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# THREADING Catalog

## Holemaking

## Threading

## Milling

GREENFIELD INDUSTRIES

MADE IN THE U.S.A.

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| Style | Page | Product | Type | Set | Tool Material: HSS | Tool Material: HSS-E | Blank: 302A | Blank: 311 | Blank: DIN / ANSI | Chamfer: Taper | Chamfer: Plug | Chamfer: Bottoming | Chamfer: Mod Bottoming | Application: Steel | Application: Stainless | Application: Cast Iron | Application: Non-Ferrous | Application: High-Temp Alloy | Application: Hardened Steel | Hole: Blind | Hole: Thru | Surface Treatment: Bright | Surface Treatment: Black Oxide | Surface Treatment: TiN | Surface Treatment: TiCN | Surface Treatment: TiAlN | Surface Treatment: AlCrN | Surface Treatment: Oxide over Nitride | Surface Treatment: Hardlube |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **STRAIGHT FLUTE** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1001 | T-21 |  | General Purpose | yes | • | | • | | | • | | | | • | • | • | • | | | | • | • | | • | | | | | | |
| 1002 | T-21 |  | General Purpose | yes | • | | • | | | | • | | | • | • | • | • | | | | • | • | • | • | • | | | | | |
| 1003 | T-21 |  | General Purpose | yes | • | | • | | | | | • | | • | • | • | • | | | • | | • | | • | | | | | | |
| 1004 | T-21 |  | Set *(Styles: 1001, 1002, 1003)* | yes | • | | • | | | • | • | • | | • | • | • | • | | | | | • | | • | | | | | | |
| 1002L | T-26 |  | General Purpose - Left Hand | | • | | • | | | | • | | | • | | • | • | | | | • | • | | | | | | | | |
| CI-1000 | T-27 |  | Cast Iron | | | • | • | | | | | | • | • | | • | | | • | • | | | | • | | | | • | | |
| **SPIRAL POINT** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1011 | T-28 |  | General Purpose | | • | | • | | | | • | | | • | • | • | • | | | | | • | • | • | • | | | | | |
| 1053 | T-32 |  | Low Shear | | • | | • | | | | • | | | • | | • | | | | | | • | • | | | | | | | |
| 1012 | T-28 |  | Bottoming | | • | | • | | | | | • | | • | | • | • | | | • | | • | | • | | | | | | |
| 1011E | T-33 |  | 6" Extended Length | | • | | 303-A | | | | • | | | • | | • | | | | | | • | • | | | | | | | |
| T-101 | T-33 |  | Stainless Steel & Steel | | | • | • | | | | • | | | • | • | • | | | | | | • | • | | | | | | | |
| PRO-961SP | T-34 |  | Universal | | | • | | | • | | • | | | • | • | • | | | | | | • | • | | | | | | | |
| PRO-861SP | T-34 | | Universal | | | • | | | • | | • | | | • | • | • | | | | | | • | | | | • | | | | |
| PER-862SP | T-36 |  | Stainless Steel | | | • | | | • | | • | | | • | • | • | | | | | | • | • | | | | | | | |
| PER-960SP | T-36 | | Stainless Steel | | | • | | | • | | • | | | • | • | • | | | | | | • | | | | | | | | • |
| **SPIRAL FLUTE** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1093 | T-38 |  | General Purpose | | • | | • | | | | • | | | • | • | | • | | | • | | • | | • | • | | | | | |
| 1094 | T-38 |  | General Purpose | | • | | • | | | | | • | | • | • | | • | | | • | | • | | • | • | | | | | |
| 1095 | T-39 |  | Heavy Duty | | • | | • | | | | • | | | • | • | | | | | • | | | • | | | | | | | |
| 1096 | T-39 |  | Heavy Duty | | • | | • | | | | | | • | • | • | | | | | • | | | • | | | | | | | |
| PRO-981SF | T-40 |  | Universal | | | • | | | • | | | | • | • | • | • | | | | • | | | • | | | | | | | |
| PRO-892SF | T-40 | | Universal | | | • | | | • | | | | • | • | • | • | | | | • | | | | | | • | | | | |
| PER-893SF | T-42 |  | Stainless Steel | | | • | | | • | | | | • | • | • | • | | | | • | | | • | | | | | | | |
| PER-980SF | T-42 | | Stainless Steel | | | • | | | • | | | | • | • | • | • | | | | • | | | | | | | | | | • |

| Style | Page | Product | Type | Set | Tool Material: HSS | Tool Material: HSS-E | Blank: 302A | Blank: 311 | Blank: DIN / ANSI | Chamfer: Taper | Chamfer: Plug | Chamfer: Bottoming | Chamfer: Mod Bottoming | Application: Steel | Application: Stainless | Application: Cast Iron | Application: Non-Ferrous | Application: High-Temp Alloy | Application: Hardened Steel | Hole: Blind | Hole: Thru | Surface Treatment: Bright | Surface Treatment: Black Oxide | Surface Treatment: TiN | Surface Treatment: TiCN | Surface Treatment: TiAlN | Surface Treatment: AlCrN | Surface Treatment: Oxide over Nitride | Surface Treatment: Hardlube |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FORM** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1091 | T-44 |  | General Purpose | | • | | • | | | | • | | | • | • | | • | | | • | | • | | | | | | | |
| 1092 | T-44 |  | General Purpose | | • | | • | | | | | • | | • | • | | • | | | • | | • | | | | | | | |
| **PIPE** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 965 | T-45 |  | NPT Medium Hook | | • | | | • | | • | | | | • | | • | • | | | | | • | | • | | | | | |
| 975 | T-45 | | NPTF Medium Hook | | • | | | • | | • | | | | • | | • | • | | | | | • | | • | | | | | |
| 964B | T-46 |  | NPT Interrupted Thread | | • | | | • | | • | | | | • | | • | | | | | | • | | | | | | | |
| 966B | T-46 | | NPTF Interrupted Thread | | • | | | • | | • | | | | • | | • | | | | | | • | | | | | | | |
| 963B | T-47 |  | NPS | | • | | | • | | | | | • | • | | • | | | | | | • | | | | | | | |
| 967B | T-47 | | NPSF | | • | | | • | | | | | • | • | | • | | | | | | • | | | | | | | |

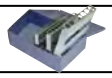
| Style | Page | Product | Type | Tool Material: HSS | Tool Material: Cobalt | Tool Material: Carbide | Thread: UNC | Thread: UNF | Thread: NPT | Thread: NPTF | Thread: Metric Coarse | Thread: Metric Fine | Thread: BSPP | Thread: BSPT | Thread: DIN | Application: Steel | Application: Stainless | Application: Cast Iron | Application: Non-Ferrous | Application: Special Alloy | Application: Hardened Steel | Coolant: Non | Coolant: Thru | Surface Treatment: TiAlN | Surface Treatment: AlCrN | Surface Treatment: Hardlube |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **THREAD MILLS** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CMTM2, CMTMM2 | T-48 |  | Mini | | | • | • | • | | | • | • | | | | • | • | • | • | • | • | • | | | • | |
| CMTM3, CMTMM3 | T-49 | | Mini | | | • | • | • | | | • | • | | | | • | • | • | • | • | • | • | | | • | |
| CTM, CTMC | T-50 |  | General Purpose - Inch | | | • | • | • | | | | | | | | • | • | • | | • | • | • | • | • | | |
| CTMM, CTMMC | T-51 |  | General Purpose - Metric | | | • | | | | | | | | | • | • | • | • | | • | • | • | • | • | | |
| CTMNP, CTMNPC | T-52 |  | National Pipe Tapered | | | • | | | • | • | | | | | | • | • | • | | • | • | • | • | • | | |
| CTMBPP, CTMBPPC | T-52 |  | British Pipe Tapered | | | • | | | | | | | • | | | • | • | • | | • | • | • | • | • | | |
| CTMBPT, CTMBPTC | T-52 |  | British Pipe Parallel | | | • | | | | | | | | • | | • | • | • | | • | • | • | • | • | | |

Index

| Style | Page | Product | Type | Set | Tool Material: HSS | Tool Material: Carbon Steel | Tool Material: Steel | Surface Treatment: Bright | Surface Treatment: Black Oxide | Surface Treatment: TiN | Surface Treatment: TiCN | Surface Treatment: TiAlN | Surface Treatment: AlCrN | Surface Treatment: Oxide over Nitride | Surface Treatment: Hardlube |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DIES** | | | | | | | | | | | | | | | |
| 0650, 0650M, 492 | T-53 |  | Hexagon Rethreading | yes | • | • | | • | | | | | | | |
| 0660 | T-54 | | Taper Pipe | | • | • | | • | | | | | | | |
| 0610, 0710 | T-55 |  | Round Adjustable | | • | • | | • | | | | | | | |
| 0710M | T-57 | | Round Adjustable | | • | | | • | | | | | | | |
| 0620 | T-56 | | Round Adjustable - Pipe | | | • | | • | | | | | | | |
| 222 | T-57 |  | Die Stock, Adjustable | | | | | | | | | | | | |
| 0550 | T-58 |  | Die Set: Die Halves | | | | • | • | | | | | | | |
| 0551 | T-58 |  | Die Set: Cap | | | | • | • | | | | | | | |
| 0552 | T-58 |  | Die Set: Guide | | | | • | • | | | | | | | |
| 0553 | T-58 |  | Die Set: Collet (cap and guide) | | | | • | • | | | | | | | |
| 0554 | T-58 |  | Die Set Assembly (0550,0553,0551,0552) | | | | • | • | | | | | | | |
| 223 | T-59 |  | Quick Set Die Stock | | | • | | | • | | | | | | |
| 225 | T-59 |  | Quick Set Jr. Die Stock | | | • | | | • | | | | | | |
| 226 | T-59 | | Quick Set Spanner Wrench | | | | | | | | | | | | |

| Style | Page | Product | Type |
|---|---|---|---|
| **WRENCHES** | | | |
| 240 | T-60 |  | Straight Wrench |
| 242 | T-60 |  | Plain T-Handle Wrench |
| 243 | T-60 |  | Slip T-Handle Wrench |

| Style | Page | Product | Type |
|---|---|---|---|
| 244 | T-60 |  | Combo Ratchet & Slip Handle Wrench |
| 245 | T-60 |  | Long Shank T-Handle Wrench |

| Style | Page | Product | Product | Type | Set | Tool Material: HSS | Tool Material: Cobalt | Tool Material: Carbide | Tool Material: TCT | Application: Steel | Application: Stainless | Application: Cast Iron | Application: High-Temp Alloy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **OTHER TOOLS** | | | | | | | | | | | | | |
| 192 | T-84 | Screw Extractor |  | Ezy-Out® | yes | • | | | | • | | • | |
| 850 | T-85 | Tool Bits |  | Square | | • | | | | • | | • | |
| 855 | | | | Square | | | • | | | • | • | • | |
| 860 | | | | Square | | | • | | | | • | | • |
| 851 | T-86 | |  | Rectangular | | • | | | | • | | • | |
| 856 | | | | Rectangular | | | • | | | • | • | • | |
| 861 | | | | Rectangular | | | • | | | | • | | • |
| 902 | T-87 | Blanks |  | Oversize | | • | | | | • | | • | • |
| 903 | | | | Undersize | | • | | | | • | | • | • |
| CASE | T-88 | Metal Cases |  | Empty | | | | | | | | | |

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| Style | Page | Product | Type | Set | Tool Material: HSS | Tool Material: Cobalt | Tool Material: Carbide | Tool Material: TCT | Application: Steel | Application: Stainless | Application: Cast Iron | Application: Non-Ferrous | Application: High-TempAlloy | Application: HardenedSteel | Point: 118° | Point: 118° Split | Point: 118° 4-facet | Point: 118° K-Notch | Point: 135° Split | Surface Treatment: Bright | Surface Treatment: Black Oxide | Surface Treatment: Straw | Surface Treatment: TiN | Surface Treatment: TiCN | Surface Treatment: TiAlN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SCREW MACHINE / STUB LENGTH DRILLS** | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2120 | Scan QR code above or request our DRILLING catalog |  | General Purpose | yes | • | | | | • | | • | • | | | • | | | | | • | | | | | | |
| 2175 | |  | Wide Land Parabolic | | | • | | | • | • | • | • | | | | | | | • | | | • | • | • | • |
| 2330 | |  | NAS907-C Heavy Duty | yes | • | | | | • | • | • | • | | | | | | | • | • | | | | | |
| 2133 | |  | Heavy Duty | | | • | | | • | • | • | • | • | | | | | | • | | | • | | • | |
| 1765 | |  | Carbide Spade Drill | | | | • | | • | • | • | | | • | • | | | | | • | | | | | |
| 1767 | |  | Carbide Stub Length | | | | • | | • | • | • | • | | • | | | • | | | • | | | | | |
| **JOBBER DRILLS** | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2001, 2002 | Scan QR code above or request our DRILLING catalog |  | General Purpose | yes | • | | | | • | | • | • | | | • | | | | | • | • | | | | • |
| 2020 | |  | Low Helix | | • | | | | • | | | • | | | • | | | | | • | | | | | |
| 2012 | |  | High Helix | | • | | | | • | | | • | | | • | | | | | • | | | | | |
| 2065 | |  | Parabolic | | • | | | | • | • | | • | | | | | | • | | • | | | • | | |
| 2075 | |  | Wide Land Parabolic | yes | | • | | | • | • | • | • | | | | | | | • | | | • | • | • | • |
| 2006 | |  | Left Hand | | • | | | | • | | • | • | | | • | | | | | • | | | | | |
| 2228 | |  | NAS907-A General Purpose | | • | | | | • | • | | • | | | | • | | | | • | | | | | |
| 2222 | |  | NAS907-B Heavy Duty | yes | • | | | | • | • | • | • | | | | | | | • | • | | | | | |
| 2213 | |  | NAS907-J Heavy Duty | yes | | • | | | • | • | | • | • | | | | | | | • | | • | | | |
| 2011 | |  | Cotter Pin Heavy Duty | | • | | | | • | • | • | | | | | | | | • | • | | | | | |
| 3780 | |  | Q-AMD Short Flute | yes | | • | | | • | • | • | | • | | | | | | • | | • | | | | |
| 2727 | |  | Carbide Tipped | | | | | • | • | • | • | • | | | • | | | | | • | | | | | |
| 1766 | |  | Straight Flute | | | | • | | • | • | • | • | | • | 140° 4-facet | | | | | • | | | | | |
| 1727 | |  | Carbide Heavy Duty | | | | • | | • | • | • | • | | | | | • | | | • | | | | | |

*Tool Material is Premium HSS

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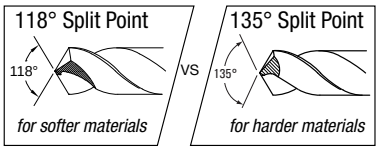
| Style | Page | Product | Type | Set | Tool Material: HSS | Cobalt | Carbide | TCT | Application: Steel | Stainless | Cast Iron | Non-Ferrous | High-Temp Alloy | Hardened Steel | Point: 118° | 118° Split | 118° 4-facet | 118° K-Notch | 135° Split | Surface Treatment: Bright | Black Oxide | Straw | TiN | TiCN | TiAlN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TAPER LENGTH DRILLS** | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2745 | Scan QR code above or request our DRILLING catalog |  | Carbide Tipped Heavy Duty, Tanged | | | | | • | • | | • | • | | | • | | | | | • | | | | | | |
| 2510 | |  | General Purpose | yes | • | | | | • | | • | | | | • | | | | | | • | | | | | |
| 2513 | |  | Heavy Duty | | | • | | | • | • | • | | | | | | | | • | | | • | | | | |
| 2565 | |  | Parabolic | | • | | | | • | • | | • | | | | | | | • | • | | | • | | | |
| 2575 | |  | Wide Land Parabolic | | | • | | | • | • | • | • | | | | | | | • | | | • | • | | | |
| **AIRCRAFT EXTENSION DRILLS** | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3957 | Scan QR code |  | NAS907-B 6" and 12" | | • | | | | • | • | • | • | | | | | | | • | • | | | | | | |
| 3722 | |  | NAS907-J 6" and 12" | | | • | | | • | • | • | • | • | | | | | | • | | | • | | | | |
| **EXTRA LENGTH DRILLS** | | | | | | | | | | | | | | | | | | | | | | | | | |
| 950E | Scan QR code |  | Extra Length | | • | | | | • | | • | | | | | | | • | | | • | | | | |
| **TAPER SHANK DRILLS** | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2410 | Scan QR code |  | Standard | | • | | | | • | | • | | | | • | | | | | | • | | | | | |
| 2411 | |  | Undersized | | • | | | | • | | • | | | | • | | | | | | • | | | | | |
| 2412 | |  | Oversized | | • | | | | • | | • | | | | • | | | | | | • | | | | | |

