



Multi-form Threadmilling Guide

Series: 169xx, 173xx, 700xx

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 #70094 to machine a 9/16-18 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)

$$\begin{aligned} \text{RPM} &= (\text{SFM} \times 3.82) / \text{Cutter Diameter} \\ &= (200 \times 3.82) / .370 \\ &= 2065 \end{aligned}$$

$$\begin{aligned} \text{Linear Feed (IPM)} &= \text{RPM} \times \text{IPT} \times \text{Number of Flutes} \\ &= 2065 \times .00101 \times 4 \\ &= 8.3 \end{aligned}$$

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

$$\begin{aligned} \text{Adj Internal Feed} &= [(\text{Major Thread Dia} - \text{Cutter Dia}) / \text{Major Thread Dia}] \times \text{Linear Feed} \\ &= [(.562 - .370) / .562] \times 8.3 \\ &= 2.8 \end{aligned}$$

$$\begin{aligned} \text{Adj External Feed} &= [(\text{Major Thread Dia} + \text{Cutter Dia}) / \text{Major Thread Dia}] \times \text{Linear Feed} \\ &= [(.562 + .370) / .562] \times 8.3 \\ &= 13.8 \end{aligned}$$

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 Lead 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

Thread Size	Major Thread Diameter	Number of Radial Passes		
		Easy	Moderate	Difficult
		Machinability	Machinability	Machinability
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	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				
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
<p>INTERNAL, RIGHT HAND THREAD (CLIMB MILLING)</p> <p>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</p>
<p>INTERNAL, LEFT HAND THREAD (CLIMB MILLING)</p> <p>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</p>
<p>EXTERNAL, RIGHT HAND THREAD (CLIMB MILLING)</p> <p>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</p>
<p>EXTERNAL, LEFT HAND THREAD (CLIMB MILLING)</p> <p>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</p>

