OSG PHOENIX®

PSE 90° Shoulder Cutter
P H Machining Guide

Side Milling - Roughing & Semi-Finishing (LDR 4xD)

For LDR Greater See LDR Notes

High Speed Machining Guide (Aggressive Parameters)

Material				Carbon/Alloy Steel (30-40 HRC)				Tool Steel (40-50 HRC)				Tool Steel (50-60 HRC)*			
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)
ZDKT11	0.625	16	2	3820	0.010	76.40	0.200	1990	0.006	23.88	0.200	1500	0.004	12.00	0.100
	0.750	20	3	3185	0.010	95.55	0.200	1655	0.006	29.79	0.200	1250	0.004	15.00	0.100
	1.000	25	3	2390	0.010	71.70	0.200	1240	0.006	22.32	0.200	935	0.004	11.22	0.100
			4	2390	0.010	95.60	0.200	1240	0.006	29.76	0.200	935	0.004	14.96	0.100
	1.250	32	3	1910	0.010	57.30	0.200	995	0.006	17.91	0.200	750	0.004	9.00	0.100
			5	1910	0.010	95.50	0.200	995	0.006	29.85	0.200	750	0.004	15.00	0.100
	2.000	50	5	1195	0.010	59.75	0.200	620	0.006	18.60	0.200	470	0.004	9.40	0.100
			7	1195	0.010	83.65	0.200	620	0.006	26.04	0.200	470	0.004	13.16	0.100
	2.500	63	6	955	0.010	57.30	0.200	500	0.006	18.00	0.200	375	0.004	9.00	0.100
			8	955	0.010	76.40	0.200	500	0.006	24.00	0.200	375	0.004	12.00	0.100
	3.000	80	7	795	0.010	55.65	0.200	415	0.006	17.43	0.200	310	0.004	8.68	0.100
			10	795	0.010	79.50	0.200	415	0.006	24.90	0.200	310	0.004	12.40	0.100
ZDKT15	1.000	25	2	2390	0.0125	59.75	0.250	1240	0.0075	18.60	0.250	935	0.005	9.35	0.200
	1.250	32	2	1910	0.0125	47.75	0.250	995	0.0075	14.93	0.250	750	0.005	7.50	0.200
			3	1910	0.0125	71.63	0.250	995	0.0075	22.39	0.250	750	0.005	11.25	0.200
	1.500	40	3	1590	0.0125	59.63	0.250	830	0.0075	18.68	0.250	625	0.005	9.38	0.200
			4	1590	0.0125	79.50	0.250	830	0.0075	24.90	0.250	625	0.005	12.50	0.200
	2.000	50	3	1195	0.0125	44.81	0.250	620	0.0075	13.95	0.250	470	0.005	7.05	0.200
			5	1195	0.0125	74.69	0.250	620	0.0075	23.25	0.250	470	0.005	11.75	0.200
	2.500	63	4	955	0.0125	47.75	0.250	500	0.0075	15.00	0.250	375	0.005	7.50	0.200
			6	955	0.0125	71.63	0.250	500	0.0075	22.50	0.250	375	0.005	11.25	0.200
	3.000	80	5	795	0.0125	49.69	0.250	415	0.0075	15.56	0.250	310	0.005	7.75	0.200
			8	795	0.0125	79.50	0.250	415	0.0075	24.90	0.250	310	0.005	12.40	0.200
	4.000	100	7	600	0.0125	52.50	0.250	310	0.0075	16.28	0.250	235	0.005	8.23	0.200
			10	600	0.0125	75.00	0.250	310	0.0075	23.25	0.250	235	0.005	11.75	0.200
	5.000	125	8	480	0.0125	48.00	0.250	250	0.0075	15.00	0.250	190	0.005	7.60	0.200
			11	480	0.0125	66.00	0.250	250	0.0075	20.63	0.250	190	0.005	10.45	0.200
	6.000	160	10	400	0.0125	50.00	0.250	210	0.0075	15.75	0.250	155	0.005	7.75	0.200
			12	400	0.0125	60.00	0.250	210	0.0075	18.90	0.250	155	0.005	9.30	0.200

*Materials hardened to 50-60HRC are very difficult to machine and not recommended.

