

Undercutting end mills, often referred to as lollipop cutters, are extremely versatile tools. Harvey tool offers a variety of reach and wrap angles to provide an answer for even the most difficult of applications. Due to the varying neck lengths and applications, specific machining parameters must be calculated to avoid breakage.

Speeds & Feeds calculations:

1. Determine the correct SFM and Base Chip Load (IPT) for the cutter, material and application (see application descriptions Figure 1.)
2. Adjust Chip Load to account for neck length to cutter diameter ratio. For reduced shank undercuts, the neck length is equal to the shank length that extends out of the tool holder. (see Table 2)
3. Calculate the Speed (RPM) and Linear Feed (IPM)
4. Determine correct number of passes

Example: Tool #956132 for a Deburring application in 4140 steel at 32 Rc and the neck length is extended 2.0 inches from the tool holder.

1. Using Figure 1 (upper right), determine the type of application you will be performing.
From Speeds & Feeds chart (next page), SFM is 200 and Base Chip Load (IPT) for Deburring is .00074.
2. Calculate the neck length to neck diameter ratio for the tool. Calculate adjusted chipload based on values in Table 1.

$$\begin{aligned} \text{Neck Length Ratio} &= (\text{Neck Length} / \text{Neck Diameter}) \\ &= (2.0 / .312) \\ &= 6.3 \\ \text{Adjusted Chip Load} &= \text{Adjustment Factor} \times \text{Base Chip Load} \\ &= .8 \times .00074 \\ &= .00059 \end{aligned}$$

3. Calculate Speed (RPM) and Linear Feed (IPM)

$$\begin{aligned} \text{RPM} &= (\text{SFM} \times 3.82) / \text{Cutter Diameter} \\ &= (200 \times 3.82) / .500 \\ &= 1528 \end{aligned}$$

$$\begin{aligned} \text{Linear Feed (IPM)} &= \text{RPM} \times \text{IPT} \times \text{Number of Flutes} \\ &= 1528 \times .00059 \times 6 \\ &= 5.4 \end{aligned}$$

4. From Speeds & Feeds chart (next page), the number of passes for a deburring operation in 4140 steel is 1 pass.

5. Conclusion

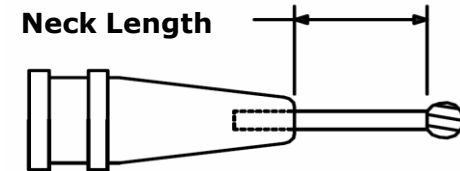
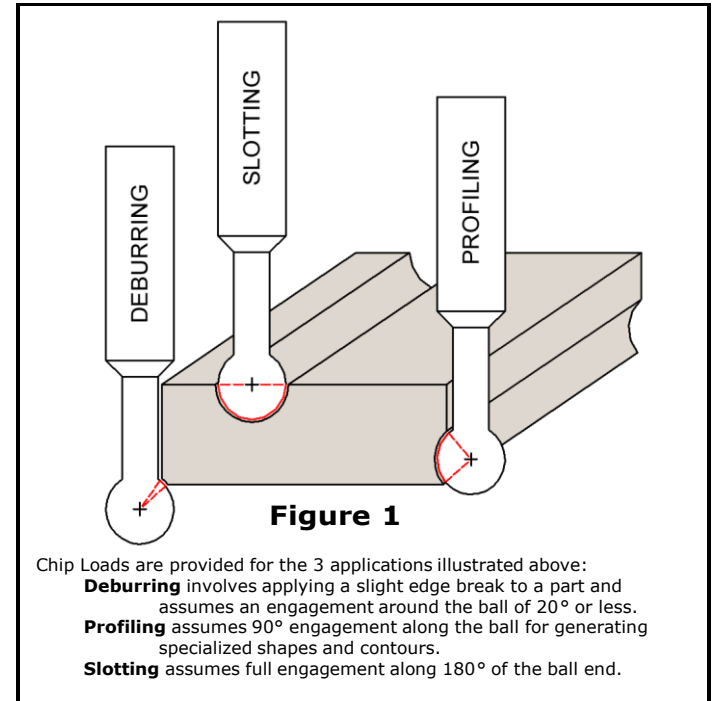


Table 1	
Neck Length Multiple	Chip Load
3x	120%
5x	100%
8x	80%
12x	65%
15x	55%



Speeds & Feeds

Product Table: Undercutting End Mills - 270° Reduced Shank
Characteristics: 6 Flutes
Series: 9561xx

Product notes:

Posted values are Base Chip Loads and do not account for varying neck lengths. Use Table 1 (previous page) to determine the correct adjustment multiplier and calculate final adjusted chip loads.

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, 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 **Harveytech@harveyperformance.com**.