## TECH TIP

Watch our video for more helpful information

# 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.

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| Style | Page | Product | Type | Set | Tool Material: HSS | Tool Material: Cobalt | Tool Material: Carbide | Application: Steel | Application: Stainless | Application: Cast Iron | Application: Non-Ferrous | Application: High-Temp Alloy | Application: Hardened Steel | Point: 118° | Point: Various degrees - see product page | Surface Treatment: Bright | Surface Treatment: Black Oxide | Surface Treatment: Straw | Surface Treatment: TiN | Surface Treatment: TiCN | Surface Treatment: TiAlN | Surface Treatment: AlTiN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MISCELLANEOUS DRILLS** | | | | | | | | | | | | | | | | | | | | | | |
| 1798 | Scan QR code above or request our DRILLING catalog |  | Combined Drill Countersink | | | • | • | • | • | • | • | | | | 60° | • | | | | | | |
| 996 | |  | Bell Type Drill & Countersink | | • | | | • | | • | • | | | • | 60°, 120° | • | | | | | | |
| 998 | |  | Plain Drill & Countersink | yes | • | | | • | | • | • | | | • | 60° | • | | | | | | |
| 3001 | |  | Countersink & Deburring | yes | | • | | • | • | | • | | | | 60°, 82°, 90°, 100° | • | | | | | | |
| 995 | |  | Spotting & Centering - Short | | • | | | • | | • | • | | | • | | • | | | | | | |
| 1799 | |  | Spotting & Centering | | | | • | • | • | • | • | • | | | 90°, 120°, 142° | | | | | | | • |
| 2636 | |  | NC Spotting & Centering - Short | yes | | • | | • | • | • | • | • | | | 90°, 120° | | | • | | | | |
| 2646 | |  | Spotting & Centering - Long | yes | | • | | • | • | • | • | • | | | 90°, 120° | | | • | | | | |
| 2635 | |  | NC Spotting Drill - Short | yes | • | | | • | • | • | • | | | | 90°, 120° | • | | | | | | |
| 2645 | |  | NC Spotting Drill - Long | yes | • | | | • | • | • | • | | | | 90°, 120° | • | | | | | | |
| 110C1 | |  | Single Flute Countersink | | | | • | • | | • | | | | | 60°, 82°, 90°, 100°, 120° | • | | | | | | |
| 110C3 | |  | 3 Flute Countersink | | | | • | • | | • | | | | | 60°, 82°, 90°, 100°, 120° | • | | | | | | |
| 110C6 | |  | 6 Flute Countersink | | | | • | • | | • | | | | | 60°, 82°, 90°, 100°, 120° | • | | | | | | |
| 10001 | |  | Single Flute Countersink | yes | • | | | • | | • | | | | | 60°, 82°, 90°, 100°, 120° | | • | | | | | |
| 10003 | |  | 3 Flute Countersink | yes | • | | | • | | • | | | | | 60°, 82°, 90°, 100°, 120° | | • | | | | | |
| 610 | |  | 4 Flute Countersink | yes | • | | | • | | • | | | | | 60°, 82°, 90°, 100° | | • | | | | | |
| 105 | |  | Drift Drill | | • | | | | | | | | | | | • | | | | | | |

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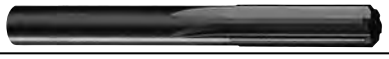
| Style | Page | Product | Type | Set | Tool Material: HSS | Tool Material: Cobalt | Tool Material: Carbide | Application: Steel | Application: Stainless | Application: Cast Iron | Application: Non-Ferrous | Application: High-Temp Alloy | Application: Hardened Steel | Hole: Blind Hole | Hole: Thru Hole | Surface Treatment: Bright | Surface Treatment: Black Oxide | Surface Treatment: Straw | Surface Treatment: TiN | Surface Treatment: TiCN | Surface Treatment: TiAlN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **REAMERS** | | | | | | | | | | | | | | | | | | | | | |
| 1730 | Scan QR code above or request our DRILLING catalog |  | Straight Shank, Straight Flute | | | | • | • | • | • | • | | | | • | • | | | | | | |
| 4001 | |  | Straight Shank, Straight Flute | yes | • | | | • | • | • | • | | | | • | • | | | | | | |
| 4030 | |  | Straight Shank, Spiral Flute | | • | | | • | • | • | • | | | • | | • | | | | | | |
| 4005 | |  | Taper Shank, Straight Flute | | • | | | • | • | • | • | | | | • | • | | | | | | |
| 4703 | |  | Straight Shank, Straight Flute | | • | | | • | • | • | • | | | | • | • | | | | | | |
| 616 | |  | Taper Shank, Bridge Reamer | | • | | | • | | • | | | | | | | • | | | | | |
| 618 | |  | Taper Shank, Car Reamer | | • | | | • | | • | | | | | | | • | | | | | |
| 642 | |  | Taper Pipe Reamer | | • | | | • | | | • | | | | | | | | | | | |
| 650 | |  | High Spiral Spirex Taper Pin | | • | | | • | | | • | | | | | | | | | | | |
| 657 | |  | Taper Pin Straight Shank, Straight Flute | | • | | | • | | • | • | | | | | | | | | | | |
| 659 | |  | Taper Pin Straight Shank, Helical Flute | | • | | | • | | • | • | | | | | | | | | | | |
| **COUNTERBORES** | | | | | | | | | | | | | | | | | | | | | |
| 879 | Scan QR code above or request our DRILLING catalog |  | Straight Shank C'bore & Spot Facer | | • | | | • | | • | • | | | | | • | | | | | | |
| 884 | |  | Short Aircraft Type | | • | | | • | | • | • | | | | | • | | | | | | |
| 879P | |  | Interchangeable Pilot for Style 879 & 884 | | • | | | • | | • | • | | | | | • | | | | | | |
| 655 | |  | Clearance or Taper Router | | • | | | • | | • | • | | | | | • | | | | | | |
| 183 | |  | 3 Flute Continuous Pilot | yes | • | | | • | | • | | | | | | • | | | | | | |

Check out a quick look at our facility

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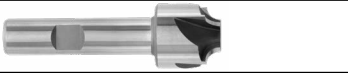
| Style | Page | Product | Type | No. of Flutes | End: Square | End: Ball | End: Chamfer | End: Radius/Rounding | Application: Steel | Application: Stainless | Application: Cast Iron | Application: Non-Ferrous | Application: High-Temp Alloy | Application: Hardened Steel | Machining: Slot | Machining: Profile | Machining: Plunging | Machining: Ramping | Machining: Drilling | Machining: Chamfer | Machining: Slot w/ Radius | Surface Treatment: Bright | Surface Treatment: TiN | Surface Treatment: TiCN | Surface Treatment: TiAlN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **HIGH SPEED STEEL** | | | | | | | | | | | | | | | | | | | | | | | | | |
| HMD-2 | Scan QR code above or request our MILLING catalog |  | Miniature | 2 | • | | | | • | | • | • | | | • | • | • | • | | | | • | | • | |
| HD-2 | |  | Finisher | 2 | • | | | | • | | • | • | | | • | • | • | • | | | | • | • | • | |
| HD-2B | |  | Finisher | 2 | | • | | | • | | • | • | | | • | • | • | • | | | • | • | • | • | |
| HD-3 | |  | Finisher | 3 | • | | | | • | | • | • | | | • | • | | • | • | | | • | • | • | |
| HD-4C | |  | Finisher | 4 | • | | | | • | | • | • | | | | • | | • | | | | • | • | • | |
| HG-2 | |  | Finisher | 2 | • | | | | • | | • | • | | | • | • | • | • | | | | • | • | • | |
| HG-2B | |  | Finisher | 2 | | • | | | • | | • | | | | • | • | • | • | | | | • | • | • | |
| HG-2K | |  | Keyway | 2 | • | | | | • | | • | • | | | • | • | • | • | | | | • | • | • | |
| HGN-2 | |  | Finisher - Extended Neck | 2 | • | | | | • | | • | • | | | • | • | • | • | | | | • | | | |
| HGA-2 | |  | Finisher - High Helix | 2 | • | | | | | | | • | | | • | • | • | • | | | | • | • | • | |
| HPDM-2 | |  | Finisher - Drill Mill | 2 | *Pointed end* | | | | • | | • | • | | | • | | • | | • | | | • | • | • | |
| HG-3 | |  | General Purpose | 3 | • | | | | • | | • | • | | | • | • | | • | | | | • | • | • | |
| HG-4C | |  | General Purpose | M | • | | | | • | | • | • | | | | • | | • | | | | • | • | • | |
| HG-4MC | |  | General Purpose | 4 | • | | | | • | | • | | | | | • | | • | | | | • | | | |
| HG-4B | |  | General Purpose | 4 | | • | | | • | | • | | | | | • | | • | | | | • | • | • | |
| HG-4LL | |  | Left Hand Helix / Cut | 4 | • | | | | • | | • | • | | | | • | | • | | | | • | • | • | |
| CRE | |  | Corner Radius | 4 | | | | • | • | | • | | | | | • | | | | | | • | | | |

M = Multi Flute

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| Style | Page | Product | Type | No. of Flutes | End: Square | End: Ball | End: Chamfer | End: Radius/Rounding | Application: Steel | Application: Stainless | Application: Cast Iron | Application: Non-Ferrous | Application: High-Temp Alloy | Application: Hardened Steel | Machining: Slot | Machining: Profile | Machining: Plunging | Machining: Ramping | Machining: Drilling | Machining: Chamfer | Machining: Slot w/ Radius | Surface Treatment: Bright | Surface Treatment: TiN | Surface Treatment: TiCN | Surface Treatment: TiAlN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COBALT** | | | | | | | | | | | | | | | | | | | | | | | | | |
| HDC-2 | Scan QR code above or request our MILLING catalog |  | Finisher | 2 | • | | | | • | • | | | • | | • | • | • | • | | | | • | | • | |
| HDC-4C | |  | Finisher | 4 | • | | | | • | • | | | • | | | • | | • | | | | • | • | • | |
| HGC-2 | |  | Finisher | 2 | • | | | | • | • | | | • | | • | • | • | • | | | | • | • | • | |
| HGC-4C | |  | Finisher | M | • | | | | • | • | | | • | | | • | | • | | | | • | • | • | |
| RG6 | |  | Rougher Fine Pitch | M | • | | | | • | • | | | • | | | • | | • | | | | • | | • | • |
| RG8 | |  | Rougher Coarse Pitch | M | | | • | | • | • | | | | | | • | | • | • | | | • | | • | • |
| **POWDERED METAL** | | | | | | | | | | | | | | | | | | | | | | | | | |
| PM-4 | Scan QR code above or request our MILLING catalog |  | Finisher | M | • | | | | • | • | • | | • | • | | • | | • | | | | • | • | • | |
| PM-539R | |  | Finisher High Helix | 3 | • | | | • | | | | • | | | • | • | | • | | | • | • | | • | |
| PM-539L | |  | Finisher - Left - High Helix/Cut | 3 | • | | | | | | | • | | | • | • | | • | | | | • | | • | |
| PMRC-C | |  | Rougher Coarse Profile | M | • | | | | • | • | | • | • | | | • | | • | | | | • | • | • | |
| PMRF-C | |  | Rougher Fine Profile | M | • | | | | • | • | | | • | | | • | | • | • | | | • | | • | • |
| PM-538R | |  | Rougher Coarse Profile | 3 | • | | | • | | | | • | | | • | • | | • | | | • | • | | • | |

M = Multi Flute

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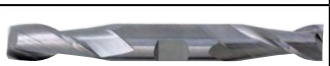
| Style | Page | Product | Type | No. of Flutes | End: Square | End: Ball | End: Chamfer | End: Radius | Application: Steel | Application: Stainless | Application: Cast Iron | Application: Non-Ferrous | Application: High-Temp Alloy | Application: Hardened Steel | Machining: Slot | Machining: Profile | Machining: Plunging | Machining: Ramping | Machining: Drilling | Machining: Chamfer | Machining: Slot w/ Radius | Surface Treatment: Bright | Surface Treatment: TiCN | Surface Treatment: TiAlN | Surface Treatment: AlCrN | Surface Treatment: AP-Max | Surface Treatment: T-Max |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CARBIDE** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CEM-V-4R | Scan QR code above or request our MILLING catalog |  | Variable Index Ferrous Material | 4 | • | | | • | • | • | | | • | • | • | • | • | • | | | • | • | | • | | | • |
| CEM-V-4B | |  | Variable Index Ferrous Material | 4 | | • | | | • | • | | | • | • | • | • | • | • | | | • | • | | • | | | • |
| CEM-V2-5R | |  | Variable Index Ferrous Material | 5 | • | | | • | • | • | | | • | • | • | • | • | • | | | • | • | | • | | | • |
| CEM-V3-7R<br>CEM-V3-7RCB | |  | Steel Material | 7 | • | | | • | • | • | | | • | • | • | • | • | • | | | • | | | | • | | • |
| CEM-HPDE-5 | |  | Steel Material | 5 | • | | | | • | • | | | | • | | • | | • | | | • | | • | | | | |
| CEM-EMS-3 | |  | Steel Material | 3 | • | | | • | • | • | | | | • | • | • | • | • | • | | • | • | | • | | | |
| CEM-EMS-5 | |  | Steel Material | 5 | • | | | | • | • | | | | • | • | • | | | | | • | | • | | | | |

## Tolerances for Solid Carbide End Mills

**Cutting Diameter:** 1/32" through 1": +0.000 – 0.002

**Shank Diameter:** h6

| Style | Page | Product | Type | No. of Flutes | End: Square | End: Ball | End: Chamfer | End: Radius | Application: Steel | Application: Stainless | Application: Cast Iron | Application: Non-Ferrous | Application: High-Temp Alloy | Application: Hardened Steel | Machining: Slot | Machining: Profile | Machining: Plunging | Machining: Ramping | Machining: Drilling | Machining: Chamfer | Machining: Slot w/ Radius | Surface Treatment: Bright | Surface Treatment: TiCN | Surface Treatment: TiAlN | Surface Treatment: AlCrN | Surface Treatment: AP-Max | Surface Treatment: ZrN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CARBIDE** (CONTINUED) | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CEM-AM2 | Scan QR code above or request our MILLING catalog |  | Aluminum Material | 2 | • | | | | | | | • | | | • | | | • | • | • | | • | | | | | • |
| CEM-AM3 | |  | Aluminum Material | 3 | • | | | | | | | • | | | • | • | • | • | | | | • | | | | | • |
| CEM-RS | |  | Rougher | 4 | • | | | | • | • | | | | • | | • | | • | | | | • | | • | | | |
| CEM-RA | |  | Rougher | 3 | • | | | | | • | | • | | | • | | • | • | | | | • | • | | | | |
| CEM-DE2 | |  | General Purpose | 2 | • | | | | • | • | • | | | | • | | • | • | | | | • | | • | | | |
| CEM-DE2B | |  | General Purpose | 2 | | • | | | • | • | • | | | | • | • | • | • | | | • | • | | • | | | |
| CEM-DE4 | |  | General Purpose | 4 | • | | | | • | • | • | | | • | | • | | • | | | | • | | • | | | |
| CEM-DE4B | |  | General Purpose | 4 | | • | | | • | • | • | | | | • | | | • | | | • | • | | • | | | |
| CMCE-2<br>CMCE-2AL | |  | Miniature | 2 | • | | | | • | • | • | • | • | • | • | • | • | • | | | | • | | | • | | |