Machining Guide (Moderate Parameters)

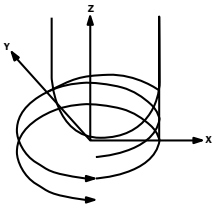
Material				Carbon/Alloy Steel (30-40 HRC)				Tool Steel (40-50 HRC)				Tool Steel (50-60 HRC)*			
Insert Size	Tool Dia. (Inch)	Tool Dia. (mm)	No. Teeth	RPM	Feed per Tooth	Feed Rate (IPM)	Axial Cut Depth (aa)	RPM	Feed per Tooth	Feed Rate (IPM)	Axial Cut Depth (aa)	RPM	Feed per Tooth	Feed Rate (IPM)	Axial Cut Depth (aa)
ZDKT11	0.625	16	2	3055	0.008	48.88	0.200	1620	0.005	22.30	0.200	1190	0.003	7.14	0.100
	0.750	20	3	2550	0.008	61.20	0.200	1350	0.005	27.90	0.200	995	0.003	8.96	0.100
	1.000	25	3	1910	0.008	45.84	0.200	1015	0.005	20.93	0.200	745	0.003	6.71	0.100
			4	1910	0.008	61.12	0.200	1015	0.005	27.90	0.200	745	0.003	8.94	0.100
	1.250	32	3	1530	0.008	36.72	0.200	810	0.005	16.73	0.200	595	0.003	5.36	0.100
			5	1530	0.008	61.20	0.200	810	0.005	27.88	0.200	595	0.003	8.93	0.100
	2.000	50	5	955	0.008	38.20	0.200	510	0.005	17.50	0.200	375	0.003	5.63	0.100
			7	955	0.008	53.48	0.200	510	0.005	24.50	0.200	375	0.003	7.88	0.100
	2.500	63	6	765	0.008	36.72	0.200	405	0.005	16.80	0.200	300	0.003	5.40	0.100
			8	765	0.008	48.96	0.200	405	0.005	22.40	0.200	300	0.003	7.20	0.100
	3.000	80	7	640	0.008	35.84	0.200	340	0.005	16.28	0.200	250	0.003	5.25	0.100
			10	640	0.008	51.20	0.200	340	0.005	23.25	0.200	250	0.003	7.50	0.100
ZDKT15	1.000	25	2	1910	0.010	38.20	0.250	1015	0.006	16.74	0.250	745	0.004	5.96	0.200
	1.250	32	2	1530	0.010	30.60	0.250	810	0.006	13.38	0.250	595	0.004	4.76	0.200
			3	1530	0.010	45.90	0.250	810	0.006	20.07	0.250	595	0.004	7.14	0.200
	1.500	40	3	1275	0.010	38.25	0.250	675	0.006	16.74	0.250	500	0.004	6.00	0.200
			4	1275	0.010	51.00	0.250	675	0.006	22.32	0.250	500	0.004	8.00	0.200
	2.000	50	3	955	0.010	28.65	0.250	510	0.006	12.60	0.250	375	0.004	4.50	0.200
			5	955	0.010	47.75	0.250	510	0.006	21.00	0.250	375	0.004	7.50	0.200
	2.500	63	4	765	0.010	30.60	0.250	405	0.006	13.44	0.250	300	0.004	4.80	0.200
			6	765	0.010	45.90	0.250	405	0.006	20.16	0.250	300	0.004	7.20	0.200
	3.000	80	5	640	0.010	32.00	0.250	340	0.006	13.95	0.250	250	0.004	5.00	0.200
			8	640	0.010	51.20	0.250	340	0.006	22.32	0.250	250	0.004	8.00	0.200
	4.000	100	7	480	0.010	33.60	0.250	255	0.006	14.70	0.250	190	0.004	5.32	0.200
			10	480	0.010	48.00	0.250	255	0.006	21.00	0.250	190	0.004	7.60	0.200
	5.000	125	8	385	0.010	30.80	0.250	205	0.006	13.44	0.250	150	0.004	4.80	0.200
			11	385	0.010	42.35	0.250	205	0.006	18.48	0.250	150	0.004	6.60	0.200
	6.000	160	10	320	0.010	32.00	0.250	170	0.006	10.20	0.250	125	0.004	5.00	0.200
			12	320	0.010	38.40	0.250	170	0.006	12.24	0.250	125	0.004	6.00	0.200

*Materials hardened to 50-60HRC are very difficult to machine and not recommended.