WARNING: Cutting tools may shatter under improper use. Government regulations require use of safety glasses and other

MATERIAL	SFM	Hardness: ≤ 28 Rc (≤ 271 HBn)											Depth of Cut Passes			
		Chip Load (IPT) By Cutter Diameter														
		0.062	0.078	0.093	0.125	0.187	0.250	0.312	0.375	0.500	0.625	0.750		1.000		
ALUMINUM ALLOYS																
Casings (2xx, 5xx, 7xx, 8xx)	750	Deburring	.00044	.00055	.00066	.00089	.00132	.00177	.00221	.00266	.00354	.00443	.00531	.00708	1	
		Profiling	.00038	.00048	.00057	.00077	.00115	.00154	.00192	.00231	.00308	.00385	.00462	.00616	2	
Wrought (1xxx, 2xxx, 3xxx, 5xxx, 6xxx, 7xxx, 8xxx)	1000	Slotting	.00038	.00048	.00057	.00077	.00115	.00154	.00192	.00231	.00308	.00385	.00462	.00616	3	
		Deburring	.00040	.00050	.00059	.00080	.00119	.00159	.00199	.00239	.00319	.00398	.00478	.00638	1	
Casting - 3%-5% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx)	750	Profiling	.00034	.00043	.00052	.00069	.00104	.00139	.00173	.00208	.00277	.00347	.00416	.00554	2	
		Slotting	.00034	.00043	.00052	.00069	.00104	.00139	.00173	.00208	.00277	.00347	.00416	.00554	3	
Casting - 5%-8% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx)	700	Deburring	.00040	.00050	.00059	.00080	.00119	.00159	.00199	.00239	.00319	.00398	.00478	.00638	1	
		Profiling	.00034	.00043	.00052	.00069	.00104	.00139	.00173	.00208	.00277	.00347	.00416	.00554	2	
Casting - 8%-12% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx)	650	Slotting	.00034	.00043	.00052	.00069	.00104	.00139	.00173	.00208	.00277	.00347	.00416	.00554	3	
		Deburring	.00034	.00043	.00052	.00069	.00104	.00139	.00173	.00208	.00277	.00347	.00416	.00554	3	
Casting - 12%-16% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx)	475	Profiling	.00034	.00043	.00052	.00069	.00104	.00139	.00173	.00208	.00277	.00347	.00416	.00554	2	
		Slotting	.00034	.00043	.00052	.00069	.00104	.00139	.00173	.00208	.00277	.00347	.00416	.00554	3	
Wrought - 5%-8% Si (4xxx)	1000	Deburring	.00034	.00043	.00052	.00069	.00104	.00139	.00173	.00208	.00277	.00347	.00416	.00554	3	
		Profiling	.00034	.00043	.00052	.00069	.00104	.00139	.00173	.00208	.00277	.00347	.00416	.00554	2	
Wrought - 8%-12% Si (4xxx)	800	Deburring	.00034	.00043	.00052	.00069	.00104	.00139	.00173	.00208	.00277	.00347	.00416	.00554	3	
		Profiling	.00034	.00043	.00052	.00069	.00104	.00139	.00173	.00208	.00277	.00347	.00416	.00554	2	
MAGNESIUM ALLOYS																
1500	1500	Deburring	.00044	.00055	.00066	.00089	.00132	.00177	.00221	.00266	.00354	.00443	.00531	.00708	1	
		Profiling	.00038	.00048	.00057	.00077	.00115	.00154	.00192	.00231	.00308	.00385	.00462	.00616	2	
800	800	Slotting	.00038	.00048	.00057	.00077	.00115	.00154	.00192	.00231	.00308	.00385	.00462	.00616	3	
ZINC ALLOYS																
225	225	Deburring	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
		Profiling	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
500	500	Slotting	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
COPPER ALLOYS																
High Coppers - 90% (C1xxx)	225	Deburring	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
		Profiling	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
Brass (Copper Zinc alloys, C2xxx, C3xxx, C4xxx, C66400-C69800)	500	Deburring	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
		Profiling	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
Phosphor Bronzes (Copper Tin alloys, C5xxx)	500	Deburring	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
		Profiling	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
Aluminum Bronzes (Copper Aluminum alloys, C69800-C64200)	500	Deburring	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
		Profiling	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
Silicon Bronzes (Copper Silicon alloys, C64700-C66100)	500	Deburring	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
		Profiling	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
Copper Nickels, Nickel Silvers (Copper Nickel alloys, C7xxx)	225	Deburring	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
		Profiling	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
Cast Copper Alloys (C83300-C86200, C86400-C87900, C92200-C95800, C97300-C97800, C99400-C99700)	550	Deburring	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	
		Profiling	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1	