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## CARBIDE (CONTINUED)

| Style | Page | Product | Type | No. of Flutes | End Work: Square | End Work: Ball | End Work: Chamfer | End Work: Radius | Application: Steel | Application: Stainless | Application: Cast Iron | Application: Non-Ferrous | Application: High-Temp Alloy | Application: Hardened Steel | Machining: Slot | Machining: Profile | Machining: Plunging | Machining: Ramping | Machining: Drilling | Machining: Chamfer | Machining: Slot w/ Radius | Surface Treatment: Bright | Surface Treatment: TiCN | Surface Treatment: TiAlN | Surface Treatment: AlCrN | Surface Treatment: AP-Max | Surface Treatment: ZrN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CEM-SE2 | Scan QR code above or request our MILLING catalog |  | General Purpose | 2 | • | | | • | • | • | • | • | | | • | | • | • | • | | • | • | | • | | | |
| CEM-SE2B | |  | General Purpose | 2 | | • | | | • | • | • | • | | | • | • | • | • | | | • | • | | • | | | |
| CEM-SE3 | |  | General Purpose | 3 | • | | | • | • | • | • | • | | | • | • | • | • | | | • | • | | • | | | |
| CMCE-4<br>CMCE-4AL | |  | Miniature | 4 | • | | | | • | • | • | • | • | • | | • | | • | | | | • | | | • | | |
| CEM-SE4 | |  | General Purpose | 4 | • | | | • | • | • | • | • | | | | • | | • | | | | • | | • | | | |
| CEM-SE4B | |  | General Purpose | 4 | | • | | | • | • | • | • | | | • | • | | • | | | • | • | | • | | | |
| CEM-SEST2 | |  | Straight Flute | 2 | | | | | • | • | • | • | | • | • | | • | | • | | | • | | • | | | |
| CEM-EG2 | |  | Engraving Tool | 2 | | • | | | • | | • | • | | | • | | | | | | • | | • | | | | |
| CEM-CH2 | |  | Chamfer Tool | 2 | | | • | | • | | | • | | | | | | | | • | | • | | | | | |
| CEM-CH2D | |  | Chamfer Tool | 2 | | | • | | • | | | • | | | | | | | | • | | • | | | | | |
| CEM-CH4 | |  | Chamfer Tool | 4 | | | • | | • | | | • | | • | | | | | | • | | • | | | | | |
| CEM-CH4D | |  | Chamfer Tool | 4 | | | • | | • | | | • | | • | | | | | | • | | • | | | | | |

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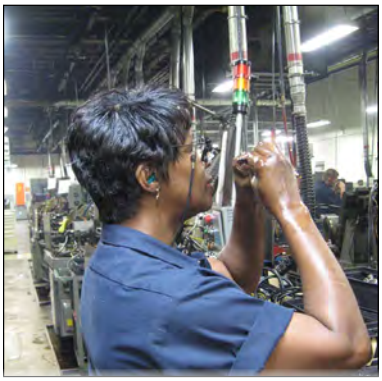

CLEVELAND | WALTER

**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.

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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.

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- Manufactured in the U.S.A.
- Quality product by quality people.
- Knowledgeable and informed sales and engineering staff.

ESTABLISHED 1874 INCORPORATED 1904
THE CLEVELAND TWIST DRILL CO.

# A HISTORY OF EXCELLENCE

**1874**
Cleveland Twist Drill established in Cleveland, Ohio.

**1912**
Greenfield Industries founded.

GREENFIELD INDUSTRIES

**1995**
Greenfield Industries purchases Cleveland Twist Drill.

**2009**
Greenfield Industries is acquired by TDC.

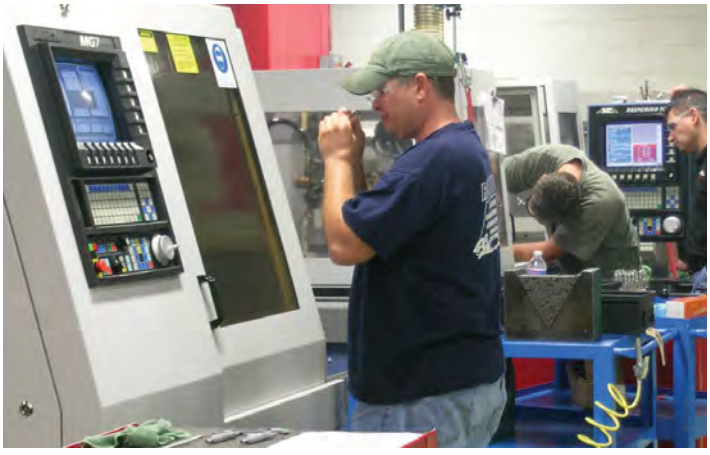
**2014**
TDC establishes Greenfield US and Canadian headquarters moving headquarters to Seneca, S.C., USA.

**2024**
Greenfield Industries joined WALTER Surface Technologies in 2024

CLEVELAND | WALTER


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.



GREENFIELD INDUSTRIES

CLEVELAND | WALTER

WALTER Surface Technologies acquired Greenfield U.S.A., Canada, & Mexico 2024

# HELPING METALWORKERS ACHIEVE GREATNESS

In 1952, WALTER Surface Technologies was founded by a will to outperform and improve productivity. To this day, this unique customer-centric approach provides significant and measurable improvements and sets WALTER apart.

At WALTER, we believe that everyone has the potential to build, fabricate and construct great projects. With safer tools, productive consumables and a team of specialized metalworking specialists, workers are able to work better. We provide metalworkers with the means to achieve greatness through three pillars: Productivity, Safety and Customer Experience.

# SOLUTIONS DESIGNED TO HELP YOU WORK BETTER.

- Metalworking
- Cutting Tools
- Safety Solutions

LEARN HOW WALTER CAN HELP YOU WORK BETTER!

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Our Partnership in Productivity Programs are all designed to help you work better and safer through the synergy of interconnected components.

## THE BUCKET PROGRAM

Identify cost saving opportunities and improve worker safety

## PRODUCTIVITY REPORTS

Measurably impact your business

## PRODUCT DEMONSTRATION

Make fabricating & finishing processes more efficient at your worksite

## SAFETY SEMINARS AND INDUSTRY TRAINING

Because health and safety are top priority

## RISK-FREE TRIAL PROGRAM

Your total satisfaction is paramount to us

**ASK YOUR GREENFIELD OR WALTER TERRITORY MANAGER HOW WE CAN HELP YOU WORK BETTER & ACHIEVE GREATNESS**


**US**

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Fax: 1 866 274-4435
Email: info.us@walter.com

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Tel.: 1 800 363-7368
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Email: csr@walter.com

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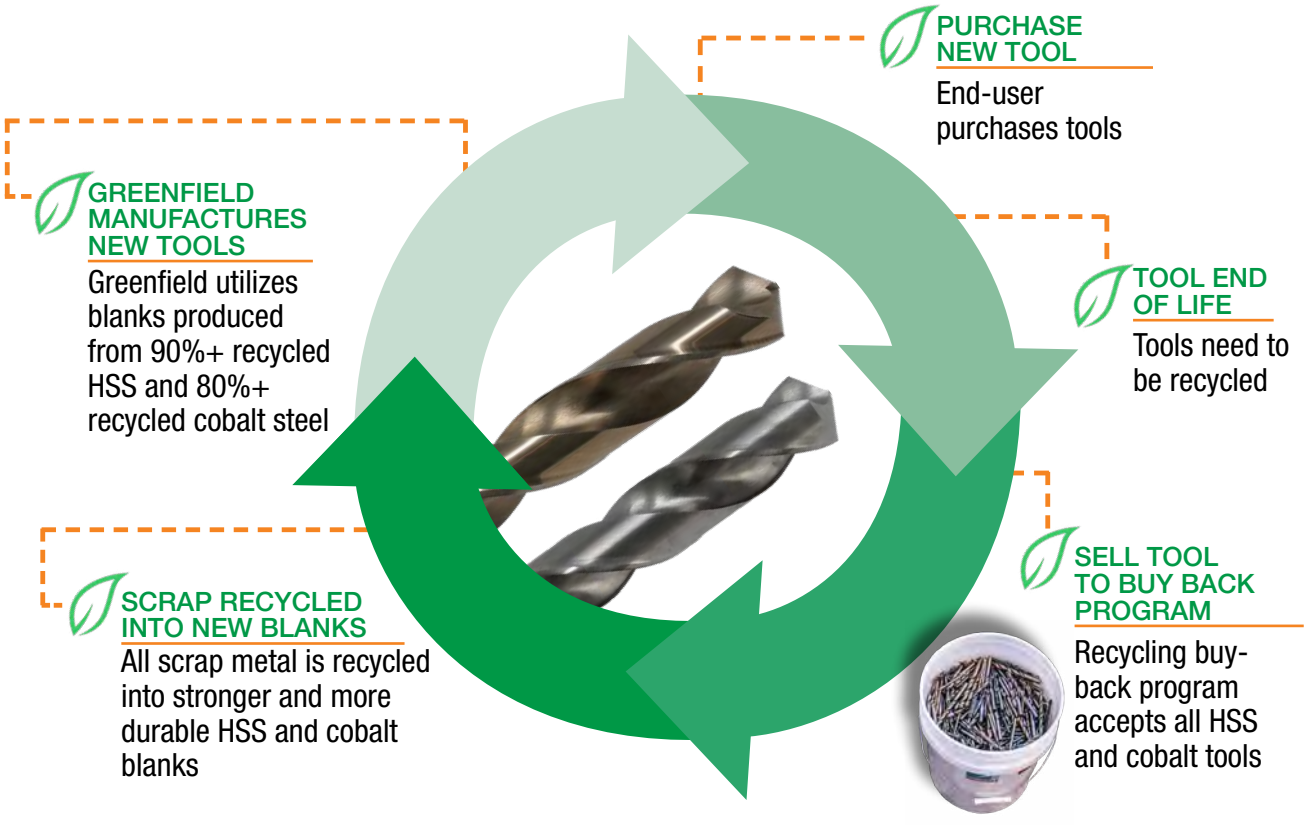
# BENEFITS OF DRILLS MADE WITH RECYCLED MATERIALS

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

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Call: (706) 305-7371 dparadis@greentech-smr.com

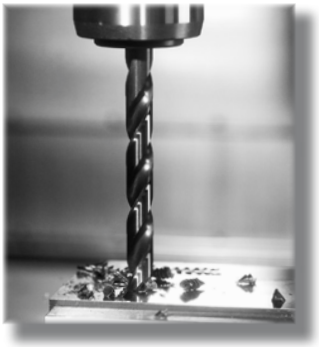
GreenTech was founded in 2012. They supply large volume, special recycled metals that can be further processed by global operations. GreenTech buys non-ferrous material that is industry specific from end-users, scrap and metal recyclers (including brokers), and local consumers.

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.

# WE HAVE THE PRODUCT FOR YOUR INDUSTRY ...

CLEVELAND | WALTER

## Holemaking
Drills, Reamers, Counterbores



## Threading
PAGE ....T-2

Thread Mills, Taps

## Milling
End Mills

## Other Tools
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Screw Extractors, Saws

# SEE OUR INDUSTRY SOLUTIONS

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.

- » Aerospace
- » Food and Beverage
- » Heavy Manufacturing
- » Medical
- » Oil/Gas/Chemical
- » Welding and Fabrication

SEE THEM ALL!

## 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**

# WE HAVE THE PRODUCT FOR YOUR INDUSTRY

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.

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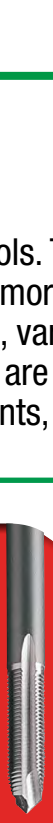
CLEVELAND

## FAST TAP

*Common Special Taps and Special Taps from Blanks*



**SEE OUR COMPLETE *FAST TAP* CATALOG**


**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.

# THREADING .... T-20



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# COST SAVING SETS

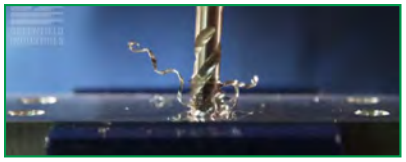


# TECHNICAL INFORMATION



## Cleveland Carbide Thread Mill


## Tap Styles

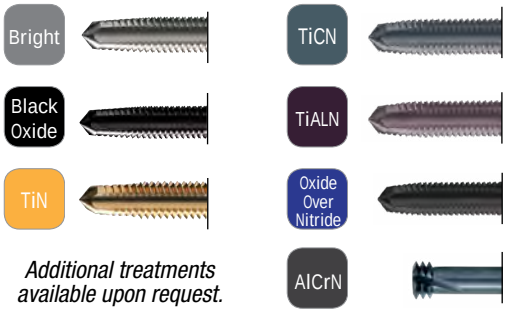


## Thread Cutting Tips

## TECH TIPS



# SURFACE TREATMENT




*Additional treatments available upon request.*

**Cleveland Tech Tips YouTube Channel for helpful information**

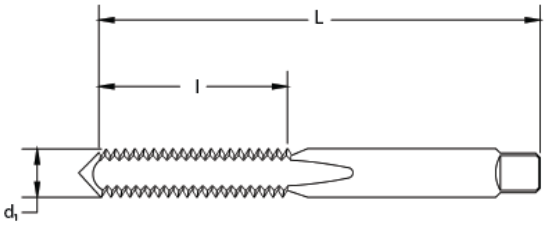
CLEVELAND | WALTER

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

- Tapping Speeds and Feeds see Technical section.
- Set # 1004 consists of one each taper, plug, and bottoming chamfers - Bright.

HSS | 302 | Straight Flute | Blind Holes | Thru Holes | Taper 7-10 | Plug 3-5 | Bottom 1-2

Surface Treatment: Bright | Black Oxide | TiN | TiCN




***Feature:***

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

| tap size pitch $d_1$ | thrd form | dec. equiv. | # of flutes | H-limit | overall length **L** (in) | thread length **l** (in) | order number: Taper 1001 Bright | Taper 1001TN TiN | Plug 1002 Bright | Plug 1002SO Bl. oxide | Plug 1002TN TiN | Plug 1002TC TiCN | Bottoming 1003 Bright | Bottoming 1003TN TiN | Set 1004 Bright | Set 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 |

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

*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

# THREADING

## General Purpose - *Inch*

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

CLEVELAND | WALTER



| tap size pitch $d_1$ | thrd form | dec. equiv. | # of flutes | H-limit | overall length L (in) | thread length l (in) | order number: Taper 1001 Bright | Taper 1001TN TiN | Plug 1002 Bright | Plug 1002SO Bl. oxide | Plug 1002TN TiN | Plug 1002TC TiCN | Bottoming 1003 Bright | Bottoming 1003TN TiN | Set 1004 Bright | Set 1004TN TiN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | — |
| 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 |

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

*continued on next page*

| tap size pitch $d_1$ | thrd form | dec. equiv. | # of flutes | H-limit | overall length L (in) | thread length l (in) | order number: Taper 1001 Bright | Taper 1001TN TiN | Plug 1002 Bright | Plug 1002SO Bl. oxide | Plug 1002TN TiN | Plug 1002TC TiCN | Bottoming 1003 Bright | Bottoming 1003TN TiN | Set 1004 Bright | Set 1004TN TiN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/4-28 | UNF | .2500 | 4 | H4 | 2.500 | 1.000 | — | — | C83820 | — | — | — | C83907 | — | — | — |
| 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 | — | — | — | — | — | — | — |

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

*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

# THREADING

## General Purpose - *Inch*

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

CLEVELAND | WALTER



| tap size pitch $d_1$ | thrd form | dec. equiv. | # of flutes | H-limit | overall length L (in) | thread length l (in) | order number: Taper 1001 Bright | Taper 1001TN TiN | Plug 1002 Bright | Plug 1002SO Bl. oxide | Plug 1002TN TiN | Plug 1002TC TiCN | Bottoming 1003 Bright | Bottoming 1003TN TiN | Set 1004 Bright | Set 1004TN TiN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9/16-12 | UNC | .5625 | 4 | H2 | 3.594 | 1.656 | — | — | C54770 | — | — | — | — | — | — | — |
| 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 | — | — | — |

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

*Metric on Next Page*

SET

## Hand Taps
**Style: 1002**

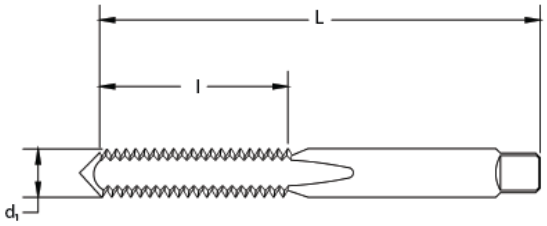
| plug chamfer | | bright finish | order number 1002 |
|---|---|---|---|
| Tap Sizes: | UNC | 1/4-20, 5/16-18, 3/8-16, 7/16-14, 1/2-13 | C55090 |
| | UNF | 1/4-28, 5/16-24, 3/8-24, 7/16-20, 1/2-20 | |

# Styles: 1001, 1001TN, 1002, 1002TN, 1003, 1003TN, 1004, 1004TN

- Tapping Speeds and Feeds see Technical section.
- Set #1004 consists of one each taper, plug, and bottoming chamfers.

