HARVEY TOOL

# Single Form Thread Milling Guide

Single Form Threadmills are the most versatile threading tool due to their ability to mill multiple pitch sizes. Since they are used in a helical interpolation environment, specific machining parameters are needed to avoid deflection and breakage. These tools can be used successfully in materials ranging from Aluminum to Steels.

**Speeds & Feeds calculations**:
1. Determine the correct SFM and Chip Load (IPT) for the cutter and material
2. Calculate the Speed (RPM) and Linear Feed (IPM)
3. Adjust Linear Feed to account for helical interpolation of internal or external threads
4. Determine correct number of radial passes at full axial depth

Example: Tool #736990 to machine a 1-5 internal thread in 6061 aluminum

1. From Speeds & Feeds chart (next page), SFM is 300 and Chip Load (IPT) is .00344
2. Calculate Speed (RPM) and Linear Feed (IPM)

   RPM = (SFM x 3.82) / Cutter Diameter
   = (300 x 3.82) / .62
   = 1848

   Linear Feed (IPM) = RPM x IPT x Number of Flutes
   = 1848 x .00344 x 6
   = 38.1

3. Adjust Linear Feed (use Table 1 to determine Major Thread Diameter)

   Adj Internal Feed = [(Major Thread Dia - Cutter Dia) / Major Thread Dia] x Linear Feed
   = [(1.00 - .620) / 1.00] x 37
   = 14.5

   Adj External Feed = [(Major Thread Dia + Cutter Dia) / Major Thread Dia] x Linear Feed
   = [(1.00 + .620) / 1.00] x 37
   = 61.7

4. Determine Number of Radial Passes using Table 1
   (Note: The number of passes should be based on the thread size of the tool, and not the machined part)

   For Easy Machinability = 2 Radial Pass at full Axial Depth
   For Moderate Machinability = 3 Radial Passes at full Axial Depth
   For Difficult Machinability = 4 Radial Passes at full Axial Depth

   Definitions:
   Easy Machinability materials include Non-Ferrous alloys and Leaded Steels
   Moderate Machinability materials include 200/300/400 Stainless Steels and Steels up to 35 Rc
   Difficult Machinability materials include Inconel, Titanium and Steels 36-45 Rc

5. Conclusion

   In this example, the tool would run at 1848 RPM, 14.5 IPM and make 2 Radial Passes

**Setup & Use:**
1. Check software and input proper feed values (Linear or Adjusted)
2. Choke up on tool
3. Minimize runout (consider entire system of spindle, collet, holders etc)
4. Minimize all vibration (consider tool holding, work holding, rpm "sweet spot" etc)
5. Break in tool by reducing feed rates by 25% on first 1-2 holes
6. Cutter should engage part using an arcing toolpath to avoid shock loading (see Table 2)
7. Climb mill for best finish and tool life (see Table 2)
8. Flush chips with coolant to avoid recutting

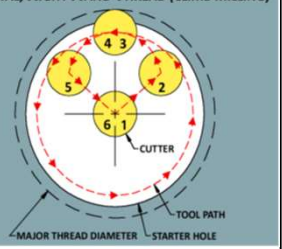
**Table 1**

| Tool Thread Size | Major Thread Diameter | Number of Radial Passes* | | |
|---|---|---|---|---|
| | | Easy Machinabilty | Moderate Machinabilty | Difficult Machinabilty |
| 1/4 | 0.250 | 2 | 2 | 3 |
| 3/8 | 0.375 | 2 | 2 | 3 |
| 7/16 | 0.437 | 2 | 2 | 3 |
| 1/2 | 0.500 | 2 | 2 | 3 |
| 5/8 | 0.625 | 2 | 2 | 3 |
| 3/4 | 0.750 | 2 | 2 | 3 |
| 7/8 | 0.875 | 2 | 2 | 3 |
| 1 | 1.000 | 2 | 3 | 4 |

* Number of Radial Passes are based on the coarsest pitch by thread size. For finer pitches, the number of passes may be reduced by 1 pass.

