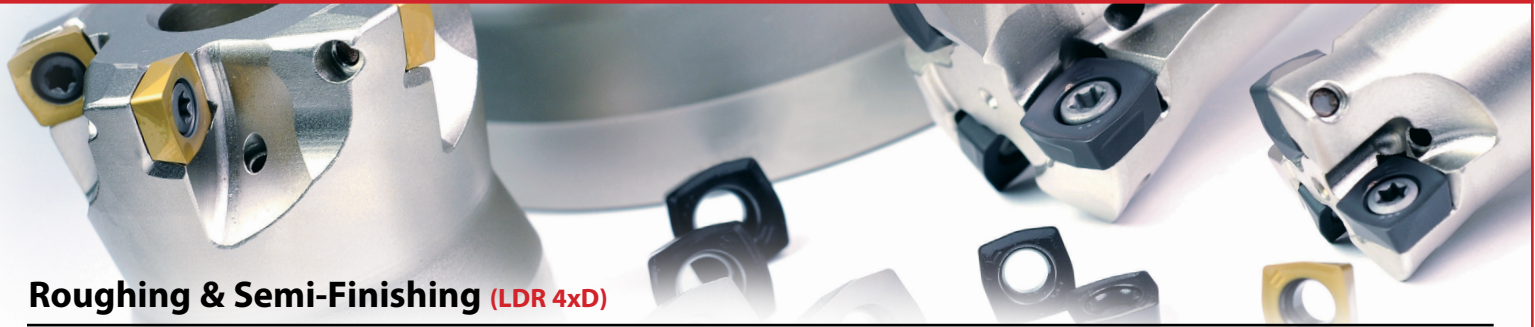




PHC High Feed Cutter
MS Machining Guide



Roughing & Semi-Finishing (LDR 4xD)

For LDR Greater See LDR Notes

High Speed Machining Guide (Aggressive Parameters)