HSS | 302 | Straight Flute | Blind Holes | Thru Holes | Taper 7-10 | Plug 3-5 | Bottom 1-2

Surface Treatment: Bright | TiN




**Feature:**
New neck down style.

| tap size pitch $d_1$ | thrd form | dec. equiv. | # of flutes | D-limit | overall length L in | overall length L mm | thread length l in | thread length l mm | order number Taper 1001 Bright | Taper 1001TN TiN | Plug 1002 Bright | Plug 1002TN TiN | Bottoming 1003 Bright | Bottoming 1003TN TiN | Set 1004 Bright | Set 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*

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

# THREADING

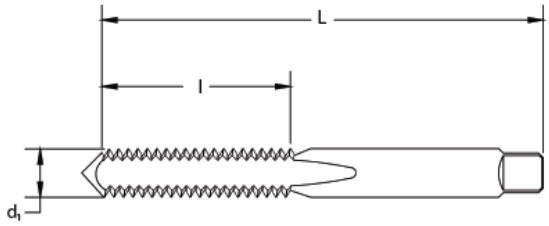
## General Purpose - *Left*
## Styles: 1002L

CLEVELAND | WALTER

♦ Tapping Speeds and Feeds see Technical section.

HSS | 302 | Straight Flute | Thru Holes | Plug 3-5

**Surface Treatment** — Bright




| 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 **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** | ☆ | | ☆ | | | | | ✦ | | ☆ | | | |

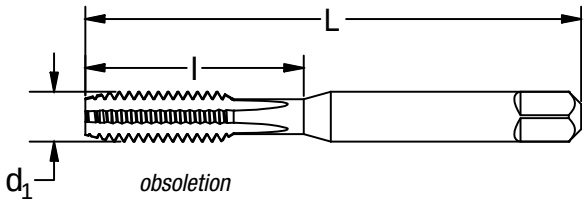
☆ = Best Performance ✦ = Acceptable

# Cast Iron & Harder Materials- Inch
## Styles: CI-1000, CI-1000-TC

♦ Tapping Speeds and Feeds see Technical section.

HSS-E | 302A | Straight Flute | Blind Holes | Modified Bottom 2-3

Surface Treatment: Oxide over Nitride | TiCN




**Feature:**
Premium steel substrate.

| 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 CI-1000 Oxide over Nitride | order number 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 | — |



# Cast Iron & Harder Materials - Metric
## Styles: CI-1000, CI-1000-TC

| tap size and pitch $d_1$ | decimal equiv. | number of flutes | D-limit | overall length L inch | overall length L mm | thread length l inch | thread length l mm | order number CI-1000 Oxide over Nitride | order number 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 | Titanium | |
| Hardness | 13-38 | >38 | 16-38 | > 38 | 300 Series | 400 series | | 18-22 | 22-32 | | | | >45 |
| Oxide over Nitride | | ✦ | | ✦ | | | | ☆ | | | | | ✦ |

☆ = Best Performance ✦ = Acceptable

# THREADING

## General Purpose - *Inch*

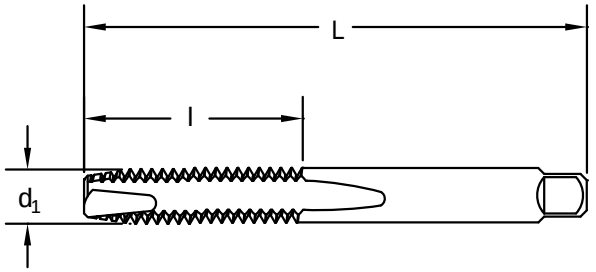
## Styles: 1011, 1011SO, 1011TN, 1011TC, 1012, 1012TN

CLEVELAND | WALTER

♦ Tapping Speeds and Feeds see Technical section.

HSS | 302 | Spiral Point | Thru Holes | Plug 3-5 | Blind Holes | Bottom 1-2

Surface Treatment: Bright | Black Oxide | TiN | TiCN




***Feature:***

Thru hole application in a variety of materials.

Spiral Point

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 Plug 1011 Bright | Plug 1011SO Black Oxide | Plug 1011TN TiN | Plug 1011TC TiCN | Bottoming 1012 Bright | Bottoming 1012TN TiN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-80 | UNF | .0600 | 2 | H1 | 1.688 | .313 | C57009 | — | — | — | — | — |
| 0-80 | UNF | .0600 | 2 | H2 | 1.688 | .313 | C57011 | C57600 | C55290 | C55370 | C57012 | — |
| 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 | C57032 | — |
| 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 | C57049 | C83347 |
| 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 | C57063 | — |
| 6-32 | UNC | .1380 | 2 | H1 | 2.000 | .688 | C57069 | — | — | — | — | — |
| 6-32 | UNC | .1380 | 2 | H2 | 2.000 | .688 | C57070 | C57608 | C55299 | C83069 | C83074 | — |
| 6-32 | UNC | .1380 | 2 | H3 | 2.000 | .688 | C57072 | C57609 | C55300 | C55378 | C57073 | C83348 |
| 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 | — | C83075 | — |
| 8-32 | UNC | .1640 | 2 | H3 | 2.125 | .750 | C57085 | C57611 | C55304 | C55380 | C57086 | C83349 |
| 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 | — | C83076 | — |
| 10-24 | UNC | .1900 | 2 | H3 | 2.375 | .875 | C57097 | C57001 | C55308 | C55382 | C57098 | C83350 |
| 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 | — | C83077 | — |
| 10-32 | UNF | .1900 | 2 | H3 | 2.375 | .875 | C57104 | C57002 | C55310 | C55383 | C57105 | C83351 |
| 10-32 | UNF | .1900 | 2 | H7 | 2.375 | .875 | C57106 | — | C55346 | — | — | — |

*continued on next page*

| tap size and pitch d1 | thread form | decimal equiv. | number of flutes | H-limit | overall length L (in) | thread length l (in) | order number Plug 1011 Bright | Plug 1011SO Black Oxide | Plug 1011TN TiN | Plug 1011TC TiCN | Bottoming 1012 Bright | Bottoming 1012TN TiN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12-24 | UNC | .2160 | 2 | H1 | 2.375 | .938 | C83044 | — | — | — | — | — |
| 12-24 | UNC | .2160 | 2 | H3 | 2.375 | .938 | C57112 | C57616 | C55312 | C55384 | C83078 | C83352 |
| 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 | C83079 | — |
| 1/4-20 | UNC | .2500 | 2 | H3 | 2.500 | 1.000 | C57129 | C57619 | C55316 | C83071 | C57131 | C83353 |
| 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 | — | — | — |
| 1/4-20 | UNC | .2500 | 3 | H3 | 2.500 | 1.000 | C57130 | C57620 | C83058 | C55386 | C83080 | C83354 |
| 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 | C57140 | C83355 |
| 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 | C83081 | C83356 |
| 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 | C57153 | C83357 |
| 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 | — | C57162 | — |
| 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 | C83082 | C83358 |
| 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 | C83083 | — |
| 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 | C83084 | — |
| 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 | C83085 | — |
| 7/16-20 | UNF | .4375 | 3 | H5 | 3.156 | 1.438 | C57196 | — | — | — | — | — |

*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 - *Inch*

### Styles: 1011, 1011SO, 1011TN, 1011TC, 1012, 1012TN

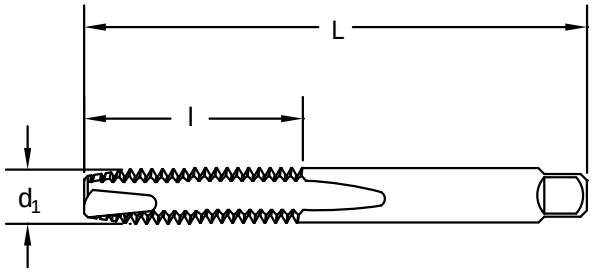




| tap size and pitch d1 | thread form | decimal equiv. | number of flutes | H-limit | overall length L (in) | thread length l (in) | order number: Plug 1011 Bright | Plug 1011SO Black Oxide | Plug 1011TN TiN | Plug 1011TC TiCN | Bottoming 1012 Bright | Bottoming 1012TN TiN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | C83086 | C83359 |
| 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 | C83087 | — |
| 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 | C83088 | — |
| 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 | C83089 | — |
| 3/4-10 | UNC | .7500 | 3 | H5 | 4.250 | 2.000 | C57247 | — | — | — | — | — |
| 3/4-16 | UNF | .7500 | 3 | H3 | 4.250 | 2.000 | C60999 | — | — | — | — | — |

♦ 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.

| tap size and pitch $d_1$ | decimal equiv. | number of flutes | D-limit | overall length L inch | overall length L mm | thread length l inch | thread length l mm | order number Plug 1011 Bright | Plug 1011TN TiN | Plug 1011TC TiCN | Bottoming 1012 Bright |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M1.6 x 0.35 | .0630 | 2 | D3 | 1.750 | 44.45 | .313 | 11.11 | C57015 | C83062 | — | C83090 |
| 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 | — | C83091 |
| 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 | — | C83092 |
| M3 x 0.5 | .1181 | 2 | D3 | 1.938 | 49.21 | .625 | 15.88 | C57055 | C55360 | C55415 | C83093 |
| 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 | C83094 |
| 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 | C83095 |
| M6 x 1 | .2362 | 2 | D5 | 2.500 | 63.50 | 1.000 | 25.40 | C57118 | C55362 | C55418 | C83096 |
| 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 | — | C83097 |
| M8 x 1.25 | .3150 | 2 | D5 | 2.719 | 69.06 | 1.125 | 28.58 | C57171 | C55363 | C55419 | C83098 |
| M10 x 1.25 | .3937 | 3 | D5 | 2.938 | 74.61 | 1.250 | 31.75 | C57187 | C83067 | — | C83099 |
| M10 x 1.5 | .3937 | 3 | D6 | 2.938 | 74.61 | 1.250 | 31.75 | C57189 | C55364 | C55420 | C83345 |
| 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 | C83346 |
| 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 | — | — | — |

| 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

# THREADING

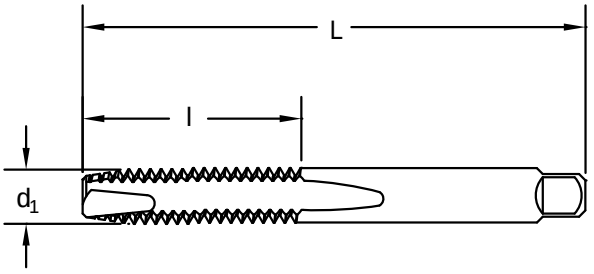
## Low Shear
## Styles: 1053

CLEVELAND | WALTER

♦ Tapping Speeds and Feeds see Technical section.

HSS | 302 | Spiral Point | Thru Holes | Plug 3-5

Surface Treatment: Bright




Spiral Point

High Speed Steel

***Feature:***
Thru hole applications in iron and harder steels.

| 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 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 |

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** | ☆ | | ☆ | | | | | ☆ | ✦ | | | | |

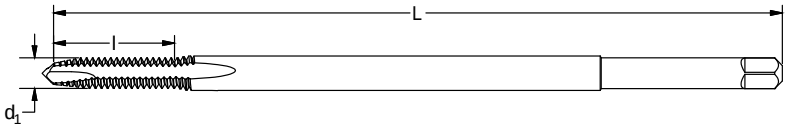
☆ = Best Performance ✦ = Acceptable

# 6" Extended Length
## Styles: 1011E

♦ 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.

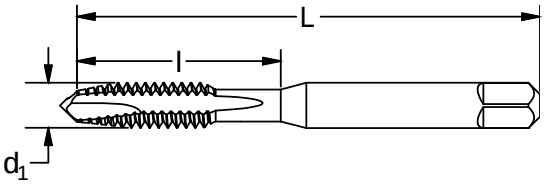
| tap size and pitch $d_1$ | thread form | decimal equiv. | number of flutes | H-limit | overall length L (in) | thread length l (in) | order number 1011E Bright |
|---|---|---|---|---|---|---|---|
| #8-32 | UNC | .1640 | 2 | H3 | 6.0000 | .7500 | C59106 |
| #10-24 | UNC | .1900 | 2 | H3 | 6.0000 | .8750 | 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 |

# Stainless Steel & Steels - *SD Powder Metal*
## Style: T-101

♦ Tapping Speeds and Feeds see Technical section.

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

Surface Treatment: Black Oxide




**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 number T-101 Bright |
|---|---|---|---|---|---|---|---|
| 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 |

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 |
| 1011E | ☆ | | ☆ | | | | | ☆ | ✦ | | | | |
| T-101 | ☆ | | ☆ | | ☆ | ☆ | ✦ | ✦ | ✦ | | | | |

☆ = Best Performance ✦ = Acceptable

# THREADING

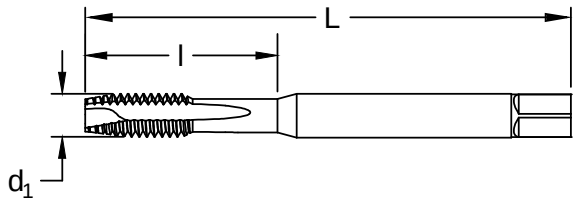
## Universal - Inch - *Progress*

## Styles: PRO-961SP and PRO-861SP

CLEVELAND | WALTER

- Tapping Speeds and Feeds see Technical section.

HSS-E | DIN with ASME SHANK | Spiral Point | Straight Flute | Thru Holes | Plug 3-5 | Surface Treatment: Black Oxide, TiAlN




***Feature:***

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

Spiral Point

Premium High Speed Steel

| tap size and pitch $d_1$ | thread form | decimal equiv. | number of flutes | Class of fit | shank diameter | overall length **L** (in) | thread length **l** (in) | order number PRO-961SP Black Oxide | order number PRO-861SP TiAlN |
|---|---|---|---|---|---|---|---|---|---|
| 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*

| tap size and pitch $d_1$ | thread form | decimal equiv. | # of flutes | Class of fit | shank diameter inch | shank diameter mm | overall length L inch | overall length L mm | thread length l inch | thread length l mm | order number PRO-961SP Black Oxide | order number PRO-861SP TiAlN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |



| 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

# THREADING

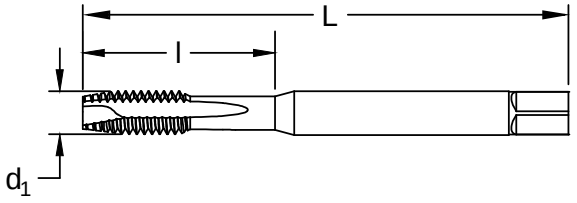
## Stainless Steel - Inch - *Performance*

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

CLEVELAND | WALTER

♦ Tapping Speeds and Feeds see Technical section.

HSS-E | DIN with ASME SHANK | Spiral Point | Straight Flute | Thru Holes | Plug 3-5 | Surface Treatment: Black Oxide, Hardlube




***Feature:***

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

Spiral Point

Premium High Speed Steel

| tap size and pitch $d_1$ | thread form | decimal equiv. | number of flutes | Class of fit | shank diameter | overall length **L** (in) | thread length **l** (in) | order number PER-862SP Black Oxide | order number PER-960SP Hardlube |
|---|---|---|---|---|---|---|---|---|---|
| 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*

| tap size and pitch $d_1$ | thread form | decimal equiv. | # of flutes | Class of fit | shank diameter inch | shank diameter mm | overall length L inch | overall length L mm | thread length l inch | thread length l mm | order number PER-862SP Black Oxide | order number PER-960SP Hardlube |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |



| 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

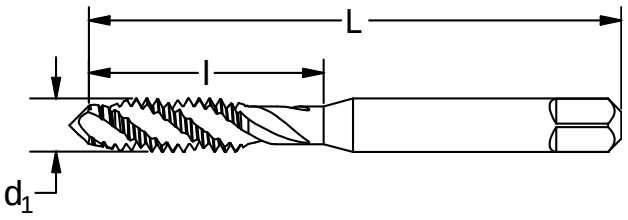
# General Purpose High-Spiral - Inch
## Styles: 1093, 1093-TN, 1094, 1094-TN

CLEVELAND | WALTER

♦ Tapping Speeds and Feeds see Technical section.

