HARVEY TOOL

Multi-form Threadmilling Guide

Series: 7843xx

Multi-Form Thread Mills are a fast way to threadmill a part. Since they use the entire length of cut 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 up to and including Hardened 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 #784314 to machine a 1/4-18 internal thread in 17-4 stainless steel

1. From Speeds & Feeds chart (next page), SFM is 200 and Chip Load (IPT) is .00101
2. Calculate Speed (RPM) and Linear Feed (IPM)

   RPM = (SFM x 3.82) / Cutter Diameter
   = (200 x 3.82) / .363
   = 2104

   Linear Feed (IPM) = RPM x IPT x Number of Flutes
   = 2104 x .00101 x 4
   = 8.50

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
   = [(.540 - .363) / .540] x 8.50
   = 2.79

   Adj External Feed = [(Major Thread Dia + Cutter Dia) / Major Thread Dia] x Linear Feed
   = [(.540 + .363) / .540] x 8.50
   = 14.21

4. Determine Number of Radial Passes using Table 1

   For Easy Machinability = 1 Radial Pass at full Axial Depth
   For Moderate Machinability = 1 Radial Pass at full Axial Depth
   For Difficult Machinability = 2 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 2104 RPM, 2.79 IPM and make 1 Radial Pass

Setup & Use:

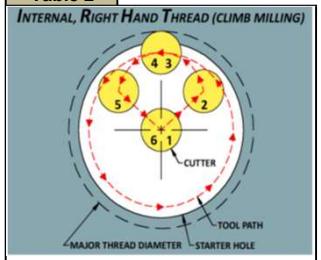
1. Check software and input proper feed values (Linear or Adjusted)
2. Choke up on tool
3. Minimize runout (consider entire system of spindle, collet, holders etc)
4. Minimize all vibration (consider tool holding, work holding, rpm "sweet spot" etc)
5. To break in the tool, reduce feed rates by 75% on the on the first one to two 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

Thread Size	Major Thread Diameter	Number of Radial Passes		
		Easy Machinabilty	Moderate Machinabilty	Difficult Machinabilty
0-80	0.060	2	3	4
1-64	0.073	2	3	4
2-56	0.086	2	3	3
3-48	0.099	2	3	3
4-40	0.112	2	3	3
5-40	0.125	2	3	3
5-44	0.125	2	3	3
6-32	0.138	2	2	3
8-32	0.164	2	2	3
8-36	0.164	1	2	2
10-24	0.190	2	2	3
10-28	0.190	1	2	2
10-32	0.190	1	2	2
12-24	0.216	2	2	3
12-28	0.216	1	2	2
1/4-20	0.250	2	2	3
1/4-28	0.250	1	1	2
5/16-18	0.312	2	2	3
5/16-24	0.312	1	1	2
3/8-16	0.375	2	2	3
3/8-24	0.375	1	1	2
7/16-14	0.437	2	2	3
7/16-20	0.437	1	1	2
1/2-13	0.500	2	2	3
1/2-20	0.500	1	1	2
9/16-12	0.562	2	2	3
9/16-18	0.562	1	2	2
5/8-11	0.625	2	2	3
5/8-18	0.625	1	2	2
3/4-10	0.750	2	2	3
3/4-12	0.750	1	2	
3/4-16	0.750	1	2	2
7/8-9	0.875	2	2	3
7/8-14	0.875	1	2	2
1-8	1.000	2	3	4
1-12	1.000	2	2	2
1-14	1.000	2	2	2
NPT/NPTF				
1/16-27	0.312	1	1	2
1/8-27	0.405	1	1	2
1/4-18	0.540	1	1	2
3/8-18	0.675	1	1	2
1/2-14	0.840	1	2	3
3/4-14	1.050	1	2	3
1-11.5	1.315	1	2	3
2-11.5	2.375	1	2	3
METRIC				
M4.5 x .75	.177 (4.5mm)	1	2	2
M5 X .8	.197 (5mm)	1	2	2
M6 X .75	.236 (6mm)	1	2	2
M6 X 1	.236 (6mm)	1	2	2
M8 X .75	.315 (8mm)	1	2	2
M8 X 1.25	.315 (8mm)	2	2	3
M10 X 1	.394 (10mm)	1	1	2
M10 X 1.5	.394 (10mm)	2	2	3
M12 X 1	.472 (12mm)	1	1	2
M12 X 1.75	.472 (12mm)	2	2	3
M14 X 1.5	.551 (14mm)	1	2	2
M14 X 2.0	.551 (14mm)	2	2	3
M16 X 1	.630 (16mm)	1	2	2
M16 X 2.0	.630 (16mm)	2	2	3
M18 X 1.5	.709 (18mm)	1	2	2
M18 X 2	.709 (18mm)	2	2	3
M20 X 2.5	.787 (20mm)	2	2	3

