | | |
| TiAlN | ☆ | | ☆ | | ◆ | ◆ | | ☆ | ☆ | | | | |

☆ = Best Performance ◆ = Acceptable

Style: **CEM-SEST2**

Solid Carbide 2 Flute CC Straight Flute

Surface Treatment: Bright, TiAlN



| cutting diameter | | shank diameter | length of cut | overall length | no. of flutes | order number | |
|---------------------------|------------------------|----------------|---------------|----------------|---------------|----------------|----------------------|
| d ₁ fractional | d ₁ decimal | | | | | d ₂ | l ₂ (i n) |
| 1/16 | .0625 | 1/8 | 3/16 | 1-1/2 | 2 | C60649 | C80649 |
| 1/8 | .1250 | 1/8 | 1/2 | 1-1/2 | 2 | C60650 | C80650 |
| 3/16 | .1875 | 3/16 | 5/8 | 2 | 2 | C60651 | C80651 |
| 1/4 | .2500 | 1/4 | 3/4 | 2-1/2 | 2 | C60652 | C80652 |
| 5/16 | .3125 | 5/16 | 13/16 | 2-1/2 | 2 | C60653 | C80653 |
| 3/8 | .3750 | 3/8 | 7/8 | 2-1/2 | 2 | C60654 | C80654 |
| 1/2 | .5000 | 1/2 | 1 | 3 | 2 | C60655 | C80655 |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| Bright | ★ | | ★ | | | | | ★ | ★ | ☆ | | | |
| TiAlN | ☆ | | ☆ | | ★ | ★ | | ☆ | ☆ | | | | ★ |

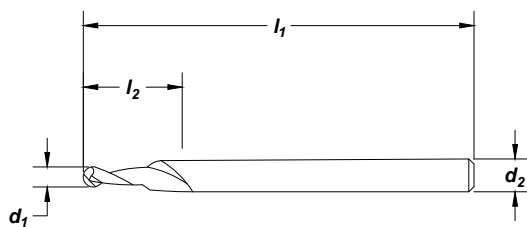
☆ = Best Performance ★ = Acceptable

Style: **CEM-EG2**

Engraving Tool

Solid Carbide 2 Flute CC Ball End

Surface Treatment: TiCN



| cutting diameter | | shank diameter | length of cut | overall length | no. of flutes | order number | |
|------------------------|-----------------------|----------------|---------------|----------------|---------------|----------------|---------------------|
| d ₁ decimal | d ₁ metric | | | | | d ₂ | l ₂ (in) |
| .021 | 0.53 | 1/8 | .040 | 1-1/2 | 2 | C70374 | |
| .025 | 0.64 | 1/8 | .040 | 1-1/2 | 2 | C70375 | |
| .030 | 0.76 | 1/8 | .040 | 1-1/2 | 2 | C70376 | |

| Material Reference | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|--------------------|-------------|-------|-------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| | Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | >45 |
| TiCN | ☆ | | ☆ | | | | | ☆ | ☆ | ☆ | | | |

☆ = Best Performance ★ = Acceptable

Carbide Center Cutting

**General Purpose
Chamfer Tool**
Styles: CEM-CH2 Single End CEM-CH2D Double End

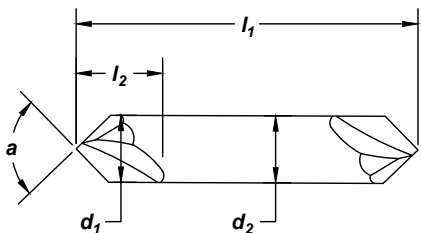
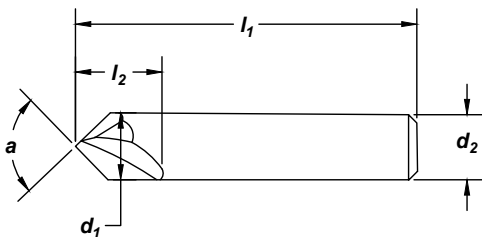
Note
60°, 82°, 90°, & 120° Point

Solid Carbide



Surface Treatment

Bright



| cutting diameter d₁ | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | profile angle (°) a | order number | |
|--|---------|--|--|---|-------------------------------|------------------------------|-------------------------------|
| fractional | decimal | d₂ | | | | CEM-CH2 single end | CEM-CH2D double end |
| 1/8 | .1250 | 1/8 | 1-1/2 | 2 | 60 | C61112 | - |
| 1/8 | .1250 | 1/8 | 1-1/2 | 2 | 82 | C61113 | - |
| 1/8 | .1250 | 1/8 | 1-1/2 | 2 | 90 | C61114 | C61226 |
| 3/16 | .1875 | 3/16 | 2 | 2 | 90 | C61115 | C61227 |
| 1/4 | .2500 | 1/4 | 2-1/2 | 2 | 60 | C61116 | - |
| 1/4 | .2500 | 1/4 | 2-1/2 | 2 | 82 | C61117 | - |
| 1/4 | .2500 | 1/4 | 2-1/2 | 2 | 90 | C61118 | C61228 |
| 3/8 | .3750 | 3/8 | 2-1/2 | 2 | 60 | C61119 | - |
| 3/8 | .3750 | 3/8 | 2-1/2 | 2 | 82 | C61120 | - |
| 3/8 | .3750 | 3/8 | 2-1/2 | 2 | 90 | C61121 | C61229 |
| 3/8 | .3750 | 3/8 | 2-1/2 | 2 | 120 | C61127 | - |
| 1/2 | .5000 | 1/2 | 3 | 2 | 60 | C61122 | - |
| 1/2 | .5000 | 1/2 | 3 | 2 | 82 | C61123 | - |
| 1/2 | .5000 | 1/2 | 3 | 2 | 90 | C61124 | C61230 |
| 1/2 | .5000 | 1/2 | 3 | 2 | 120 | C61125 | - |
| 3/4 | .7500 | 3/4 | 4 | 2 | 90 | C61126 | C61231 |

Carbide
Center Cutting

| Material Reference | Steel (HRC) | | | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-----|-------|------|-----------------|-------------|----|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Bright | ☆ | ◆ | ☆ | ◆ | | | | | | ◆ | | | |

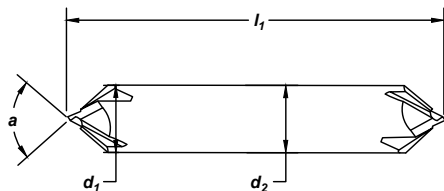
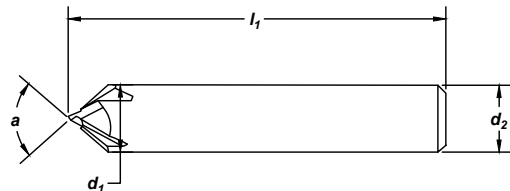
☆ = Best Performance ◆ = Acceptable

Styles: **CEM-CH4** Single End **CEM-CH4D** Double End

Note
60°, 82°, 90°, & 120° Point



Surface Treatment **Bright**



| cutting diameter d₁ | | shank diameter d₂ | length of cut l₂ (in) | overall length l₁ (in) | profile angle (°) a | order number | |
|--|---------|--|--|---|-------------------------------|------------------------------|-------------------------------|
| fractional | decimal | | | | | CEM-CH4 single end | CEM-CH4D double end |
| 1/4 | .2500 | 1/4 | 2-1/2 | 4 | 60 | C66219 | - |
| 1/4 | .2500 | 1/4 | 2-1/2 | 4 | 82 | C66220 | - |
| 1/4 | .2500 | 1/4 | 2-1/2 | 4 | 90 | C66221 | C60228 |
| 3/8 | .3750 | 3/8 | 2-1/2 | 4 | 60 | C66222 | - |
| 3/8 | .3750 | 3/8 | 2-1/2 | 4 | 82 | C66223 | - |
| 3/8 | .3750 | 3/8 | 2-1/2 | 4 | 90 | C66224 | C60229 |
| 3/8 | .3750 | 3/8 | 2-1/2 | 4 | 120 | C66218 | - |
| 1/2 | .5000 | 1/2 | 3 | 4 | 60 | C66225 | - |
| 1/2 | .5000 | 1/2 | 3 | 4 | 82 | C66226 | - |
| 1/2 | .5000 | 1/2 | 3 | 4 | 90 | C66227 | C60230 |
| 1/2 | .5000 | 1/2 | 3 | 4 | 120 | C66228 | - |
| 3/4 | .7500 | 3/4 | 4 | 4 | 90 | C66229 | C60231 |

Carbide

Center Cutting

| Material Reference | Steel (HRC) | | Stainless Steel | | | Cast Iron (HRC) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRC) |
|--------------------|-------------|-------|-----------------|-------------|------------|-----------------|---------|--------------------------|------------------------------|----------|----------------------|
| | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | | | | >45 |
| Bright | ☆ | ◆ | ☆ | ◆ | | | | ◆ | ◆ | ◆ | ◆ |

☆ = Best Performance ◆ = Acceptable



Technical Information



Technical Information

| | | | |
|--|-----|---|-----|
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| End Mill Finishes and Their Applications | 326 | Operating Parameters, Variable Index | |
| Speeds and Feeds | 327 | Style CEM-V-4 (R and B), CEM-V2-5R | 333 |
| Operating Parameters, HSS and Cobalt | 329 | Style CEM-HPDE-5, CEM-EMS (-3 and -5) | 334 |
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| | | Style CEM-V3-7R | 336 |
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End Mill Nomenclature

An end mill is a straight or tapered shank milling cutter which extends or projects, unobstructed, from the milling machine spindle. It is one of the most versatile of cutting tools, capable of milling, drilling, reaming, planing, shaping, contour cutting, and more. Improvements in cutting efficiency, through both design and material changes, have increased the usage of this style tool over time.

Axial Relief

The relief measured in the axial direction between a plane perpendicular to the axis at the cutting edge and the relieved surface.

Clearance (Secondary Relief)

The additional space provided behind the relieved land to eliminate undesirable contact between the mill and work piece.

Cutting Edge

The leading edge of the cutter tooth.

Flute

The chip space between the back of one tooth and the face of the following tooth.

Gash

Secondary cuts on a mill to provide chip room.

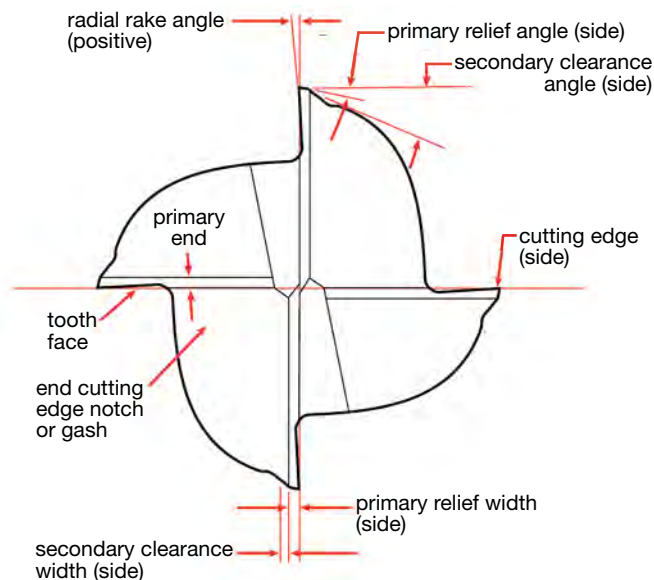
Hand of Cut

Right Hand, RH: When viewed from the cutting end of the mill, a counterclockwise rotation of the end mill is required in order to cut. Most end mills are right hand.

Left Hand, LH: When viewed from the cutting end of mill, a clockwise rotation of mill is required to cut.

Heel

The back edge of the relieved land.



TECHNICAL High Speed Steel



Helix Angle

The cutting edge angle which a helical cutting edge makes with a plane containing the axis of a cylindrical mill. When viewed from the cutter end of the mill, the flute will move clockwise for a right hand helix.

Helical Rake

The helical rake at a given point on the flute face is the angle between the tool axis and a tangent plane at the given point.

Hook

A concave condition of a tooth face. The rake of a hooked tooth face must be determined at a given point.

Land

Used to define the width of a specified surface.

Length of Cut

The effective axial length of the peripheral cutting edge which has been relieved to cut

Primary Relief

The relief measured in the axial direction between a plane perpendicular to the axis at the cutting edge and the relieved surface.

Primary Relief

The relief immediately behind the cutting edge.

Rake

The angular relationship between the tooth face or a tangent to the tooth face at a given point and a reference plane or line.

Radial Rake

The angle between the tooth face and a radial line passing through the cutting edge in a plane perpendicular to the cutting axis.

Relief

The result of the removal of tool material behind or adjacent to the cutting edge to provide clearance and prevent rubbing.

Relief Angle

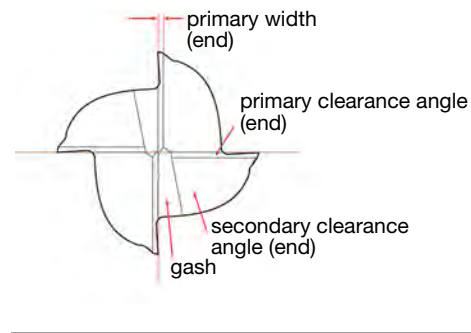
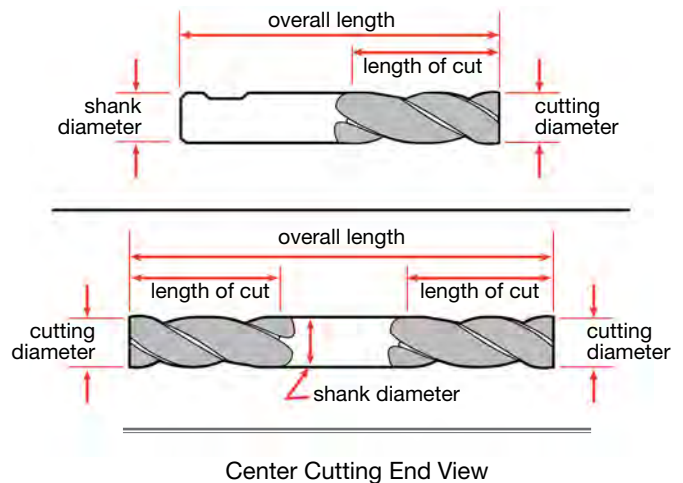
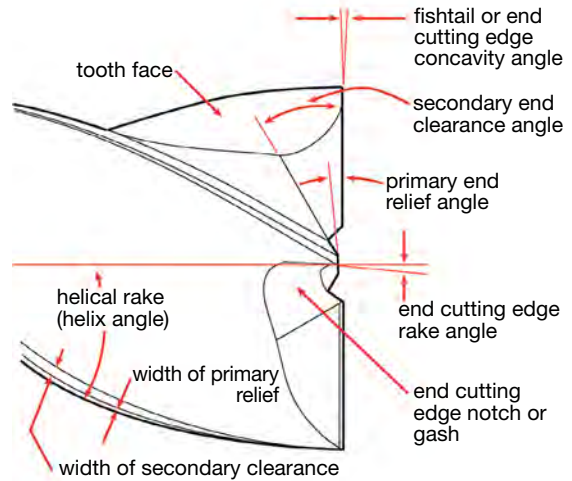
The angle formed between a relieved surface and a given plane tangent to the axis at the cutting edge or to a point on the cutting edge.

Shank

The projecting portion of a cutter which locates and drives the cutter from the machine spindle.

Tooth Face

The surface of the tooth on which the chip impinges.



TECHNICAL High Speed Steel

End Mill Finishes and Their Applications

Cleveland's cutting tools with TiN or TiCN coatings provide exceptional performance benefits. Coatings are matched with designs which are intended for aggressive material removal with significant increases in tool life and machining rates.

- Coatings reduce heat and abrasion to increase tool life.
 - The increased lubricity of the coating surface reduces material adhesion and built-up edge, enabling even higher feed rates.
 - Coatings reduce the amount of torque required for machining to allow more efficient use of equipment.
 - Increase machining speeds to achieve optimum performance when using Cleveland coatings.
- **Straw finish**
 - bronze color
 - for general machining
 - operate at conventional cobalt speeds and heavier feed rates.
 - **TiN (titanium nitride) coating**
 - gold color
 - intended for aggressive machining
 - increase machining speed 25% to 30% versus bright speeds
 - **TiCN (titanium carboni tride) coating**
 - blue-gray color
 - for very aggressive machining of stainless steels and non-ferrous materials
 - extremely hard, wear resistant
 - increase machining speeds 35% to 50% versus bright speeds
 - **TiAlN (titanium aluminum nitride) coating**
 - violet/blue-gray color
 - for aggressive machining of stainless steels, high alloy carbon steels, nickel-based high-temperature alloys, and titanium alloys
 - increase machining speeds 75% to 100% versus bright speeds.



TECH TIP

Reducing Vibration & Chatter: When chatter arises it tends to be self-sustaining until the problem is corrected. This condition causes poor finish on the part and will damage and significantly reduce the life of end mills. Carbide end mills are peculiarly susceptible to damage.

A common source of chatter is the machining of corners. As the end mills enters the corner the percentage of engagement increases the number of teeth in the cut. This drastically increases the cutting forces, causing chatter. Using circular interpolation and producing a bigger corner radius than the part print calls for and then going back and removing the remaining stock with a smaller end mill using circular interpolation will reduce the tendency to chatter.

When experiencing chatter problems, the basic reflex action is the reduction of cutting forces. This can be done by:

- (1) Reducing the number of flutes.
 - (2) Decreasing the chip load per tooth by reducing the feed or increasing the speed or RPM.
 - (3) Reducing the axial or radial depth of cut.
- Even though these steps can and will reduce chatter, slowing down the cutting process is not always the best course of action and reducing the chip load can be detrimental to the cutter.

Better first steps are to improve rigidity and stability:

- (1) Use a larger end mill with a larger core diameter.
- (2) Use end mills with reduced clearance or a small circular margin.
- (3) Use the shortest overhang from spindle nose to tip of tool.
- (4) Use stub length end mills where possible.
- (5) Use balanced tool holders.
- (6) Rework fixture to hold the work piece more securely.
- (7) Reprogram the cutter path shifting cutting forces into stiffer portions of the work piece.
- (8) Look for sweet spots in spindle speeds then adjust feed accordingly.

Speeds and Feeds

Speeds and feeds are the most important factors to consider for best results in milling. Improper feeds and speeds often cause low production, poor work quality, and unnecessary damage to the cutter. Too high a speed or too light a feed leads to rapid wear and dulling of the cutter, reducing tool life.

In milling, **speed** is measured in peripheral feet per minute. Oftentimes, speed is referred to as cutting speed, surface speed, or peripheral speed. The relationship of peripheral speed to the diameter of the end mill and the rotational speed of the machine spindle are indicated in the table on page 201.

Feed is normally measured and stated in inches per minute (IPM). It is, as shown on page 201, the product of the number of cutting teeth in the end mill x the feed per tooth x the revolutions per minute. In establishing operating conditions, all feed rates should be calculated from the chip load or feed per tooth. The individual cutting tooth must be able to sustain the load or feed applied to it without fracturing, regardless of the number of teeth in the mill. Because feed per tooth affects thickness, it is a very important factor in tool life.

The highest possible feed per tooth will usually give longer tool life between grinds and greater production per grind. Excessive feeds may overload the mill teeth and cause breakage or chipping of the cutting edge. Reasonable safe starting feeds for end mills under 0.5000" diameter will range from 0.0002 to 0.002 inches per tooth. For end mills equal to or greater than 0.5000" diameter, starting feeds will range from 0.002 to 0.003 inches per tooth.

Milling Corrective Actions

| Trouble | Corrective Action |
|--------------------------------|--|
| lack of rigidity | increase speed, decrease feed |
| excessive abrasion of the tool | decrease speed, increase feed |
| chipping of the cutting edge | decrease feed per tooth |
| burning of the cutting edge | decrease speed |
| chatter | use other combinations of speed and feed |

Starting Points

All recommended speeds and feeds are suggested starting points. These may be increased or decreased depending upon variables, such as finish desired, condition of the milling machine, magnitude of the cut, rigidity of the part, use of coolant, power available, etc. Consider these points when choosing starting speeds and feeds.

