HARVEY TOOL

Metric 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 #882130 to machine an M6-32 internal thread in 17-4 stainless steel

1. From Speeds & Feeds chart (next page), SFM is 150 and Chip Load (IPT) is .00045
2. Calculate Speed (RPM) and Linear Feed (IPM)

   RPM = (SFM x 3.82) / Cutter Diameter
   = (150 x 3.82) / .189
   = 3031

   Linear Feed (IPM) = RPM x IPT x Number of Flutes
   = 3031 x .00045 x 2
   = 2.73 in/min

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
   = [(.236 - .189) / .236] x 2.73
   = .54 in/min

   Adj External Feed = [(Major Thread Dia + Cutter Dia) / Major Thread Dia] x Linear Feed
   = [(.236 + .189) / .236] x 2.73
   = 4.92 in/min

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 3031 RPM, .54 IPM and make 3 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

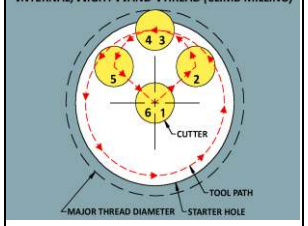
Table 1

Tool Thread Size	Major Thread Diameter		Number of Radial Passes*		
	Millimeters	Inches	Easy Machinabilty	Moderate Machinabilty	Difficult Machinabilty
M1.6	1.50	0.059	2	3	4
M2	2.00	0.079	2	3	4
M2.5	2.50	0.098	2	3	4
M3	3.00	0.118	2	3	4
M3.5	3.50	0.138	2	3	4
M4	4.00	0.157	2	3	4
M5	5.00	0.197	2	3	4
M6	6.00	0.236	2	3	4
M8	8.00	0.315	2	2	3
M10	10.00	0.394	2	2	3
M12	12.00	0.472	2	2	3
M14	14.00	0.551	2	2	3
M15	15.00	0.591	2	2	3
M16	16.00	0.630	2	2	3
M17	17.00	0.669	2	2	3
M18	18.00	0.709	2	2	3
M20	20.00	0.787	2	2	3
M22	22.00	0.866	2	2	3
M24	24.00	0.945	2	2	3

* 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.

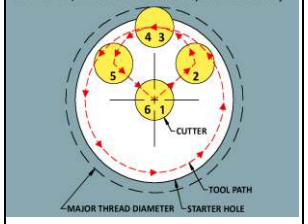
Table 2

INTERNAL, RIGHT HAND THREAD (CLIMB MILLING)



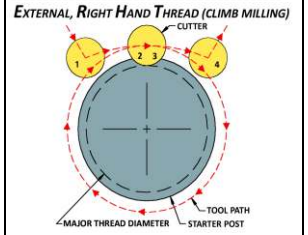
Step 1-2: Cutter moves into position
Step 2-3: Cutter engages part with arcing tool path while "Z" feeds up from bottom
Step 3-4: Cutter moves helically
Step 4-5: Cutter exits part along arcing tool path while maintaining "Z" feed
Step 5-6: Cutter returns to center

INTERNAL, LEFT HAND THREAD (CLIMB MILLING)



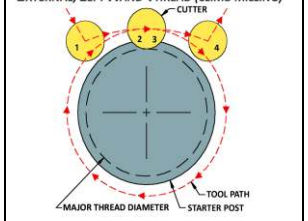
Step 1-2: Cutter moves into position
Step 2-3: Cutter engages part with arcing tool path while "Z" feeds down from top
Step 3-4: Cutter moves helically
Step 4-5: Cutter exits part along arcing tool path while maintaining "Z" feed
Step 5-6: Cutter returns to center

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

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 - Metric
Characteristics: 5x Neck
Series: 8821xx

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)	750	.00015	.00020	.00025	.00030	.00040	.00084	.00113	.00172	.00206	.00275	.00344	.00413
Wrought (1xxx, 2xxx, 3xxx, 5xxx, 6xxx, 7xxx, 8xxx)	1000												
Casting - 3%-5% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx)	750	.00014	.00018	.00022	.00027	.00036	.00076	.00101	.00154	.00186	.00248	.00309	.00371
Casting - 5%-8% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx)	700												
Casting - 8%-12% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx)	650												
Casting - 12%-16% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx)	475												
Wrought - 5%-8% Si (4xxx)	1000												
Wrought - 8%-12% Si (4xxx)	800												
MAGNESIUM ALLOYS	1500	.00015	.00020	.00025	.00030	.00040	.00084	.00113	.00172	.00206	.00275	.00344	.00413
ZINC ALLOYS	800												
COPPER ALLOYS High Coppers - 90%+ (C1xxxx)	225	.00014	.00019	.00024	.00029	.00038	.00068	.00091	.00144	.00173	.00231	.00288	.00346
Brass (Copper Zinc alloys, C2xxxx, C3xxxx, C4xxxx, C66400-C69800)	500												
Phosphor Bronzes (Copper Tin alloys, C5xxxx)	225												
Aluminum Bronzes (Copper Aluminum alloys, C60600-C64200)	500												
Silicon Bronzes (Copper Silicon alloys, C64700-C66100)	500												
Copper Nickels, Nickel Silvers (Copper Nickel alloys, C7xxxx)	225												
Cast Copper Alloys (C83300-C86200, C86400-C87900, C92000-C95800, C97300-C97800, C99400-C99700)	550												
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	600	.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	200	.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	450	.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	200	.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	150	.00011	.00015	.00019	.00022	.00030	.00045	.00060	.00084	.00101	.00135	.00169	.00203
TOOL STEELS A, L, O, P, W series	200	.00012	.00016	.00021	.00025	.00033	.00049	.00066	.00110	.00132	.00176	.00220	.00264
D, H, M, T, S series	200	.00011	.00015	.00019	.00022	.00030	.00045	.00060	.00100	.00120	.00160	.00200	.00240
TITANIUM ALLOYS	150	.00012	.00016	.00021	.00025	.00033	.00049	.00066	.00096	.00116	.00154	.00193	.00231
HIGH TEMP ALLOYS Inconel, Hastelloy, Waspalloy, Monel, Nimonic, Haynes, Discoloy, Incoloy	70	.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)												
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
100	.00010	.00013	.00016	.00019	.00026	.00038	.00051	.00080	.00096	.00128	.00159	.00191
90	.00010	.00013	.00016	.00019	.00026	.00038	.00051	.00072	.00086	.00115	.00143	.00172
100	.00011	.00014	.00018	.00021	.00028	.00042	.00056	.00093	.00112	.00150	.00187	.00224
90	.00010	.00013	.00016	.00019	.00026	.00038	.00051	.00085	.00102	.00136	.00170	.00204
75	.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**.