**Table 2**

INTERNAL, RIGHT HAND THREAD (CLIMB MILLING)




Step 1-2: Cutter moves into position
Step 2-3: Cutter engages part with arcing tool path while "Z" feeds up from bottom
Step 3-4: Cutter moves helically
Step 4-5: Cutter exits part along arcing tool path while maintaining "Z" feed
Step 5-6: Cutter returns to center

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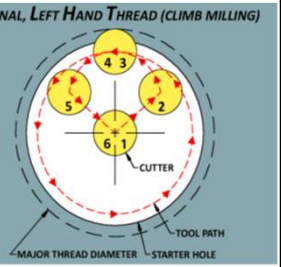
INTERNAL, LEFT HAND THREAD (CLIMB MILLING)




Step 1-2: Cutter moves into position
Step 2-3: Cutter engages part with arcing tool path while "Z" feeds down from top
Step 3-4: Cutter moves helically
Step 4-5: Cutter exits part along arcing tool path while maintaining "Z" feed
Step 5-6: Cutter returns to center

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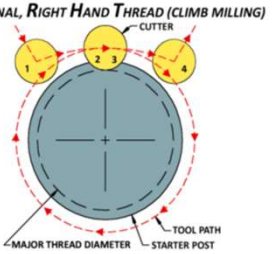
EXTERNAL, RIGHT HAND THREAD (CLIMB MILLING)




Step 1-2: Cutter engages part with arcing tool path while "Z" feeds down from top
Step 2-3: Cutter moves helically
Step 3-4: Cutter exits part along arcing tool path while maintaining "Z" feed

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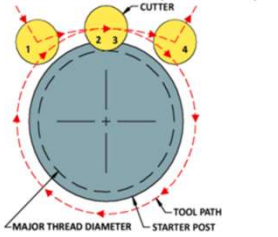
EXTERNAL, LEFT HAND THREAD (CLIMB MILLING)




Step 1-2: Cutter engages part with arcing tool path while "Z" feeds up from bottom
Step 2-3: Cutter moves helically
Step 3-4: Cutter exits part along arcing tool path

## Speeds & Feeds

**Product Table:** Thread Milling Cutters - Single Form - ACME
**Characteristics:** 3x Reach Internal ACME
**Series:** 7369xx

| MATERIAL | SFM | Chip Load (IPT) By Cutter Diameter | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.047 | 0.062 | 0.078 | 0.093 | 0.125 | 0.187 | 0.250 | 0.312 | 0.375 | 0.500 | 0.625 | 0.750 |
| **Hardness: ≤ 28 Rc (≤ 271 HBn)** | | | | | | | | | | | | | |
| **ALUMINUM ALLOYS** | | | | | | | | | | | | | |
| Casting (2xx, 5xx, 7xx, 8xx) | 220 | .00015 | .00020 | .00025 | .00030 | .00040 | .00084 | .00113 | .00172 | .00206 | .00275 | .00344 | .00413 |
| Wrought (1xxx, 2xxx, 3xxx, 5xxx, 6xxx, 7xxx, 8xxx) | 300 | | | | | | | | | | | | |
| Casting - 3%-5% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx) | 220 | .00014 | .00018 | .00022 | .00027 | .00036 | .00076 | .00101 | .00154 | .00186 | .00248 | .00309 | .00371 |
| Casting - 5%-8% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx) | 200 | | | | | | | | | | | | |
| Casting - 8%-12% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx) | 200 | | | | | | | | | | | | |
| Casting - 12%-16% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx) | 140 | | | | | | | | | | | | |
| Wrought - 5%-8% Si (4xxx) | 300 | | | | | | | | | | | | |
| Wrought - 8%-12% Si (4xxx) | 230 | | | | | | | | | | | | |
| **MAGNESIUM ALLOYS** | 200 | .00015 | .00020 | .00025 | .00030 | .00040 | .00084 | .00113 | .00172 | .00206 | .00275 | .00344 | .00413 |
| **ZINC ALLOYS** | 170 | | | | | | | | | | | | |
| **COPPER ALLOYS** | | | | | | | | | | | | | |
| High Coppers - 90%+ (C1xxxx) | 50 | .00014 | .00019 | .00024 | .00029 | .00038 | .00068 | .00091 | .00144 | .00173 | .00231 | .00288 | .00346 |
| Brass (Copper Zinc alloys, C2xxxx, C3xxxx, C4xxxx, C66400-C69800) | 120 | | | | | | | | | | | | |
| Phosphor Bronzes (Copper Tin alloys, C5xxxx) | 50 | | | | | | | | | | | | |
| Aluminum Bronzes (Copper Aluminum alloys, C60600-C64200) | 120 | | | | | | | | | | | | |
| Silicon Bronzes (Copper Silicon alloys, C64700-C66100) | 120 | | | | | | | | | | | | |
| Copper Nickels, Nickel Silvers (Copper Nickel alloys, C7xxxx) | 50 | | | | | | | | | | | | |
| Cast Copper Alloys (C83300-C86200, C86400-C87900, C9200-C95800, C97300-C97800, C99400-C99700) | 130 | | | | | | | | | | | | |
| **Hardness: 29-37 Rc (279-344 HBn)** | | | | | | | | | | | | | |
| **CARBON STEELS** | | | | | | | | | | | | | |
| Free-Machining/Low Carbon steels, 10xx - 1029 & all 10Lxx, 11xx - 1139 & all 11Lxx, 12xx - 1215 & all 12Lxx | 140 | .00011 | .00015 | .00019 | .00022 | .00030 | .00067 | .00090 | .00140 | .00169 | .00225 | .00281 | .00338 |
| 1030 - 1095, 1140 - 1151, 13xx, 15xx, 2xxx, 3xxx, 4xxx & 4xLxx, 5xxx & 5xLxx, 51xxx & 50Lxxx, 51xxx & 51Lxxx, 52xxx & 52Lxxx, 6xxx, 8xxx, 9xxx | 50 | .00011 | .00015 | .00019 | .00022 | .00030 | .00067 | .00090 | .00125 | .00150 | .00200 | .00250 | .00300 |
| **STAINLESS STEELS** | | | | | | | | | | | | | |
| 203 EZ, 303 (all types), 416, 416Se, 416 Plus X, 420F, 420FSe, 430F, 430FSe, 440F, 440FSe | 110 | .00011 | .00015 | .00019 | .00022 | .00030 | .00067 | .00090 | .00140 | .00169 | .00225 | .00281 | .00338 |
| 201, 202, 203, 205, 301, 302, 304, 304L, 308, 309, 310, 314, 316, 316L, 317, 321, 329, 330, 347, 348, 385, 403, 405, 409, 410, 413, 420, 429, 430, 434, 436, 442, 446, 501, 502 | 50 | .00011 | .00015 | .00019 | .00022 | .00030 | .00045 | .00060 | .00094 | .00113 | .00150 | .00188 | .00225 |
| 414, 431, 440A, 440B, 440C, 13-8, 15-5, 15-7, 17-4, 17-7 | 40 | .00011 | .00015 | .00019 | .00022 | .00030 | .00045 | .00060 | .00084 | .00101 | .00135 | .00169 | .00203 |
| **TOOL STEELS** | | | | | | | | | | | | | |
| A, L, O, P, W series | 65 | .00012 | .00016 | .00021 | .00025 | .00033 | .00049 | .00066 | .00110 | .00132 | .00176 | .00220 | .00264 |
| D, H, M, T, S series | 65 | .00011 | .00015 | .00019 | .00022 | .00030 | .00045 | .00060 | .00100 | .00120 | .00160 | .00200 | .00240 |
| **TITANIUM ALLOYS** | 55 | .00012 | .00016 | .00021 | .00025 | .00033 | .00049 | .00066 | .00096 | .00116 | .00154 | .00193 | .00231 |
| **HIGH TEMP ALLOYS** | | | | | | | | | | | | | |
| Inconel, Hastelloy, Waspalloy, Monel, Nimonic, Haynes, Discoloy, Incoloy | 50 | .00010 | .00014 | .00017 | .00020 | .00028 | .00041 | .00055 | .00081 | .00098 | .00130 | .00163 | .00195 |

