

HARVEY TOOL

Undercutting Guide

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

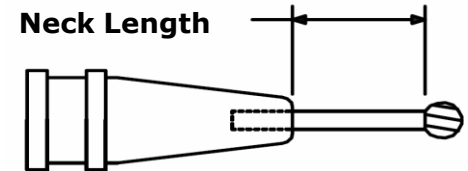
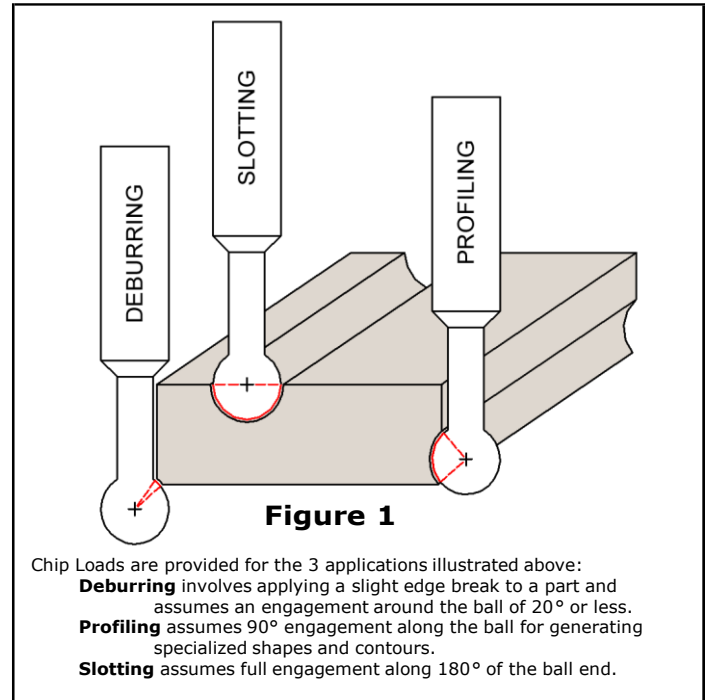


Table 1	
Neck Length Multiple	Chip Load
3x	120%
5x	100%
8x	80%
12x	65%
15x	55%



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	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	.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
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	.00044	.00055	.00066	.00089	.00132	.00177	.00221	.00266	.00354	.00443	.00531	.00708	1
Casting - 12%-16% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx)	475	Profiling	.00038	.00048	.00057	.00077	.00115	.00154	.00192	.00231	.00308	.00385	.00462	.00616	2
		Slotting	.00038	.00048	.00057	.00077	.00115	.00154	.00192	.00231	.00308	.00385	.00462	.00616	3
Wrought - 5%-8% Si (4xxx)	1000	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 - 8%-12% Si (4xxx)	800	Slotting	.00038	.00048	.00057	.00077	.00115	.00154	.00192	.00231	.00308	.00385	.00462	.00616	3
		Deburring	.00044	.00055	.00066	.00089	.00132	.00177	.00221	.00266	.00354	.00443	.00531	.00708	1
MAGNESIUM ALLOYS	1500	Profiling	.00038	.00048	.00057	.00077	.00115	.00154	.00192	.00231	.00308	.00385	.00462	.00616	2
		Slotting	.00038	.00048	.00057	.00077	.00115	.00154	.00192	.00231	.00308	.00385	.00462	.00616	3
ZINC ALLOYS	800	Deburring	.00035	.00044	.00053	.00071	.00106	.00142	.00177	.00213	.00283	.00354	.00425	.00567	1
		Profiling	.00031	.00038	.00046	.00062	.00092	.00123	.00154	.00185	.00246	.00308	.00370	.00493	2
COPPER ALLOYS High Coppers - 90%+ (C1xxx) Brass (Copper Zinc alloys, C2xxx, C3xxx, C4xxx, C66400-C69800) Phosphor Bronzes (Copper Tin alloys, C5xxx) Aluminum Bronzes (Copper Aluminum alloys, C69800-C64200) Silicon Bronzes (Copper Silicon alloys, C64700-C66100) Copper Nickels, Nickel Silvers (Copper Nickel alloys, C7xxx)	225	Slotting	.00031	.00038	.00046	.00062	.00092	.00123	.00154	.00185	.00246	.00308	.00370	.00493	3
		Deburring	.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	Profiling	.00031	.00038	.00046	.00062	.00092	.00123	.00154	.00185	.00246	.00308	.00370	.00493	2
		Slotting	.00031	.00038	.00046	.00062	.00092	.00123	.00154	.00185	.00246	.00308	.00370	.00493	3