HSS | 302A | Avg. Helix ∠49° | Blind Holes | Plug 3-5 | Bottom 1-2

Surface Treatment: Bright | TiN | TiCN




Spiral Flute

High Speed Steel

| 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 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 High-Spiral - Metric
## Styles: 1093, 1093-TN, 1094, 1094-TN

| tap size and pitch $d_1$ | decimal equiv. | # of flutes | D-limit | overall length L inch | overall length L mm | thread length l inch | thread length l mm | order number 1093 Bright | 1093-TN TiCN | 1094 Bright | 1094-TN 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 | — |

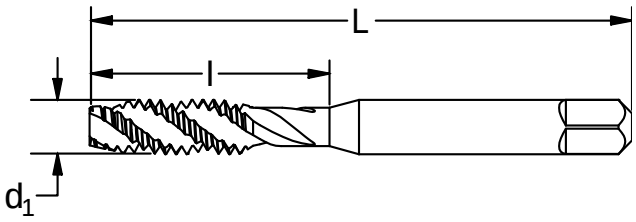
Material Reference

| | 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 | | 18-22 | 22-32 | | | | >45 |
| Bright | ✦ | | ✦ | | | | | | | ☆ | | | |
| TiN | ☆ | | ☆ | | ☆ | | | | | | | | |
| TiCN | ☆ | | ☆ | | ☆ | | | | | ☆ | | | |

☆ = Best Performance ✦ = Acceptable

♦ Tapping Speeds and Feeds see Technical section.

HSS | 302A | Avg. Helix ∠48° | Blind Holes | Plug 3-5 | Bottom 1-2 | Surface Treatment: Black Oxide




| 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 1095 Plug | order number 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

# THREADING

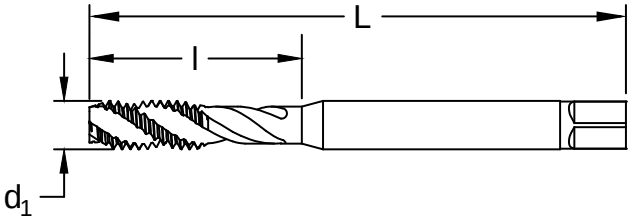
## Universal - Inch - *Progress*

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

CLEVELAND | WALTER

♦ Tapping Speeds and Feeds see Technical section.

HSS-E | DIN with ASME SHANK | 38° Spiral Flute | Blind Holes | Modified Bottom 2-3 | Surface Treatment: Black Oxide, TiAlN




Spiral Flute

Premium High Speed Steel

| tap size and pitch $d_1$ | thread form | decimal equiv. | number of flutes | Class of fit | shank diameter | overall length L (in) | thread length l (in) | order number PRO-981SF Black Oxide | order number PRO-892SF TiAlN |
|---|---|---|---|---|---|---|---|---|---|
| 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

| tap size and pitch $d_1$ | thread form | decimal equiv. | # of flutes | Class of fit | shank diameter inch | shank diameter mm | overall length L inch | overall length L mm | thread length l inch | thread length l mm | order number PRO-981SF Black Oxide | order number PRO-892SF TiAlN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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

# THREADING

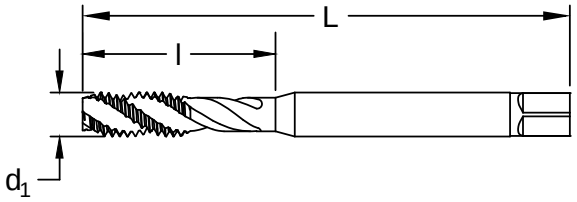
## Stainless Steel - Inch - *Performance*

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

CLEVELAND | WALTER

♦ Tapping Speeds and Feeds see Technical section.

HSS-E | DIN with ASME SHANK | 38° Spiral Flute | Blind Holes | Modified Bottom 2-3 | Surface Treatment: Black Oxide, Hardlube




Spiral Flute

Premium High Speed Steel

| tap size and pitch $d_1$ | thread form | decimal equiv. | number of flutes | Class of fit | shank diameter | overall length **L** (in) | thread length **l** (in) | order number PER-893SF Black Oxide | order number PER-980SF Hardlube |
|---|---|---|---|---|---|---|---|---|---|
| 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*

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

| tap size and pitch $d_1$ | thread form | decimal equiv. | # of flutes | Class of fit | shank diameter inch | shank diameter mm | overall length L inch | overall length L mm | thread length l inch | thread length l mm | order number PER-893SF Black Oxide | order number PER-980SF Hardlube |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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

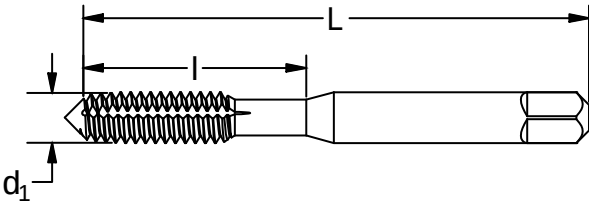
# THREADING

## General Purpose - Inch
## Styles: 1091, 1092

CLEVELAND | WALTER

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

HSS | 302A | Blind Holes | Plug 3-5 | Bottom 1-2 | Surface Treatment: Bright






| tap size and pitch $d_1$ | thread form | decimal equiv. | H-limit | overall length L (in) | thread length l (in) | order number 1091 Plug | order number 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*

## General Purpose - Metric
## Styles: 1091, 1092

| tap size and pitch $d_1$ | decimal equiv. | D-limit | overall length L inch | overall length L mm | thread length l inch | thread length l mm | order number 1091 Plug | order number 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 |

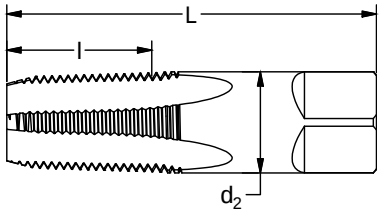
Material Reference

| | 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

♦ Tapping Speeds and Feeds see Technical section.

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




| tap size and pitch | decimal equivalent | number of flutes | shank diameter $d_2$ (in) | overall length L (in) | thread length l (in) | order number Bright 965B NPT | Bright 975 NPTF | TiN 965TN NPT | TiN 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*

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** | ☆ | | ☆ | | | | | ✦ | ✦ | | | | |
| **TiN** | | | | | | | | | | | | | |

☆ = Best Performance ✦ = Acceptable

# THREADING

## NPT/NPTF - Interrupted Thread - *Taper*

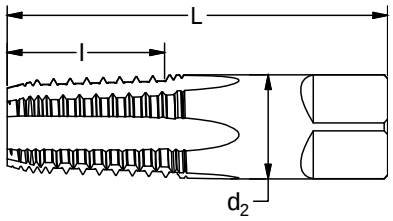
## Styles: 964B, 966B

CLEVELAND | WALTER

♦ 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 equivalent | number of flutes | shank diameter **$d_2$** (in) | overall length **L** (in) | thread length **l** (in) | order number Bright 964B NPT | order number Bright 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*

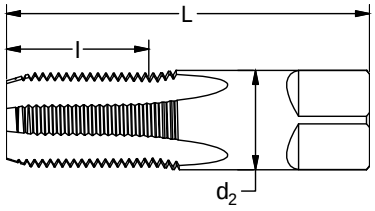
**Material Reference**

| | 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

♦ Tapping Speeds and Feeds see Technical section.

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




| tap size and pitch | decimal equivalent | number of flutes | shank diameter **$d_2$** (in) | overall length **L** (in) | thread length **l** (in) | order number Bright **963B** NPS | order number Bright **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

# THREADING

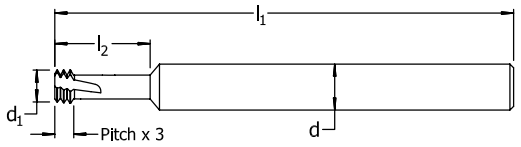
## Mini 2x Diameter - Inch
## Style: CMTM2

CLEVELAND | WALTER

- Formula: 2 x $d_1$ ( $l_2 \leq$ 2 x Thread Diameter )
- * Bore diameter applies to the smallest thread diameter.
- For Internal & External Threads

Carbide

**Surface Treatment** AlCrN




***Feature:***

Excel in internal deep threads in hard to cut materials.

| American UN | | thread | | shank diameter | cutting diameter | overall length | cut depth | pitch x 2 thread length | no. of flutes | no. of teeth | *bore dia. | order number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UNC | UNF | TPI | pitch | d | $d_1$ | $l_1$ | $l_2$ | | | | | CMTM2 |
| | 1-72 | 72 | 0.014 | 1/4 | .057 | 2.5 | .154 | 0.042 | 3 | 3 | .060 | C95102 |
| 1-64 | 2-64 | 64 | 0.016 | 1/4 | .057 | 2.5 | .165 | 0.047 | 3 | 3 | .060 | C95103 |
| 2-56 | 3-56 | 56 | 0.018 | 1/4 | .065 | 2.5 | .197 | 0.054 | 3 | 3 | .069 | C95104 |
| 3-48 | 4-48 | 48 | 0.021 | 1/4 | .075 | 2.5 | .236 | 0.063 | 3 | 3 | .080 | C95105 |
| 4, 5-40 | 6-40 | 40 | 0.025 | 1/4 | .085 | 2.5 | .236 | 0.075 | 3 | 3 | .090 | C95106 |
| | 8-36 | 36 | 0.028 | 1/4 | .115 | 2.5 | .343 | 0.083 | 3 | 3 | .125 | C95107 |
| 6, 8-32 | 10-32 | 32 | 0.031 | 1/4 | .100 | 2.5 | .292 | 0.094 | 3 | 3 | .110 | C95108 |
| 8-32 | 10-32 | 32 | 0.031 | 1/4 | .120 | 2.5 | .394 | 0.094 | 3 | 3 | .130 | C95109 |
| | 1/4"x28 | 28 | 0.036 | 1/4 | .180 | 2.5 | .520 | 0.107 | 3 | 3 | .190 | C95110 |
| 10-24 | 5/16"x24 | 24 | 0.042 | 1/4 | .130 | 2.5 | .400 | 0.125 | 3 | 3 | .140 | C95111 |
| | 5/16"x24 | 24 | 0.042 | 1/4 | .240 | 2.5 | .650 | 0.125 | 3 | 3 | .255 | C95112 |
| 1/4"x20 | 7/16"x20 | 20 | 0.05 | 1/4 | .185 | 2.5 | .530 | 0.150 | 3 | 3 | .200 | C95113 |
| | 7/16"x20 | 20 | 0.05 | 3/8 | .340 | 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 2x Diameter - Metric
## Style: CMTMM2

- Formula: 2 x $d_1$ ( $l_2 \leq$ 2 x Thread Diameter )
- * Bore diameter applies to the smallest thread diameter.
- For Internal & External Threads

Carbide

**Surface Treatment** AlCrN

| ISO metric | | pitch | | shank diameter d | cutting diameter $d_1$ | overall length $l_1$ | cut depth $l_2$ | pitch x 2 thread length | no. of flutes | no. of teeth | *bore dia. | order number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M course | M fine | mm | inch | mm | mm | mm | mm | mm | | | | 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

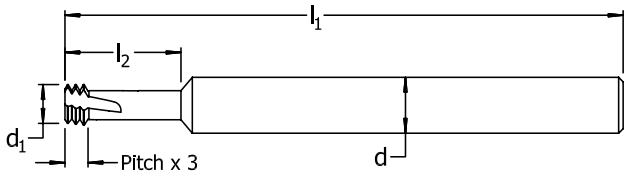
| | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy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

☆ = Best Performance ✦ = Acceptable

# Mini 3x Diameter - Inch
## Style: CMTM3

- Formula: 3 x $d_1$ ( $l_2 \leq$ 3 x Thread Diameter )
- * Bore diameter applies to the smallest thread diameter.
- For Internal & External Threads

Carbide | Surface Treatment: AlCrN




| 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 3x Diameter- Metric
## Style: CMTM3

- Formula: 3 x $d_1$ ( $l_2 \leq$ 3 x Thread Diameter )
- * Bore diameter applies to the smallest thread diameter.
- For Internal & External Threads

Carbide | Surface Treatment: AlCrN

| ISO metric | | pitch | | shank diameter d | cutting diameter $d_1$ | overall length $l_1$ | cut depth $l_2$ | pitch x 3 thread length | no. of flutes | no. of teeth | *bore dia. | order number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M course | M fine | mm | inch | mm | mm | mm | mm | 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 |
| AlCrN | ✦ | ☆ | ✦ | ☆ | ☆ | ☆ | ☆ | ✦ | ✦ | ✦ | ☆ | ☆ | ☆ |

☆ = Best Performance ✦ = Acceptable

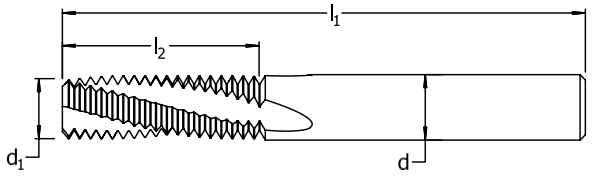
# THREADING

## General Purpose - *Inch - Helical Thread Mills*
## Styles: CTM Solid / CTMC Coolant-Thru

CLEVELAND | WALTER

♦ For Internal & External Threads

UNC UNF | Carbide | Surface Treatment: TiAlN




***Feature:***
Capable of producing right or left hand threads.



| thread size | shank diameter **d** | cutting diameter **$d_1$** | overall length **$l_1$** | cut depth **$l_2$** | number of flutes | order number non-coolant **CTM** | order number coolant-thru **CTMC** |
|---|---|---|---|---|---|---|---|
| 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 |

**Material Reference**

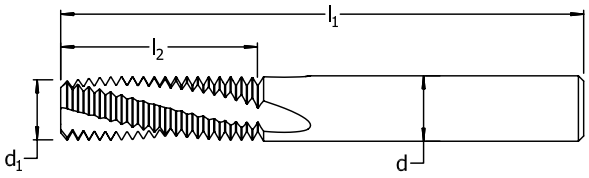
| | Steel (HRc) | | | | Stainless Steel | | | Cast Iron (HRc) | | Aluminum and Non-Ferrous | Hi-Temp Alloy | | Hardened Steel (HRc) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low Carbon | | Alloy | | Austenitic | Martensitic | PH | Gray | Nodular | | Ni, Co, Fe Based Super Alloy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

☆ = Best Performance ✦ = Acceptable

## General Purpose - *Metric - Helical Thread Mills*
## Styles: CTMM Solid / CTMMC Coolant-Thru

♦ For Internal & External Threads

DIN | Carbide | Surface Treatment: TiAlN



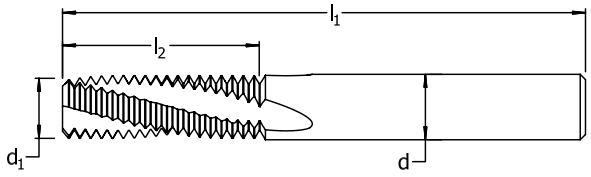

***Feature:***
Excellent option in difficult materials.

| thread size | shank diameter **d** | cutting diameter **$d_1$** | overall length **$l_1$** | cut depth **$l_2$** | number of flutes | order number non-coolant **CTMM** | order number coolant-thru **CTMMC** |
|---|---|---|---|---|---|---|---|
| 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 | 516 | .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 / CTMNPC Coolant-Thru

♦ 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 **$l_1$** | cut depth **$l_2$** | number of flutes | order number non-coolant **CTMNP** | order number coolant-thru **CTMNPC** |
|---|---|---|---|---|---|---|---|
| 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

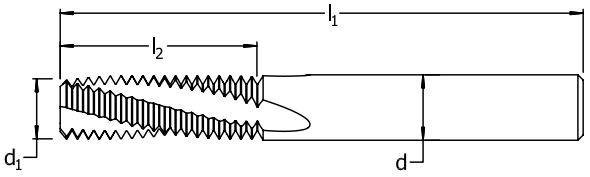


## British Pipe Parallel - *Inch - Helical Thread Mills*
## Styles: CTMBPP Solid / CTMBPPC Coolant-Thru

CLEVELAND | WALTER

♦ For Internal & External Threads

BSPP | Carbide | Surface Treatment: TiAlN




***Feature:***

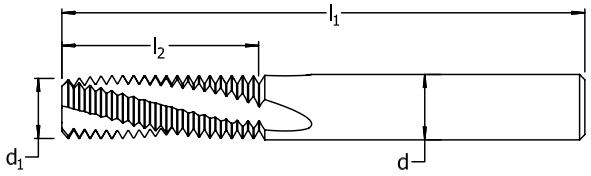
55 degree thread profile.