Adjusting Starting Speeds and Feeds

Speed Adjustments

| Use lower speeds for: | Use higher speeds for: |
|------------------------------|-------------------------------|
| hard materials | softer materials |
| tough materials | better finishes |
| abrasive materials | small diameter mills |
| heavy cuts | light cuts |
| minimum tool wear | frail work piece or set-ups |
| maximum mill life | maximum production rates |
| | non metallic |

Feed Adjustments

| Use higher feeds for: | Use lighter feeds for: |
|---------------------------------|--------------------------------|
| heavy roughing cuts | light and finishing cuts |
| rigid set-ups | frail set-ups |
| easy to machine work materials | hard to machine work materials |
| rugged heavy duty mills | deep slots |
| high tensile strength materials | frail and small diameter mills |
| coarse tooth mills | low tensile strength materials |
| abrasive materials | |

Technical Information

| To Find... | Known Values | Formulae |
|--------------------------------|--|---|
| peripheral cutting speed – SFM | mill diameter, D rotational speed RPM | $SFM = 0.262 \times RPM \times D$ $SFM \text{ estimated} = (RPM \times D) / 4$ |
| rotational speed – RPM | peripheral cutting speed, SFM mill diameter, D | $RPM = SFM / (0.262 \times D)$ $RPM \text{ estimated} = (4 \times SFM) / D$ |
| machine feed rate - IPM | rotational speed, RPM number of flutes (Teeth), T feed per tooth, IPT | $IPM = T \times IPT \times RPM$ |
| feed per tooth - IPT | machine feed rate, IPM rotational speed, RPM number of teeth, T | $IPT = IPM / (RPM \times T)$ |
| feed per revolution - IPR | machine feed rate, IPM | $IPR = IPM / RPM$ |
| cutting power input - HP | width of cut, WOC depth of cut, DOC machine feed rate, IPM workpiece material power constant, K | $HP = WOC \times DOC \times IPM \times K$ |

Power Constants* for Use in Power Calculations

| Work Material | K (Constant) | Work Material | K (Constant) | Work Material | K (Constant) |
|----------------|--------------|-------------------|--------------|-----------------------|--------------|
| Aluminum | .03 | High Temp. Alloys | | High Tensile Alloys | |
| Magnesium | .03 | Ferritic | .17 | 180,000 - 220,000 psi | .20 |
| Copper | .05 | Austenitic | .20 | 220,000 - 260,000 psi | .25 |
| Brass | .04 | Nickel Base | .25 | 260,000 - 300,000 psi | .33 |
| Bronze | .05 | Cobalt Base | .25 | Titanium | |
| Cast Irons | | Steel | | under 100,000 psi | .13 |
| Ferritic | .07 | up to 150 Brinell | .14 | 100,000 - 135,000 psi | .17 |
| Pearlitic | .10 | up to 300 Brinell | .17 | 135,000 psi & over | .25 |
| Chilled | .17 | up to 400 Brinell | .20 | Stainless Steel | |
| Malleable Iron | .10 | up to 500 Brinell | .25 | Free Machining | .10 |
| | | | | Others | .17 |

*Horsepower required to remove one cubic inch of material per minute assuming a 60% power efficiency at the spindle nose and a 25% allowance for dulling of the end mill.

Definition of Symbols and Measurement Units

| Attribute | Symbol | Measurement Unit |
|---------------------|--------|----------------------------------|
| cutting speed | SFM | surface feet per minute |
| rotational speed | RPM | revolutions per minute |
| end mill diameter | D | inches |
| feed per tooth | IPT | inches per tooth |
| machine feed rate | IPM | inches per minute |
| feed per revolution | IPR | inches per revolution |
| cutting power input | HP | horsepower |
| power constant | K | horsepower/cubic inch/ minute |
| width of cut | WOC | inches |
| depth of cut | DOC | inches |
| number of teeth | T | — |



Operating Parameters
HSS and Cobalt

Technical Information

Speed and Feed Data in Selected Materials – Regular HSS and Cobalt HSS End Mills

| Material | Heat-Resistant Cobalt Base Alloys, High Tensile Steels (50-55C) | Heat-Resistant Austenitic Alloys, High Tensile Steels (46-50C) | Heat-Resistant Nickel Base Alloys, High Strength Stainless Steels, High Strength Titanium Alloys | High Strength Stainless Steels, High Tensile Steels (40-46C) Medium Strength Titanium Alloys | Heat-Resistant Ferritic Base Alloys, Medium Strength Stainless Steels, Unalloyed Titanium Tool Steels (30-40C) |
|---------------------|---|--|--|--|--|
| End Mill Style | Cobalt HSS HSS 2 or more flute | Cobalt HSS HSS 2 or more flute | Cobalt HSS HSS 2 or more flute | Cobalt HSS HSS 2 or more flute | HSS 2 or more flute |
| Speed all diameters | 5-10 SFM | 10-15 SFM | 15-20 SFM | 20-40 SFM | 40-60 SFM (all diameters) |

| mill diameter | Speed | Feed | Speed | Feed | Speed | Feed | Speed | Feed | Speed | Feed |
|---------------|--------|---------------------|---------|---------------------|---------|---------------------|-----------|---------------------|-----------|---------------------|
| | RPM | Chip Load per tooth | RPM | Chip Load per tooth | RPM | Chip Load per tooth | RPM | Chip Load per tooth | RPM | Chip Load per tooth |
| 1/16 | * | * | * | * | * | * | 1222-2444 | .0002-.0005 | 2444-3667 | .0002-.0005 |
| 3/32 | * | * | * | * | 611-815 | .0002-.0005 | 815-1629 | .0002-.0005 | 1629-2750 | .0002-.0005 |
| 1/8 | * | * | * | * | 456-611 | .0002-.0005 | 611-1222 | .0002-.0005 | 1222-1833 | .0002-.0005 |
| 3/16 | * | * | 204-306 | .0002-.0005 | 306-407 | .0002-.0005 | 407-815 | .0002-.0005 | 815-1222 | .0002-.0005 |
| 1/4 | 76-153 | .0002-.0010 | 153-230 | .0002-.0010 | 229-306 | .0002-.0010 | 306-611 | .0002-.0010 | 611-917 | .0002-.0010 |
| 5/16 | 61-122 | .0002-.0010 | 122-183 | .0002-.0010 | 183-244 | .0002-.0010 | 244-489 | .0002-.0010 | 489-733 | .0002-.0010 |
| 3/8 | 51-102 | .0002-.0010 | 102-153 | .0002-.0010 | 153-203 | .0002-.0010 | 203-407 | .0005-.0020 | 407-611 | .0005-.0020 |
| 7/16 | 44-88 | .0005-.0010 | 88-132 | .0005-.0010 | 131-175 | .0005-.0020 | 175-349 | .0005-.0020 | 349-524 | .0005-.0020 |
| 1/2 | 38-76 | .0005-.0010 | 76-115 | .0005-.0010 | 115-153 | .0005-.0020 | 153-306 | .0005-.0030 | 306-458 | .0010-.0030 |
| 9/16 | 34-68 | .0005-.0020 | 68-104 | .0005-.0020 | 104-136 | .0005-.0020 | 136-272 | .0005-.0030 | 272-412 | .0010-.0030 |
| 3/8 | 31-61 | .0005-.0020 | 61-92 | .0005-.0020 | 92-122 | .0005-.0020 | 122-244 | .0010-.0040 | 244-367 | .0010-.0040 |
| 11/16 | 28-56 | .0005-.0020 | 56-84 | .0005-.0020 | 84-111 | .0005-.0020 | 111-222 | .0010-.0040 | 222-337 | .0010-.0040 |
| 3/4 | 26-51 | .0005-.0020 | 51-76 | .0005-.0020 | 76-102 | .0010-.0040 | 102-203 | .0010-.0040 | 203-306 | .0010-.0040 |
| 13/16 | 24-47 | .0010-.0030 | 47-71 | .0010-.0030 | 71-94 | .0010-.0040 | 94-189 | .0010-.0040 | 189-284 | .0010-.0040 |
| 7/8 | 22-44 | .0010-.0030 | 44-65 | .0010-.0030 | 65-87 | .0010-.0040 | 87-175 | .0010-.0040 | 175-262 | .0020-.0060 |
| 15/16 | 20-40 | .0010-.0030 | 40-62 | .0010-.0030 | 62-81 | .0010-.0040 | 81-163 | .0010-.0040 | 163-246 | .0020-.0060 |
| 1 | 19-38 | .0010-.0030 | 38-58 | .0010-.0030 | 58-76 | .0010-.0040 | 76-153 | .0020-.0060 | 153-229 | .0020-.0060 |
| 1-1/8 | 34 | .0015-.0040 | 34-51 | .0015-.0040 | 51-68 | .0015-.0050 | 68-136 | .0020-.0060 | 136-204 | .0020-.0060 |
| 1-1/4 | 31 | .0015-.0040 | 31-46 | .0015-.0040 | 46-61 | .0015-.0050 | 61-122 | .0020-.0060 | 122-183 | .0020-.0060 |
| 1-3/8 | 28 | .0015-.0040 | 28-42 | .0015-.0040 | 42-55 | .0015-.0050 | 55-111 | .0020-.0060 | 111-167 | .0030 + |
| 1-1/2 | 26 | .0015-.0040 | 26-38 | .0015-.0040 | 38-51 | .0020 + | 51-102 | .0030 + | 102-153 | .0030 + |
| 1-5/8 | 24 | .0020 + | 35 | .0020 + | 35-47 | .0020 + | 47-94 | .0030 + | 94-141 | .0030 + |
| 1-3/4 | 22 | .0020 + | 32 | .0020 + | 32-43 | .0020 + | 43-87 | .0030 + | 87-131 | .0030 + |
| 1-7/8 | 20 | .0020 + | 30 | .0020 + | 30-40 | .0030 + | 40-81 | .0030 + | 81-122 | .0030 + |
| 2 | 19 | .0020 + | 29 | .0030 + | 29-38 | .0030 + | 38-76 | .0030 + | 76-115 | .0030 + |
| 2-1/8 | 18 | .0030 + | 28 | .0030 + | 36 | .0030 + | 36-72 | .0030 + | 72-108 | .0030 + |
| 2-1/4 | 17 | .0030 + | 26 | .0030 + | 34 | .0030 + | 34-68 | .0030 + | 68-102 | .0030 + |
| 2-3/8 | 16 | .0030 + | 25 | .0030 + | 32 | .0030 + | 32-64 | .0030 + | 64-97 | .0030 + |
| 2-1/2 | 15 | .0030 + | 23 | .0030 + | 30 | .0030 + | 30-61 | .0030 + | 61-92 | .0030 + |
| 2-5/8 | 15 | .0030 + | 22 | .0030 + | 29 | .0030 + | 29-58 | .0030 + | 58-88 | .0030 + |
| 2-3/4 | 14 | .0030 + | 21 | .0030 + | 28 | .0030 + | 28-56 | .0030 + | 56-83 | .0030 + |
| 2-7/8 | 14 | .0030 + | 20 | .0030 + | 27 | .0030 + | 27-53 | .0030 + | 53-80 | .0030 + |
| 3 | 13 | .0030 + | 19 | .0030 + | 26 | .0030 + | 26-51 | .0030 + | 51-76 | .0030 + |

* For small diameter applications in materials harder than 46C consult Cleveland Technical Support.

TECHNICAL High Speed Steel and Cobalt



Operating Parameters
HSS and Cobalt
Technical Information
Speed and Feed Data in Selected Materials – Regular HSS and Cobalt HSS End Mills (continued)

| | | | | |
|--------------------------------------|---|---|---|---------------------------------|
| Material | Machine Steel Hard Brass & Bronze Electrolytic Copper Mild Steel Forming | Cast Iron Mild Steel Half-Hard Brass and Bronze | Brass and Bronze Alloyed Aluminum Abrasive Plastics | Aluminum Plastics Wood |
| End Mill Style | HSS 2 or more flute | HSS surface treatment helpful in cast iron 2 or more flute | High Helix HSS 1 to 6 flutes | High Helix HSS 1 to 6 flutes |
| Speed <i>all diameters</i> | 60-80 SFM | 80-100 SFM | 100-200 SFM | 200-600 SFM |

TECHNICAL

| mill diameter | Speed | | Feed | | Speed | | Feed | | Speed | | Feed | |
|---------------|-----------|---------------------|-----------|---------------------|------------|---------------------|------------|---------------------|-------|---------------------|------|---------------------|
| | RPM | Chip Load per tooth | RPM | Chip Load per tooth | RPM | Chip Load per tooth | RPM | Chip Load per tooth | RPM | Chip Load per tooth | RPM | Chip Load per tooth |
| 1/16 | 3667-4888 | .0002-.0005 | 4888-6111 | .0002-.0005 | 6111-12222 | .0002-.0005 | 12222 + | .0002-.0005 | | | | |
| 3/32 | 2750-3259 | .0002-.0005 | 3259-4073 | .0002-.0005 | 4073-8146 | .0002-.0005 | 8146 + | .0002-.0005 | | | | |
| 1/8 | 1833-2440 | .0002-.0010 | 2440-3056 | .0002-.0010 | 3056-6112 | .0002-.0010 | 6112 + | .0002-.0010 | | | | |
| 3/16 | 1222-1625 | .0002-.0010 | 1625-2037 | .0002-.0010 | 2037-4074 | .0002-.0010 | 4074-12222 | .0002-.0010 | | | | |
| 1/4 | 917-1222 | .0005-.0020 | 1222-1528 | .0005-.0020 | 1528-3056 | .0005-.0020 | 3056-9168 | .0005-.0020 | | | | |
| 5/16 | 733-978 | .0005-.0020 | 978-1222 | .0005-.0020 | 1222-2444 | .0005-.0020 | 2444-7332 | .0005-.0020 | | | | |
| 3/8 | 611-815 | .0010-.0030 | 815-1019 | .0010-.0030 | 1019-2038 | .0005-.0030 | 2038-6114 | .0005-.0020 | | | | |
| 7/16 | 524-698 | .0010-.0030 | 698-873 | .0010-.0030 | 873-1746 | .0005-.0030 | 1746-5238 | .0005-.0020 | | | | |
| 1/2 | 458-611 | .0010-.0030 | 611-764 | .0010-.0030 | 764-1528 | .0005-.0030 | 1528-4584 | .0005-.0020 | | | | |
| 9/16 | 412-543 | .0010-.0040 | 543-678 | .0010-.0040 | 678-1356 | .0005-.0040 | 1356-4071 | .0005-.0030 | | | | |
| 3/8 | 367-489 | .0010-.0040 | 489-611 | .0010-.0040 | 611-1222 | .0005-.0040 | 1222-3666 | .0005-.0030 | | | | |
| 11/16 | 337-444 | .0010-.0040 | 444-555 | .0010-.0040 | 555-1110 | .0005-.0040 | 1110-3330 | .0005-.0030 | | | | |
| 3/4 | 306-407 | .0010-.0040 | 407-509 | .0020-.0060 | 509-1018 | .0010-.0060 | 1018-3054 | .0010-.0040 | | | | |
| 13/16 | 284-379 | .0020-.0060 | 379-469 | .0020-.0060 | 469-938 | .0010-.0060 | 938-2814 | .0010-.0040 | | | | |
| 7/8 | 262-349 | .0020-.0060 | 349-436 | .0020-.0060 | 436-872 | .0010-.0060 | 872-2616 | .0010-.0040 | | | | |
| 15/16 | 246-326 | .0020-.0060 | 326-407 | .0020-.0060 | 407-814 | .0010-.0060 | 814-2442 | .0010-.0040 | | | | |
| 1 | 229-306 | .0020-.0060 | 306-382 | .0020-.0060 | 382-764 | .0020 + | 764-2292 | .0020 + | | | | |
| 1-1/8 | 204-272 | .0020-.0060 | 272-340 | .0030 + | 340-680 | .0020 + | 680-2040 | .0020 + | | | | |
| 1-1/4 | 183-244 | .0030 + | 244-306 | .0030 + | 306-612 | .0020 + | 612-1836 | .0020 + | | | | |
| 1-3/8 | 167-222 | .0030 + | 222-278 | .0030 + | 278-556 | .0020 + | 556-1668 | .0020 + | | | | |
| 1-1/2 | 153-204 | .0030 + | 204-255 | .0030 + | 255-510 | .0030 + | 510-1530 | .0020 + | | | | |
| 1-5/8 | 141-188 | .0030 + | 188-235 | .0030 + | 235-470 | .0030 + | 470-1410 | .0020 + | | | | |
| 1-3/4 | 131-175 | .0030 + | 175-218 | .0030 + | 218-436 | .0030 + | 436-1308 | .0020 + | | | | |
| 1-7/8 | 122-163 | .0030 + | 163-204 | .0030 + | 201-408 | .0030 + | 408-1224 | .0030 + | | | | |
| 2 | 115-153 | .0030 + | 153-191 | .0030 + | 191-382 | .0030 + | 382-1146 | .0030 + | | | | |
| 2-1/8 | 108-144 | .0030 + | 144-179 | .0030 + | 179-358 | .0030 + | 358-1074 | .0030 + | | | | |
| 2-1/4 | 102-136 | .0030 + | 136-170 | .0030 + | 170-340 | .0030 + | 340-1020 | .0030 + | | | | |
| 2-3/8 | 97-128 | .0030 + | 128-161 | .0030 + | 161-322 | .0030 + | 322-966 | .0030 + | | | | |
| 2-1/2 | 92-122 | .0030 + | 122-153 | .0030 + | 153-306 | .0030 + | 306-918 | .0030 + | | | | |
| 2-5/8 | 88-116 | .0030 + | 116-145 | .0030 + | 145-290 | .0030 + | 290-870 | .0030 + | | | | |
| 2-3/4 | 83-111 | .0030 + | 111-139 | .0030 + | 139-278 | .0030 + | 278-834 | .0030 + | | | | |
| 2-7/8 | 80-106 | .0030 + | 106-132 | .0030 + | 132-264 | .0030 + | 264-792 | .0030 + | | | | |
| 3 | 76-102 | .0030 + | 102-127 | .0030 + | 127-254 | .0030 + | 254-762 | .0030 + | | | | |



Technical Information

Speed and Feed Data in Selected Materials – PM Plus™ Powder Metal End Mills

| Material | Hardness BHN | Surface Feet per Minute SFM | | | | Chip Load Per Tooth by Cutting Diameter | | | |
|------------------------------|-----------------|-----------------------------|---------|---------|----------|---|-------|-------|-------|
| | | Bright | TiN | TiCN | TiAlN | 1/8" | 1/4" | 1/2" | 1" |
| Titanium | 300 | 60-75 | 75-94 | 90-113 | 120-150 | .0015 | .0025 | .0050 | .0070 |
| Annealed Alloys | 340 | 30-45 | 38-56 | 45-68 | 60-90 | .0010 | .0020 | .0040 | .0060 |
| Sol. Trtd. & Aged | 400 | 15-30 | 19-38 | 23-45 | 30-60 | .0007 | .0015 | .0020 | .0040 |
| High Temp. Alloys | 300 | 30-45 | 38-56 | 45-68 | 60-90 | .0020 | .0025 | .0040 | .0060 |
| Inconel, Monel, Hastelloy | 400 | 10-24 | 13-30 | 15-36 | 20-48 | .0015 | .0020 | .0030 | .0050 |
| Tool Steels | 370 | 40-55 | 50-69 | 60-83 | 80-110 | .0005 | .0007 | .0012 | .0020 |
| Tool Steels | 450 | 20-30 | 25-38 | 30-45 | 40-60 | .0003 | .0005 | .0007 | .0010 |
| Free Machining Steel | 200 | 90-120 | 113-150 | 135-180 | 180-240 | .0010 | .0020 | .0040 | .0060 |
| Alloyed & UnAlloyed | 275 | 75-90 | 94-113 | 90-135 | 150-180 | .0007 | .0012 | .0030 | .0050 |
| Alloy Steels - Med. to Hard | 400 | 40-50 | 50-63 | 60-75 | 80-100 | .0010 | .0015 | .0020 | .0040 |
| Stainless Steel | | | | | | | | | |
| Work Hardening | Various | 55-75 | 69-94 | 83-113 | 110-150 | .0005 | .0007 | .0012 | .0020 |
| Precipitation Hardening | Various | 35-50 | 44-63 | 53-75 | 70-100 | .0005 | .0007 | .0012 | .0020 |
| Copper Alloys | | | | | | | | | |
| Long Chip | Various | 250-500 | 313-625 | 375-750 | 500-1000 | .0050 | .0025 | .0050 | .0080 |
| Short Chip | 250 | 180-240 | 225-300 | 270-360 | 360-480 | .0010 | .0020 | .0040 | .0060 |
| Aluminum, Soft Gummy | | 750 | 938 | 1125 | 1500 | .0020 | .0030 | .0060 | .0100 |
| Heat Treated Aluminum Alloys | Various | 1000 | 1250 | 1500 | 2000 | .0020 | .0030 | .0060 | .0100 |
| Aircraft Alloys | | | | | | | | | |