| SFM | Chip Load (IPT) By Cutter Diameter | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.047 | 0.062 | 0.078 | 0.093 | 0.125 | 0.187 | 0.250 | 0.312 | 0.375 | 0.500 | 0.625 | 0.750 |
| **Hardness: 38-45 Rc (353-421 HBn)** | | | | | | | | | | | | |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| 25 | .00010 | .00013 | .00016 | .00019 | .00026 | .00038 | .00051 | .00080 | .00096 | .00128 | .00159 | .00191 |
| 25 | .00010 | .00013 | .00016 | .00019 | .00026 | .00038 | .00051 | .00072 | .00086 | .00115 | .00143 | .00172 |
| 30 | .00011 | .00014 | .00018 | .00021 | .00028 | .00042 | .00056 | .00093 | .00112 | .00150 | .00187 | .00224 |
| 30 | .00010 | .00013 | .00016 | .00019 | .00026 | .00038 | .00051 | .00085 | .00102 | .00136 | .00170 | .00204 |
| 30 | .00011 | .00014 | .00018 | .00021 | .00028 | .00042 | .00056 | .00082 | .00098 | .00131 | .00164 | .00196 |
| 50 | .00009 | .00012 | .00015 | .00017 | .00023 | .00035 | .00047 | .00069 | .00083 | .00111 | .00138 | .00166 |

**Please note:**

All posted speed and feed parameters are suggested starting values that may be increased given optimal setup conditions. Chip loads reflect uncoated cutters and may be increased 5%-10% if coated. For ferrous materials with hardness ≤ 28 Rc, chip loads can be increased 3%-5%.

If you require additional information, Harvey Tool has a team of technical experts available to assist you through even the most challenging applications. Please contact us at **800-645-5609** or **Harveytech@harveyperformance.com**.