MATERIAL	SFM	Hardness: 29-37 Rc (279-344 HBn)											Depth of Cut Passes		
		Chip Load (IPT) By Cutter Diameter													
		0.062	0.078	0.093	0.125	0.187	0.250	0.312	0.375	0.500	0.625	0.750		1.000	
CARBON STEELS															
Free-Machining/Low Carbon steels, 10xx - 1029 & all 10Lxx, 11xx - 1139 & all 11Lxx, 12xx - 1215 & all 12Lxx	600	Deburring	.00016	.00020	.00024	.00032	.00048	.00065	.00081	.00097	.00129	.00162	.00194	.00259	1
		Profiling	.00014	.00018	.00021	.00028	.00042	.00056	.00070	.00084	.00112	.00141	.00169	.00225	3
		Slotting	.00014	.00018	.00021	.00028	.00042	.00056	.00070	.00084	.00112	.00141	.00169	.00225	4
1030 - 1095, 1140 - 1151, 13xx, 15xx, 20xx, 30xx, 40xx & 4xLxx, 50xx & 5xLxx, 50xx & 50Lxx, 51xx & 51Lxx, 52xx & 52Lxx, 60xx, 80xx, 90xx	200	Deburring	.00015	.00018	.00022	.00030	.00044	.00059	.00074	.00089	.00118	.00148	.00177	.00236	1
		Profiling	.00013	.00016	.00019	.00026	.00038	.00051	.00064	.00077	.00103	.00129	.00154	.00206	3
		Slotting	.00013	.00016	.00019	.00026	.00038	.00051	.00064	.00077	.00103	.00129	.00154	.00206	4
203 EZ, 303 (all types), 416, 416Se, 416 Plus X, 420F, 420FSe, 430F, 430FSe, 440F, 440FSe	450	Deburring	.00016	.00020	.00024	.00032	.00048	.00065	.00081	.00097	.00129	.00162	.00194	.00259	1
		Profiling	.00014	.00018	.00021	.00028	.00042	.00056	.00070	.00084	.00112	.00141	.00169	.00225	3
		Slotting	.00014	.00018	.00021	.00028	.00042	.00056	.00070	.00084	.00112	.00141	.00169	.00225	4
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	200	Deburring	.00015	.00018	.00022	.00030	.00044	.00059	.00074	.00089	.00118	.00148	.00177	.00236	1
		Profiling	.00013	.00016	.00019	.00026	.00038	.00051	.00064	.00077	.00103	.00129	.00154	.00206	3
		Slotting	.00013	.00016	.00019	.00026	.00038	.00051	.00064	.00077	.00103	.00129	.00154	.00206	4
414, 431, 440A, 440B, 440C, 13-8, 15-5, 15-7, 17-4, 17-7	150	Deburring	.00009	.00012	.00014	.00018	.00028	.00037	.00046	.00055	.00074	.00092	.00111	.00148	1
		Profiling	.00008	.00010	.00012	.00016	.00024	.00032	.00040	.00048	.00064	.00080	.00096	.00129	3
		Slotting	.00008	.00010	.00012	.00016	.00024	.00032	.00040	.00048	.00064	.00080	.00096	.00129	4
TOOL STEELS															
A, L, O, P, W series	200	Deburring	.00015	.00018	.00022	.00030	.00044	.00059	.00074	.00089	.00118	.00148	.00177	.00236	1
		Profiling	.00013	.00016	.00019	.00026	.00038	.00051	.00064	.00077	.00103	.00129	.00154	.00206	3
		Slotting	.00013	.00016	.00019	.00026	.00038	.00051	.00064	.00077	.00103	.00129	.00154	.00206	4
D, H, M, T, S series	150	Deburring	.00009	.00012	.00014	.00018	.00028	.00037	.00046	.00055	.00074	.00092	.00111	.00148	1
		Profiling	.00008	.00010	.00012	.00016	.00024	.00032	.00040	.00048	.00064	.00080	.00096	.00129	3
		Slotting	.00008	.00010	.00012	.00016	.00024	.00032	.00040	.00048	.00064	.00080	.00096	.00129	4
TITANIUM ALLOYS															
150	150	Deburring	.00009	.00012	.00014	.00018	.00028	.00037	.00046	.00055	.00074	.00092	.00111	.00148	1
		Profiling	.00008	.00010	.00012	.00016	.00024	.00032	.00040	.00048	.00064	.00080	.00096	.00129	3
		Slotting	.00008	.00010	.00012	.00016	.00024	.00032	.00040	.00048	.00064	.00080	.00096	.00129	4
HIGH TEMP ALLOYS															
Inconel, Hastelloy, Waspalloy, Monel, Nimonic, Haynes, Incoloy	70	Deburring	.00009	.00012	.00014	.00018	.00028	.00037	.00046	.00055	.00074	.00092	.00111	.00148	1
		Profiling	.00008	.00010	.00012	.00016	.00024	.00032	.00040	.00048	.00064	.00080	.00096	.00129	3
		Slotting	.00008	.00010	.00012	.00016	.00024	.00032	.00040	.00048	.00064	.00080	.00096	.00129	4

MATERIAL	SFM	Hardness: 38-45 Rc (353										
----------	-----	-------------------------	--	--	--	--	--	--	--	--	--	--