Speed and Feed Data in Selected Materials – PM Plus and Cobalt HSS Roughing End Mills

| | Surface Feet per Minute SFM | | | Chip Load Per Tooth by Cutting Diameter | | | |
|---------------------------------------|-----------------------------|----------|---|---|--------|-------|-------|
| | Bright | TiCN | TiAlN | 1/4" | 1/2" | 3/4" | 1" |
| Coarse Profile Cobalt Roughers | | | | | | | |
| Steel < 20 HRc | 98 | 230 | 262 | .0006 | .0022 | .0033 | .0039 |
| Steels 20-30 HRc | 82 | 180 | 197 | .0005 | .0019 | .0032 | .0039 |
| Cast iron | 82 | 180 | 197 | .0005 | .0019 | .0032 | .0039 |
| Fine Profile Cobalt Roughers | | | | | | | |
| Steel < 20 HRc | 96 | 230 | 295 | .0006 | .0021 | .0031 | .0043 |
| Steels 20-30 HRc | 82 | 131 | 246 | .0005 | .0019 | .0028 | .0038 |
| Steels 32-40 HRc | 49 | 131 | 147 | .0005 | .0016 | .0024 | .0031 |
| Stainless Steels | 33 | 82 | 115 | .0004 | .0016 | .0024 | .0031 |
| Titanium > 40 HRc | 33 | 82 | 82 | .0004 | .0016 | .0024 | .0031 |
| PM Roughers | | | | | | | |
| Steels < 32 HRc | 59 | 157 | 180 | .0005 | .0019 | .0032 | .0033 |
| Steels 32-42 HRc | 49 | 98 | 157 | .0006 | .0017 | .0029 | .0034 |
| Cast Iron < 180 HR | 59 | 157 | 180 | .0005 | .0019 | .0032 | .0033 |
| Cast Iron > 180 HR | 49 | 98 | 157 | .0006 | .0017 | .0029 | .0034 |
| Stainless Steels | 39 | 72 | 98 | .0005 | .0016 | .0028 | .0031 |
| Titanium > 40 HRc | 32 | 59 | 82 | .0004 | .0016 | .0028 | .0030 |
| High-Temp Alloys | 22 | 36 | 49 | .0006 | .0017 | .0029 | .0034 |
| | Surface Feet per Minute SFM | | Chip Load Per Tooth by Cutting Diameter | | | | |
| | Bright | TiCN | 1/8" | 1/4" | 1/2" | 1" | 2" |
| Aluminum, soft/gummy | 250-500 | 400-2500 | .005" | .007" | .010" | .012" | .015" |
| Aluminum alloys < 10% silicon | 250-750 | 500-3250 | .005" | .007" | .010" | .012" | .015" |
| Aluminum alloys > 10% silicon | N/R | N/R | N/R | N/R | N/R | N/R | N/R |
| Copper alloys, long chipping | 250-500 | 350-1500 | .005" | .007" | .009** | .012" | .015" |
| Copper alloys, short chipping | 150-250 | 200-1250 | .003" | .006" | .008" | .010" | .013" |

*for Style 538, .010" is recommended.

Note: All the speeds and feeds shown are suggested starting points. They may be increased or decreased, dependent upon such variables as finish desired, condition of milling machine, magnitude of cut, coolant, etc. In many cases they may be increased slightly. The above speeds and feeds are applicable for slotting cuts, one (1) diameter deep. For deeper slotting cuts or cavity applications, feeds should be decreased.



Choosing the correct tool material

Cleveland end mills are available in a variety of tool materials: regular high speed steel, premium cobalt high speed steel, and PM/Plus powder metal cobalt high speed steel for higher production rates. The choice of tool material will depend on the following factors:

- Machinability of the workpiece
- Hardness and structure of the workpiece
- Shape and conditions of the workpiece
- Number of work pieces to be processed.

High speed steel end mills have low initial cost and general purpose versatility. End mills of high speed steel with cobalt have proven most effective in titanium alloys, alloy steels, Rc-40-50, high strength stainless steels, and thermal and heat resistant materials such as nickel or cobalt base alloys. PM/Plus end mills which use a special cobalt high speed steel coupled with a heat treatment and special mechanical designs, are capable of greater than normal feed rates and longer tool life in these same material groups.

Consider the number of flutes

To determine selection of either a two flute or a multiple flute end mill, several basics need to be considered.

- Type of cut
- Chip space required
- Production rate desired
- Surface finish required

Two fluted end mills have greater chip handling capacity than multiple fluted end mills. In order for an end mill to axially plunge-cut (drill), it must be manufactured as a center cutting tool. All two flute and multiple flute tools are available as center cutting end mills.

When two flute end mills and multiple flute end mills are run at the same feed rate (inches per minute), multiple flute end mills may produce finer finishes and longer tool life than two flute end mills, owing to a lighter chip load per tooth. Some caution must be exercised to insure that the chip load does not become so light as to cause excessive wear. Generally for production runs where either a two flute or multiple flute end mill would be applicable, it is more economical to use the multiple flute end mill.

Roughing versus finishing end mills

Roughing end mills are designed to be used in a variety of materials and to remove more cubic inches of material in the same period of time than conventional end mills. In order to achieve these rates of material removal, as well as to obtain full tool life, the feed rates employed must be heavier than with conventional end mills.

Selection of cutting fluids

Coolants control the temperatures of the end mill and the work, and provide a lubricant between the end mill, the chip and the workpiece. The proper type and application of coolant will protect the end mill cutting edges from damage, prevent deformation of the work piece through overheating, and improve finish by allowing cool, clean chip formation and efficient chip disposal.

The theory that a copious flow of coolant (or even total immersion of the workpiece in the coolant) is the surest way to provide proper cooling and lubrication, is not necessarily true. Recent tests have shown that multiple streams or jets of coolant, directed at strategic locations of the end mill rotating in or against the work, have greater cooling effects than a slow-moving copious flow.

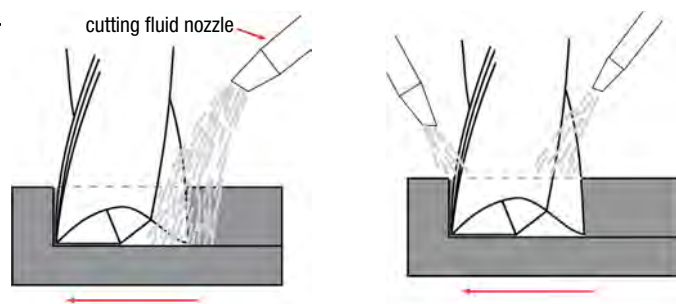
The optimum application of coolant is achieved by the use of coolant feeding end mills. These end mills are designed and manufactured to meet your specific need.

When using coolant, care should always be taken to insure that coolant lines are clean and free of obstructions, and that the coolant is both clean and free of fines.

No matter how well the cutting fluid is directed between the end mill and the work, a dull end mill will generate more heat than can be dissipated by adequate cooling. Proper cutting fluid application will protect a sharp cutting edge to insure maximum tool life per grind. An interrupted flow of cutting fluid can cause rapid damage to the cutting edges in a few revolutions of the end mill.

It is always wise to consult a cutting fluid supplier when experiencing problems of an unusual nature.

A cutting fluid or coolant is required when using high speed steel end mills for milling steel. For milling with high speed end mills, water emulsified cutting oil generally is considered the least expensive and most applicable coolant for nearly all materials except those that are milled dry. Some of the harder steel forgings and die steels may be milled with somewhat better results when mineral or lard oils, or sulfurized oils are used. Plastics and cast iron should be milled dry or with a jet of air, while aluminum and aluminum alloys are best milled with water emulsified cutting oil, either in a properly directed jet stream, or in a mist.



Technical Information
Operating Parameters
 Variable Index Style: **CEM-V-4***

*4R or 4B

Tolerances for Solid Carbide End Mills
Cutting Diameter: 1/32" through 1": +0.000 -0.002
Shank Diameter: h6

Formula: Regular and Stub Length

Side milling axial = 1.5 x D Side milling radial = 0.5 x D Slotting axial = 1 x D

| Material | Speed sfm | feed per tooth (inches) | | | | | | | | |
|---|--------------|-------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 5/32 | 3/16 | 1/4 | 5/16 | 3/8 | 1/2 | 5/8 | 3/4 | 1 |
| easy to cut stainless steel (303) | 340 | 0.0010 | 0.0012 | 0.0016 | 0.0020 | 0.0024 | 0.0026 | 0.0028 | 0.0028 | 0.0030 |
| moderately difficult to cut stainless (304) | 290 | 0.0008 | 0.0010 | 0.0014 | 0.0018 | 0.0020 | 0.0022 | 0.0024 | 0.0026 | 0.0028 |
| difficult to cut stainless steels (316L) | 240 | 0.0006 | 0.0010 | 0.0012 | 0.0016 | 0.0018 | 0.0020 | 0.0022 | 0.0024 | 0.0024 |
| soft steels (1020) | 600 | 0.0010 | 0.0012 | 0.0016 | 0.0024 | 0.0024 | 0.0028 | 0.0030 | 0.0031 | 0.0039 |
| titanium alpha beta alloys (Ti6Al4V) | 200 | 0.0005 | 0.0006 | 0.0008 | 0.0012 | 0.0012 | 0.0016 | 0.0018 | 0.0020 | 0.0028 |
| gray cast iron (GG) | 600 | 0.0010 | 0.0012 | 0.0016 | 0.0024 | 0.0024 | 0.0028 | 0.0030 | 0.0031 | 0.0039 |

Formula: Long Length

Side milling axial = 1.3 x D Side milling radial = 0.2 - 0.3 x D Slotting axial = 0.3 - 0.5 x D

| Material | Speed sfm | feed per tooth (inches) | | | | | | | | |
|---|--------------|-------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 5/32 | 3/16 | 1/4 | 5/16 | 3/8 | 1/2 | 5/8 | 3/4 | 1 |
| easy to cut stainless steel (303) | 340 | 0.0009 | 0.0011 | 0.0014 | 0.0018 | 0.0022 | 0.0023 | 0.0025 | 0.0025 | 0.0027 |
| moderately difficult to cut stainless (304) | 290 | 0.0007 | 0.0009 | 0.0013 | 0.0016 | 0.0018 | 0.0020 | 0.0022 | 0.0023 | 0.0025 |
| difficult to cut stainless steels (316L) | 240 | 0.0005 | 0.0009 | 0.0011 | 0.0014 | 0.0016 | 0.0018 | 0.0020 | 0.0022 | 0.0022 |
| soft steels (1020) | 600 | 0.0009 | 0.0011 | 0.0014 | 0.0022 | 0.0022 | 0.0025 | 0.0027 | 0.0028 | 0.0035 |
| titanium alpha beta alloys (Ti6Al4V) | 200 | 0.0005 | 0.0005 | 0.0007 | 0.0011 | 0.0011 | 0.0014 | 0.0016 | 0.0018 | 0.0025 |
| gray cast iron (GG) | 600 | 0.0009 | 0.0011 | 0.0014 | 0.0022 | 0.0022 | 0.0025 | 0.0027 | 0.0028 | 0.0035 |

Technical Information
Operating Parameters
 Variable Index Style: **CEM-V2-5R**
**ENHANCED
GEOMETRY**

 TECHNICAL
 Carbide

Formula:

Side milling axial = 1.5 x D Side milling radial = 0.5 x D Slotting axial = 1 x D

| Material | Speed sfm | chip load per tooth (inches) | | | | | | | |
|--|--------------|------------------------------|--------|--------|--------|--------|--------|--------|--------|
| | | 3/16 | 1/4 | 5/16 | 3/8 | 1/2 | 5/8 | 3/4 | 1 |
| medium and high carbon steels >0.3% C | 600-750 | 0.0015 | 0.0021 | 0.0023 | 0.0026 | 0.0028 | 0.0030 | 0.0031 | 0.0039 |
| alloy steels and tool steels <330HB, <35HRc | 600-700 | 0.0011 | 0.0017 | 0.0020 | 0.0023 | 0.0028 | 0.0030 | 0.0031 | 0.0039 |
| alloy steels and tool steels 340-450 HB, 36-48 HRc | 525-625 | 0.0010 | 0.0015 | 0.0016 | 0.0020 | 0.0028 | 0.0030 | 0.0031 | 0.0039 |
| austenitic stainless steel 302, 303, 304 | 350-445 | 0.0011 | 0.0017 | 0.0020 | 0.0023 | 0.0022 | 0.0024 | 0.0026 | 0.0028 |
| austenitic stainless steel 316, 316L | 225-315 | 0.0009 | 0.0013 | 0.0016 | 0.0019 | 0.0020 | 0.0024 | 0.0024 | 0.0024 |
| austenitic stainless steel duplex | 190-230 | 0.0008 | 0.0010 | 0.0014 | 0.0015 | 0.0020 | 0.0024 | 0.0024 | 0.0024 |
| cast iron, gray GG | 520-660 | 0.0014 | 0.0022 | 0.0025 | 0.0030 | 0.0028 | 0.0030 | 0.0031 | 0.0039 |
| ductile and maleable cast iron CGI < 80 KSI | 430-660 | 0.0009 | 0.0013 | 0.0018 | 0.0019 | 0.0028 | 0.0030 | 0.0031 | 0.0039 |
| nickel-based heat-resistant alloys | 100-160 | 0.0004 | 0.0007 | 0.0011 | 0.0015 | 0.0016 | 0.0019 | 0.0023 | 0.0028 |
| alpha-beta titanium alloys Ti6Al4V | 195-240 | 0.0008 | 0.0010 | 0.0014 | 0.0015 | 0.0016 | 0.0018 | 0.0020 | 0.0028 |

| Material | Hardness | | Speed | | Chip Load per Tooth | | |
|--|----------|--------|-------|------|---------------------|-------------|-----------|
| | Brinell | HRc | Range | SFM | 1/32" - 1/4" | 1/4" - 1/2" | 1/2" - 1" |
| low alloy steels | <220 HB | <19 | Low | 600 | .0005 | .0010 | .0020 |
| | | | High | 750 | .0010 | .0020 | .0030 |
| medium alloy steels 01 to 07, W1 to W3, M1 to M3, T1 to T5, A2 to A3, S1 to S7, P2 to P3 | 225-286 | 20-30 | Low | 600 | .0003 | .0005 | .0010 |
| | | | High | 750 | .0005 | .0010 | .0015 |
| high alloy steels M4 to M7, T6 to T15, D2 to D7, A4 to A7, P4 | 294-371 | 31-40 | Low | 525 | .0003 | .0005 | .0008 |
| | | | High | 625 | .0005 | .0010 | .0015 |
| stainless steels 200/300 series | 135-275 | <28 | Low | 250 | .0005 | .0010 | .0020 |
| | | | High | 350 | .0010 | .0020 | .0030 |
| stainless steels 400/500 series | 135-330 | <35 | Low | 340 | .0003 | .0008 | .0010 |
| | | | High | 400 | .0005 | .0010 | .0015 |
| nickel-based alloys | 140-475 | <32-50 | Low | 100 | .0005 | .0010 | .0015 |
| | | | High | 160 | .0010 | .0015 | .0040 |
| titanium alloys | 110-450 | <48 | Low | 195 | .0005 | .0010 | .0025 |
| | | | High | 240 | .0010 | .0030 | .0050 |
| inconel | 140-475 | <48 | Low | 100 | .0005 | .0010 | .0015 |
| | | | High | 160 | .0010 | .0015 | .0030 |
| aluminum, low silicon | — | — | Low | 800 | .0030 | .0040 | .0060 |
| | | | High | 1600 | .0040 | .0060 | .0080 |

Higher values for surface speed should be used for radial depths of cut less than 25% of the diameter. Lower values for surface speed should be used for radial depths of cut greater than 25% of the diameter. The above recommendations are for axial lengths of cut not to exceed 1 times the cutter diameter for profiling and .5 times the diameter for slotting. Recommended speeds above are for uncoated tools only and should be adjusted when using

coated tools. Generally, speeds can be increased by the following factors: TiCN-coated tools – 20-25% increase; TiAlN-coated tools – 40-50% increase. The above speeds are a recommended starting point only. If the tool is working well, without vibrations or significant noise, increase the SFM in 5-10% increments. Ultimate speeds will depend upon setup conditions. Higher or lower parameters may be required to achieve optimum conditions.

TECHNICAL

Stainless Steel / Exotic Material

Applications:

- Designed for cutting applications involving excessive mechanical stress.
- Ideally suited for use in stainless steel and exotics such as hastalloy, waspalloy, and inconel.
- 3 flute square end for pocketing, slotting, or roughing.
- 3 flute ball nose gives enhanced surface finish in contour cutting and rapid chip removal in plunge cutting.
- 5 flute design for profiling and finishing applications.

Features and Benefits:

- Maximized strength due to increased cross-sectional area in the core and flute body.
- Combination of micro grain carbide substrate with high-performance coatings.
- Achieve 50% greater chip loads and 20% to 40% higher speeds than conventional end mills.

Formula:

$$\text{RPM} = (\text{SFM} \times 3.82) / \text{tool diameter}$$

$$\text{IPM} = \text{number of flutes} \times \text{RPM} \times \text{chip load per tooth}$$

| Type of Cut | Aluminum Alloys 6061-T6, 7075-T6, 440, 356, 380, 61300 | Depth of Cut % of Tool diameter | Speed sfm | End Mills Diameter Chip Load per Tooth | | | | | |
|----------------------------------|--|---------------------------------------|-----------------|--|----------------|----------------|----------------|----------------|----------------|
| | | | | 1/4" | 3/8" | 1/2" | 5/8" | 3/4" | 1" |
| medium radial 1.0 x dia depth | < 32 HRC > 32 HRC | 30% x dia. radial | 1200 + 600 + | .0045 .0036 | .0071 .0057 | .0100 .0080 | .0123 .0098 | .0149 .0119 | .0200 .0160 |
| heavy radial 1.0 x dia depth | < 32 HRC | 50% x dia. radial | 1200 + | .0036 | .0057 | .0080 | .0098 | .0119 | .0160 |
| medium radial 2.0 x dia depth | < 32 HRC > 32 HRC | 30% x dia. radial | 1200 + 600+ | .0045 .0036 | .0071 .0057 | .0100 .0080 | .0123 .0098 | .0149 .0119 | .0200 .0160 |
| heavy radial 2.0 x dia depth | < 32 HRC | 50% x dia. radial | 1200 + | .0036 | .0057 | .0080 | .0098 | .0119 | .0160 |
| finishing medium radial | < 32 HRC > 32 HRC | < 25% of dia. | 1200 + 600 + | .0045 .0036 | .0071 .0057 | .0100 .0080 | .0123 .0098 | .0149 .0119 | .0200 .0160 |
| finishing light radial | < 32HRC | < 10% of dia. | 1200 + | .0045 | .0071 | .0100 | .0123 | .0149 | .0200 |
| finishing | < 32 HRC > 32 HRC | < .010 radial depth | 1200 + 600+ | .0054 .0045 | .0086 .0071 | .0120 .0100 | .0147 .0123 | .0178 .0149 | .0240 .0200 |

This chart represents starting points based on a coated tool. Reduce rates up to 50% when using an uncoated tool.