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	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
Free-Machining/Low Carbon steels, 10xx - 1029 & all 10Lxx, 11xx - 1139 & all 11Lxx, 12xx - 1215 & all 12Lxx	200	Slotting	.00014	.00018	.00021	.00028	.00042	.00056	.00070	.00084	.00112	.00141	.00169	.00225	4
		Deburring	.00015	.00018	.00022	.00030	.00044	.00059	.00074	.00089	.00118	.00148	.00177	.00236	1
1030 - 1095, 1140 - 1151, 13xx, 15xx, 20xx, 30xx, 40xx & 4xLxx, 50xx & 5xLxx, 50xxx & 50Lxxx, 51xxx & 51Lxxx, 52xxx & 52Lxxx, 60xx, 80xx, 90xx	200	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
STAINLESS STEELS	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
203 EZ, 303 (all types), 416, 416Se, 416 Plus X, 420F, 420FSe, 430F, 430FSe, 440F, 440FSe	200	Slotting	.00014	.00018	.00021	.00028	.00042	.00056	.00070	.00084	.00112	.00141	.00169	.00225	4
		Deburring	.00015	.00018	.00022	.00030	.00044	.00059	.00074	.00089	.00118	.00148	.00177	.00236	1
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	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
TOOL STEELS	200	Slotting	.00008	.00010	.00012	.00016	.00024	.00032	.00040	.00048	.00064	.00080	.00096	.00129	4
		Deburring	.00015	.00018	.00022	.00030	.00044	.00059	.00074	.00089	.00118	.00148	.00177	.00236	1
A, L, O, P, W series	150	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
TITANIUM ALLOYS	150	Slotting	.00008	.00010	.00012	.00016	.00024	.00032	.00040	.00048	.00064	.00080	.00096	.00129	4
		Deburring	.00009	.00012	.00014	.00018	.00028	.00037	.00046	.00055	.00074	.00092	.00111	.00148	1
HIGH TEMP ALLOYS	70	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
Inconel, Hastelloy, Waspalloy, Monel, Nimonic, Haynes, Discoloy, 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
Inconel, Hastelloy, Waspalloy, Monel, Nimonic, Haynes, Discoloy, Incoloy	70	Slotting	.00008	.00010	.00012	.00016	.00024	.00032	.00040	.00048	.00064	.00080	.00096	.00129	4

MATERIAL	SFM	Hardness: 38-45 Rc (353-421 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	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
Free-Machining/Low Carbon steels, 10xx - 1029 & all 10Lxx, 11xx - 1139 & all 11Lxx, 12xx - 1215 & all 12Lxx	200	Slotting	.00014	.00018	.00021	.00028	.00042	.00056	.00070	.00084	.00112	.00141	.00169	.00225	4
		Deburring	.00015	.00018	.00022	.00030	.00044	.00059	.00074	.00089	.00118	.00148	.00177	.00236	1
1030 - 1095, 1140 - 1151, 13xx, 15xx, 20xx, 30xx, 40xx & 4xLxx, 50xx & 5xLxx, 50xxx & 50Lxxx, 51xxx & 51Lxxx, 52xxx & 52Lxxx, 60xx, 80xx, 90xx	200	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
STAINLESS STEELS	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
203 EZ, 303 (all types), 416, 416Se,															