| thread size | shank diameter **d** | cutting diameter **$d_1$** | overall length **$l_1$** | cut depth **$l_2$** | number of flutes | order number non-coolant **CTMBPP** | order number coolant-thru **CTMBPPC** |
|---|---|---|---|---|---|---|---|
| 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 |

## British Pipe Tapered - *Inch - Helical Thread Mills*
## Styles: CTMBPT Solid / CTMBPTC Coolant-Thru

♦ 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 **$l_1$** | cut depth **$l_2$** | number of flutes | order number non-coolant **CTMBPT** | order number coolant-thru **CTMBPTC** |
|---|---|---|---|---|---|---|---|
| 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 |

**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



| die diameter TPI and series | | | decimal equivalent | length across flats inch | thickness inch | order number 0650 carbon steel | order number 492 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

CLEVELAND | WALTER

HSS | Carbon Steel | Surface Treatment: Bright

***Feature:***
Suitable for the repair of existing threads.

| die diameter TPI and series | | | decimal equivalent | length across flats inch | thickness inch | order number 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 |

# Hexagon Rethreading - *Metric*
## Styles: 0650M

| die diameter TPI and series | decimal equivalent | length across flats inch | length across flats mm | thickness inch | thickness mm | order number 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

# Hexagon Die - *Carbon Steel*
## Styles: 0650, 0650M

| set number | number of sizes | die sizes | | order number 0650 |
|---|---|---|---|---|
| 42NC | 8 | 1/4-20 NC<br>5/1 6-18 NC<br>3/8-16 NC<br>7/16-14 NC | 1/2-13 NC<br>9/16-12 NC<br>5/8-11 NC<br>3/4-10 NC | C67275 |
| 42NF | 8 | 1/4-28 NF<br>5/16-24 NF<br>3/8-24 NF<br>7/16-20 NF | 1/2-20 NF<br>9/16-18 NF<br>5/8-18 NF<br>3/4-16 NF | C67276 |
| 44NC | 10 | 1/4-20 NC<br>5/16-18 NC<br>3/8-16 NC<br>7/16-14 NC<br>1/2-13 NC | 9/16-12 NC<br>5/8-11 NC<br>3/4-10 NC<br>7/8-9 NC<br>1-8 NC | C67278 |
| 45NCNF | 20 | 1/4-20 NC<br>5/16-18 NC<br>3/8-16 NC<br>7/16-14 NC<br>1/2-13 NC<br>9/16-12 NC<br>5/8-11 NC<br>3/4-10 NC<br>7/8-9 NC<br>1-8 NC | 1/4-28 NF<br>5/16-24 NF<br>3/8-24 NF<br>7/16-20 NF<br>1/2-20 NF<br>9/16-18 NF<br>5/8-18 NF<br>3/4-16 NF<br>7/8-14 NF<br>1-14 NF | C67282 |

| set number | number of sizes | die sizes | order number 0650M |
|---|---|---|---|
| 49Metric | 7 | M6 x 1<br>M8 x 1.25<br>M10 x 1.5<br>M12 x 1.75<br>M14 x 2<br>M16 x 2<br>M20 x 2.5 | C67283 |

Set C67275

Set C67278

HSS | Carbon Steel | Surface Treatment: Bright

***Feature:***

Designed to cut threads in bar stock.

| die diameter | | | decimal | outside diameter | thickness | order number | |
|---|---|---|---|---|---|---|---|
| TPI and series | | | equivalent | inch | inch | 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*



## Round Adjustable - *Inch*
## Styles: 0610, 0710 (continued)

CLEVELAND | WALTER



| die diameter TPI and series | | | decimal equivalent | outside diameter inch | thickness inch | order number 0610 carbon steel | order number 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 | — |

## Round Adjustable - *Inch*
## Style: 0620

| die diameter TPI and series | | | decimal equivalent | outside diameter inch | thickness inch | 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

| die diameter TPI and series | decimal equivalent | outside diameter inch | outside diameter mm | thickness inch | thickness mm | order number 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

- Style 222 holds round adjustable dies with three adjusting screws

Style 222 Die Stock

| product number | die O.D. | overall length | order number 222 |
|---|---|---|---|
| 2 | 13/16 | 6-3/8 | C67223 |
| 3 | 1 | 9 | C67224 |
| 5 | 1-1/2 | 12-1/4 | C67226 |
| 6 | 2 | 15-1/2 | C67227 |
| 7 | 2-1/2 | 18-5/8 | C67228 |
| 8 | 3 | 24 | C67229 |

# THREADING

## Die Set - *Quick Set - Inch*

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

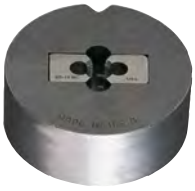
CLEVELAND | WALTER

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

| nominal size TPI and series | | | decimal equiv. | order number 0554 complete assembly | 0550 die blank | 0550 die halves | 0553 no. | 0553 collet | 0551 O.D. | 0551 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 equivalent | order number 0550 die blank | 0550 die halves | 0553 no. | 0553 collet | 0551 cap | 0552 O.D. | 0552 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.*



## Die Set - *Accessories*
## Styles: 223, 225

Surface Treatment: TiAlN

### 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.

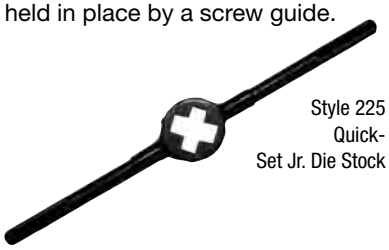
Style 223 Regular Quick-Set Die Stock

| stock no. | collet no. | collet capacity | length of stock | order number 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 number 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.

# Tap Wrenches
## Styles: 240, 242, 243, 244, 245





### *Standard Straight*
### Style: 240

| product number | machine screw | tap size ranges fractional | tap size ranges metric | pipe | overall length | order number 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 |

- Used for hand tapping.

### *Plain T-Handle*
### Style: 242

| product number | machine screw | tap size ranges fractional | tap size ranges metric | overall length | order number 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 |

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

### *Slip T-Handle*
### Style: 243

| product number | machine screw | tap size ranges fractional | tap size ranges metric | overall length | order number 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 |

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

### *Combination Ratchet and Slip Handle*
### Style: 244

| product number | machine screw | tap size ranges fractional | tap size ranges metric | overall length | order number 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 |

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

### *Long Shank T-Handle*
### Style: 245

| product number | machine screw | tap size ranges fractional | tap size ranges metric | overall length | order number 246 |
|---|---|---|---|---|---|
| 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 |

- Used for hand tapping where extra reach is required.

## General Purpose Tap

| | Type | Style | Order No. | Number of pieces | Surface Treatment: Bright | H-Limit | Size Range: Inch | Case Type: Metal | Case Type: 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

| | Type | Style | Order No. | Number of Sizes | Set Number | Size Range: Inch | | Case Type: Metal | Case Type: Plastic |
|---|---|---|---|---|---|---|---|---|---|
|  | General Purpose | **0650** | C67275 | 8 | 42NC | 1/4-20 NC<br>5/1 6-18 NC<br>3/8-16 NC<br>7/16-14 NC | 1/2-13 NC<br>9/16-12 NC<br>5/8-11 NC<br>3/4-10 NC | | • |
| | | | C67276 | 8 | 42NF | 1/4-28 NF<br>5/16-24 NF<br>3/8-24 NF<br>7/16-20 NF | 1/2-20 NF<br>9/16-18 NF<br>5/8-18 NF<br>3/4-16 NF | | • |
| | | | C67278 | 10 | 44NC | 1/4-20 NC<br>5/16-18 NC<br>3/8-16 NC<br>7/16-14 NC<br>1/2-13 NC | 9/16-12 NC<br>5/8-11 NC<br>3/4-10 NC<br>7/8-9 NC<br>1-8 NC | | • |
| | | | C67284 | 10 | NCNF | 1/4-20 NC<br>5/16-18 NC<br>3/8-16 NC<br>7/16-14 NC<br>1/2-13 NC | 1/4-28 NF<br>5/16-24 NF<br>3/8-24 NF<br>7/16-20 NF<br>1/2-20 NF | • | |
| | | | C67282 | 20 | 45NCNF | 1/4-20 NC<br>5/16-18 NC<br>3/8-16 NC<br>7/16-14 NC<br>1/2-13 NC<br>9/16-12 NC<br>5/8-11 NC<br>3/4-10 NC<br>7/8-9 NC<br>1-8 NC | 1/4-28 NF<br>5/16-24 NF<br>3/8-24 NF<br>7/16-20 NF<br>1/2-20 NF<br>9/16-18 NF<br>5/8-18 NF<br>3/4-16 NF<br>7/8-14 NF<br>1-14 NF | • | |

Set C67275

Set C67276

Set C67278

Set C67282

## Dies - Metric

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

SETS

## 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 ¾" 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



## 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

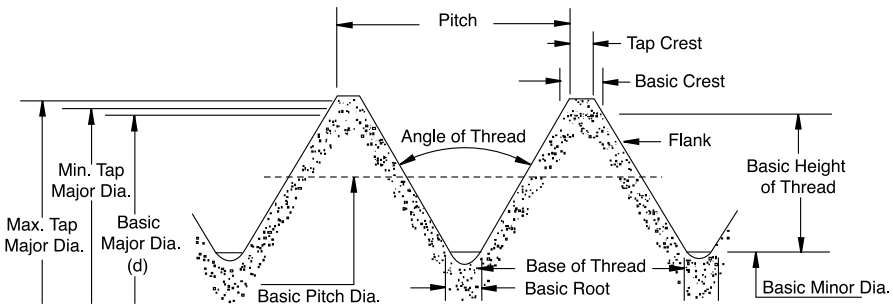
A concave face having an angle of inclination specified between a chord passing through the root and crest of a thread form at the cutting face, and a radial line through the crest at the cutting edge.

### Hook, Tangential

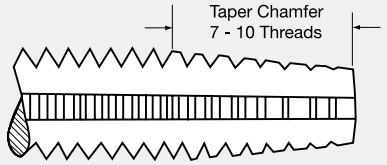
A concave face having an angle of inclination specified between a line tangent to the hook surface at the cutting edge and a radial line to the same point.

*continued on next page*

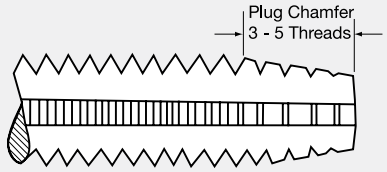
## Illustration of Tap Terms



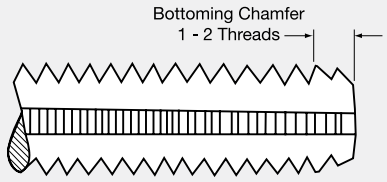

## Tap Chamfers



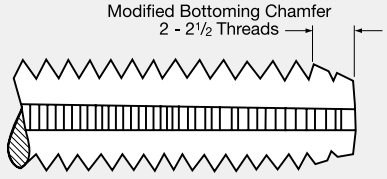

**Taper (7 to 10 pitches)**
*The taper chamfer has the longest standard chamfer ensuring easier starting. It requires less tapping torque because of more working teeth.*




**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.*

## Tap Nomenclature (continued)



### 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.

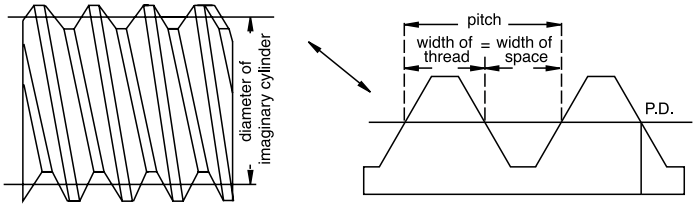
### Square

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

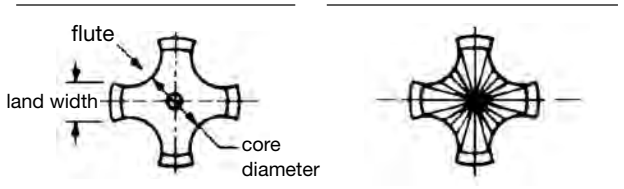
### Taper Tap

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

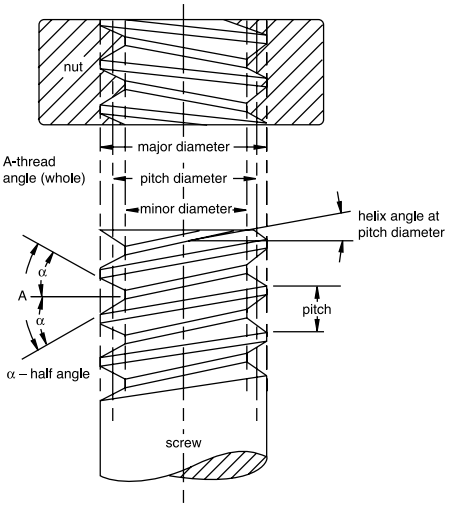
#### Pitch Diameter




#### 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.

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

# Tap – Drill Recommendations

## 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 | * | * |

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

## 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 without reamer | NPT & NPTF with reamer | NPSM | NPSC | NPSF |
|---|---|---|---|---|---|
| 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 | — |

TECHNICAL

## Hardness Conversion Table



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 | | | | | |

# Standard Tap Marking System

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 CoarseThread 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 PipeThread |
| 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 flatted 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.*



# Application Data
# Progress/Performance Taps





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<br>*1 = First Choice, 2 = Second Choice, (3) = Also Suitable*<br>Black Oxide | TiAlN | Hardlube | Tapping Speed (SFM)<br>Vc = SFM<br>RPM = (SFM/Diameter) x 3.82<br>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.



