



**Product Table:** Miniature End Mills - Ball - Long Reach, Stub Flute  
**Characteristics:** 15x Reach Multiple  
**Series:** 492xx, 493xx

Hardness: ≤ 28 Rc (≤ 271 HBn)																	
MATERIAL	SFM	Chip Load (IPT) by Dia			Depth of Cut		Chip Load (IPT) by Cutter Dia						Depth of Cut				
		0.015	0.031	0.047	Radial	Axial	0.062	0.078	0.093	0.125	0.187	0.250	0.375	0.500	Radial	Axial	
ALUMINUM ALLOYS	750	Slotting	.00009	.00018	.00027	1 x Dia	.06 x Dia	.00031	.00039	.00046	.00062	.00093	.00124	.00186	.00248	1 x Dia	.15 x Dia
		Roughing	.00011	.00022	.00033	.15 x Dia	.25 x Dia	.00038	.00048	.00058	.00077	.00116	.00155	.00232	.00309	.30 x Dia	.25 x Dia
Wrought (1xxx, 2xxx, 3xxx, 5xxx, 6xxx, 7xxx, 8xxx)	1000	Finishing	.00022	.00045	.00068	.04 x Dia	1.5 x Dia	.00078	.00098	.00116	.00156	.00234	.00313	.00469	.00626	.08 x Dia	1.5 x Dia
		Slotting	.00008	.00016	.00024	1 x Dia	.06 x Dia	.00028	.00035	.00041	.00056	.00083	.00111	.00167	.00223	1 x Dia	.15 x Dia
Casting - 3%-5% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx)	750	Finishing	.00022	.00045	.00068	.04 x Dia	1.5 x Dia	.00078	.00098	.00116	.00156	.00234	.00313	.00469	.00626	.08 x Dia	1.5 x Dia
		Slotting	.00008	.00016	.00024	1 x Dia	.06 x Dia	.00028	.00035	.00041	.00056	.00083	.00111	.00167	.00223	1 x Dia	.15 x Dia
Casting - 5%-8% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx)	700	Finishing	.00022	.00045	.00068	.04 x Dia	1.5 x Dia	.00078	.00098	.00116	.00156	.00234	.00313	.00469	.00626	.08 x Dia	1.5 x Dia
		Slotting	.00008	.00016	.00024	1 x Dia	.06 x Dia	.00028	.00035	.00041	.00056	.00083	.00111	.00167	.00223	1 x Dia	.15 x Dia
Casting - 8%-12% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx)	650	Finishing	.00022	.00045	.00068	.04 x Dia	1.5 x Dia	.00078	.00098	.00116	.00156	.00234	.00313	.00469	.00626	.08 x Dia	1.5 x Dia
		Slotting	.00008	.00016	.00024	1 x Dia	.06 x Dia	.00028	.00035	.00041	.00056	.00083	.00111	.00167	.00223	1 x Dia	.15 x Dia
Casting - 12%-16% Si (3xx, A3xx, C3xx, 4xx, A4xx, B4xx)	475	Finishing	.00022	.00045	.00068	.04 x Dia	1.5 x Dia	.00078	.00098	.00116	.00156	.00234	.00313	.00469	.00626	.08 x Dia	1.5 x Dia
		Slotting	.00008	.00016	.00024	1 x Dia	.06 x Dia	.00028	.00035	.00041	.00056	.00083	.00111	.00167	.00223	1 x Dia	.15 x Dia
Wrought - 5%-8% Si (4xxx)	1000	Finishing	.00019	.00040	.00061	.04 x Dia	1.5 x Dia	.00070	.00088	.00105	.00141	.00211	.00282	.00422	.00563	.08 x Dia	1.5 x Dia
		Slotting	.00009	.00018	.00027	1 x Dia	.06 x Dia	.00031	.00039	.00046	.00062	.00093	.00124	.00186	.00248	1 x Dia	.15 x Dia
Wrought - 8%-12% Si (4xxx)	800	Finishing	.00019	.00040	.00061	.04 x Dia	1.5 x Dia	.00070	.00088	.00105	.00141	.00211	.00282	.00422	.00563	.08 x Dia	1.5 x Dia
		Slotting	.00009	.00018	.00027	1 x Dia	.06 x Dia	.00031	.00039	.00046	.00062	.00093	.00124	.00186	.00248	1 x Dia	.15 x Dia