These speed and feed rates are suggested as general guidelines. Machine type, horsepower, spindle speed limitations, toolholding and workholding devices all may

impact a cutting tool's ability to perform properly. Greenfield Industries is not responsible for tool failure, part damage, or injury that may be caused by following these general recommendations.

Aluminum and nonferrous material

Applications:

- Delivers superior performance, providing increased tool life and improved part finish.
- Concentric margins stabilize the tool in the cut and reduce chatter at elevated speeds.
- Greater resistance to chipping with increased feed and speed rates over conventional carbide tools.
- Design incorporates rake enhancements in the flute for improved chip flow and higher feed rates at high and low spindle speeds.
- Tool design eliminates excess pressure that causes chip packing.

Features and Benefits:

- 2 flute square end offers excellent performance in roughing and finishing, in ramp cutting and in plunging.
- 2 flute ball nose designed for contouring aluminum, copper, and other non-ferrous materials.
- 3 flute square end gives superior surface finishes without sacrificing metal removal rates in high-speed slotting, profiling, and ramping.

Operating Parameters

 Style: **CEM-R***

*S or A

Technical Information

| <i>Material</i> | Hardness | | SFM | | | Chip Load per Tooth | |
|---|------------------------|------------------|------------|------------------------|-----------|--------------------------------|--------------------------------|
| | Brinell | HRc | Bright | TiCN | TiAlN | 1/4" to 1/2" | 1/2" - 1" |
| low and plain carbon, alloy, and tool steels | <220 HB | <19 | - | 325 - 500 | 430 - 575 | .0015 - .0030 | .0030 - .0045 |
| plain carbon, alloy and tool steels | 225 - 286 294 - 371 | 20 - 30 31-40 | - | 215 - 375 180 - 280 | 350 - 430 | .0015 - .0030 .0011 - .0021 | .0030 - .0045 .0021 - .0032 |
| austenitic stainless steels 200 and 300 series | 135 - 275 | <28 | - | 215 - 440 | 250 - 500 | .0010 - .0025 | .0025 - .0040 |
| ferritic, martensitic, 400/500 series and PH stainless steels | 135 - 330 | <35 | - | 190 - 375 | 225 - 430 | .0015 - .0030 | .0030 - .0045 |
| aluminum, low silicon and other non-ferrous alloys | 50 -150 | 600 | 2000 | 2400 - 2500 | - | .0020 - .0038 | .0038 - .0077 |
| aluminum, high silicon | | | 600 - 2000 | 720 - 2500 | - | .0018 - .0035 | .0035 - .0071 |

Operating Parameters

 Style: **CEM-V3-7R**

The new Cleveland CEM-V3-7R High Performance 7 Flute Variable Index End Mills were specifically designed to excel at HEM Trochoidal Milling. High Efficiency Milling (HEM) is a style of machining that features high axial depths of cut and low radial depths of cut. One common type of HEM is Trochoidal Milling. The modified cutting depths in Trochoidal Milling allow the CNC Machine to implement a spiral machining pattern that reduces tool load and wear in a part. This is accomplished by allowing the end mill to alternate between repeated short cutting times within a part and longer spiral rotations outside of the part. Trochoidal Milling uses a much smaller tool diameter than one would typically use in slotting applications. By implementing this smaller tool, a wider slot in the part is created, allowing additional space for the chips produced and the spiral tool path of the end mill.

The process of Trochoidal Milling developed as a result of the theory of chip thinning. This theory holds that tools have an ideal chip load that creates chips with the perfect size and width. To prevent chips from thinning in the cut outside of this ideal range, it is best to maintain a higher chip load in the milling operation to maintain this ideal chip thickness. This need to maintain a higher and ever changing chip load while milling a part requires that HEM Trochoidal Milling only be attempted on CNC Machines with Trochoidal Milling capabilities.

Benefits:

- Lower heat and cycle times for machining applications.
- Better end mill tool life and accuracy.
- The ability to use one tool for multiple applications and different slots.

Challenges:

Trochoidal Milling must be used on a CNC Machine capable of running the changing feed rates necessary in this process with software adept at generating HEM Tool Paths.

continued on next page



Technical Information

Operating Parameters
Style: **CEM-V3-7R Cont'd**

| Material | Peripheral/Roughing HEM | | Speed (SFM) | Feed (IPT) | | | | | | |
|---|-------------------------|------------|-------------|------------|-------|-------|-------|-------|-------|-------|
| | Axial DOC | Radial DOC | | 3/16 | 1/4 | 3/8 | 1/2 | 5/8 | 3/4 | 1 |
| Gray Cast Iron | ≤ 3 x D | .1 x D | 400 | 0.002 | 0.003 | 0.005 | 0.007 | 0.009 | 0.010 | 0.014 |
| | 3 x D - 4 x D | .08 x D | | 0.002 | 0.003 | 0.004 | 0.006 | 0.007 | 0.009 | 0.012 |
| Malleable Cast Iron | ≤ 3 x D | .08 x D | 400 | 0.002 | 0.002 | 0.004 | 0.005 | 0.007 | 0.008 | 0.011 |
| | 3 x D - 4 x D | | | 0.001 | 0.002 | 0.003 | 0.004 | 0.006 | 0.007 | 0.009 |
| Low Carbon Steels | ≤ 3 x D | .08 x D | 500 | 0.002 | 0.003 | 0.005 | 0.007 | 0.009 | 0.011 | 0.015 |
| | 3 x D - 4 x D | | 450 | 0.002 | 0.003 | 0.004 | 0.006 | 0.007 | 0.010 | 0.012 |
| Medium Carbon Steels | ≤ 3 x D | .08 x D | 450 | 0.002 | 0.003 | 0.005 | 0.007 | 0.008 | 0.010 | 0.014 |
| | 3 x D - 4 x D | | | 0.002 | 0.003 | 0.004 | 0.006 | 0.007 | 0.009 | 0.012 |
| Tool and Die Steels | ≤ 3 x D | .08 x D | 400 | 0.002 | 0.003 | 0.004 | 0.006 | 0.008 | 0.009 | 0.012 |
| | 3 x D - 4 x D | | | 0.002 | 0.002 | 0.004 | 0.005 | 0.006 | 0.008 | 0.01 |
| Austenitic Stainless Steels, FeNi Alloys, 300 Series Stainless Steels | ≤ 3 x D | .08 x D | 400 | 0.002 | 0.003 | 0.004 | 0.006 | 0.008 | 0.009 | 0.012 |
| | 3 x D - 4 x D | .07 x D | 450 | 0.002 | 0.002 | 0.004 | 0.005 | 0.006 | 0.008 | 0.01 |
| Martensitic and Ferritic Stainless Steels | ≤ 3 x D | .08 x D | 450 | 0.002 | 0.003 | 0.005 | 0.007 | 0.009 | 0.011 | 0.015 |
| | 3 x D - 4 x D | | | 0.002 | 0.003 | 0.004 | 0.006 | 0.007 | 0.009 | 0.012 |
| Precipitation Hardening Stainless Steels | ≤ 3 x D | .08 x D | 450 | 0.002 | 0.003 | 0.004 | 0.006 | 0.007 | 0.009 | 0.012 |
| | 3 x D - 4 x D | .07 x D | 400 | 0.002 | 0.002 | 0.003 | 0.005 | 0.006 | 0.007 | 0.01 |
| Titanium Alloys | ≤ 3 x D | .1 x D | 400 | 0.001 | 0.002 | 0.003 | 0.004 | 0.005 | 0.006 | 0.008 |
| | 3 x D - 4 x D | .08 x D | | 0.001 | 0.001 | 0.002 | 0.003 | 0.004 | 0.005 | 0.007 |
| Difficult to Machine Titanium Alloys | ≤ 2.5 x D | .08 x D | 350 | 0.001 | 0.002 | 0.003 | 0.004 | 0.005 | 0.006 | 0.008 |
| | 2.5 x D - 4 x D | .06 x D | 300 | 0.001 | 0.001 | 0.002 | 0.003 | 0.004 | 0.005 | 0.006 |
| Hi Temp Alloys | ≤ 1.5 x D | .07 x D | 100 | 0.003 | 0.004 | 0.007 | 0.009 | 0.011 | 0.014 | 0.018 |
| | 1.5 x D - 3 x D | .06 x D | | 0.002 | 0.003 | 0.005 | 0.007 | 0.009 | 0.011 | 0.015 |

| Material | Finishing | | Speed (SFM) | Feed (IPT) | | | | | | |
|---|-----------|------------|-------------|------------|-------|-------|-------|-------|-------|-------|
| | Axial DOC | Radial DOC | | 3/16 | 1/4 | 3/8 | 1/2 | 5/8 | 3/4 | 1 |
| Gray Cast Iron | 3 x D | .015 x D | 450 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.003 | 0.005 |
| Malleable Cast Iron | | | 350 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.004 |
| Low Carbon Steels | | | 400 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.004 | 0.005 |
| Medium Carbon Steels | | | 400 | 0.001 | 0.001 | 0.001 | 0.002 | 0.003 | 0.003 | 0.005 |
| Tool and Die Steels | | | 350 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.004 |
| Austenitic Stainless Steels, FeNi Alloys, 300 Series Stainless Steels | | | 400 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.004 | 0.005 |
| Martensitic and Ferritic Stainless Steels | | | 400 | 0.001 | 0.001 | 0.001 | 0.002 | 0.003 | 0.003 | 0.005 |
| Precipitation Hardening Stainless Steels | | | 350 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.004 |
| Titanium Alloys | | | 350 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 |
| Difficult to Machine Titanium Alloys | | | 2 x D | .01 x D | 300 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| Hi Temp Alloys | 100 | 0.001 | | | 0.002 | 0.003 | 0.004 | 0.006 | 0.007 | 0.009 |

TECHNICAL

High Speed Steel



Cutting Data
General Purpose Carbide
Technical Information

| Material | Hardness | | Surface feet per minute | Chip Load per Tooth | | | | | | | | | |
|--|----------|-------|----------------------------|---------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | Brinell | HRC | | 1/16" | 1/8" | 3/16" | 1/4" | 5/16" | 3/8" | 1/2" | 5/8" | 3/4" | 1" |
| low and plain carbon, alloy and tool steels | <220 HB | <19 | Low 270 | .0004 | .0006 | .0010 | .0015 | .0020 | .0025 | .0030 | .0035 | .0040 | .0045 |
| | | | High 360 | | | | | | | | | | |
| plain carbon, alloy, and tool steels | 225-286 | 20-30 | Low 180 | .0004 | .0006 | .0010 | .0015 | .0020 | .0025 | .0030 | .0035 | .0040 | .0045 |
| | | | High 270 | | | | | | | | | | |
| austenitic stainless steels 200 and 300 series | 294-371 | 31-40 | Low 135 | .0003 | .0004 | .0007 | .0011 | .0014 | .0018 | .0021 | .0025 | .0028 | .0032 |
| | | | High 180 | | | | | | | | | | |
| ductile and malleable cast iron | 135-275 | <28 | Low 180 | .0002 | .0004 | .0006 | .0010 | .0015 | .0020 | .0025 | .0030 | .0035 | .0040 |
| | | | High 315 | | | | | | | | | | |
| cast iron (gray) | 120-320 | <35 | Low 160 | .0003 | .0004 | .0007 | .0011 | .0014 | .0018 | .0021 | .0025 | .0028 | .0032 |
| | | | High 270 | | | | | | | | | | |
| nickel-based high-temperature alloys | 120-220 | <18 | Low 315 | .0008 | .0012 | .0020 | .0030 | .0040 | .0050 | .0060 | .0070 | .0080 | .0090 |
| | | | High 450 | | | | | | | | | | |
| low-silicon aluminum & other non-ferrous alloys | 220-320 | 19-34 | Low 225 | .0005 | .0007 | .0012 | .0018 | .0024 | .0030 | .0036 | .0042 | .0048 | .0055 |
| | | | High 315 | | | | | | | | | | |
| cobalt-based high-temperature alloys | 50-150 | — | Low 720 | .0006 | .0010 | .0016 | .0024 | .0032 | .0040 | .0048 | .0560 | .0064 | .0072 |
| | | | High 900 | | | | | | | | | | |
| nickel-based high-temperature alloys | 150-425 | <45 | Low 30 | .0004 | .0006 | .0010 | .0015 | .0020 | .0025 | .0030 | .0035 | .0040 | .0045 |
| | | | High 45 | | | | | | | | | | |
| cobalt-based high-temperature alloys | 140-300 | <32 | Low 45 | .0002 | .0004 | .0006 | .0009 | .0012 | .0015 | .0018 | .0021 | .0024 | .0027 |
| | | | High 90 | | | | | | | | | | |
| nickel-based high-temperature alloys | 300-475 | 32-50 | Low 40 | .0002 | .0004 | .0006 | .0009 | .0012 | .0015 | .0018 | .0021 | .0024 | .0027 |
| | | | High 70 | | | | | | | | | | |

Higher values for surface speed should be used for radial depths of cut less than 25% of the diameter. Lower values for surface speed should be used for radial depths of cut greater than 25% of the diameter.

The above recommendations are for axial lengths of cut not to exceed 1 times the cutter diameter for profiling and .5 times the diameter for slotting.

Recommended speeds above are for uncoated tools only and should be adjusted when using coated tools. Generally, speeds can be increased by the following factors:

- TiCN-coated tools – 20-25% increase
- TiAlN-coated tools – 40-50% increase

The above speeds are a recommended starting point only. If the tool is working well, without vibrations or significant noise, increase the SFM in 5-10% increments. Ultimate speeds will depend upon setup conditions. Higher or lower parameters may be required to achieve optimum conditions.

Applications

- Use in general milling applications in medium to low-carbon steels, cast iron, non-ferrous light metals, and plastics.
- Double-end end mills economically increase productivity.
- 2 flute end mills are generally used for plunging, slotting, and heavy peripheral cuts.
- 3 flute end mills provide a compromise between the chip clearance of a 2 flute tool and the rigidity and wear resistance of a 4 flute tool; especially useful for many slotting operations.
- 4 flute end mills are most commonly used in profiling and in harder materials; stiffer construction results in minimal deflection. They also provide good surface finishes and wear-resistant characteristics for excellent size control.

Features and Benefits:

- 10% cobalt submicron grain carbide substrate.
- 30° right-hand spiral, right-hand cut helix designed for maximum chip clearance.
- 2, 3, and 4 flute configurations available.
- Square end and ball nose end geometries available.
- Multiple lengths in select styles and sizes.
- TiAlN-coated tools available in most styles.



In every manufacturing plant today, large and small, an effective, organized end mill regrinding program is essential. No matter how large or small the end mill usage may be, an organized regrinding system will pay dividends in greater production per end mill.

General Information

End mills should be removed from the machine at the end of a predetermined production run, or when dull. If possible, a predetermined amount of stock should be removed on dull end mills (normal stock removal is .005" or .010" for each regrind) and color coding or size etching might be marked on the end mill to indicate its size. After several regrinds (this, too, can be predetermined) the end mill will tend to lose its effective rake angle and flute depth, and, at this point, the end mill must be scrapped.

Charts and data for the correct relief angles, relief widths, and rake angles for regrinding end mills are shown on pages 268 and 270.

After regrinding and inspection, all end mills should be dipped in rust-preventative oil, and, if suitable cartons are not available, they should be dipped in plastic coating for the full flute length. They should be stored in their original container, in separate bins or wooden containers. Small wooden containers that can be carried about are usually better than ordinary bin storage, as rough handling, in some cases, ruins more cutting edges than the actual milling operation.

The basic requirements for efficient end mill regrinding are:

- Tool grinding equipment in good condition.
- Adequate information for particular applications with reference to correct reliefs and rake angles.
- A workable tool conservation program.
- Adequate storage facilities and efficient handling techniques.

Nothing decreases the usable tool life of an end mill more than continued use of a dull end mill. The cutting action of a dull end mill is such that all the shearing qualities are gone and the material being milled is actually pushed on ahead of the individual cutting edges. This results in drawing the temper of the individual high-speed steel cutting edges, poorer finishes and accelerated wear. Continued use of a dull end mill makes it necessary to remove much more stock at regrinding to make the end mill usable once again. In the case of carbide end mills excessive dullness will chip and crater the cutting edges and will often cause breakage.

The point in the milling operation at which an end mill begins to dull can be determined in several ways. A dull end mill begins to spring or chatter, causes finishes to become poorer, and glazes or smears some materials. In addition, a wear land begins to form on the top of each individual cutting edge. Many milling machine operators can determine the first signs of end mill dulling by the sound of the cutting action, or by slight variations in machine vibrations.

Generally, an end mill is ready for resharpening when a wear land is visible on the top of the cutting edge. For smaller diameter end mills, and when milling some of the harder, ferrous materials, a wear land of approximately .005 may be used as an indication of the maximum allowable wear prior to resharpening. When using larger diameter end mills, and when milling in other classes of materials, a wider wear land may be used as an end point prior to regrinding.

In the final analysis, the many variables of each individual end mill application will determine the amount of cutting edge wear or degree of end mill dullness allowable before regrinding.

Regrinding Equipment

The tool cutter grinders on the market today are extremely versatile, and are capable of end mill regrinding between centers or off-the-shank. Tool and cutter grinders specifically designed for this type of work are easy to set up, operate and maintain, and versatile enough to regrind many types of cutting tools other than end mills. For a large volume of regrinding work some facilities utilize NC or CNC grinding equipment which maintains uniformity of reground mills at each regrinding.

Wheel Selection for Regrinding High Speed Steel (HSS) End Mills

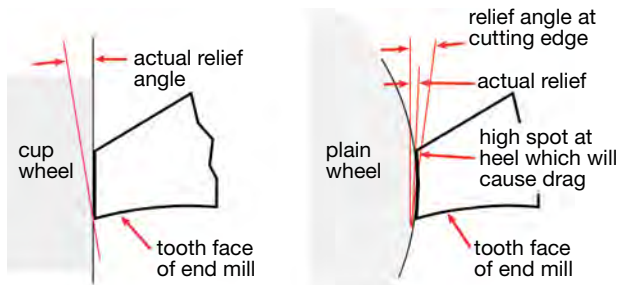
Efficient end mill regrinding is possible without the necessity of stocking a large inventory of various wheel types. For general purpose regrinding, aluminum oxide wheels of 46 to 80 grit are usually satisfactory, although, for finer finishes finer grit wheels may be used. When using wheels with a grit finer than 80, and particularly when resharpening thin cutting edges, approximately .002" should be the maximum amount of stock removal. Heavier cuts than .002" with fine grit wheels usually cause wheel loading and cutting edge burning. CBN wheels are recommended for minimum heat generation and may allow greater stock removal on roughing operations.



Wheel Selection for HSS End Mills (continued)

Two basic types of wheels may be used: plain or cupped. The cutting edge sections shown below are those which will be produced on the end mill cutting edges by each of these wheels. For a conventional type of regrinding, cup-shaped wheels are often preferred. This preference is caused by the fact that regrinding with a plain wheel tends to leave a high heel portion on the cutting edge, which might cause drag. If the heel portion is too high, it must be cleared also, requiring an additional regrinding setup and operation. Then too, the relief ground on an end mill cutting edge with a cupped wheel is easier to measure, as this type of regrinding leaves a flat, angular relief.