## 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 x tool diameter) / 3.82<br>or 0.262 x RPM x tool diameter |
| RPM | = | (3.82 x SFM) / tool diameter |
| IPM | = | RPM / TPI*<br>or *P x RPM |

### Metric Sizes

| | | |
|---|---|---|
| S m/m | = | (p x tool diameter x RPM) / 1000 |
| RPM | = | (m/m x 1000) / p x tool diameter |
| mm/m | = | mm P x RPM |

# Tapping Speeds



## UNC/UNF and NPT/NPTF Sizes

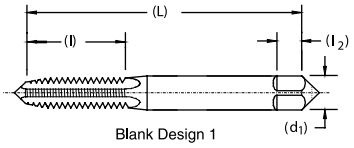
| UNC UNF Tap Size | NPT NPTF Taper Pipe | Surface Feet per Minute (SFM) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5' | 10' | 15' | 20' | 25' | 30' | 40' | 50' | 60' | 70' | 80' | 90' | 100' | 110' | 120' | 130' | 140' | 150' |
| | | Revolutions per Minute (RPM) | | | | | | | | | | | | | | | | | |
| 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 |

## Metric Sizes

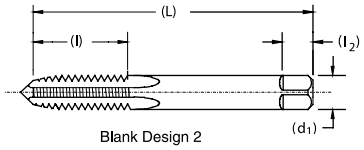
| Tap Size | Surface Feet per Minute (SFM) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5' | 10' | 15' | 20' | 25' | 30' | 40' | 50' | 60' | 70' | 80' | 90' | 100' | 110' | 120' | 130' | 140' | 150' |
| | Revolutions per Minute (RPM) | | | | | | | | | | | | | | | | | |
| 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 | 347 | 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 | 1491 | 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 |

CLEVELAND | WALTER

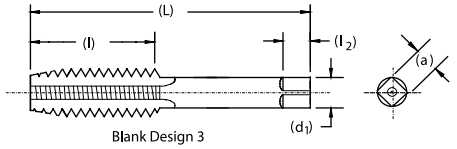
# Standard Tap Dimensions *Ground Thread*
## USCTI Table 302



Blank Design 1



Blank Design 2



Blank Design 3

| 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 |
| 1.358 | 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 |

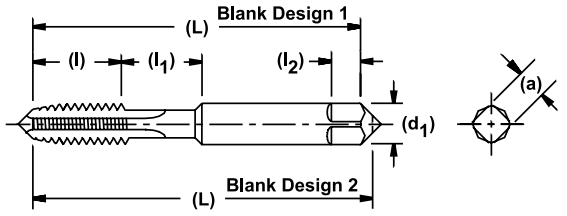
# Standard Tap Dimensions *Tolerances*
## USCTI Table 302

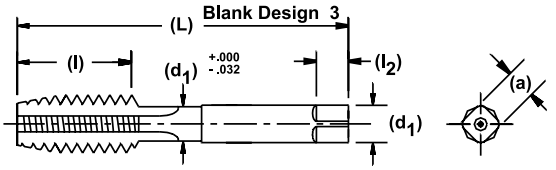


| Element | Nominal Diameter Range in inches Over | To (inc.) | Direction | Tolerance inches |
|---|---|---|---|---|
| Length Overall - **L** | .0520 | 1.0100 | Plus or Minus | .031 |
| | 1.0100 | 4.0100 | Plus or Minus | .063 |
| Length of Thread - **l** | .0520 | .2230 | Plus or Minus | .047 |
| | .2230 | .5100 | Plus or Minus | .063 |
| | .5100 | 1.5100 | Plus or Minus | .094 |
| | 1.5100 | 4.0100 | Plus or Minus | .125 |
| Length of square - $l_2$ | .0520 | 1.0100 | Plus or Minus | .031 |
| | 1.0100 | 4.0100 | Plus or Minus | .063 |
| Diameter of shank - $d_1$ | .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 |

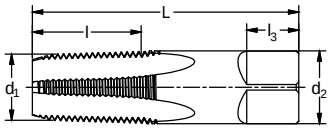


## USCTI Table 302A
## Optional Neck and Shortened Thread Length

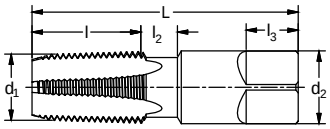


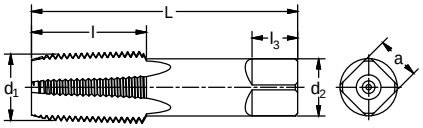

| nominal diameter range inches over | to (inc.) | machine screw size number | inches | nominal fractional diameter inches | | nominal metric diameter millimeters | (inches) | blank design no. | L overall length | l thread length | $l_1$ neck length | $l_2$ square length | $d_1$ shank diameter | a square 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 |




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 **$l_3$** | shank dia. **$d_2$** | square size **a** | optional neck **$l_2$** |
|---|---|---|---|---|---|---|---|
| 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 **- L** | 1/16" to 3/4" inc. | + / – | .031 |
| | 1" to 4" inc. | + / – | .063 |
| Length of Thread **- l** | 1/16" to 3/4" inc. | + / – | .063 |
| | 1" to 1-1/4" inc. | + / – | .094 |
| | 1-1/2" to 4" | + / – | .125 |
| Length of Square **- $l_3$** | 1/16" to 3/4" inc. | + / – | .031 |
| | 1" to 4" inc. | + / – | .063 |
| Diameter of Shank **- $d_2$** | 1/16" to 1/8" | – | .0015 |
| | 1/4" to 1" inc. | – | .0020 |
| | 1-1/4" to 4" inc. | – | .0030 |
| Size of Square **- a** | 1/16" to 1/8" | – | .004 |
| | 1/4" to 3/4" inc. | – | .006 |
| | 1" to 4" inc. | – | .008 |

# Ground Thread Unified & American National Form *Fractional*
# USCTI Table 327



## 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 NC UNC | NF UNF | NS UNS | major diameter basic | min | max | basic pitch dia | pitch diameter limits H1 limit min | max | H2 limit min | max | H3 limit min | max | H4 limit min | max | H5 limit min | max | H6 limit 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 | — | — | — | — |

## 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.*



## Thread Limits

| nom size | threads per inch NC UNC | NF UNF | NS UNS | major diameter basic | min | max | basic pitch dia | pitch diameter limits H1 limit min | max | H2 limit min | max | H3 limit min | max | H7 limit 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 | — | — |

# Special Taps, Ground Thread Unified & American National Form
# USCTI Table 331





## 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.*

## 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 inch | X inch | Y M1.6 thru M6.3 | Y over M6.3 thru M25 | Y over M25 thru M90 | Y over M90 | Z M1.6 thru M6.3 | Z over M6.3 thru M25 | Z over M25 thru M90 | Z 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 |

# 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 |
|---|---|---|---|---|---|
| 0 | 80 | .0600 | .0519 | .0438 | .0514 |
| 1 | 64 | .0730 | .0629 | .0527 | .0623 |
| 1 | 72 | .0730 | .0640 | .0550 | .0635 |
| 2 | 56 | .0860 | .0744 | .0628 | .0737 |
| 2 | 64 | .0860 | .0759 | .0657 | .0753 |
| 3 | 48 | .0990 | .0855 | .0719 | .0845 |
| 3 | 56 | .0990 | .0874 | .0758 | .0865 |
| 4 | 32 | .1120 | .0917 | .0714 | .0880 |
| 4 | 36 | .1120 | .0940 | .0759 | .0919 |
| 4 | 40 | .1120 | .0958 | .0795 | .0939 |
| 4 | 48 | .1120 | .0985 | .0849 | .0968 |
| 5 | 40 | .1250 | .1088 | .0925 | .1062 |
| 5 | 44 | .1250 | .1102 | .0955 | .1079 |
| 6 | 32 | .1380 | .1177 | .0974 | .1140 |
| 6 | 36 | .1380 | .1200 | .1019 | .1165 |
| 6 | 40 | .1380 | .1218 | .1055 | .1186 |
| 8 | 32 | .1640 | .1437 | .1234 | .1389 |
| 8 | 36 | .1640 | .1460 | .1279 | .1416 |
| 8 | 40 | .1640 | .1478 | .1315 | .1437 |
| 10 | 24 | .1900 | .1629 | .1359 | .4156 |
| 10 | 28 | .1900 | .1668 | .1436 | .1604 |
| 10 | 30 | .1900 | .1684 | .1467 | .1630 |
| 10 | 32 | .1900 | .1697 | .1494 | .1641 |
| 12 | 24 | .2160 | .1889 | .1619 | .1807 |
| 12 | 28 | .2160 | .1928 | .1696 | .1857 |
| 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 in | pitch mm | constant for basic pitch dia. Unified | constant for basic pitch dia. ISO | constant for basic minor dia. Unified | constant for basic minor dia. ISO |
|---|---|---|---|---|---|---|
| – | .0079 | 0.2 | – | .00511 | – | .01022 |
| – | .0088 | 0.225 | – | .00575 | – | .01150 |
| – | .0098 | 0.25 | – | .00639 | – | .01278 |
| – | .0118 | 0.3 | – | .00767 | – | .01534 |
| 80 | .0125 | – | .00812 | – | .01624 | – |
| – | .0138 | 0.35 | – | .00895 | – | .01790 |
| 72 | .0139 | – | .00902 | – | .01804 | – |
| 64 | .0156 | – | .01015 | – | .02030 | – |
| – | .0157 | 0.4 | – | .01023 | – | .02046 |
| – | .0177 | 0.45 | – | .01151 | – | .02302 |
| 56 | .0178 | – | .01160 | – | .02320 | – |
| – | .0197 | 0.5 | – | .01279 | – | .02558 |
| 48 | .0208 | – | .01353 | – | .02706 | – |
| 44 | .0227 | – | .01476 | – | .02952 | – |
| – | .0236 | 0.6 | – | .01534 | – | .03068 |
| 40 | .0250 | – | .01624 | | .03248 | – |
| – | .0275 | 0.7 | – | .01790 | – | .03580 |
| 36 | .0278 | – | .01804 | | .03608 | – |
| – | .0295 | 0.75 | – | .01918 | – | .03836 |
| 32 | .0312 | – | .02030 | | .04060 | – |
| – | .0315 | 0.8 | – | .02046 | – | .04092 |
| 28 | .0357 | – | .02320 | | .04640 | – |
| 27 | .0370 | – | .02406 | | .04812 | – |
| – | .0394 | 1.0 | – | .02557 | – | .05114 |
| 24 | .0417 | – | .02706 | | .05412 | – |
| – | .0492 | 1.25 | – | .03196 | – | .06392 |
| 20 | .0500 | – | .03248 | – | .06496 | – |
| 18 | .0555 | – | .03608 | – | .07216 | – |
| – | .0590 | 1.5 | – | .03836 | – | .07672 |
| 16 | .0625 | – | .04060 | – | .08120 | – |
| – | .0689 | 1.75 | – | .04475 | – | .08950 |
| 14 | .0714 | – | .04639 | – | .09278 | – |
| 13 | .0769 | – | .04996 | – | .09992 | – |
| – | .0787 | 2.0 | – | .05117 | – | .10228 |
| 12 | .0833 | – | .05413 | – | .10826 | – |
| 11.5 | .0869 | – | .05648 | – | .11296 | – |
| 11 | .0909 | – | .05905 | – | .11810 | – |
| – | .0984 | 2.5 | – | .06393 | – | .12786 |
| 10 | .1000 | – | .06495 | – | .12990 | – |
| 9 | .1111 | – | .07217 | – | .14434 | – |
| – | .1181 | 3.0 | – | .07672 | – | .15344 |
| 8 | .1250 | – | .08119 | – | .16238 | – |
| – | .1378 | 3.5 | – | .08950 | – | .17900 |
| 7 | .1428 | – | .09279 | – | .18558 | – |
| – | .1575 | 4.0 | – | .10229 | – | .20458 |
| 6 | .1667 | – | .10825 | – | .21650 | – |
| – | .1772 | 4.5 | – | .11507 | – | .23014 |
| – | .1968 | 5.0 | – | .12786 | – | .25572 |
| 5 | .2000 | – | .12990 | – | .25980 | – |
| – | .2165 | 5.5 | – | .14064 | – | .28128 |
| 4.5 | .2222 | – | .14434 | – | .28868 | – |
| – | .2362 | 6.0 | – | .15343 | – | .30353 |
| 4 | .2500 | – | .16238 | – | .32476 | – |

*continued on next page*

# Basic Thread Dimensions Unified & American National Form
## USCTI Table 352 Fractional Sizes

| 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 |
| 3/32 | 48 | .0938 | .0803 | .0667 | .0793 |
| 1/8 | 40 | .1250 | .1088 | .0925 | .1062 |
| 5/32 | 32 | .1563 | .1360 | .1157 | .1311 |
| 5/32 | 36 | .1563 | .1382 | .1202 | .1339 |
| 3/16 | 24 | .1875 | .1604 | .1334 | .1530 |
| 3/16 | 32 | .1875 | .1672 | .1469 | .1616 |
| 7/32 | 24 | .2188 | .1917 | .1646 | .1834 |
| 7/32 | 32 | .2188 | .1985 | .1782 | .1922 |
| 1/4 | 20 | .2500 | .2175 | .1850 | .2067 |
| 1/4 | 24 | .2500 | .2229 | .1959 | .2139 |
| 1/4 | 28 | .2500 | .2268 | .2036 | .2190 |
| 1/4 | 32 | .2500 | .2297 | .2094 | .2229 |
| 5/16 | 18 | .3125 | .2764 | .2403 | .2630 |
| 5/16 | 20 | .3125 | .2800 | .2476 | .2680 |
| 5/16 | 24 | .3125 | .2854 | .2584 | .2754 |
| 5/16 | 32 | .3125 | .2922 | .2719 | .2847 |
| 3/8 | 16 | .3750 | .3344 | .2938 | .3182 |
| 3/8 | 20 | .3750 | .3425 | .3100 | .3297 |
| 3/8 | 24 | .3750 | .3479 | .3209 | .3372 |
| 3/8 | 32 | .3750 | .3547 | .3344 | .3469 |
| 7/16 | 14 | .4375 | .3911 | .3447 | .3717 |
| 7/16 | 20 | .4375 | .4050 | .3726 | .3916 |
| 7/16 | 24 | .4375 | .4104 | .3834 | .3994 |
| 7/16 | 28 | .4375 | .4143 | .3911 | .4051 |
| 1/2 | 12 | .5000 | .4459 | .3918 | .4223 |
| 1/2 | 13 | .5000 | .4500 | .4001 | .4284 |
| 1/2 | 20 | .5000 | .4675 | .4351 | .4537 |
| 1/2 | 24 | .5000 | .4729 | .4459 | .4619 |
| 1/2 | 28 | .5000 | .4768 | .4536 | .4676 |
| 9/16 | 12 | .5625 | .5084 | .4542 | .4843 |
| 9/16 | 18 | .5625 | .5264 | .4903 | .5106 |
| 9/16 | 24 | .5625 | .5354 | .5084 | .5244 |
| 5/8 | 11 | .6250 | .5660 | .5069 | .5391 |
| 5/8 | 12 | .6250 | .5709 | .5168 | .5463 |
| 5/8 | 18 | .6250 | .5889 | .5528 | .5730 |
| 5/8 | 24 | .6250 | .5979 | .5709 | .5869 |
| 11/16 | 11 | .6875 | .6285 | .5694 | .6012 |
| 11/16 | 12 | .6875 | .6334 | .5793 | .6085 |
| 11/16 | 16 | .6875 | .6469 | .6063 | .6284 |
| 11/16 | 24 | .6875 | .6604 | .6334 | .6494 |
| 3/4 | 10 | .7500 | .6850 | .6201 | .6545 |
| 3/4 | 12 | .7500 | .6959 | .6418 | .6707 |
| 3/4 | 16 | .7500 | .7094 | .6688 | .6908 |
| 3/4 | 20 | .7500 | .7175 | .6850 | .7037 |
| 13/16 | 12 | .8125 | .7584 | .7042 | .7329 |
| 13/16 | 16 | .8125 | .7719 | .7313 | .7533 |
| 13/16 | 20 | .8125 | .7800 | .7475 | .7662 |
| 7/8 | 9 | .8750 | .8028 | .7307 | .7681 |
| 7/8 | 12 | .8750 | .8209 | .7668 | .7952 |
| 7/8 | 14 | .8750 | .8286 | .7822 | .8068 |
| 7/8 | 16 | .8750 | .8344 | .7938 | .8158 |
| 7/8 | 18 | .8750 | .8389 | .8028 | .8230 |
| 7/8 | 20 | .8750 | .8425 | .8100 | .8287 |
| 15/16 | 12 | .9375 | .8834 | .8293 | .8575 |
| 15/16 | 16 | .9375 | .8969 | .8563 | .8783 |
| 15/16 | 20 | .9375 | .9050 | .8725 | .8912 |
| 1 | 8 | 1.0000 | .9188 | .8376 | .8797 |
| 1 | 12 | 1.0000 | .9459 | .8918 | .9198 |
| 1 | 14 | 1.0000 | .9536 | .9072 | .9315 |
| 1 | 16 | 1.0000 | .9594 | .9188 | .9408 |
| 1 | 20 | 1.0000 | .9675 | .9350 | .9537 |
| 1-1/6 | 12 | 1.0625 | 1.0084 | .9543 | .9823 |
| 1-1/6 | 16 | 1.0625 | 1.0219 | .9813 | 1.0033 |
| 1-1/6 | 18 | 1.0625 | 1..0264 | .9903 | 1.0105 |
| 1-1/8 | 7 | 1.1250 | 1.0322 | .9394 | .9875 |
| 1-1/8 | 8 | 1.1250 | 1.0438 | .9626 | 1.0047 |
| 1-1/8 | 12 | 1.1250 | 1.0709 | 1.0168 | 1.0448 |
| 1-1/8 | 16 | 1.1250 | 1.0844 | 1.0438 | 1.0658 |
| 1-1/8 | 18 | 1.1250 | 1.0889 | 1.0528 | 1.0730 |
| 1-3/16 | 12 | 1.1875 | 1.1334 | 1.0793 | 1.1073 |
| 1-3/16 | 16 | 1.1875 | 1.1469 | 1.1063 | 1.1283 |
| 1-3/16 | 18 | 1.1875 | 1.1514 | 1.1153 | 1.1355 |
| 1-1/4 | 7 | 1.2500 | 1.1572 | 1.0644 | 1.1125 |
| 1-1/4 | 8 | 1.2500 | 1.1688 | 1.0876 | 1.1297 |
| 1-1/4 | 12 | 1.2500 | 1.1959 | 1.1418 | 1.1698 |
| 1-1/4 | 16 | 1.2500 | 1.2094 | 1.1688 | 1.1908 |
| 1-1/4 | 18 | 1.2500 | 1.2139 | 1.1778 | 1.1980 |
| 1-5/16 | 12 | 1.3125 | 1.2584 | 1.2043 | 1.2323 |
| 1-5/16 | 16 | 1.3125 | 1.2719 | 1.2313 | 1.2533 |
| 1-5/16 | 18 | 1.3125 | 1.2764 | 1.2403 | 1.2605 |
| 1-3/8 | 6 | 1.3750 | 1.2667 | 1.1585 | 1.2146 |
| 1-3/8 | 8 | 1.3750 | 1.2938 | 1.2126 | 1.2547 |
| 1-3/8 | 12 | 1.3750 | 1.3209 | 1.2668 | 1.2948 |
| 1-3/8 | 16 | 1.3750 | 1.3344 | 1.2938 | 1.3158 |
| 1-3/8 | 18 | 1.3750 | 1.3389 | 1.3028 | 1.3230 |
| 1-7/16 | 12 | 1.4375 | 1.3834 | 1.3293 | 1.3573 |
| 1-7/16 | 16 | 1.4375 | 1.3969 | 1.3563 | 1.3783 |
| 1-7/16 | 18 | 1.4375 | 1.4014 | 1.3653 | 1.3855 |



# Basic Thread Dimensions (continued)
## USCTI Table 352 Fractional Sizes





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

# 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 x RPM x ipr
**For external threads**: (D1 + d1) / D1 x RPM x ipr
where:
D1 is the major diameter of the thread
d1 is the cutting diameter
RPM is the calculated speed rate = (3.82 x SFM) / Diameter
ipr is the calculated feed rate = IPT (inches per tooth) x 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) x (3438 RPM x .016) or 23.6 ipm



## Operating Parameters for Helical Thread Mills

| | | cutter diameter (inches) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0.125 | 0.250 | 0.375 | 0.500 | 0.750 | 1.000 |
| material | surface feet per minute (SFM) | 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 Bhyn | 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 |

## Tech Tip

### How to request Made-to-Order taps:

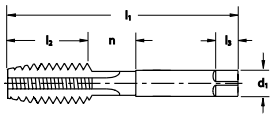
**Information required for every order:**

- 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

## 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.

#### 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 |

## 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 resharpening, 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.