Material				Stainless Steel (annealed)				Stainless Steel (hardened)				Titanium Alloys				Heat Resistant Alloys (annealed)				Heat Resistant Alloys (hardened)			
Insert Size	Tool Dia. (Inch)	Tool Dia. (mm)	No. Teeth	RPM	Feed per Tooth	Feed Rate (IPM)	Axial Cut Depth (aa)	RPM	Feed per Tooth	Feed Rate (IPM)	Axial Cut Depth (aa)	RPM	Feed per Tooth	Feed Rate (IPM)	Axial Cut Depth (aa)	RPM	Feed per Tooth	Feed Rate (IPM)	Axial Cut Depth (aa)	RPM	Feed per Tooth	Feed Rate (IPM)	Axial Cut Depth (aa)
SDMT09	1.000	25	2	2275	0.030	136.50	0.020	1820	0.025	91.00	0.020	1205	0.025	60.25	0.010	555	0.025	27.75	0.010	460	0.020	18.40	0.010
			3	2275	0.030	204.75	0.020	1820	0.025	136.50	0.020	1205	0.025	90.38	0.010	555	0.025	41.63	0.010	460	0.020	27.60	0.010
	1.250	32	2	1820	0.030	109.20	0.020	1455	0.025	72.75	0.020	965	0.025	48.25	0.010	445	0.025	22.25	0.010	365	0.020	14.60	0.010
	2.000	50	5	1140	0.030	171.00	0.020	915	0.025	114.38	0.020	600	0.025	75.00	0.010	275	0.025	34.38	0.010	230	0.020	23.00	0.010
	2.500	63	6	910	0.030	163.80	0.020	730	0.025	109.50	0.020	480	0.025	72.00	0.010	220	0.025	33.00	0.010	185	0.020	22.20	0.010
3.000	80	8	760	0.030	182.40	0.020	610	0.025	122.00	0.020	400	0.025	80.00	0.010	185	0.025	37.00	0.010	155	0.020	24.80	0.010	
SXMT12	1.250	32	2	1820	0.055	200.20	0.040	1455	0.045	130.95	0.040	965	0.035	67.55	0.020	445	0.030	26.70	0.020	365	0.025	18.25	0.020
			3	1820	0.055	300.30	0.040	1455	0.045	196.43	0.040	965	0.035	101.33	0.020	445	0.030	40.05	0.020	365	0.025	27.38	0.020
	1.500	40	3	1515	0.055	249.98	0.040	1215	0.045	164.03	0.040	805	0.035	84.53	0.020	370	0.030	33.30	0.020	305	0.025	22.88	0.020
	2.000	50	4	1140	0.055	250.80	0.040	915	0.045	164.70	0.040	600	0.035	54.00	0.020	275	0.030	33.00	0.020	230	0.025	23.00	0.020
	2.500	63	5	910	0.055	250.25	0.040	730	0.045	164.25	0.040	480	0.035	54.00	0.020	220	0.030	33.00	0.020	185	0.025	23.13	0.020
	3.000	80	7	760	0.055	292.60	0.040	610	0.045	192.15	0.040	400	0.035	98.00	0.020	185	0.030	38.85	0.020	155	0.025	27.13	0.020
	4.000	100	8	570	0.055	250.80	0.040	455	0.045	163.80	0.040	300	0.035	84.00	0.020	140	0.030	33.60	0.020	115	0.025	23.00	0.020
	2.500	63	4	910	0.055	200.20	0.040	730	0.045	131.40	0.040	480	0.035	67.20	0.020	220	0.030	26.40	0.020	185	0.025	18.50	0.010
			5	910	0.055	250.25	0.040	730	0.045	164.25	0.040	480	0.035	54.00	0.020	220	0.030	33.00	0.020	185	0.025	23.13	0.010
	3.000	80	5	760	0.055	209.00	0.040	610	0.045	137.25	0.040	400	0.035	70.00	0.020	185	0.030	27.75	0.020	155	0.025	19.38	0.010
			7	760	0.055	292.60	0.040	610	0.045	192.15	0.040	400	0.035	98.00	0.020	185	0.030	38.85	0.020	155	0.025	27.13	0.010
	4.000	100	6	570	0.055	188.10	0.040	455	0.045	122.85	0.040	300	0.035	63.00	0.020	140	0.030	25.20	0.020	115	0.025	17.25	0.010
			8	570	0.055	250.80	0.040	455	0.045	163.80	0.040	300	0.035	84.00	0.020	140	0.030	33.60	0.020	115	0.025	23.00	0.010
	5.000	125	10	455	0.055	250.25	0.040	365	0.045	164.25	0.040	240	0.035	84.00	0.020	110	0.030	33.00	0.020	90	0.025	22.50	0.010
	6.000	160	12	380	0.055	250.80	0.040	300	0.045	162.00	0.040	200	0.035	84.00	0.020	95	0.030	34.20	0.020	75	0.025	22.50	0.010

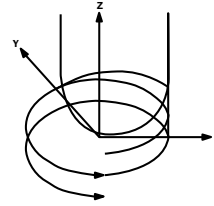
Machining Guide (Moderate Parameters)