MAGNESIUM ALLOYS	1500	Slotting	.00009	.00018	.00027	1 x Dia	.06 x Dia	.00031	.00039	.00046	.00062	.00093	.00124	.00186	.00248	1 x Dia	.15 x Dia
ZINC ALLOYS	800	Roughing	.00011	.00022	.00033	.15 x Dia	.25 x Dia	.00038	.00048	.00058	.00077	.00116	.00155	.00232	.00309	.30 x Dia	.25 x Dia
		Finishing	.00022	.00045	.00068	.04 x Dia	1.5 x Dia	.00078	.00098	.00116	.00156	.00234	.00313	.00469	.00626	.08 x Dia	1.5 x Dia
COPPER ALLOYS	225	Slotting	.00007	.00014	.00021	1 x Dia	.06 x Dia	.00025	.00031	.00037	.00050	.00074	.00099	.00149	.00198	1 x Dia	.15 x Dia
		Roughing	.00009	.00018	.00027	.15 x Dia	.25 x Dia	.00031	.00039	.00046	.00062	.00093	.00124	.00186	.00248	.30 x Dia	.25 x Dia
High Coppers - 90%+ (C1xxx)	500	Slotting	.00007	.00014	.00021	1 x Dia	.06 x Dia	.00025	.00031	.00037	.00050	.00074	.00099	.00149	.00198	1 x Dia	.15 x Dia
		Roughing	.00009	.00018	.00027	.15 x Dia	.25 x Dia	.00031	.00039	.00046	.00062	.00093	.00124	.00186	.00248	.30 x Dia	.25 x Dia
Brass (Copper Zinc alloys, C2xxx, C3xxx, C4xxx, C66400-C69800)	225	Slotting	.00007	.00014	.00021	1 x Dia	.06 x Dia	.00025	.00031	.00037	.00050	.00074	.00099	.00149	.00198	1 x Dia	.15 x Dia
		Roughing	.00009	.00018	.00027	.15 x Dia	.25 x Dia	.00031	.00039	.00046	.00062	.00093	.00124	.00186	.00248	.30 x Dia	.25 x Dia
Phosphor Bronzes (Copper Tin alloys, C5xxx)	500	Slotting	.00007	.00014	.00021	1 x Dia	.06 x Dia	.00025	.00031	.00037	.00050	.00074	.00099	.00149	.00198	1 x Dia	.15 x Dia
		Roughing	.00009	.00018	.00027	.15 x Dia	.25 x Dia	.00031	.00039	.00046	.00062	.00093	.00124	.00186	.00248	.30 x Dia	.25 x Dia
Aluminum Bronzes (Copper Aluminum alloys, C60600-C64200)	500	Slotting	.00007	.00014	.00021	1 x Dia	.06 x Dia	.00025	.00031	.00037	.00050	.00074	.00099	.00149	.00198	1 x Dia	.15 x Dia
		Roughing	.00009	.00018	.00027	.15 x Dia	.25 x Dia	.00031	.00039	.00046	.00062	.00093	.00124	.00186	.00248	.30 x Dia	.25 x Dia
Silicon Bronzes (Copper Silicon alloys, C64700-C66100)	500	Slotting	.00007	.00014	.00021	1 x Dia	.06 x Dia	.00025	.00031	.00037	.00050	.00074	.00099	.00149	.00198	1 x Dia	.15 x Dia
		Roughing	.00009	.00018	.00027	.15 x Dia	.25 x Dia	.00031	.00039	.00046	.00062	.00093	.00124	.00186	.00248	.30 x Dia	.25 x Dia
Copper Nicksels, Nickel Silvers (Copper Nickel alloys, C7xxx)	225	Slotting	.00007	.00014	.00021	1 x Dia	.06 x Dia	.00025	.00031	.00037	.00050	.00074	.00099	.00149	.00198	1 x Dia	.15 x Dia
		Roughing	.00009	.00018	.00027	.15 x Dia	.25 x Dia	.00031	.00039	.00046	.00062	.00093	.00124	.00186	.00248	.30 x Dia	.25 x Dia
Cast Copper Alloys (C83300-C86200, C86400-C87900, C92200-C95800, C97300-C97800, C99400-C99700)	550	Slotting	.00017	.00036	.00054	.04 x Dia	1.5 x Dia	.00062	.00078	.00093	.00125	.00187	.00250	.00375	.00501	.08 x Dia	1.5 x Dia
		Finishing	.00019	.00040	.00061	.04 x Dia	1.5 x Dia	.00070	.00088	.00105	.00141	.00211	.00282	.00422	.00563	.08 x Dia	1.5 x Dia