## Call for a Quote

## Special Taps

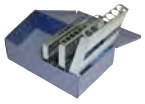
**Call Customer Service at 800.348.2885 for your quote**

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.

# OTHER TOOLS. . . . . T-83

## Tech Tips



| Style | Page | Product | | Type | Set | Tool Material: HSS | Tool Material: Cobalt | Tool Material: Carbide | Tool Material: TCT | Application: Steel | Application: Stainless | Application: Cast Iron | Application: Non-Ferrous | Application: High-Temp Alloy | Application: Hardened Steel |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **OTHER TOOLS** | | | | | | | | | | | | | | | |
| 192 | T-84 | Screw Extractor |  | Ezy-Out® | yes | • | | | | • | | • | | | |
| 850 | T-85 | Tool Bits |  | Square | | • | | | | • | | • | | | |
| 855 | | | | Square | | | • | | | • | • | • | | | |
| 860 | | | | Square | | | • | | | | • | | | • | |
| 851 | T-86 | |  | Rectangular | | • | | | | • | | • | | | |
| 856 | | | | Rectangular | | | • | | | • | • | • | | | |
| 861 | | | | Rectangular | | | • | | | | • | | | • | |
| 902 | T-87 | Blanks |  | Oversize | | • | | | | • | | • | | • | |
| 903 | | | | Undersize | | • | | | | • | | • | | • | |
| CASE | T-88 | Metal Cases |  | Empty | | | | | | | | | | | |

## 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) |
| | | 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 |

Index

## Ezy-Out® Screw Extractor
**Style: 192**

CLEVELAND | WALTER

P K

ANSI SIZES

ALLOY STEEL SUBSTRATE

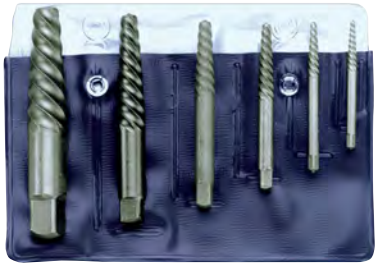
| extractor number | small end inch | large end inch | overall length inch | screw size | pipe size | use this drill size | order number 192 |
|---|---|---|---|---|---|---|---|
| #1 | .054 | .156 | 2.000 | #8 - 1/4 | -- | 5/64 | C53651 |
| #2 | .080 | .188 | 2.375 | #12 - 5/16 | -- | 7/64 | C53652 |
| #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.

## Ezy-Out® Screw Extractor Set
**Style: 192**

SET

| number of pieces | sizes | order number 192 |
|---|---|---|
| 5 | #1, 2, 3, 4, and 5 | 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 |

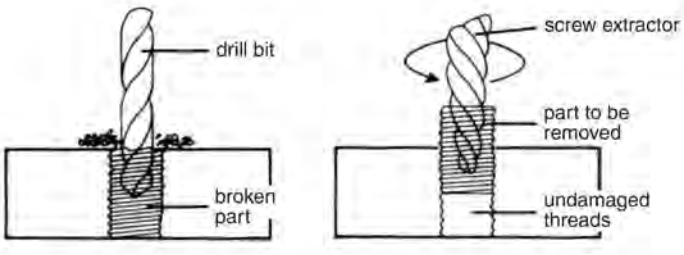


Other Tools

## 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.

## Mo-Max® HSS

**Style: 850**

P K ANSI SIZES HSS

## Mo-Max® Cobalt

**Style: 855**

M P K ANSI SIZES M42 Cobalt

## Super Mo-Max® Cobalt

**Style: 860**

M S ANSI SIZES M42 Cobalt HEAVY DUTY

| tool bit size | | overall length | order number | | |
|---|---|---|---|---|---|
| | | | 850 | 855 | 860 |
| fractional | inch | inch | M2 HSS | M42 Cobalt | M42 Cobalt |
| 1/8 | .1250 | 2.500 | C44505 | C44536 | C44567 |
| 3/16 | .1875 | 2.500 | C44509 | C44540 | C44571 |
| 1/4 | .2500 | 2.500 | C44513 | C44544 | C44575 |
| 5/16 | .3125 | 2.500 | C44514 | C44545 | C44576 |
| 3/8 | .3750 | 3.000 | C44516 | C44547 | C44578 |
| 7/16 | .4375 | 3.500 | C44518 | C44549 | C44580 |
| 1/2 | .5000 | 4.000 | C44520 | C44551 | C44582 |
| 5/8 | .6250 | 4.500 | C44522 | C44553 | C44584 |
| 3/4 | .7500 | 5.000 | C44525 | C44556 | C44587 |
| 7/8 | .8750 | 6.000 | C44527 | C44558 | C44589 |
| 1 | 1.0000 | 7.000 | C44528 | C44559 | C44590 |
| 1-1/4 | 1.2500 | 9.000 | C44530 | C44561 | C44592 |



## 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

CLEVELAND | WALTER

### Mo-Max® HSS
**Style: 850**

P K ANSI SIZES HSS

### Mo-Max® Cobalt
**Style: 855**

M P K ANSI SIZES M42 Cobalt

### Super Mo-Max® Cobalt
**Style: 860**

M S ANSI SIZES M42 Cobalt HEAVY DUTY

| tool bit size | width | height | overall length | order number 851 | 856 | 861 |
|---|---|---|---|---|---|---|
| fractional | inch | inch | inch | M2 HSS | M42 Cobalt | M42 Cobalt |
| 1/4 x 3/8 | .250 | .375 | 2.500 | C44600 | C44601 | C44602 |
| 1/4 x 1/2 | .250 | .500 | 4.000 | C44606 | C44607 | C44608 |
| 1/4 x 1/2 | .250 | .500 | 6.000 | C44609 | C44610 | C44611 |
| 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 |
| 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 | 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 | 6.000 | C44647 | C44648 | C44649 |
| 1/2 x 1 | .500 | 1.000 | 8.000 | C44650 | C44651 | C44652 |
| 5/8 x 3/4 | .625 | .750 | 5.000 | C44653 | C44654 | C44655 |
| 5/8 x 7/8 | .625 | .875 | 6.000 | C44656 | C44657 | C44658 |
| 3/4 x 1 | .750 | 1.000 | 6.000 | C44659 | C44660 | C44661 |

CLEVELAND | WALTER

## Reamer Blank
**Style: 902**

P K S

ANSI SIZES HSS

Tolerance +.0002/–.0000

| blank diameter | width inch | height inch | 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 |

## Drill Blank *Undersize*
**Style: 903**

P K S

ANSI SIZES HSS

Tolerance +.0000/–.0002

| blank diameter | width inch | height inch | 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

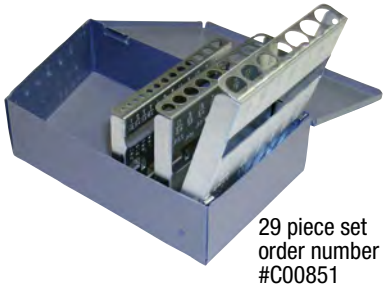
## Tech Tips

### DRILL AND REAMER BLANKS

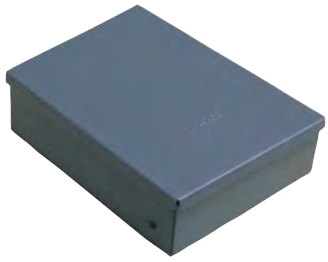
- Ideal for use as drifts of dowel pins, for gauging purposes, and for making punches.
- Also can be used for round tool bits, countersinks, boring, or burring tools.

# Set - Drill Case
## Metal, No Drills





29 piece set
order number
#C00851



| case number | slots number of pieces | holds drill sizes | 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 |

## Part Number Index

CLEVELAND | WALTER

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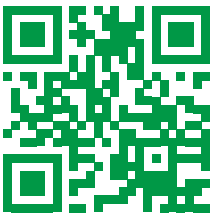

Have a great day.

# Tap & Drill Recommendations

*Machine Screw, Fractional, and Metric Sizes*

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| Tap Size & Pitch inch | Tap Size & Pitch metric | Cutting Taps drill size | Cutting Taps decimal inch | Forming Taps drill size | Forming Taps decimal inch |
|---|---|---|---|---|---|
| 0-80 | | 3/64 | .0469 | 54 | .0550 |
| | M1,6 x 0,35 | 1,25 | .0492 | 1,45 | .0571 |
| | M1,8 x 0,35 | 1,45 | .0571 | 1,65 | .0650 |
| 1-64 | | 53 | .0595 | 51 | .0670 |
| 1-72 | | 53 | .0595 | 51 | .0670 |
| | M2 x 0,4 | 1,6 | .0630 | 1,8 | .0709 |
| 2-56 | | 50 | .0700 | 5/64 | .0781 |
| 2-64 | | 50 | .0700 | 47 | .0785 |
| | M2,2 x 0,45 | 1,75 | .0689 | 2,0 | .0787 |
| | M2,5 x 0,45 | 2,05 | .0807 | 2,3 | .0906 |
| 3-48 | | 47 | .0785 | 43 | .0890 |
| 3-56 | | 46 | .0810 | 2,3 | .0906 |
| 4-40 | | 43 | .0890 | 38 | .1015 |
| 4-48 | | 42 | .0935 | 2,6 | .1024 |
| | M3 x 0,5 | 2,5 | .0984 | 7/64 | .1094 |
| 5-40 | | 38 | .1015 | 33 | .1130 |
| 5-44 | | 37 | .1040 | 2,9 | .1142 |
| | M3,5 x 0,6 | 2,9 | .1142 | 3,2 | .1260 |
| 6-32 | | 36 | .1065 | 1/8 | .1250 |
| 6-40 | | 33 | .1130 | 3,25 | .1280 |
| | M4 x 0,7 | 3,3 | .1299 | 3,7 | .1457 |
| 8-32 | | 29 | .1360 | 25 | .1495 |
| 8-36 | | 29 | .1360 | 24 | .1520 |
| | M4,5 x 0,75 | 3,7 | .1457 | 4,1 | .1614 |
| 10-24 | | 26 | .1470 | 11/64 | .1719 |
| 10-32 | | 21 | .1590 | 16 | .1770 |
| | M5 x 0,8 | 4,2 | .1654 | 14 | .1820 |
| 12-24 | | 16 | .1770 | 8 | .1990 |
| 12-28 | | 15 | .1800 | 7 | .2010 |
| | M6 x 1 | 5,0 | .1969 | 7/32 | .2188 |
| 1/4-20 | | 7 | .2010 | 1 | .2280 |
| 1/4-28 | | 3 | .2130 | 15/64 | .2340 |
| | M7 x 1 | 6,0 | .2362 | F | .2570 |
| 5/16-18 | | F | .2570 | L | .2900 |
| 5/16-24 | | I | .2720 | M | .2950 |
| | M8 x 1,25 | 6,7 | .2638 | 7,4 | .2913 |
| | M8 x 1 | 7,0 | .2756 | 19/64 | .2969 |
| 3/8-16 | | 5/16 | .3125 | S | .3480 |
| 3/8-24 | | Q | .3320 | T | .3580 |
| | M10 x 1,5 | 8,5 | .3346 | U | .3680 |
| | M10 x 1,25 | 8,7 | .3425 | 9,4 | .3701 |
| 7/16-14 | | U | .3680 | Y | .4040 |
| 7/16-20 | | 25/64 | .3906 | Z | .4130 |
| | M12 x 1,75 | 10,2 | .4016 | 11,2 | .4409 |
| | M12 x 1,25 | 10,8 | .4252 | 11,5 | .4528 |
| 1/2-13 | | 27/64 | .4219 | 15/32 | .4688 |
| 1/2-20 | | 29/64 | .4531 | 12,25 | .4823 |
| | M14 x 2 | 12,0 | .4724 | 33/64 | .5156 |
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| | M16 x 2 | 14,0 | .5512 | 19/32 | .5938 |
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| | M20 x 1,5 | 18,5 | .7283 | | |
| | M22 x 2,5 | 19,5 | .7677 | | |
| | M22 x 1,5 | 20,5 | .8071 | | |
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| | M24 x 3 | 21,0 | .8268 | | |
| | M24 x 2 | 22,0 | .8661 | | |
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| 1-12 | | 59/64 | .9219 | | |
| | M27 x 3 | 24,0 | .9449 | | |
| | M27 x 2 | 25,0 | .9843 | | |
| 1-1/8-7 | | 63/64 | .9844 | | |
| 1-1/8-12 | | 1-3/64 | 1.0469 | | |
| | M30 x 3,5 | 26,5 | 1.0433 | | |
| | M30 x 2 | 28,0 | 1.1024 | | |
| 1-1/4-7 | | 1-7/64 | 1.1094 | | |
| 1-1/4-12 | | 1-11/64 | 1.1719 | | |
| | M33 x 3,5 | 29,5 | 1.1614 | | |
| | M33 x 2 | 31,0 | 1.2205 | | |
| 1-3/8-6 | | 1-7/32 | 1.2188 | | |
| 1-3/8-12 | | 1-19/64 | 1.2969 | | |
| | M36 x 4 | 32,0 | 1.2598 | | |
| | M36 x 3 | 33,0 | 1.2992 | | |
| 1-1/2-6 | | 1-11/32 | 1.3438 | | |
| 1-1/2-12 | | 1-27/64 | 1.4219 | | |
| | M39 x 4 | 35,0 | 1.3780 | | |
| | 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 w/o reamer | NPT & NPTF w/ reamer | NPSM | NPSC | NPSF |
|---|---|---|---|---|---|
| 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 | | |

FRACTIONAL - RED WIRE GAGE - PURPLE LETTER - BLUE METRIC - GREEN

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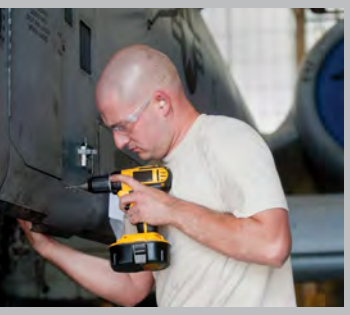



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