VALOR™ HOLEMAKING

Multi-form Threadmilling Guide

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 #V547751 to machine a 1/2-20 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) / .370
   = 2065

   Linear Feed (IPM) = RPM x IPT x Number of Flutes
   = 2065 x .00101 x 4
   = 8.3

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
   = [(.562 - .370) / .562] x 8.3
   = 2.8

   Adj External Feed = [(Major Thread Dia + Cutter Dia) / Major Thread Dia] x Linear Feed
   = [(.562 + .370) / .562] x 8.3
   = 13.8

4. Determine Number of Radial Passes using Table 1

   For Easy Machinability = 1 Radial Pass at full Axial Depth
   For Moderate Machinability = 2 Radial Passes 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 2065 RPM, 2.8 IPM and make 2 Radial Passes

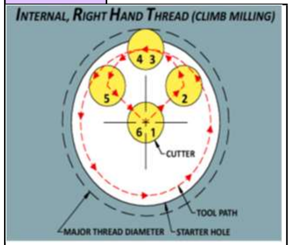
Setup & Use:

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. 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

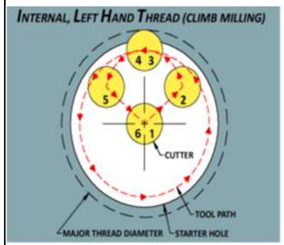
Table 1

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

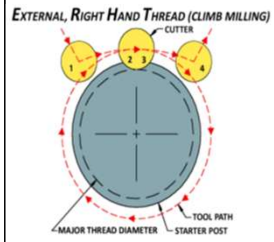
Table 2



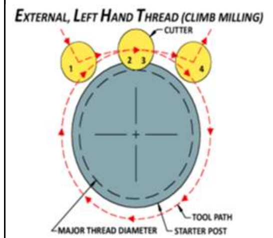
Step 1-2: Cutter moves into position
Step 2-3: Cutter engages part with arcing tool path while "Z" feeds up from bottom
Step 3-4: Cutter moves helically one rotation
Step 4-5: Cutter exits part along arcing tool path while maintaining "Z" feed
Step 5-6: Cutter returns to center



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



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



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

Product Table: Thread Mills - Multi-Form - Long Flute
Characteristics: UN, Metric

Product Notes:
Long Flute Multi-Form Thread Milling Cutters are for internal threading only.
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

Material Guide		Hardness	SFM	Chip Load (IPT) By Cutter Diameter											
				3/64	1/16	5/64	3/32	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4
Carbon Steel	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	29-37 Rc (279-344 HBn)	450	.00009	.00012	.00015	.00018	.00024	.00054	.00072	.00100	.00120	.00160	.00200	.00240
Low Alloy Steel	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	29-37 Rc (279-344 HBn)	550	.00009	.00012	.00015	.00018	.00024	.00054	.00072	.00112	.00135	.00180	.00225	.00270
Tool Steel	A, L, O, P, W series	29-37 Rc (279-344 HBn)	325	.00010	.00013	.00016	.00020	.00026	.00039	.00053	.00088	.00106	.00141	.00176	.00211
		38-45 Rc (353-421 HBn)	200	.00008	.00011	.00014	.00017	.00022	.00034	.00045	.00075	.00090	.00120	.00150	.00180
	D, H, M, T, S series	29-37 Rc (279-344 HBn)	225	.00009	.00012	.00015	.00018	.00024	.00036	.00048	.00080	.00096	.00128	.00160	.00192
		38-45 Rc (353-421 HBn)	180	.00008	.00010	.00013	.00015	.00020	.00031	.00041	.00068	.00082	.00109	.00136	.00163
Austenitic Stainless Steel	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	29-37 Rc (279-344 HBn)	400	.00009	.00012	.00015	.00018	.00024	.00054	.00072	.00112	.00135	.00180	.00225	.00270
Martensitic & Ferritic Stainless Steel	403, 410, 416, 420, 440, 430, 446	29-37 Rc (279-344 HBn)	350	.00009	.00012	.00015	.00018	.00024	.00054	.00072	.00100	.00120	.00160	.00200	.00240
		38-45 Rc (353-421 HBn)	200	.00008	.00011	.00014	.00017	.00022	.00034	.00045	.00075	.00090	.00120	.00150	.00180
PH Stainless Steel	15-5, 17-4, Carpenter 450, Carpenter 465	29-37 Rc (279-344 HBn)	200	.00009	.00012	.00015	.00018	.00024	.00036	.00048	.00080	.00096	.00128	.00160	.00192
		38-45 Rc (353-421 HBn)	160	.00008	.00010	.00013	.00015	.00020	.00031	.00041	.00068	.00082	.00109	.00136	.00163
Nickel Alloy	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	29-37 Rc (279-344 HBn)	90	.00008	.00011	.00014	.00016	.00022	.00033	.00044	.00065	.00078	.00104	.00130	.00156
		38-45 Rc (353-421 HBn)	70	.00007	.00009	.00012	.00014	.00019	.00028	.00037	.00055	.00066	.00088	.00111	.00133
Titanium Alloy	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	29-37 Rc (279-344 HBn)	275	.00010	.00013	.00016	.00020	.00026	.00039	.00053	.00077	.00092	.00123	.00154	.00185
		38-45 Rc (353-421 HBn)	150	.00008	.00011	.00014	.00017	.00022	.00034	.00045	.00065	.00079	.00105	.00131	.00157
Wrought Aluminum Alloy	2014, 5062, 6061, 7050, 7075, 7475	≤ 28 Rc (≤ 271 HBn)	1200	.00012	.00016	.00020	.00024	.00032	.00067	.00090	.00137	.00165	.00220	.00275	.00330
	5% - 8% Si (4XXX)		1000	.00011	.00014	.00018	.00021	.00029	.00061	.00081	.00124	.00149	.00198	.00248	.00297
	8% - 12% Si (4XXX)		800												
Cast Aluminum Alloy	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	≤ 28 Rc (≤ 271 HBn)	750	.00012	.00016	.00020	.00024	.00032	.00067	.00090	.00137	.00165	.00220	.00275	.00330
	3% - 5% Si (3XX, A3XX, C3XX, 4XX, A4XX, B4XX)		750	.00011	.00014	.00018	.00021	.00029	.00061	.00081	.00124	.00149	.00198	.00248	.00297
	5% - 8% Si (3XX, A3XX, C3XX, 4XX, A4XX, B4XX)		700												
	8% - 12% Si (3XX, A3XX, C3XX, 4XX, A4XX, B4XX)		650												
	12% - 16% Si (3XX, A3XX, C3XX, 4XX, A4XX, B4XX)		475												
Copper Alloy	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	≤ 28 Rc (≤ 271 HBn)	450-1000	.00012	.00015	.00019	.00023	.00031	.00055	.00073	.00115	.00138	.00184	.00231	.00277
Magnesium Alloys		≤ 28 Rc (≤ 271 HBn)	1500	.00012	.00016	.00020	.00024	.00032	.00067	.00090	.00137	.00165	.00220	.00275	.00330
Zinc Alloys			800												

General Notes:
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 10%-20% if coated. For ferrous materials with hardness ≤ 28 Rc, chip loads can be increased 10%-20%.
If you require additional information, Valor Holemaking has a team of technical experts available to assist you through even the most challenging applications. Please contact us at **800-888-8888 or Valortech@harveyperformance.com.**