Material				Stainless Steel (annealed)				Stainless Steel (hardened)				Titanium Alloys				Heat Resistant Alloys (annealed)				Heat Resistant Alloys (hardened)			
Insert Size	Tool Dia. (Inch)	Tool Dia. (mm)	No. Teeth	RPM	Feed per Tooth	Feed Rate (IPM)	Axial Cut Depth (aa)	RPM	Feed per Tooth	Feed Rate (IPM)	Axial Cut Depth (aa)	RPM	Feed per Tooth	Feed Rate (IPM)	Axial Cut Depth (aa)	RPM	Feed per Tooth	Feed Rate (IPM)	Axial Cut Depth (aa)	RPM	Feed per Tooth	Feed Rate (IPM)	Axial Cut Depth (aa)
SDMT09	1.000	25	2	1510	0.020	60.40	0.020	1210	0.016	38.72	0.020	1015	0.020	40.60	0.010	460	0.020	18.40	0.010	385	0.016	12.32	0.010
			3	1510	0.020	90.60	0.020	1210	0.016	58.08	0.020	1015	0.020	60.90	0.010	460	0.020	27.60	0.010	385	0.016	18.48	0.010
	1.250	32	2	1210	0.020	48.40	0.020	970	0.016	31.04	0.020	810	0.020	32.40	0.010	365	0.020	14.60	0.010	305	0.016	9.76	0.010
	2.000	50	5	755	0.020	75.50	0.020	605	0.016	48.40	0.020	510	0.020	51.00	0.010	230	0.020	23.00	0.010	190	0.016	15.20	0.010
	2.500	63	6	605	0.020	72.60	0.020	485	0.016	46.56	0.020	410	0.020	49.20	0.010	185	0.020	22.20	0.010	155	0.016	14.88	0.010
3.000	80	8	500	0.020	80.00	0.020	400	0.016	51.20	0.020	340	0.020	54.40	0.010	155	0.020	24.80	0.010	130	0.016	16.64	0.010	
SXMT12	1.250	32	2	1210	0.040	96.80	0.040	970	0.032	62.08	0.040	810	0.028	45.36	0.020	365	0.025	18.25	0.020	305	0.020	12.20	0.020
			3	1210	0.040	145.20	0.040	970	0.032	93.12	0.040	810	0.028	68.04	0.020	365	0.025	27.38	0.020	305	0.020	18.30	0.020
	1.500	40	3	1005	0.040	120.60	0.040	805	0.032	77.28	0.040	675	0.028	56.70	0.020	305	0.025	22.88	0.020	255	0.020	15.30	0.020
	2.000	50	4	755	0.040	120.80	0.040	605	0.032	77.44	0.040	510	0.028	57.12	0.020	230	0.025	23.00	0.020	190	0.020	15.20	0.020
	2.500	63	5	605	0.040	121.00	0.040	485	0.032	77.60	0.040	410	0.028	57.40	0.020	185	0.025	23.13	0.020	155	0.020	15.50	0.020
	3.000	80	7	500	0.040	140.00	0.040	400	0.032	89.60	0.040	340	0.028	66.64	0.020	155	0.025	27.13	0.020	130	0.020	18.20	0.020
	4.000	100	8	380	0.040	121.60	0.040	305	0.032	78.08	0.040	255	0.028	57.12	0.020	115	0.025	23.00	0.020	95	0.020	15.20	0.020
	2.500	63	4	605	0.040	96.80	0.040	485	0.032	62.08	0.040	410	0.028	45.92	0.020	185	0.025	18.50	0.020	155	0.020	12.40	0.020
			5	605	0.040	121.00	0.040	485	0.032	77.60	0.040	410	0.028	57.40	0.020	185	0.025	23.13	0.020	155	0.020	15.50	0.020
	3.000	80	5	500	0.040	100.00	0.040	400	0.032	64.00	0.040	340	0.028	47.60	0.020	155	0.025	19.38	0.020	130	0.020	13.00	0.020
			7	500	0.040	140.00	0.040	400	0.032	89.60	0.040	340	0.028	66.64	0.020	155	0.025	27.13	0.020	130	0.020	18.20	0.020
	4.000	100	6	380	0.040	91.20	0.040	305	0.032	58.56	0.040	255	0.028	42.84	0.020	115	0.025	17.25	0.020	95	0.020	11.40	0.020
			8	380	0.040	121.60	0.040	305	0.032	78.08	0.040	255	0.028	57.12	0.020	115	0.025	23.00	0.020	95	0.020	15.20	0.020
	5.000	125	10	300	0.040	120.00	0.040	240	0.032	76.80	0.040	200	0.028	56.00	0.020	90	0.025	22.50	0.020	75	0.020	15.00	0.020
	6.000	160	12	250	0.040	120.00	0.040	200	0.032	76.80	0.040	170	0.028	57.12	0.020	75	0.025	22.50	0.020	65	0.020	15.60	0.020

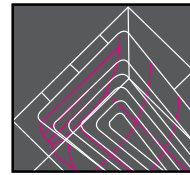
High Speed Machining Guide

Machining Tips

- Use Z-Level climb cutting for roughing operations.
- Use Helical for material engagement whenever possible for material entry (See Helical chart for ramp angles and arc limits depending on tool diameter).
- Add radiuses larger than cutter to corner of tool path for smooth operation.
- LDR should always be as short as possible.
- LDR of 4xD or less use chart on reverse side.
- LDR of 6xD to 10xD reduce spindle speed by 35% and feed rate by 25% to get started.
- LDR of 10xD and over reduce RPM by 50% and depth of cut by 65% to get started. **Machining is very difficult over 10xD.**
- Leave extra stock for semi-finishing to prevent gouging of surface when using long reach tools.
- Use air or oil mist for all applications except those involving gummy or sticky materials such as stainless, which machines well with water based coolant.