Effect of Wheel Shape on End Mill Relief Angle
Cup Wheel versus Plain Wheel



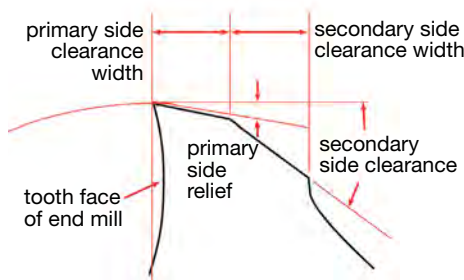
In actual regrinding, after the flute finger and wheel-to-flute location have been set, each flute is traversed past the wheel, taking a light cut and maintaining a steady motion. After the first light cut, the end mill should be measured to make certain that no taper is being added to the end mill. After the proper amounts of stock have been removed, to re-sharpen the end mill completely, a very light cut should be taken on all flutes, to make certain that roundness and concentricity is maintained.

In choosing the correct relief for the milling job at hand, it is best to regrind end mills to produce just enough primary relief to eliminate drag. Drag will cause friction and overheating of the cutting edges, and usually some buildup of the material on the heel of the primary relief. On the other hand, too much relief will cause the end mill to chatter and the cutting edges will tend to deteriorate rapidly. Too much relief is the least objectionable of the two choices, but the ideal situation is to have just enough relief. The amount of secondary clearance necessary is usually dependent on the size of the end mill, the width of the primary relief, and the feeds being used. For example, if the feed per tooth per revolution is .004", the heel of the secondary clearance must be at least .005" below the cutting edge. The table below lists the approximate side relief for various end mills.

The best re-sharpening procedure is to first regrind the primary relief until all of the wear has been removed, taking care to avoid excessive diameter loss. Next, the secondary clearance is ground to bring the primary relief land to the desired widths. After grinding the secondary clearance, it is often desirable that the primary relief surfaces be given a light finish grind to refine the cutting edges. To minimize runout, this light finishing cut should be made at one machine sitting, going completely around the end mill.

Regrinding the Sides

Producing the correct relief angle on an end mill is accomplished by establishing the proper location of the wheel and the end mill. On NC or CNC equipment, this relationship is established through use of a probe or other locating type device. On tool and cutter grinding equipment, a finger or flute rest is used as the locating device. The location of the flute finger should be such that it is mounted in proximity to the wheel. It must be adjustable but not attached to the table. The flute finger may be mounted on the table only when regrinding straight fluted end mills, and then its use is confined to that of an indexing finger.



Side Relief Angles

| | End Mill Diameter | Primary Clearance | Primary Width | Secondary Clearance Angle |
|--------------------------|-------------------|-------------------|---------------|---------------------------|
| HSS and Cobalt Mills | 1/8" - 1/4" | 13° - 10° | .005" - .011" | 26° |
| HSS High-Helix End Mills | 1/2" - 3/4" | 10° - 9° | .012" - .024" | 17° |
| PM Plus | 1" - 2" | 9° - 7° | .020" - .035" | 15° |
| Powder Metal End Mills | 1/8" - 1/4" | 14° | .017" - .013" | 27° |
| | 1/2" - 3/4" | 13° - 12° | .015" - .027" | 21° |
| | 1" - 2" | 11° - 10° | .022" - .040" | 18° |
| | 1/8" - 1/4" | 22° - 18° | .004" - .013" | 29° |
| | 1/2" - 3/4" | 16° - 12° | .010" - .018" | 22° |
| | 1" - 2" | 11° - 10° | .015" - .030" | 19° |

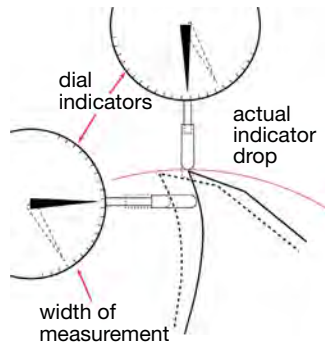
Checking Relief Angles

The universally accepted method of checking relief angles on the sides of end mills is to mount the end mill to rotate about its axis. Position a dial indicator above or to the side of the end mill, (with the dial indicator finger at right angles to the axis of the end mill being checked) and measure the indicator drop in thousandths of an inch on the primary relief.

This method, shown in the illustration, may be used for any type of side relief, be it dish shaped, flat, or radial. The measurable width of primary relief may be any predetermined amount.

The table below shows the amount of indicator drop for various primary relief angles when the cutting edge of the end mill is moved or rotated the tabulated measured primary width.

Off-hand side relief regrinding of end mills for any milling application should never be done under any circumstance.



Regrinding the Ends

Regrinding of the ends of end mills does not differ too much from regrinding of the sides, in that the basic principles still apply. However the method of grinding varies in that nearly all regrinding is done off of the shank. The task at hand is to reproduce an end that may be center cutting, square end, ball nose or square end with a corner radius. Almost any of the tool or cutter grinders may be used to produce accurate regrinding and re-notching of the square end style and some are built to also permit accurate reproduction of ball and radius ends. NC or CNC equipment can be programmed to achieve all of the required end configurations during regrinding.

Whenever possible, end notching or gashing cuts should be produced with grinding wheels which have corner radii so as to reduce stress concentration at the bottom of the gash. End tooth notch angles should produce about 0° to 5° positive axial rake.

In re-sharpening of end teeth the first step is always the removal of the wear on the end teeth and at the corner intersection of the end and peripheral teeth. Particular care must be taken so that all of the corner wear is removed.

Once the wear has been removed, it then is a matter of using the proper set-up and wheel shapes to produce the desired center cutting end configuration capability. On center cutting end mills one or more teeth must be cleared to cut to or past center. A gash is normally provided on the center cutting teeth to aid chip removal and prevent chip packing in the center of the end mill.

Ball end mills present re-sharpening problems due to their relieved radius form and roughly spherical form of the secondary clearance. Most users will end up using a machine to generate the cleared form and then hand clear the secondary and trailing heel. Care must always be exercised in regrinding the ends regardless of their shape to avoid generating any chip pockets.

Primary relief land widths of end teeth will be approximately 1-1/2 to 3 times that recommended for peripheral teeth. The table on the next page is a listing of typical details for clearing the ends of end mills.

Primary end relief is usually increased for softer materials and decreased as the hardness of the work material increases or the machinability of the work material decreases. Primary end relief angles should also be increased on small diameter mills used for plunge-cutting.

continued on next page

Primary Relief Angle for Side Teeth of End Mills

| End Mill Diameter | Measured Primary Relief Width | Indicator Drop in Measured Primary Relief Width | | | | | |
|-------------------|-------------------------------|---|-------|-------|-------|-------|-------|
| | | 4° | 6° | 8° | 10° | 12° | 15° |
| 1/8 | 1/64 | .0000 | .0000 | .0002 | .0008 | .0015 | .0021 |
| 3/16 | 1/64 | .0000 | .0003 | .0009 | .0014 | .0020 | .0028 |
| 1/4 | 1/64 | .0001 | .0007 | .0012 | .0018 | .0023 | .0031 |
| 5/16 | 1/64 | .0003 | .0009 | .0014 | .0019 | .0025 | .0033 |
| 3/8 | 1/64 | .0004 | .0010 | .0015 | .0021 | .0026 | .0034 |
| 7/16 | 1/64 | .0005 | .0011 | .0016 | .0022 | .0027 | .0035 |
| 1/2 | 1/64 | .0006 | .0012 | .0017 | .0022 | .0028 | .0036 |
| 5/8 | 1/32 | .0006 | .0017 | .0028 | .0039 | .0050 | .0066 |
| 3/4 | 1/32 | .0009 | .0020 | .0029 | .0042 | .0052 | .0069 |
| 7/8 | 1/32 | .0011 | .0022 | .0032 | .0043 | .0054 | .0070 |
| 1 | 1/32 | .0012 | .0023 | .0034 | .0045 | .0056 | .0072 |
| 1-1/8 | 1/32 | .0013 | .0024 | .0035 | .0046 | .0057 | .0073 |
| 1-1/4 | 3/64 | .0015 | .0032 | .0048 | .0064 | .0080 | .0105 |
| 1-3/8 | 3/64 | .0017 | .0033 | .0050 | .0066 | .0082 | .0106 |
| 1-1/2 | 3/64 | .0018 | .0034 | .0051 | .0067 | .0083 | .0107 |
| 1-3/4 | 3/64 | .0020 | .0037 | .0053 | .0069 | .0085 | .0109 |
| 2 | 3/64 | .0022 | .0038 | .0054 | .0071 | .0087 | .0111 |
| 2-1/4 | 1/16 | .0027 | .0048 | .0070 | .0092 | .0113 | .0145 |
| 2-1/2 | 1/16 | .0028 | .0050 | .0072 | .0093 | .0115 | .0147 |
| 2-3/4 | 1/16 | .0029 | .0051 | .0073 | .0095 | .0116 | .0148 |
| 3 | 1/16 | .0031 | .0052 | .0074 | .0096 | .0117 | .0150 |

Regrinding the Ends (continued)

Primary end relief is usually increased for softer materials and decreased as the hardness of the work material increases or the machinability of the work material decreases. Primary end relief angles should also be increased on small diameter mills used for plunge-cutting.

Secondary End Clearance

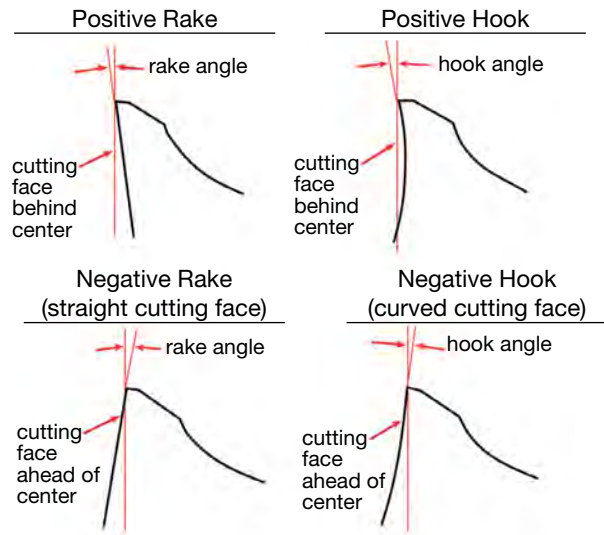
Secondary end clearance depends on the material being milled and the type of operation. Some tracer milling operations, requiring comparatively heavy in-feeds, will necessitate additional secondary clearance, whereas shallow traversing cuts would require less secondary end clearance.

In addition, milling of the higher density steels require less secondary end clearance, but aluminum and other non-ferrous milling applications require increased secondary end clearances. In most cases, off hand grinding of secondary end clearances on end mills is the quickest and most economical method, as no absolute degree of accuracy is required. For combination notching and secondary end clearing of end mills, however, where the side of the wheel makes contact with the cutting face of one of the end teeth, care must be exercised, and some users prefer to notch and clear end teeth in one grinding operation, by machine.

Regrinding End Mill Tooth Rake Angles

While correct relief angles on end mill teeth are essential for economical milling, too often little attention is given to maintaining the correct rake angles. Rake angles or hook angles are shown below.

As the illustration shows, the term rake is commonly used when referring to a comparatively straight cutting face. The rake or hook angle formed by the side cutting faces of an end mill is often referred to as radial rake.



End Relief Angles

| | End Mill Diameter | Primary Clearance | Primary Width | Secondary Clearance Angle |
|-----------------------------------|---------------------------------------|-------------------|---|---------------------------|
| HSS, Cobalt and PM Plus End Mills | 1/8" - 1/4" 1/2" - 3/4" 1" - 2" | 6° - 8° | .025" - .035" .035" - .050" .045" - .075" | 25° - 30° |
| HSS High-Helix End Mills | 1/8" - 1/4" 1/2" - 3/4" 1" - 2" | 8° - 10° | .025" - .045" .035" - .060" .050" - .100" | 30° 23° 23° |

Most end mills are manufactured with a hook rather than a rake because the curved cutting face aids in curling and ejecting the chips. The proper rake angle is governed by the material being cut and the material from which the end mill is made. Most high-speed steel end mills usually have generous positive rake angles on the side cutting teeth, whereas tungsten carbide types of end mills are usually manufactured with lower positive or even negative rake angles. Softer materials usually will allow higher rake angles to be used, whereas the harder, tougher materials require lower rake angles.

Radial rake is not to be confused with axial or helical rake. Axial rake is that angle formed about the axis of the mill by a straight cutting edge at one given point, whereas helical rake is that helical angle formed around the axis of the mill by the cutting edge.

Axial rake is formed by a straight angular cutting edge, and is not constant, whereas helical rake is formed by a helical cutting edge and is constant. Helix angles or helical rake angles for end mills may range, from 0° up to 60°. For general purpose milling, helix angles of 25° to 35° are the most popular.

Regrinding Tooth Rake Angles (continued)

During manufacturing a specific radial rake is built into each end mill type based upon its intended area of work material application. As an end mill is reground on the outside diameter, there is a continual reduction in the radial rake present in the tool, resulting in higher cutting forces and generally shorter tool life. An end mill generally can only be reduced in cutting diameter by about 10% to 15% of the original diameter before the mill must be discarded or the correct radial rake reground into face of the flute.

Width of Tooth Face being Measured

| rake angle | indicator drop in thousandths of an inch | | | |
|------------|--|-------|-------|-------|
| | 1/32" | 1/16" | 3/32" | 1/8" |
| 1° | .0005 | .0011 | .0016 | .0022 |
| 2° | .0011 | .0022 | .0034 | .0044 |
| 3° | .0016 | .0033 | .0049 | .0065 |
| 4° | .0022 | .0044 | .0066 | .0087 |
| 5° | .0027 | .0054 | .0082 | .0108 |
| 6° | .0033 | .0065 | .0099 | .0131 |
| 7° | .0038 | .0076 | .0115 | .0152 |
| 8° | .0044 | .0087 | .0132 | .0174 |
| 9° | .0049 | .0098 | .0148 | .0195 |
| 10° | .0055 | .0109 | .0165 | .0217 |
| 11° | .0061 | .0119 | .0182 | .0238 |
| 12° | .0066 | .0130 | .0200 | .0260 |
| 15° | .0084 | .0162 | .0251 | .0323 |
| 20° | .0114 | .0227 | .0341 | .0455 |

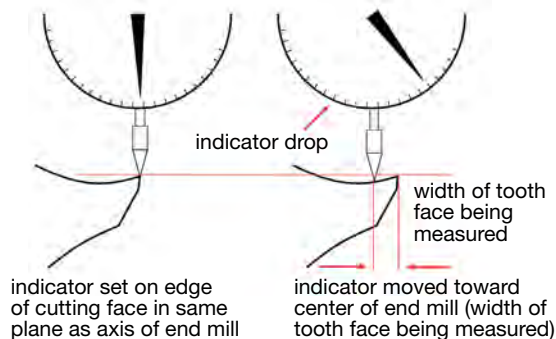
Regrinding Radial Rake Angles

The practice of regrinding radial rake or hook angles on end mills of diameters below 1/2" is usually not economical, unless large quantities of the same size are involved. Thus the regrinding of radial rake is usually confined to end mills of larger sizes. There are three accurate methods of regrinding the rake angles in the helical flutes of an end mill.

1. Use of a tool room grinder with a spiral lead attachment.
2. Use of a fixture, mounted on a tool room grinder having a former (a bar grooved with the same lead as the end mill) which rotates the end mill at the correct helix angle as it moves forward into the grinding wheel.
3. Use of a properly programmed CNC grinder.

Inspecting Radial Rake Angles

The illustration shows one method of inspecting the radial hook or rake in the side tooth of an end mill, when the end mill is located in inspection centers or in an accurate horizontal spindle. This method measures the amount of rake of the tooth being measured in indicator drop. Convert this amount of indicator drop to the angular equivalent of the actual rake angle by reference to the table at left.

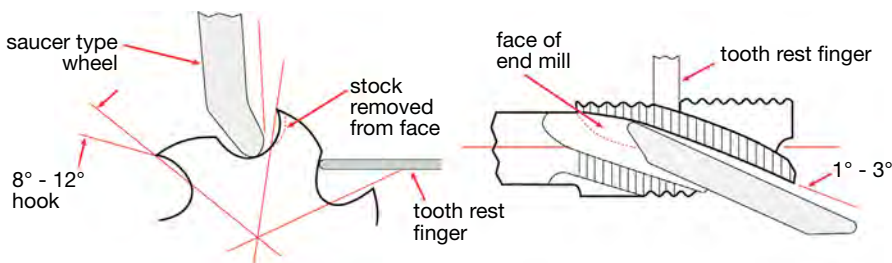


Sharpening Roughing End Mills

Roughing end mills are designed as form-relieved cutters, and as such, the OD wear is removed by grinding the radial rake face of the teeth and fillet of the flute. Generally this is accomplished on a tool and cutter grinding machine. If a roughing end mill is center or end cutting, the end teeth are re-sharpened the same way as end teeth on standard end mills.

A saucer-shaped grinding wheel, dressed to match the form of the flute face from OD to the fillet, is used. The grinding head is turned to an angle 1° to 3° greater than the helix angle of the mill. This will allow the leading edge of the wheel to hollow grind the rake face. (Typically the finished hook is 8° to 12°).

A tooth support finger or lead-generating device may be used to ensure that the proper lead is maintained. The support finger rides on the back of the tooth being sharpened, located below the form. Unless equal stock is removed from each rake face, the re-sharpened mill will have more radial run-out during use. Normally this should not prove to be a problem, provided enough stock is left on the roughed out part for finishing.



TECHNICAL
High Speed Steel, PM, and Cobalt



Product Index



Other Tool Product Index. 346

TECH TIPS

- Use Screw Extractors to Remove Broken Screws and Bolts. [347](#)
- Ground Tool Bits. [348](#)
- Drill and Reamer Blanks. [351](#)

Other Tools

| Style | Page | Description | Image | Type | Set | Tool Material | | | | Application | | | | | | | |
|--------|---------------------|-------------------------|-------|-------------------|-----|---------------|--------|---------|-----|-------------|-----------|-----------|-------------|-----------------|----------------|--|--|
| | | | | | | HSS | Cobalt | Carbide | TCT | Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | | |
| 192 | 347 | Screw Extractor | | Ezy-Out® | yes | • | | | | • | | | | | | | |
| 850 | 348 | Tool Bits | | Square | | • | | | | • | | | | | | | |
| 855 | | | | Square | | • | | | | • | | | | | | | |
| 860 | | | | Square | | • | | | | | • | | | | | | |
| **3507 | | | | Square | | • | | | | | • | | | | | | |
| 851 | | | | Square | | • | | | | | • | | | | | | |
| 856 | 349 | Tool Bits | | Rectangular | | • | | | | • | | | | | | | |
| 861 | | | | Rectangular | | • | | | | • | | | | | | | |
| **3517 | | | | Rectangular | | • | | | | | • | | | | | | |
| 902 | 350 | Blanks | | Oversize | | • | | | | • | | | | | | | |
| 903 | | | | Undersize | | • | | | | • | | | | | | | |
| 321 | 351 | Milling Cutter and Saws | | Woodruff Key Seat | | • | | | | • | | | | | | | |
| 326 | 352 | | | Plain Metal | | • | | | | • | | | | | | | |
| | 353 | Metal Cases | | Empty | | | | | | | | | | | | | |

Index

Material Icons

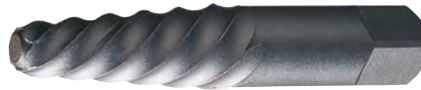
| Material Reference | Icon Reference | P | | M | | K | | N | S | | H | |
|--------------------|----------------|-------------|-------|-----------------|-------------|-----------------|------------|--------------------------|---------------|------------------------------|----------------------|----------|
| | Type | Steel (HRc) | | Stainless Steel | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) | |
| | Hardness | Low Carbon | Alloy | Austenitic | Martensitic | PH | Gray | | Nodular | Ni, Co, Fe Based Super Alloy | | Titanium |
| | | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | | | | >45 |
| | | | | | | | | | | | | |





Style: **192**

Ezy-Out®
Screw Extractor



| extractor number | small end (in) | large end (in) | overall length (in) | screw size | pipe size | use this drill size | order number |
|------------------|----------------|----------------|---------------------|---------------|-----------|---------------------|----------------------|
| #1 | .054 | .156 | 2.000 | #8 - 1/4 | -- | 5/64 | 192 C53651 |
| #2 | .080 | .188 | 2.375 | #12 - 5/16 | -- | 7/64 | C53652 |
| #3 | .125 | .250 | 2.688 | 5/16 - 7/16 | -- | 5/32 | C53653 |
| #4 | .188 | .328 | 2.875 | 7/16 - 9/16 | -- | 1/4 | C53654 |
| #5 | .250 | .438 | 3.375 | 9/16 - 3/4 | 1/8, 1/4 | 9/32 | C53655 |
| #5-1/4 | .343 | .531 | 3.375 | 11/16 - 15/16 | 1/4 | 23/64 | C53669 |
| #6 | .375 | .594 | 3.750 | 3/4 - 1 | 3/8 | 13/32 | C53656 |
| #6-3/8 | .468 | .687 | 3.750 | 15/16 - 1-1/8 | 3/8 | 31//64 | C53670 |
| #7 | .500 | .750 | 4.125 | 1 - 1-3/8 | 1/2 | 17/32 | C53657 |
| #7-1/2 | .593 | .875 | 4.125 | 1-1/8 - 1-1/2 | 1/2 | 39/64 | C53671 |
| #8 | .750 | 1.000 | 4.375 | 1-3/8 - 1-3/4 | 3/4 | 13/16 | C53658 |
| #9 | 1.000 | 1.281 | 4.625 | 1-3/4 - 2-1/8 | 1 | 1-1/16 | C53659 |
| #10 | 1.250 | 1.563 | 5.000 | 2-1/8 - 2-1/2 | 1-1/4 | 1-5/16 | C53660 |
| #11 | 1.500 | 1.875 | 5.625 | 2-1/2 - 3 | 1-1/2 | 1-9/16 | C53661 |
| #12 | 1.875 | 2.313 | 6.250 | 3 - 3-1/2 | 2 | 1-15/16 | C53662 |

NOTE: Recommended drill size and extractor size shown above are for normal conditions. Unusual conditions will require the use of other size extractors and drills, depending on the length of the broken section and the depth of the hole. In general, use the largest possible screw extractor.