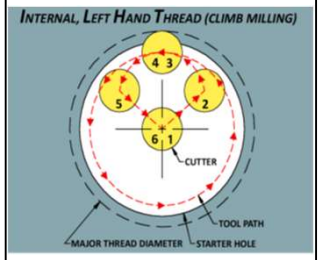
Table 2

INTERNAL, RIGHT HAND THREAD (CLIMB MILLING)



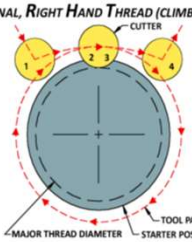
Step 1-2: Cutter moves into position
Step 2-3: Cutter engages part with arcing tool path while "Z" feeds up from bottom
Step 3-4: Cutter moves helically one rotation
Step 4-5: Cutter exits part along arcing tool path while maintaining "Z" feed
Step 5-6: Cutter returns to center

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 one rotation
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 one rotation
Step 3-4: Cutter exits part along arcing tool path while maintaining "Z" feed

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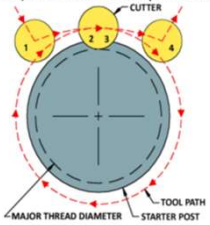
EXTERNAL, LEFT HAND THREAD (CLIMB MILLING)



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

Speeds & Feeds

Product Table: Thread Milling Cutters - Multi-Form - N.P.T.F. Threads
Characteristics: NPTF
Series: 7843xx

Hardened Steels:

For 46-54 Rc:
130 SFM, 75% of IPT (from 29-37 Rc section)
3-4 Radial Passes at full Axial Depth

For 55-60 Rc:
80 SFM, 50% of IPT (from 29-37 Rc section)
4-5 Radial Passes at full Axial Depth

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 **tech@harveytool.com**.

WARNING: Cutting tools may shatter under improper use. Government regulations require use of safety glasses and other appropriate safety equipment in the vicinity of use.

MATERIAL	Hardness: ≤ 28 Rc (≤ 271 HBn)												
	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
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)	1200												
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)	450	.00014	.00019	.00024	.00029	.00038	.00068	.00091	.00144	.00173	.00231	.00288	.00346
Brass (Copper Zinc alloys, C2xxxx, C3xxxx, C4xxxx, C66400-C69800)	1000												
Phosphor Bronzes (Copper Tin alloys, C5xxxx)	450												
Aluminum Bronzes (Copper Aluminum alloys, C60600-C64200)	600												
Silicon Bronzes (Copper Silicon alloys, C64700-C66100)	1000												
Copper Nickels, Nickel Silvers (Copper Nickel alloys, C7xxxx)	450												
Cast Copper Alloys (C83300-C86200, C86400-C87900, C9200-C95800, C97300-C97800, C99400-C99700)	1000												

MATERIAL	Hardness: 29-37 Rc (279-344 HBn)												
	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
CARBON STEELS													
Free-Machining/Low Carbon steels, 10xx - 1029 & all 10Lxx, 11xx - 1139 & all 11Lxx, 12xx - 1215 & all 12Lxx	550	.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	450	.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	400	.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	350	.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	200	.00011	.00015	.00019	.00022	.00030	.00045	.00060	.00084	.00101	.00135	.00169	.00203
TOOL STEELS													
A, L, O, P, W series	325	.00012	.00016	.00021	.00025	.00033	.00049	.00066	.00110	.00132	.00176	.00220	.00264
D, H, M, T, S series	225	.00011	.00015	.00019	.00022	.00030	.00045	.00060	.00100	.00120	.00160	.00200	.00240
TITANIUM ALLOYS	275	.00012	.00016	.00021	.00025	.00033	.00049	.00066	.00096	.00116	.00154	.00193	.00231
HIGH TEMP ALLOYS													
Inconel, Hastelloy, Waspalloy, Monel, Nimonic, Haynes, Discoloy, Incoloy	90	.00010	.00014	.00017	.00020	.00028	.00041	.00055	.00081	.00098	.00130	.00163	.00195

Hardness: 38-45 Rc (353-421 HBn)													
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
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
200	.00010	.00013	.00016	.00019	.00026	.00038	.00051	.00080	.00096	.00128	.00159	.00191
160	.00010	.00013	.00016	.00019	.00026	.00038	.00051	.00072	.00086	.00115	.00143	.00172
200	.00011	.00014	.00018	.00021	.00028	.00042	.00056	.00093	.00112	.00150	.00187	.00224
180	.00010	.00013	.00016	.00019	.00026	.00038	.00051	.00085	.00102	.00136	.00170	.00204
150	.00011	.00014	.00018	.00021	.00028	.00042	.00056	.00082	.00098	.00131	.00164	.00196
70	.00009	.00012	.00015	.00017	.00023	.00035	.00047	.00069	.00083	.00111	.00138	.00166