**Please note:**

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](mailto:Harveytech@harveyperformance.com).

WARNING: Cutting tools may shatter under improper use. Government regulations require use of safety glasses and other appropriate safety equipment in the vicinity of use.

Hardness: 29-37 Rc (279-344 HBn)																	
MATERIAL	SFM	Chip Load (IPT) by Dia			Depth of Cut		Chip Load (IPT) by Cutter Dia						Depth of Cut				
		0.015	0.031	0.047	Radial	Axial	0.062	0.078	0.093	0.125	0.187	0.250	0.375	0.500	Radial	Axial	
CARBON STEELS	600	Slotting	.00003	.00006	.00009	1 x Dia	.06 x Dia	.00011	.00013	.00016	.00021	.00032	.00043	.00064	.00085	1 x Dia	.15 x Dia
		Roughing	.00003	.00007	.00010	.15 x Dia	.25 x Dia	.00012	.00015	.00018	.00024	.00036	.00048	.00072	.00096	.30 x Dia	.25 x Dia
		Finishing	.00007	.00014	.00021	.04 x Dia	1.5 x Dia	.00024	.00031	.00036	.00049	.00073	.00098	.00147	.00196	.08 x Dia	1.5 x Dia
1030 - 1095, 1140 - 1151, 13xx, 15xx, 2xxx, 3xxx, 4xxx & 4Lxx, 5xxx & 5Lxx, 50xxx & 50Lxx, 51xxx & 51Lxx, 52xxx & 52Lxx, 6xxx, 8xx, 9xxx	200	Slotting	.00003	.00006	.00008	1 x Dia	.06 x Dia	.00010	.00012	.00014	.00019	.00029	.00039	.00058	.00078	1 x Dia	.15 x Dia
		Roughing	.00003	.00006	.00009	.15 x Dia	.25 x Dia	.00011	.00014	.00016	.00022	.00033	.00044	.00066	.00087	.30 x Dia	.25 x Dia
		Finishing	.00006	.00013	.00019	.04 x Dia	1.5 x Dia	.00022	.00028	.00033	.00045	.00067	.00089	.00134	.00179	.08 x Dia	1.5 x Dia
STAINLESS STEELS	450	Slotting	.00003	.00006	.00009	1 x Dia	.06 x Dia	.00011	.00013	.00016	.00021	.00032	.00043	.00064	.00085	1 x Dia	.15 x Dia
		Roughing	.00003	.00007	.00010	.15 x Dia	.25 x Dia	.00012	.00015	.00018	.00024	.00036	.00048	.00072	.00096	.30 x Dia	.25 x Dia
		Finishing	.00007	.00014	.00021	.04 x Dia	1.5 x Dia	.00024	.00031	.00036	.00049	.00073	.00098	.00147	.00196	.08 x Dia	1.5 x Dia
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	Slotting	.00003	.00006	.00008	1 x Dia	.06 x Dia	.00010	.00012	.00014	.00019	.00029	.00039	.00058	.00078	1 x Dia	.15 x Dia
		Roughing	.00003	.00006	.00009	.15 x Dia	.25 x Dia	.00011	.00014	.00016	.00022	.00033	.00044	.00066	.00087	.30 x Dia	.25 x Dia
		Finishing	.00006	.00013	.00019	.04 x Dia	1.5 x Dia	.00022	.00028	.00033	.00045	.00067	.00089	.00134	.00179	.08 x Dia	1.5 x Dia
414, 431, 440A, 440B, 440C, 13-8, 15-5, 15-7, 17-4, 17-7	150	Slotting	.00002	.00003	.00005	1 x Dia	.06 x Dia	.00008	.00009	.00012	.00018	.00024	.00036	.00049	1 x Dia	.15 x Dia	
		Roughing	.00002	.00004	.00006	.15 x Dia	.25 x Dia	.00007	.00009	.00010	.00014	.00020	.00027	.00041	.00055	.30 x Dia	.25 x Dia
		Finishing	.00004	.00008	.00012	.04 x Dia	1.5 x Dia	.00014	.00017	.00021	.00028	.00042	.00056	.00084	.00112	.08 x Dia	1.5 x Dia
TOOL STEELS	200	Slotting	.00003	.00006	.00008	1 x Dia	.06 x Dia	.00010	.00012	.00014	.00019	.00029	.00039	.00058	.00078	1 x Dia	.15 x Dia
		Roughing	.00003	.00006	.00009	.15 x Dia	.25 x Dia	.00011	.00014	.00016	.00022	.00033	.00044	.00066	.00087	.30 x Dia	.25 x Dia
		Finishing	.00006	.00013	.00019	.04 x Dia	1.5 x Dia	.00022	.00028	.00033	.00045	.00067	.00089	.00134	.00179	.08 x Dia	1.5 x Dia
A, L, O, P, W series	150	Slotting	.00002	.00003	.00005	1 x Dia	.06 x Dia	.00008	.00008	.00009	.00012	.00018	.00024	.00036	.00049	1 x Dia	.15 x Dia
		Roughing	.00002	.00004	.00006	.15 x Dia	.25 x Dia	.00007	.00009	.00010	.00014	.00020	.00027	.00041	.00055	.30 x Dia	.25 x Dia
		Finishing	.00004	.00008	.00012	.04 x Dia	1.5 x Dia	.00014	.00017	.00021	.00028	.00042	.00056	.00084	.00112	.08 x Dia	1.5 x Dia
D, H, M, T, S series	150	Slotting	.00002	.00003	.00005	1 x Dia	.06 x Dia	.00008	.00008	.00009	.00012						