Sets

Style: **192**

Other Tools
Ezy-Out® Screw Extractor Set

| no. of pieces | sizes | order number |
|---------------|---|----------------------|
| 5 | #1, 2, 3, 4, and 5 | 192 C00906 |
| 6 | #1, 2, 3, 4, 5, and 6 | C00907 |
| 3 | #4, 5, and 6 | C00909 |
| 4 | #5, 5-1/4, 6-3/8, and 7-1/2 | C00917 |
| 6 | #5, 5-1/4, 6-3/8, 7-1/2, 8, and 9 | C00918 |
| 4 | #6, 7, 8, and 9 | C00908 |
| 12 | #1, 2, 3, 4, 5, and 6 plus drills 5/64", 7/64", 5/32", 1/4", 9/32", 13/32" | C00910 |

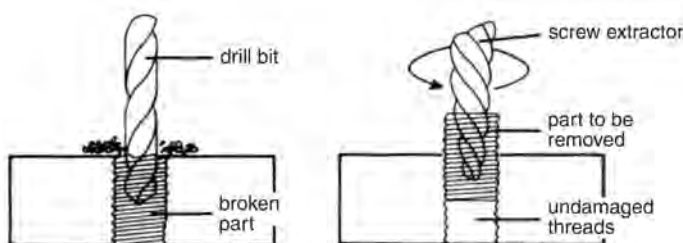


Other Tools

TECH TIPS

Use Screw Extractors to Remove Broken Screws and Bolts

Screw extractors are often used in maintenance departments, machine shops, garages, and workshops to remove broken screws, bolts, or other threaded parts.



To remove a broken screw, follow this procedure.

- Drill a hole into the broken screw using the recommended drill size from the table above.
- Insert the proper screw extractor into the hole and start a counter-clockwise (left-hand) rotation using a tap wrench on the square on the shank.
- The extractor will grip the wall of the hole in the screw and back the screw out without damaging the threads.
- A penetrating oil can be helpful in removing rusty or corroded parts.





Tool Bits Square

Styles: **850, 855, 860, 3507**

Mo-Max® HSS

Style: **850**



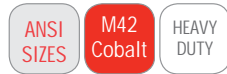
Mo-Max® Cobalt

Style: **855**



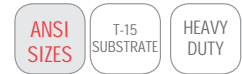
Super Mo-Max® Cobalt

Style: **860**



Super Cle-Max® Cobalt

Style: **3507**



****Items are being OBSOLETED, only available until inventory is depleted.**

| tool bit size | | overall length (in) | order number | | | |
|---------------|--------|------------------------|----------------------|--------------------------|--------------------------|--------------------|
| fractional | (in) | | 850 M2 HSS | 855 M42 Cobalt | 860 M42 Cobalt | 3507 T15 |
| 1/8 | .1250 | 2.500 | C44505 | C44536 | C44567 | — |
| 3/16 | .1875 | 2.500 | C44509 | C44540 | C44571 | **C44671 |
| 1/4 | .2500 | 2.500 | C44513 | C44544 | C44575 | — |
| 5/16 | .3125 | 2.500 | C44514 | C44545 | C44576 | **C44673 |
| 3/8 | .3750 | 3.000 | C44516 | C44547 | C44578 | — |
| 7/16 | .4375 | 3.500 | C44518 | C44549 | C44580 | **C44675 |
| 1/2 | .5000 | 4.000 | C44520 | C44551 | C44582 | **C44676 |
| 5/8 | .6250 | 4.500 | C44522 | C44553 | C44584 | **C44677 |
| 3/4 | .7500 | 5.000 | C44525 | C44556 | C44587 | **C44678 |
| 7/8 | .8750 | 6.000 | C44527 | C44558 | C44589 | — |
| 1 | 1.0000 | 7.000 | C44528 | C44559 | C44590 | **C44679 |
| 1-1/4 | 1.2500 | 9.000 | C44530 | C44561 | C44592 | — |

Other Tools

TECH TIPS

Ground Tool Bits

- Mo-Max tool bits are designed for general-purpose work in moderate materials.
- Mo-Max Cobalt tool bits are ideal for general-purpose work in harder materials.
- Super Mo -Max Cobalt tool bits are designed for heavy-duty work in high-temp alloys.
- Super Cle-Max Cobalt tool bits are meant for the heaviest duty work in tough materials.



Tool Bits
Rectangular

Styles: **851, 856, 861, 3517**

Mo-Max® HSS

Style: **851**



Mo-Max® Cobalt

Style: **856**



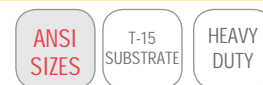
Super Mo-Max® Cobalt

Style: **861**



Super Cle-Max® Cobalt

Style: **3517**



****Items are being OBSOLETED, only available until inventory is depleted.**



| tool bit size fractional | width (in) | height (in) | overall length (in) | order number | | | |
|-----------------------------|---------------|----------------|------------------------|----------------------|--------------------------|--------------------------|--------------------|
| | | | | 851 M2 HSS | 856 M42 Cobalt | 861 M42 Cobalt | 3517 T15 |
| 1/4 x 3/8 | .250 | .375 | 2.500 | C44600 | C44601 | C44602 | - |
| 1/4 x 3/8 | .250 | .375 | 3.000 | - | - | - | **C44685 |
| 1/4 x 1/2 | .250 | .500 | 4.000 | C44606 | C44607 | C44608 | **C44686 |
| 1/4 x 1/2 | .250 | .500 | 6.000 | C44609 | C44610 | C44611 | - |
| 1/4 x 3/4 | .250 | .750 | 5.000 | - | - | - | **C44687 |
| 5/16 x 1/2 | .313 | .500 | 3.000 | C44616 | C44617 | C44618 | - |
| 3/8 x 1/2 | .375 | .500 | 3.000 | C44619 | C44620 | C44621 | - |
| 3/8 x 1/2 | .375 | .500 | 4.000 | C44622 | C44623 | C44624 | **C44689 |
| 3/8 x 1/2 | .375 | .500 | 6.000 | C44625 | C44626 | C44627 | - |
| 3/8 x 5/8 | .375 | .625 | 4.000 | C44628 | C44629 | C44630 | - |
| 3/8 x 5/8 | .375 | .625 | 4.500 | - | - | - | **C44690 |
| 3/8 x 5/8 | .375 | .625 | 5.000 | C44631 | C44632 | C44633 | - |
| 3/8 x 5/8 | .375 | .625 | 6.000 | C44634 | C44635 | C44636 | - |
| 3/8 x 3/4 | .375 | .750 | 4.000 | C44637 | C44638 | - | - |
| 3/8 x 3/4 | .375 | .750 | 6.000 | C44640 | C44641 | C44642 | - |
| 1/2 x 3/4 | .500 | .750 | 4.000 | C44644 | C44645 | C44646 | - |
| 1/2 x 3/4 | .500 | .750 | 5.000 | - | - | - | **C44692 |
| 1/2 x 3/4 | .500 | .750 | 6.000 | C44647 | C44648 | C44649 | - |
| 1/2 x 1 | .500 | 1.000 | 7.000 | - | - | - | **C44693 |
| 1/2 x 1 | .500 | 1.000 | 8.000 | C44650 | C44651 | C44652 | - |
| 5/8 x 3/4 | .625 | .750 | 5.000 | C44653 | C44654 | C44655 | **C44694 |
| 5/8 x 7/8 | .625 | .875 | 6.000 | C44656 | C44657 | C44658 | - |
| 3/4 x 1 | .750 | 1.000 | 6.000 | C44659 | C44660 | C44661 | - |
| 3/4 x 1 | .750 | 1.000 | 7.000 | - | - | - | **C44696 |
| 1 x 1-1/4 | 1.000 | 1.250 | 6.000 | - | - | - | **C44697 |

Other Tools





Style: **902**

Reamer Blank
Oversize



Tolerance $+.0002/-0.000$

| blank diameter | width (in) | height (in) | order number |
|----------------|------------|-------------|--------------|
| | | | 902 |
| 3/64 | .0469 | 1.750 | C19271 |
| #51 | .0670 | 2.000 | C19288 |
| 1/8 | .1250 | 2.750 | C19335 |
| 5/32 | .1562 | 3.125 | C19355 |
| 3/16 | .1875 | 3.500 | C19377 |
| 7/32 | .2188 | 3.750 | C19398 |
| 1/4,E | .2500 | 4.000 | C19416 |
| 5/16 | .3125 | 4.500 | C19449 |

Style: **903**

Drill Blank
Undersize



Tolerance $+.0000/-0.0002$

| blank diameter | width (in) | height (in) | order number |
|----------------|------------|-------------|--------------|
| | | | 903 |
| #55 | .0520 | 1.875 | C19562 |
| 1/16 | .0625 | 1.875 | C19570 |
| 3/32 | .0938 | 2.250 | C19599 |
| 1/8 | .1250 | 2.750 | C19622 |
| 3/16 | .1875 | 3.500 | C19664 |
| 1/4,E | .2500 | 4.000 | C19703 |
| 5/16 | .3125 | 4.500 | C19736 |
| 3/8 | .3750 | 5.000 | C19766 |
| 1/2 | .5000 | 6.000 | C19795 |

Other Tools



TECH TIPS

Drill and Reamer Blanks

- Ideal for use as drifts of dowel pins, for gauging purposes, and for making punches.
- Also can be used for round tool bits, countersinks, boring, or burring tools.



Woodruff Keyseat Cutter

HSS, 1/2" Shank

Style: **321**

Note

For milling Woodruff keys.
Furnished 1/32" large to allow for re-sharpening.



****Items are being OBSOLETEd, only available until inventory is depleted.**

| size no. key no. | nominal diameter (in) | width of face (in) | overall length (in) | teeth | order number 321 |
|---------------------|--------------------------|-----------------------|------------------------|-------|----------------------------|
| 808 (141) | 1.0000 | .250 | 2.250 | 12 | **C45506 |
| 810 | 1.2500 | .250 | 2.250 | 14 | **C45508 |
| 812 | 1.5000 | .250 | 2.250 | 16 | **C45510 |
| 1008 (131) | 1.0000 | .313 | 2.313 | 12 | **C45511 |
| 1012 | 1.5000 | .313 | 2.313 | 16 | **C45515 |
| 1210 | 1.2500 | .375 | 2.375 | 12 | **C45517 |
| 1212 | 1.5000 | .375 | 2.375 | 16 | **C45519 |

HSS Plain Metal Slitting Saws

Style: **326**

Note

For slotting and cutoff operations.

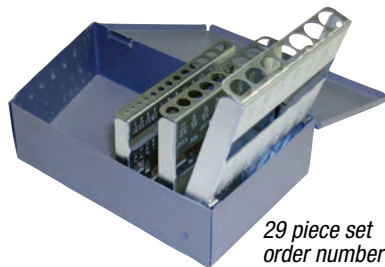


****Items are being OBSOLETEd, only available until inventory is depleted.**

| size no. | width of face (in) | cutter diameter (in) | hole size (in) | teeth | order number 326 |
|----------|--------------------|----------------------|----------------|-------|----------------------------|
| 326-9 | .0938 | 3.00 | 1.000 | 36 | **C45545 |



Set - Drill Case
Metal, No Drills



29 piece set
order number
#C00851



| case number | slots (no. of pieces) | holds drill size | order number |
|-------------|-----------------------|---|--------------|
| #4115 | 115 | 1/64" to 1/2" x 1/64", A to Z letter, #1 to #60 wire | C00878 |
| #413 | 13 | 1/16 to 1/4 x 1/64" | C00854 |
| #415 | 15 | 1/16" to 1/2" x 1/32" | C00852 |
| #421 | 21 | 1/16" to 3/8" x 1/64" | C00853 |
| #426 | 26 | A to Z letter | C00857 |
| #429 | 29 | 1/16" to 1/2" x 1/64" | C00851 |
| #460 | 60 | #1 to #60 wire | C00855 |
| #2001M | 25 | 1.0mm to 13.0 mm x 0.5mm | C00865 |