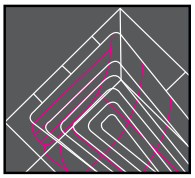
High Speed Machining Guide

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 dia.).
- 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

RPM = (3.82 x SFM) / Tool Diameter
SFM = 0.262 x RPM x Tool Diameter
IPM = RPM x # Flutes x Chip Load
Chip Load = IPM / (RPM x # Flutes)

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 up to 20% of cutter diameter. Larger amounts will result in less stability and reduce performance overall.

Diagnosing Problems

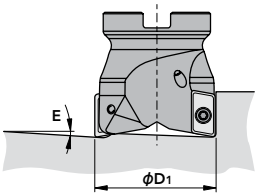
Insert Chipping - early during use means chip load too high, please reduce feed rate in increments of 20% until problem is resolved or shorten the length of the tool.

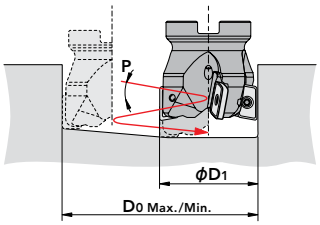
Insert Burning - of coating or glowing at the tip means RPM is too high. Reduce RPM by 20% increments until problem is resolved along with feed rate until excessive heat is subdued.

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

Maximum Helical Ramping Angle

Insert Size	ZDKT11				ZDKT15			
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
0.625	10.8°	0.935	1.187	9.5°	–	–	–	–
0.750	9.8°	1.185	1.437	7.0°	–	–	–	–
1.000	7.4°	1.685	1.927	4.4°	9.5°	1.488	1.921	7.4°
1.250	4.8°	2.158	2.437	3.2°	6.8°	1.988	2.421	5.0°
1.500	2.9°	2.685	2.937	2.2°	5.1°	2.488	2.921	3.2°
2.000	2.1°	3.685	3.937	1.6°	2.4°	3.488	3.921	2.4°
2.500	1.8°	4.685	4.937	1.4°	2.3°	4.488	4.921	1.4°
3.000	1.4°	5.685	5.937	1.0°	2.0°	5.488	5.921	1.3°
4.000	–	–	–	–	1.4°	7.488	7.921	1.0°
5.000	–	–	–	–	0.8°	9.488	9.921	0.8°
6.000	–	–	–	–	0.7°	11.488	11.921	0.6°





Recommended Materials by Application

Insert Grade	Chip Breaker	Coolant	Carbon Steels	Stainless Steels	Cast Irons	Non-Ferrous	Hi-Temp Alloys	Hardened Steels
			P	M	K	N	S	H
CK010	NM	Yes				◎		
XC3020	GL / GM / GR	-	◎		○			
XP3025	GL / GM / GR	Yes	◎		○			
XC3030	GL / GM / GR	-	◎		○			
XP3035	GL / GM / GR	-	◎	○	○			
XP2025	GL / GM	Yes	○	◎			○	
XP2040	GL / GM / GR	-	○	○				○
		Yes	○	◎			○	
XC1015	GM / GR	-			◎			
XC5035	SM	-		◎				
		Yes		○			○	
XC5040	SM	Yes		○			◎	
XP6015	HR	-	○		○			◎

GL: Light Cutting GM: Medium Cutting GR: Heavy Cutting NM: Aluminum SM: Heat Resistant Alloy HR: Hardened Steel

○ good ◎ best

osgtool.com
OSG USA, Inc. : 800-837-2223
OSG Canada, Ltd. : 905-632-8032 • OSG Royco (Mexico) : (52) 477 478-02-00