Helical Interpolation



Corner Rounding on Tool Path

Formulas

$$\begin{aligned} \text{RPM} &= (3.82 \times \text{SFM}) / \text{Tool Diameter} \\ \text{SFM} &= 0.262 \times \text{RPM} \times \text{Tool Diameter} \\ \text{IPM} &= \text{RPM} \times \# \text{ Flutes} \times \text{Chip Load} \\ \text{Chip Load} &= \text{IPM} / (\text{RPM} \times \# \text{ Flutes}) \end{aligned}$$

Depth of Cut

Adjusting depths of cuts based on LDR (Length Diameter Ratio)

Axial Depths of Cuts

- Depth of cut should be reduced by 5% per increment of LDR.

Radial Depths of Cuts

- This cutter performs best with step over amounts 100% to 50% of cutter diameter. Lesser amounts will result in less stability and reduce performance overall.

Diagnosing Problems

Insert Chipping - early during use means chip load too high, please reduce feed rate in increments of 20% until problem is resolved or shorten the length of the tool.

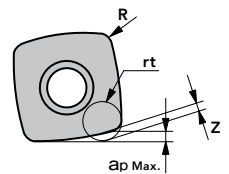
Insert Burning - of coating or glowing at the tip means RPM is too high. Reduce RPM by 20% increments until problem is resolved along with feed rate until excessive heat is subdued.

Chatter - excessive tool length is a primary cause. After reducing tool length if possible, lower RPM and feed rate until chatter is minimized.

Flute Shape Definitions

For Machining Purposes. Create machining programs for the respective simulated R radius cutters.

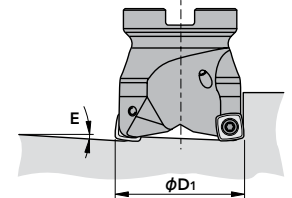
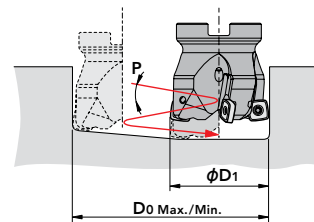
Insert Size	R (mm)	Axial Max (mm)	rt (mm)	z (mm)
SDMT09...	0.8	1	2	0.7
SXMT12...	1	2	3	1.15



Insert Size	R (inch)	Axial Max (inch)	rt (inch)	z (inch)
SDMT09...	0.03150	0.03937	0.07874	0.02755
SXMT12...	0.03937	0.07874	0.11811	0.04528

Maximum Helical Ramping Angle

Insert Size	SDMT09				SXMT12				
	Diameter (Inch)	Ramping Angle	Helical Milling (Inch)	Helical Angle	Ramping Angle	Helical Milling (Inch)	Helical Angle		
	D1	E	Do Min	Do Max	P	E	Do Min	Do Max	P
1.000	3.5°	1.409	1.921	3.0°	-	-	-	-	-
1.250	1.9°	1.909	2.421	1.7°	7.2°	1.713	2.421	6.1°	-
1.500	1.2°	2.409	2.921	1.0°	2.9°	2.213	2.921	2.5°	-
2.000	0.8°	3.409	3.921	0.7°	1.4°	3.213	3.921	1.2°	-
2.500	0.7°	4.409	4.921	0.7°	1.1°	4.213	4.921	0.9°	-
3.000	0.45°	5.409	5.921	0.4°	1.0°	5.213	5.921	0.8°	-
4.000	-	-	-	-	0.7°	7.213	7.921	0.6°	-
5.000	-	-	-	-	0.5°	9.213	9.921	0.35°	-
6.000	-	-	-	-	0.4°	11.213	11.921	0.3°	-



Recommended Materials by Application

Insert Grade	Chip Breaker	Coolant	Carbon Steels	Stainless Steels	Cast Irons	Hi-Temp Alloys	Hardened Steels
			P	M	K	S	H
XP3035	GM	-	⊙	○	○		
XP2040	GM	-	○	⊙			⊙
XC1015	GM	-			⊙		
XC5035	SM	-		⊙			○
XC5040	SM	Yes		○		○	
		Yes		○		⊙	○

GM:Medium Cutting SM:Heat Resistant Alloy

○ good ⊙ best

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