Other Tools





| Order Number | Style Number | Page Number | Order Number | Style Number | Page Number | Order Number | Style Number | Page Number | Order Number | Style Number | Page Number | Order Number | Style Number | Page Number |
|--------------|--------------|-------------|--------------|--------------|-------------|--------------|--------------|-------------|--------------|--------------|-------------|--------------|--------------|-------------|
| C01825 | 2001 | 44 | C02928 | 2012 | 47 | C03064 | 2012 | 48 | C03517 | 2020 | 45 | C03728 | 2065-TN | 49 |
| C01827 | 2001 | 44 | C02932 | 2012 | 47 | C03066 | 2012 | 48 | C03519 | 2020 | 45 | C03730 | 2065-TN | 49 |
| C01828 | 2001 | 44 | C02934 | 2012 | 47 | C03068 | 2012 | 48 | C03520 | 2020 | 45 | C03731 | 2065-TN | 49 |
| C01830 | 2001 | 44 | C02938 | 2012 | 47 | C03070 | 2012 | 48 | C03522 | 2020 | 45 | C03732 | 2065-TN | 49 |
| C01832 | 2001 | 44 | C02940 | 2012 | 47 | C03073 | 2012 | 48 | C03523 | 2020 | 45 | C03733 | 2065-TN | 49 |
| C01833 | 2001 | 44 | C02942 | 2012 | 47 | C03077 | 2012 | 48 | C03525 | 2020 | 45 | C03738 | 2065-TN | 50 |
| C01835 | 2001 | 44 | C02945 | 2012 | 47 | C03079 | 2012 | 48 | C03527 | 2020 | 46 | C03741 | 2065-TN | 50 |
| C01836 | 2001 | 44 | C02947 | 2012 | 47 | C03081 | 2012 | 48 | C03529 | 2020 | 46 | C03742 | 2065-TN | 50 |
| C02593 | 2011 | 66 | C02950 | 2012 | 47 | C03083 | 2012 | 48 | C03532 | 2020 | 46 | C03743 | 2065-TN | 50 |
| C02646 | 2011 | 66 | C02952 | 2012 | 47 | C03086 | 2012 | 48 | C03535 | 2020 | 46 | C03745 | 2065-TN | 50 |
| C02652 | 2011 | 66 | C02954 | 2012 | 47 | C03088 | 2012 | 48 | C03537 | 2020 | 46 | C03747 | 2065-TN | 50 |
| C02654 | 2011 | 66 | C02955 | 2012 | 47 | C03094 | 2012 | 48 | C03538 | 2020 | 46 | C03750 | 2065-TN | 50 |
| C02659 | 2011 | 66 | C02958 | 2012 | 47 | C03095 | 2012 | 48 | C03540 | 2020 | 46 | C03751 | 2065-TN | 50 |
| C02666 | 2011 | 66 | C02959 | 2012 | 47 | C03097 | 2012 | 48 | C03542 | 2020 | 46 | C03752 | 2065-TN | 50 |
| C02667 | 2011 | 66 | C02962 | 2012 | 47 | C03099 | 2012 | 48 | C03544 | 2020 | 46 | C03753 | 2065-TN | 50 |
| C02671 | 2011 | 66 | C02965 | 2012 | 47 | C03101 | 2012 | 48 | C03546 | 2020 | 46 | C03756 | 2065-TN | 50 |
| C02681 | 2011 | 66 | C02968 | 2012 | 47 | C03106 | 2012 | 48 | C03548 | 2020 | 46 | C03758 | 2065-TN | 50 |
| C02685 | 2011 | 66 | C02969 | 2012 | 47 | C03108 | 2012 | 48 | C03549 | 2020 | 46 | C03760 | 2065-TN | 50 |
| C02690 | 2011 | 66 | C02971 | 2012 | 47 | C03111 | 2012 | 48 | C03550 | 2020 | 46 | C03761 | 2065-TN | 50 |
| C02694 | 2011 | 66 | C02973 | 2012 | 47 | C03114 | 2012 | 48 | C03552 | 2020 | 46 | C03762 | 2065-TN | 50 |
| C02700 | 2011 | 66 | C02975 | 2012 | 47 | C03116 | 2012 | 48 | C03553 | 2020 | 46 | C03764 | 2065-TN | 50 |
| C02702 | 2011 | 66 | C02976 | 2012 | 47 | C03119 | 2012 | 48 | C03556 | 2020 | 46 | C03765 | 2065-TN | 50 |
| C02704 | 2011 | 66 | C02978 | 2012 | 47 | C03121 | 2012 | 48 | C03559 | 2020 | 46 | C03773 | 2065-TN | 50 |
| C02707 | 2011 | 66 | C02980 | 2012 | 47 | C03124 | 2012 | 48 | C03560 | 2020 | 46 | C03776 | 2065-TN | 50 |
| C02710 | 2011 | 66 | C02982 | 2012 | 47 | C03127 | 2012 | 48 | C03561 | 2020 | 46 | C03781 | 2065-TN | 50 |
| C02713 | 2011 | 66 | C02983 | 2012 | 47 | C03129 | 2012 | 48 | C03563 | 2020 | 46 | C03784 | 2065-TN | 50 |
| C02719 | 2011 | 66 | C02985 | 2012 | 47 | C03133 | 2012 | 48 | C03565 | 2020 | 46 | C03786 | 2065-TN | 50 |
| C02724 | 2011 | 66 | C02986 | 2012 | 47 | C03136 | 2012 | 48 | C03567 | 2020 | 46 | C03801 | 2065-TN | 50 |
| C02735 | 2011 | 66 | C02988 | 2012 | 48 | C03137 | 2012 | 48 | C03568 | 2020 | 46 | C03804 | 2065-TN | 50 |
| C02746 | 2011 | 66 | C02990 | 2012 | 48 | C03142 | 2012 | 48 | C03571 | 2020 | 46 | C03806 | 2065-TN | 50 |
| C02767 | 2011 | 66 | C02992 | 2012 | 48 | C03144 | 2012 | 48 | C03572 | 2020 | 46 | C03807 | 2065-TN | 50 |
| C02776 | 2011 | 66 | C02995 | 2012 | 48 | C03146 | 2012 | 48 | C03574 | 2020 | 46 | C04356 | 2120 | 22 |
| C02785 | 2011 | 66 | C02998 | 2012 | 48 | C03148 | 2012 | 48 | C03576 | 2020 | 46 | C04357 | 2120 | 22 |
| C02807 | 2011 | 66 | C03000 | 2012 | 48 | C03149 | 2012 | 48 | C03577 | 2020 | 46 | C04359 | 2120 | 22 |
| C02811 | 2011 | 66 | C03001 | 2012 | 48 | C03150 | 2012 | 48 | C03579 | 2020 | 46 | C04360 | 2120 | 22 |
| C02818 | 2011 | 66 | C03003 | 2012 | 48 | C03152 | 2012 | 48 | C03581 | 2020 | 46 | C04363 | 2120 | 22 |
| C02833 | 2011 | 66 | C03005 | 2012 | 48 | C03155 | 2012 | 48 | C03582 | 2020 | 46 | C04364 | 2120 | 22 |
| C02848 | 2011 | 66 | C03007 | 2012 | 48 | C03158 | 2012 | 48 | C03583 | 2020 | 46 | C04368 | 2120 | 22 |
| C02861 | 2011 | 66 | C03009 | 2012 | 48 | C03160 | 2012 | 48 | C03585 | 2020 | 46 | C04370 | 2120 | 22 |
| C02867 | 2011 | 66 | C03011 | 2012 | 48 | C03163 | 2012 | 48 | C03588 | 2020 | 46 | C04374 | 2120 | 22 |
| C02872 | 2011 | 66 | C03012 | 2012 | 48 | C03165 | 2012 | 48 | C03590 | 2020 | 46 | C04376 | 2120 | 22 |
| C02877 | 2011 | 66 | C03013 | 2012 | 48 | C03457 | 2020 | 45 | C03592 | 2020 | 46 | C04378 | 2120 | 22 |
| C02881 | 2012 | 47 | C03015 | 2012 | 48 | C03458 | 2020 | 45 | C03594 | 2020 | 46 | C04381 | 2120 | 22 |
| C02883 | 2012 | 47 | C03016 | 2012 | 48 | C03460 | 2020 | 45 | C03597 | 2020 | 46 | C04383 | 2120 | 22 |
| C02887 | 2012 | 47 | C03019 | 2012 | 48 | C03461 | 2020 | 45 | C03601 | 2020 | 46 | C04386 | 2120 | 22 |
| C02890 | 2012 | 47 | C03022 | 2012 | 48 | C03464 | 2020 | 45 | C03610 | 2020 | 46 | C04388 | 2120 | 22 |
| C02893 | 2012 | 47 | C03023 | 2012 | 48 | C03469 | 2020 | 45 | C03618 | 2020 | 46 | C04390 | 2120 | 22 |
| C02894 | 2012 | 47 | C03024 | 2012 | 48 | C03471 | 2020 | 45 | C03632 | 2020 | 46 | C04391 | 2120 | 22 |
| C02896 | 2012 | 47 | C03026 | 2012 | 48 | C03475 | 2020 | 45 | C03636 | 2020 | 46 | C04394 | 2120 | 22 |
| C02898 | 2012 | 47 | C03028 | 2012 | 48 | C03477 | 2020 | 45 | C03643 | 2020 | 46 | C04395 | 2120 | 22 |
| C02899 | 2012 | 47 | C03030 | 2012 | 48 | C03479 | 2020 | 45 | C03651 | 2020 | 46 | C04398 | 2120 | 22 |
| C02901 | 2012 | 47 | C03031 | 2012 | 48 | C03482 | 2020 | 45 | C03658 | 2020 | 46 | C04401 | 2120 | 22 |
| C02903 | 2012 | 47 | C03034 | 2012 | 48 | C03484 | 2020 | 45 | C03673 | 2020 | 46 | C04404 | 2120 | 22 |
| C02904 | 2012 | 47 | C03035 | 2012 | 48 | C03487 | 2020 | 45 | C03681 | 2020 | 46 | C04405 | 2120 | 22 |
| C02906 | 2012 | 47 | C03037 | 2012 | 48 | C03489 | 2020 | 45 | C03686 | 2020 | 46 | C04407 | 2120 | 22 |
| C02907 | 2012 | 47 | C03039 | 2012 | 48 | C03491 | 2020 | 45 | C03689 | 2020 | 46 | C04409 | 2120 | 22 |
| C02909 | 2012 | 47 | C03040 | 2012 | 48 | C03492 | 2020 | 45 | C03692 | 2020 | 46 | C04411 | 2120 | 22 |
| C02910 | 2012 | 47 | C03042 | 2012 | 48 | C03495 | 2020 | 45 | C03695 | 2020 | 46 | C04412 | 2120 | 22 |
| C02912 | 2012 | 47 | C03044 | 2012 | 48 | C03496 | 2020 | 45 | C03697 | 2020 | 46 | C04414 | 2120 | 22 |
| C02914 | 2012 | 47 | C03045 | 2012 | 48 | C03499 | 2020 | 45 | C03702 | 2020 | 46 | C04416 | 2120 | 22 |
| C02915 | 2012 | 47 | C03046 | 2012 | 48 | C03502 | 2020 | 45 | C03705 | 2065-TN | 49 | C04418 | 2120 | 22 |
| C02917 | 2012 | 47 | C03048 | 2012 | 48 | C03505 | 2020 | 45 | C03708 | 2065-TN | 49 | C04419 | 2120 | 22 |
| C02918 | 2012 | 47 | C03051 | 2012 | 48 | C03506 | 2020 | 45 | C03711 | 2065-TN | 49 | C04421 | 2120 | 22 |
| C02920 | 2012 | 47 | C03053 | 2012 | 48 | C03508 | 2020 | 45 | C03718 | 2065-TN | 49 | C04422 | 2120 | 22 |
| C02921 | 2012 | 47 | C03055 | 2012 | 48 | C03510 | 2020 | 45 | C03720 | 2065-TN | 49 | C04424 | 2120 | 22 |
| C02923 | 2012 | 47 | C03057 | 2012 | 48 | C03512 | 2020 | 45 | C03722 | 2065-TN | 49 | C04426 | 2120 | 22 |
| C02924 | 2012 | 47 | C03060 | 2012 | 48 | C03513 | 2020 | 45 | C03724 | 2065-TN | 49 | C04428 | 2120 | 22 |
| C02927 | 2012 | 47 | C03063 | 2012 | 48 | C03515 | 2020 | 45 | C03725 | 2065-TN | 49 | C04431 | 2120 | 22 |





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| C11682 | 2222 | 58 | C12124 | 2410 | 100 | C12678 | 2412 | 101 | C13153 | 3957-6 | 94 | C13234 | 3957-12 | 94 |
| C11683 | 2222 | 58 | C12132 | 2410 | 100 | C12684 | 2412 | 101 | C13154 | 3957-6 | 94 | C13235 | 3957-12 | 94 |
| C11684 | 2222 | 58 | C12139 | 2410 | 100 | C12691 | 2412 | 101 | C13155 | 3957-6 | 94 | C13236 | 3957-12 | 94 |
| C11685 | 2222 | 58 | C12147 | 2410 | 100 | C12705 | 2440 | 102 | C13156 | 3957-6 | 94 | C13237 | 3957-12 | 94 |
| C11686 | 2222 | 58 | C12154 | 2410 | 100 | C12728 | 2440 | 102 | C13157 | 3957-6 | 94 | C13238 | 3957-12 | 94 |
| C11687 | 2222 | 58 | C12162 | 2410 | 100 | C12751 | 2440 | 102 | C13158 | 3957-6 | 94 | C13239 | 3957-12 | 94 |
| C11688 | 2222 | 58 | C12167 | 2410 | 100 | C12765 | 2440 | 102 | C13159 | 3957-6 | 94 | C13240 | 3957-12 | 94 |
| C11689 | 2222 | 58 | C12170 | 2410 | 100 | C12775 | 2440 | 102 | C13160 | 3957-6 | 94 | C13241 | 3957-12 | 94 |
| C11690 | 2222 | 58 | C12173 | 2410 | 100 | C12786 | 2440 | 102 | C13161 | 3957-6 | 94 | C13242 | 3957-12 | 94 |
| C11691 | 2222 | 58 | C12176 | 2410 | 100 | C12796 | 2440 | 102 | C13162 | 3957-6 | 94 | C13243 | 3957-12 | 94 |
| C11692 | 2222 | 58 | C12178 | 2410 | 100 | C12806 | 2440 | 102 | C13163 | 3957-6 | 94 | C13244 | 3957-12 | 94 |
| C11693 | 2222 | 58 | C12181 | 2410 | 100 | C12814 | 2440 | 102 | C13164 | 3957-6 | 94 | C13245 | 3957-6 | 95 |
| C11694 | 2222 | 58 | C12183 | 2410 | 100 | C12828 | 2440 | 102 | C13165 | 3957-6 | 94 | C13830 | 940E | 103 |
| C11695 | 2222 | 58 | C12186 | 2410 | 100 | C12835 | 2440 | 102 | C13166 | 3957-6 | 94 | C13831 | 940E | 103 |
| C11696 | 2222 | 58 | C12188 | 2410 | 100 | C12842 | 2440 | 102 | C13167 | 3957-6 | 94 | C13832 | 940E | 103 |
| C11697 | 2222 | 58 | C12191 | 2410 | 100 | C13100 | 3957-6 | 94 | C13168 | 3957-6 | 94 | C13833 | 940E | 103 |
| C11698 | 2222 | 58 | C12194 | 2410 | 100 | C13101 | 3957-6 | 94 | C13169 | 3957-6 | 94 | C13834 | 940E | 103 |
| C11699 | 2222 | 58 | C12196 | 2410 | 100 | C13102 | 3957-6 | 94 | C13170 | 3957-6 | 94 | C13835 | 940E | 103 |
| C11700 | 2222 | 58 | C12199 | 2410 | 100 | C13103 | 3957-6 | 94 | C13171 | 3957-6 | 94 | C13836 | 940E | 103 |
| C11701 | 2222 | 58 | C12201 | 2410 | 100 | C13104 | 3957-6 | 94 | C13172 | 3957-6 | 94 | C13837 | 940E | 103 |
| C11702 | 2222 | 58 | C12204 | 2410 | 100 | C13105 | 3957-6 | 94 | C13173 | 3957-6 | 94 | C13839 | 940E | 103 |
| C11703 | 2222 | 58 | C12207 | 2410 | 100 | C13106 | 3957-6 | 94 | C13174 | 3957-6 | 94 | C13840 | 940E | 103 |
| C11704 | 2222 | 58 | C12209 | 2410 | 100 | C13107 | 3957-6 | 94 | C13176 | 3957-12 | 94 | C13841 | 940E | 103 |
| C11705 | 2222 | 58 | C12212 | 2410 | 100 | C13108 | 3957-6 | 95 | C13177 | 3957-12 | 94 | C13842 | 940E | 103 |
| C11706 | 2222 | 58 | C12214 | 2410 | 100 | C13109 | 3957-6 | 95 | C13178 | 3957-12 | 94 | C13843 | 940E | 103 |
| C11739 | 995 | 107 | C12216 | 2410 | 100 | C13110 | 3957-6 | 95 | C13179 | 3957-12 | 94 | C13844 | 940E | 103 |
| C11757 | 995 | 107 | C12218 | 2410 | 100 | C13111 | 3957-6 | 95 | C13180 | 3957-12 | 94 | C13845 | 940E | 103 |
| C11771 | 995 | 107 | C12220 | 2410 | 100 | C13112 | 3957-6 | 95 | C13181 | 3957-12 | 94 | C13847 | 940E | 103 |
| C11782 | 995 | 107 | C12222 | 2410 | 100 | C13113 | 3957-6 | 95 | C13182 | 3957-12 | 94 | C13848 | 940E | 103 |
| C11796 | 995 | 107 | C12223 | 2410 | 101 | C13114 | 3957-6 | 95 | C13183 | 3957-12 | 95 | C13849 | 940E | 103 |
| C11800 | 2222 | 58 | C12225 | 2410 | 101 | C13115 | 3957-6 | 95 | C13184 | 3957-12 | 95 | C14200 | 2175 | 24 |
| C11805 | 2222 | 58 | C12227 | 2410 | 101 | C13116 | 3957-6 | 95 | C13185 | 3957-12 | 95 | C14201 | 2175 | 24 |
| C11810 | 2222 | 58 | C12229 | 2410 | 101 | C13117 | 3957-6 | 95 | C13186 | 3957-12 | 95 | C14202 | 2175 | 24 |
| C11815 | 2222 | 58 | C12231 | 2410 | 101 | C13118 | 3957-6 | 95 | C13187 | 3957-12 | 95 | C14203 | 2175 | 24 |
| C11820 | 2222 | 58 | C12232 | 2410 | 101 | C13119 | 3957-6 | 95 | C13188 | 3957-12 | 95 | C14204 | 2175 | 24 |
| C11822 | 2222 | 58 | C12234 | 2410 | 101 | C13120 | 3957-6 | 95 | C13189 | 3957-12 | 95 | C14205 | 2175 | 24 |
| C11825 | 2222 | 58 | C12236 | 2410 | 101 | C13121 | 3957-6 | 95 | C13190 | 3957-12 | 95 | C14206 | 2175 | 24 |
| C11830 | 2222 | 59 | C12238 | 2410 | 101 | C13122 | 3957-6 | 95 | C13191 | 3957-12 | 95 | C14207 | 2175 | 24 |
| C11831 | 2222 | 59 | C12240 | 2410 | 101 | C13123 | 3957-6 | 95 | C13192 | 3957-12 | 95 | C14208 | 2175 | 25 |
| C11835 | 2222 | 59 | C12241 | 2410 | 101 | C13124 | 3957-6 | 95 | C13193 | 3957-12 | 95 | C14209 | 2175 | 25 |
| C11839 | 2222 | 59 | C12243 | 2410 | 101 | C13125 | 3957-6 | 95 | C13194 | 3957-12 | 95 | C14210 | 2175 | 25 |
| C11840 | 2222 | 59 | C12247 | 2410 | 101 | C13126 | 3957-6 | 95 | C13195 | 3957-12 | 95 | C14211 | 2175 | 25 |
| C11845 | 2222 | 59 | C12249 | 2410 | 101 | C13127 | 3957-6 | 95 | C13196 | 3957-12 | 95 | C14212 | 2175 | 25 |
| C11850 | 2222 | 59 | C12250 | 2410 | 101 | C13128 | 3957-6 | 95 | C13197 | 3957-12 | 95 | C14213 | 2175 | 25 |
| C11855 | 2222 | 59 | C12252 | 2410 | 101 | C13129 | 3957-6 | 95 | C13198 | 3957-12 | 95 | C14214 | 2175 | 25 |
| C11860 | 2222 | 59 | C12254 | 2410 | 101 | C13130 | 3957-6 | 95 | C13199 | 3957-12 | 95 | C14215 | 2175 | 25 |
| C11865 | 2222 | 60 | C12257 | 2410 | 101 | C13131 | 3957-6 | 95 | C13200 | 3957-12 | 95 | C14216 | 2175 | 25 |
| C11870 | 2222 | 60 | C12265 | 2410 | 101 | C13132 | 3957-6 | 95 | C13201 | 3957-12 | 95 | C14217 | 2175 | 25 |
| C11875 | 2222 | 60 | C12272 | 2410 | 101 | C13133 | 3957-6 | 95 | C13202 | 3957-12 | 95 | C14218 | 2175 | 25 |
| C11880 | 2222 | 60 | C12279 | 2410 | 101 | C13134 | 3957-6 | 95 | C13203 | 3957-12 | 95 | C14219 | 2175 | 26 |
| C11885 | 2222 | 60 | C12286 | 2410 | 101 | C13135 | 3957-6 | 95 | C13204 | 3957-12 | 95 | C14220 | 2175 | 26 |
| C11890 | 2222 | 60 | C12290 | 2410 | 101 | C13136 | 3957-6 | 95 | C13211 | 3957-12 | 95 | C14221 | 2175 | 26 |
| C11895 | 2222 | 60 | C12293 | 2410 | 101 | C13137 | 3957-6 | 95 | C13218 | 3957-12 | 95 | C14222 | 2175 | 26 |
| C11900 | 2222 | 60 | C12301 | 2410 | 101 | C13138 | 3957-6 | 95 | C13219 | 3957-12 | 95 | C14223 | 2175 | 26 |
| C11905 | 2222 | 60 | C12304 | 2410 | 101 | C13139 | 3957-6 | 95 | C13220 | 3957-12 | 95 | C14224 | 2175 | 26 |
| C11910 | 2222 | 60 | C12308 | 2410 | 101 | C13140 | 3957-6 | 95 | C13221 | 3957-12 | 95 | C14225 | 2175 | 26 |
| C11915 | 2222 | 60 | C12315 | 2410 | 101 | C13141 | 3957-6 | 95 | C13222 | 3957-12 | 95 | C14226 | 2175 | 26 |
| C11920 | 2222 | 60 | C12322 | 2410 | 101 | C13142 | 3957-6 | 95 | C13223 | 3957-12 | 95 | C14227 | 2175 | 26 |
| C12040 | 2410 | 100 | C12336 | 2410 | 101 | C13143 | 3957-6 | 94 | C13224 | 3957-12 | 95 | C14228 | 2175 | 26 |
| C12052 | 2410 | 100 | C12351 | 2410 | 101 | C13144 | 3957-6 | 94 | C13225 | 3957-12 | 95 | C14229 | 2175 | 26 |
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| C12075 | 2410 | 100 | C12505 | 2411 | 101 | C13147 | 3957-6 | 94 | C13228 | 3957-12 | 95 | C14232 | 2175 | 26 |
| C12082 | 2410 | 100 | C12518 | 2411 | 101 | C13148 | 3957-6 | 94 | C13229 | 3957-12 | 95 | C14233 | 2175 | 26 |
| C12091 | 2410 | 100 | C12532 | 2411 | 101 | C13149 | 3957-6 | 94 | C13230 | 3957-12 | 95 | C14234 | 2175 | 26 |
| C12099 | 2410 | 100 | C12541 | 2411 | 101 | C13150 | 3957-6 | 94 | C13231 | 3957-12 | 95 | C14235 | 2175 | 26 |
| C12113 | 2410 | 100 | C12566 | 2411 | 101 | C13151 | 3957-6 | 94 | C13232 | 3957-12 | 95 | C14236 | 2175 | 26 |
| C12117 | 2410 | 100 | C12670 | 2412 | 100 | C13152 | 3957-6 | 94 | C13233 | 3957-12 | 95 | C14237 | 2175 | 26 |





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| C14775 | 2133-TC | 33 | C14984 | 2513 | 87 | C15107 | 2175-TA | 25 | C15269 | 2175-TC | 26 | C15337 | 2175-TC | 25 |
| C14786 | 2133-TC | 32 | C14999 | 2513 | 87 | C15108 | 2175-TA | 24 | C15270 | 2175-TC | 26 | C15338 | 2175-TC | 25 |
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| C14802 | 2133 | 31 | C15037 | 2513 | 87 | C15114 | 2175-TA | 24 | C15276 | 2175-TC | 26 | C15344 | 2175-TC | 25 |
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| C14804 | 2133 | 31 | C15042 | 2513 | 87 | C15116 | 2175-TA | 24 | C15278 | 2175-TC | 26 | C15346 | 2175-TC | 25 |
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| C14807 | 2133 | 32 | C15051 | 2175-TA | 24 | C15119 | 2175-TA | 24 | C15281 | 2175-TC | 26 | C15349 | 2175-TC | 26 |
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| C96037 | PER-960SP | 177 | C98001 | PER-980SF | 183 | C98115 | PRO-981SF | 181 | C98244 | CEM-SE4 | 316 | | | |
| C96038 | PER-960SP | 177 | C98002 | PER-980SF | 183 | C98116 | PRO-981SF | 181 | C98245 | CEM-SE4 | 316 | | | |
| C96039 | PER-960SP | 177 | C98003 | PER-980SF | 183 | C98117 | PRO-981SF | 181 | C98246 | CEM-SE4 | 316 | | | |
| C96040 | PER-960SP | 177 | C98004 | PER-980SF | 183 | C98118 | PRO-981SF | 181 | C98247 | CEM-SE4 | 316 | | | |
| C96041 | PER-960SP | 177 | C98005 | PER-980SF | 183 | C98119 | PRO-981SF | 181 | C98248 | CEM-SE4 | 316 | | | |
| C96042 | PER-960SP | 177 | C98006 | PER-980SF | 183 | C98120 | PRO-981SF | 181 | C98249 | CEM-SE4 | 316 | | | |
| C96043 | PER-960SP | 177 | C98007 | PER-980SF | 183 | C98121 | PRO-981SF | 181 | C98250 | CEM-SE4 | 317 | | | |
| C96044 | PER-960SP | 177 | C98008 | PER-980SF | 183 | C98122 | PRO-981SF | 181 | C98251 | CEM-SE4 | 317 | | | |
| C96045 | PER-960SP | 177 | C98009 | PER-980SF | 183 | C98123 | PRO-981SF | 181 | C98252 | CEM-SE4 | 317 | | | |
| C96046 | PER-960SP | 177 | C98010 | PER-980SF | 183 | C98124 | PRO-981SF | 181 | C98253 | CEM-SE4 | 317 | | | |
| C96047 | PER-960SP | 177 | C98011 | PER-980SF | 183 | C98125 | PRO-981SF | 181 | C98254 | CEM-SE4 | 317 | | | |
| C96048 | PER-960SP | 177 | C98012 | PER-980SF | 183 | C98126 | PRO-981SF | 181 | C98255 | CEM-SE4 | 317 | | | |
| C96049 | PER-960SP | 177 | C98013 | PER-980SF | 183 | C98127 | PRO-981SF | 181 | C98256 | CEM-SE4 | 317 | | | |
| C96050 | PER-960SP | 177 | C98014 | PER-980SF | 183 | C98128 | PRO-981SF | 181 | C98257 | CEM-SE4 | 318 | | | |
| C96051 | PER-960SP | 177 | C98015 | PER-980SF | 183 | C98129 | PRO-981SF | 181 | C98258 | CEM-SE4 | 318 | | | |





Tap & Drill Recommendations

Machine Screw, Fractional, and Metric Sizes

| Tap Size & Pitch | | Cutting Taps | | Forming Taps | | Tap Size & Pitch | | Cutting Taps | | Forming Taps | |
|------------------|-------------|--------------|--------------|--------------|--------------|------------------|------------|--------------|--------------|--------------|--------------|
| inch | metric | drill size | decimal inch | drill size | decimal inch | inch | metric | drill size | decimal inch | drill size | decimal inch |
| 0-80 | | 3/64 | .0469 | 54 | .0550 | | M12 x 1,75 | 10,2 | .4016 | 11,2 | .4409 |
| | M1,6 x 0,35 | 1,25 | .0492 | 1,45 | .0571 | | M12 x 1,25 | 10,8 | .4252 | 11,5 | .4528 |
| | M1,8 x 0,35 | 1,45 | .0571 | 1,65 | .0650 | 1/2-13 | | 27/64 | .4219 | 15/32 | .4688 |
| 1-64 | | 53 | .0595 | 51 | .0670 | 1/2-20 | | 29/64 | .4531 | 12,25 | .4823 |
| 1-72 | | 53 | .0595 | 51 | .0670 | | M14 x 2 | 12,0 | .4724 | 33/64 | .5156 |
| | M2 x 0,4 | 1,6 | .0630 | 1,8 | .0709 | 9/16-12 | | 31/64 | .4844 | 17/32 | .5312 |
| 2-56 | | 50 | .0700 | 5/64 | .0781 | 9/16-18 | | 33/64 | .5156 | 13,5 | .5315 |
| 2-64 | | 50 | .0700 | 47 | .0785 | 5/8-11 | | 17/32 | .5312 | 14,75 | .5807 |
| | M2,2 x 0,45 | 1,75 | .0689 | 2,0 | .0787 | 5/8-18 | | 37/64 | .5781 | 15,25 | .6004 |
| | M2,5 x 0,45 | 2,05 | .0807 | 2,3 | .0906 | | M16 x 2 | 14,0 | .5512 | 19/32 | .5938 |
| 3-48 | | 47 | .0785 | 43 | .0890 | | M16 x 1,5 | 14,5 | .5709 | 15,25 | .6004 |
| 3-56 | | 46 | .0810 | 2,3 | .0906 | | M18 x 2,5 | 15,5 | .6102 | 39/64 | .6094 |
| 4-40 | | 43 | .0890 | 38 | .1015 | | M18 x 1,5 | 16,5 | .6496 | 17,25 | .6791 |
| 4-48 | | 42 | .0935 | 2,6 | .1024 | 3/4-10 | | 21/32 | .6562 | 45/64 | .7031 |
| | M3 x 0,5 | 2,5 | .0984 | 7/64 | .1094 | 3/4-16 | | 11/16 | .6875 | 23/32 | .7188 |
| 5-40 | | 38 | .1015 | 33 | .1130 | | M20 x 2,5 | 17,5 | .6890 | | |
| 5-44 | | 37 | .1040 | 2,9 | .1142 | | M20 x 1,5 | 18,5 | .7283 | | |
| | M3,5 x 0,6 | 2,9 | .1142 | 3,2 | .1260 | | M22 x 2,5 | 19,5 | .7677 | | |
| 6-32 | | 36 | .1065 | 1/8 | .1250 | | M22 x 1,5 | 20,5 | .8071 | | |
| 6-40 | | 33 | .1130 | 3,25 | .1280 | 7/8-9 | | 49/64 | .7656 | | |
| | M4 x 0,7 | 3,3 | .1299 | 3,7 | .1457 | 7/8-14 | | 13/16 | .8125 | | |
| 8-32 | | 29 | .1360 | 25 | .1495 | | M24 x 3 | 21,0 | .8268 | | |
| 8-36 | | 29 | .1360 | 24 | .1520 | | M24 x 2 | 22,0 | .8661 | | |
| | M4,5 x 0,75 | 3,7 | .1457 | 4,1 | .1614 | 1-8 | | 7/8 | .8750 | | |
| 10-24 | | 26 | .1470 | 11/64 | .1719 | 1-12 | | 59/64 | .9219 | | |
| 10-32 | | 21 | .1590 | 16 | .1770 | | M27 x 3 | 24,0 | .9449 | | |
| | M5 x 0,8 | 4,2 | .1654 | 14 | .1820 | | M27 x 2 | 25,0 | .9843 | | |
| 12-24 | | 16 | .1770 | 8 | .1990 | 1-1/8-7 | | 63/64 | .9844 | | |
| 12-28 | | 15 | .1800 | 7 | .2010 | 1-1/8-12 | | 1-3/64 | 1.0469 | | |
| | M6 x 1 | 5,0 | .1969 | 7/32 | .2188 | | M30 x 3,5 | 26,5 | 1.0433 | | |
| 1/4-20 | | 7 | .2010 | 1 | .2280 | | M30 x 2 | 28,0 | 1.1024 | | |
| 1/4-28 | | 3 | .2130 | 15/64 | .2340 | 1-1/4-7 | | 1-7/64 | 1.1094 | | |
| | M7 x 1 | 6,0 | .2362 | F | .2570 | 1-1/4-12 | | 1-11/64 | 1.1719 | | |
| 5/16-18 | | F | .2570 | L | .2900 | | M33 x 3,5 | 29,5 | 1.1614 | | |
| 5/16-24 | | I | .2720 | M | .2950 | | M33 x 2 | 31,0 | 1.2205 | | |
| | M8 x 1,25 | 6,7 | .2638 | 7,4 | .2913 | 1-3/8-6 | | 1-7/32 | 1.2188 | | |
| | M8 x 1 | 7,0 | .2756 | 19/64 | .2969 | 1-3/8-12 | | 1-19/64 | 1.2969 | | |
| 3/8-16 | | 5/16 | .3125 | S | .3480 | | M36 x 4 | 32,0 | 1.2598 | | |
| 3/8-24 | | Q | .3320 | T | .3580 | | M36 x 3 | 33,0 | 1.2992 | | |
| | M10 x 1,5 | 8,5 | .3346 | U | .3680 | 1-1/2-6 | | 1-11/32 | 1.3438 | | |
| | M10 x 1,25 | 8,7 | .3425 | 9,4 | .3701 | 1-1/2-12 | | 1-27/64 | 1.4219 | | |
| 7/16-14 | | U | .3680 | Y | .4040 | | M39 x 4 | 35,0 | 1.3780 | | |
| 7/16-20 | | 25/64 | .3906 | Z | .4130 | | M39 x 3 | 36,0 | 1.4173 | | |

FORM TAPS NOT AVAILABLE IN THESE SIZES

Pipe Taps — NPT, NPTF, NPSM, NPSC, NPSF Sizes

| Nominal Tap Size & Pitch | NPT & NPTF | | NPSM | NPSC | NPSF |
|--------------------------|------------|-----------|----------|---------|----------|
| | w/o reamer | w/ reamer | | | |
| 1/16 - 27 | C (.242) | A (.234) | — | 1/4 | D (.246) |
| 1/8 - 27 | Q (.332) | 21/64 | T (.358) | Q | R (.339) |
| 1/4 - 18 | 7/16 | 27/64 | 15/32 | 7/16 | 7/16 |
| 3/8 - 18 | 9/16 | 9/16 | .603* | 37/64 | 37/64 |
| 1/2 - 14 | 45/64 | 11/16 | 19,0mm | 23/32 | .705* |
| 3/4 - 14 | 29/32 | 57/64 | 61/64 | 59/64 | 59/64 |
| 1 - 11 1/2 | 1 9/64 | 1 1/8 | 1 13/64 | 1 5/32 | 1 5/32 |
| 1 1/4 - 11 1/2 | 1 31/64 | 1 15/32 | 1.546* | 1 1/2 | — |
| 1 1/2 - 11 1/2 | 1 23/32 | 1 45/64 | 1 25/32 | 1 47/64 | — |
| 2 - 11 1/2 | 2 3/16 | 2 11/64 | 2 1/4 | 2 1/4 | — |

*special





Decimal Equivalents

| DRILL SIZE | DECIMAL INCHES | DRILL SIZE | DECIMAL INCHES | DRILL SIZE | DECIMAL INCHES | DRILL SIZE | DECIMAL INCHES | DRILL SIZE | DECIMAL INCHES | DRILL SIZE | DECIMAL INCHES |
|------------|----------------|------------|----------------|------------|----------------|------------|----------------|------------|----------------|------------|----------------|
| 0.30mm | .0118 | 1.40mm | .0551 | 3.20mm | .1260 | 7/32 | .2188 | 8.60mm | .3386 | 37/64 | .5781 |
| 0.32mm | .0126 | 1.45mm | .0571 | 30 | .1285 | 5.60mm | .2205 | R | .3390 | 14.75mm | .5807 |
| 80 | .0135 | 1.50mm | .0591 | 3.30mm | .1299 | 2 | .2210 | 8.70mm | .3425 | 15.00mm | .5906 |
| 0.35mm | .0138 | 53 | .0595 | 3.40mm | .1339 | 5.70mm | .2244 | 11/32 | .3438 | 19/32 | .5938 |
| 79 | .0145 | 1.55mm | .0610 | 29 | .1360 | 1 | .2280 | 8.80mm | .3465 | 15.25mm | .6004 |
| 0.38mm | .0150 | 1/16 | .0625 | 3.50mm | .1378 | 5.80mm | .2283 | S | .3480 | 39/64 | .6094 |
| 1/64 | .0156 | 1.60mm | .0630 | 28 | .1405 | 5.90mm | .2323 | 8.90mm | .3504 | 15.50mm | .6102 |
| 0.40mm | .0157 | 52 | .0635 | 9/64 | .1406 | A | .2340 | 9.00mm | .3543 | 15.75mm | .6201 |
| 78 | .0160 | 1.65mm | .0650 | 3.60mm | .1417 | 15/64 | .2344 | T | .3580 | 5/8 | .6250 |
| 0.42mm | .0165 | 1.70mm | .0669 | 27 | .1440 | 6.00mm | .2362 | 9.10mm | .3583 | 16.00mm | .6299 |
| 0.45mm | .0177 | 51 | .0670 | 3.70mm | .1457 | B | .2380 | 23/64 | .3594 | 16.25mm | .6398 |
| 77 | .0180 | 1.75mm | .0689 | 26 | .1470 | 6.10mm | .2402 | 9.20mm | .3622 | 41/64 | .6406 |
| 0.48mm | .0189 | 50 | .0700 | 25 | .1495 | C | .2420 | 9.30mm | .3661 | 16.50mm | .6496 |
| 0.50mm | .0197 | 1.80mm | .0709 | 3.80mm | .1496 | 6.20mm | .2441 | U | .3680 | 21/32 | .6562 |
| 76 | .0200 | 1.85mm | .0728 | 24 | .1520 | D | .2460 | 9.40mm | .3701 | 16.75mm | .6594 |
| 75 | .0210 | 49 | .0730 | 3.90mm | .1535 | 6.30mm | .2480 | 9.50mm | .3740 | 17.00mm | .6693 |
| 0.55mm | .0217 | 1.90mm | .0748 | 23 | .1540 | 1/4 | .2500 | 3/8 | .3750 | 43/64 | .6719 |
| 74 | .0225 | 48 | .0760 | 5/32 | .1562 | E | .2500 | V | .3770 | 17.25mm | .6791 |
| 0.60mm | .0236 | 1.95mm | .0768 | 22 | .1570 | 6.40mm | .2520 | 9.60mm | .3780 | 11/16 | .6875 |
| 73 | .0240 | 5/64 | .0781 | 4.00mm | .1575 | 6.50mm | .2559 | 9.70mm | .3819 | 17.50mm | .6890 |
| 0.62mm | .0244 | 47 | .0785 | 21 | .1590 | F | .2570 | 9.80mm | .3858 | 45/64 | .7031 |
| 72 | .0250 | 2.00mm | .0787 | 20 | .1610 | 6.60mm | .2598 | W | .3860 | 18.00mm | .7087 |
| 0.65mm | .0256 | 2.05mm | .0807 | 4.10mm | .1614 | G | .2610 | 9.90mm | .3898 | 23/32 | .7188 |
| 71 | .0260 | 46 | .0810 | 4.20mm | .1654 | 6.70mm | .2638 | 25/64 | .3906 | 18.50mm | .7283 |
| 0.70mm | .0276 | 45 | .0820 | 19 | .1660 | 17/64 | .2656 | 1.00mm | .3937 | 47/64 | .7344 |
| 70 | .0280 | 2.10mm | .0827 | 4.30mm | .1693 | H | .2660 | X | .3970 | 19.00mm | .7480 |
| 69 | .0292 | 2.15mm | .0846 | 18 | .1695 | 6.80mm | .2677 | 1.20mm | .4016 | 3/4 | .7500 |
| 0.75mm | .0295 | 44 | .0860 | 11/64 | .1719 | 6.90mm | .2717 | Y | .4040 | 49/64 | .7656 |
| 68 | .0310 | 2.20mm | .0866 | 17 | .1730 | I | .2720 | 13/32 | .4062 | 19.50mm | .7677 |
| 1/32 | .0312 | 2.25mm | .0886 | 4.40mm | .1732 | 7.00mm | .2756 | Z | .4130 | 25/32 | .7812 |
| 0.80mm | .0315 | 43 | .0890 | 16 | .1770 | J | .2770 | 10.50mm | .4134 | 20.00mm | .7874 |
| 67 | .0320 | 2.30mm | .0906 | 4.50mm | .1772 | 7.10mm | .2795 | 27/64 | .4219 | 51/64 | .7969 |
| 66 | .0330 | 2.35mm | .0925 | 15 | .1800 | K | .2810 | 10.80mm | .4252 | 20.50mm | .8071 |
| 0.85mm | .0335 | 42 | .0935 | 4.60mm | .1811 | 9/32 | .2812 | 11.00mm | .4331 | 13/16 | .8125 |
| 65 | .0350 | 3/32 | .0938 | 14 | .1820 | 7.20mm | .2835 | 7/16 | .4375 | 21.00mm | .8268 |
| 0.90mm | .0354 | 2.40mm | .0945 | 4.70mm | .1850 | 7.30mm | .2874 | 11.20mm | .4409 | 53/64 | .8281 |
| 64 | .0360 | 41 | .0960 | 13 | .1850 | L | .2900 | 11.50mm | .4528 | 27/32 | .8438 |
| 63 | .0370 | 2.45mm | .0965 | 3/16 | .1875 | 7.40mm | .2913 | 29/64 | .4531 | 21.50mm | .8465 |
| 0.95mm | .0374 | 40 | .0980 | 12 | .1890 | M | .2950 | 11.80mm | .4646 | 55/64 | .8594 |
| 62 | .0380 | 2.50mm | .0984 | 4.8mm | .1890 | 7.50mm | .2953 | 15/32 | .4688 | 22.00mm | .8661 |
| 61 | .0390 | 39 | .0995 | 11 | .1910 | 19/64 | .2969 | 12.00mm | .4724 | 7/8 | .8750 |
| 1.00mm | .0394 | 38 | .1015 | 4.90mm | .1929 | 7.60mm | .2992 | 12.20mm | .4803 | 22.50mm | .8858 |
| 60 | .0400 | 2.60mm | .1024 | 10 | .1935 | N | .3020 | 31/64 | .4844 | 57/64 | .8906 |
| 59 | .0410 | 37 | .1040 | 9 | .1960 | 7.70mm | .3031 | 12.50mm | .4921 | 23.00mm | .9055 |
| 1.05mm | .0413 | 2.70mm | .1063 | 5.00mm | .1969 | 7.80mm | .3071 | 1/2 | .5000 | 29/32 | .9062 |
| 58 | .0420 | 36 | .1065 | 8 | .1990 | 7.90mm | .3110 | 12.80mm | .5039 | 59/64 | .9219 |
| 57 | .0430 | 7/64 | .1094 | 5.10mm | .2008 | 5/16 | .3125 | 13.00mm | .5118 | 23.50mm | .9252 |
| 1.10mm | .0433 | 35 | .1100 | 7 | .2010 | 8.00mm | .3150 | 33/64 | .5156 | 15/16 | .9375 |
| 1.15mm | .0453 | 2.80mm | .1102 | 13/64 | .2031 | O | .3160 | 13.20mm | .5197 | 24.00mm | .9449 |
| 56 | .0465 | 34 | .1110 | 6 | .2040 | 8.10mm | .3189 | 17/32 | .5312 | 61/64 | .9531 |
| 3/64 | .0469 | 33 | .1130 | 5.20mm | .2047 | 8.20mm | .3228 | 13.50mm | .5315 | 24.50mm | .9646 |
| 1.20mm | .0472 | 2.90mm | .1142 | 5 | .2055 | P | .3230 | 13.80mm | .5433 | 31/32 | .9688 |
| 1.25mm | .0492 | 32 | .1160 | 5.30mm | .2087 | 8.30mm | .3268 | 35/64 | .5469 | 25.00mm | .9843 |
| 1.30mm | .0512 | 3.00mm | .1181 | 4 | .2090 | 21/64 | .3281 | 14.00mm | .5512 | 63/64 | .9844 |
| 55 | .0520 | 31 | .1200 | 5.40mm | .2126 | 8.40mm | .3307 | 14.25mm | .5610 | 1 | 1.0000 |
| 1.35mm | .0531 | 3.10mm | .1220 | 3 | .2130 | Q | .3320 | 9/16 | .5625 | | |
| 54 | .0550 | 1/8 | .1250 | 5.50mm | .2165 | 8.50mm | .3346 | 14.50mm | .5709 | | |

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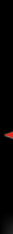


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