



**Product Table:** Counterbores - Flat Bottom  
**Characteristics:** 4 Flutes

**Product Notes:**

Chip Loads are given 2 ways:

Full Plunge refers to vertically machining into solid material with no pilot hole  
 Finishing refers to vertically machining with an existing pilot hole greater than or equal to 50% of the Counterbore cutter diameter ( $\leq 25\%$  on wall)

Full Plunge machining may require a peck cycle for proper chip evacuation  
 For Ferrous materials, pecking to a depth of 2x diameter is advised  
 For Non-Ferrous materials, pecking to a depth of 3x diameter is advised

Material Guide	Hardness	SFM	Operation	Chip Load (IPT) By Cutter Diameter													
				1/16	5/64	3/32	1/8	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4		
Carbon Steel	10XX, 11XX, 12XX, 12LXX, ASTM A27, ASTM A36	29-37 Rc (279-344 HBn)	600	Full Plunge	.00009	.00011	.00013	.00017	.00026	.00035	.00043	.00052	.00060	.00069	.00086	.00104	
				Finishing	.00012	.00016	.00018	.00025	.00037	.00050	.00062	.00075	.00087	.00099	.00124	.00149	
Low Alloy Steel	13XX, 41XX, 43XX, 51XX, 86XX, 93XX	29-37 Rc (279-344 HBn)	200	Full Plunge	.00009	.00012	.00014	.00019	.00028	.00038	.00047	.00057	.00066	.00076	.00095	.00113	
				Finishing	.00013	.00017	.00020	.00027	.00041	.00054	.00068	.00082	.00095	.00109	.00136	.00163	
Tool Steel	A, L, O, P, W series	29-37 Rc (279-344 HBn)	200	Full Plunge	.00009	.00011	.00013	.00017	.00026	.00035	.00043	.00052	.00060	.00069	.00086	.00104	
				Finishing	.00012	.00016	.00018	.00025	.00037	.00050	.00062	.00075	.00087	.00099	.00124	.00149	
		38-45 Rc (353-421 HBn)	100	Full Plunge	.00004	.00005	.00006	.00009	.00013	.00017	.00022	.00026	.00030	.00035	.00043	.00052	
	D, H, M, T, S series	29-37 Rc (279-344 HBn)	150	Full Plunge	.00005	.00007	.00008	.00011	.00016	.00022	.00027	.00032	.00038	.00043	.00054	.00065	
				Finishing	.00008	.00010	.00012	.00016	.00023	.00031	.00039	.00047	.00054	.00062	.00078	.00093	
		38-45 Rc (353-421 HBn)	75	Full Plunge	.00003	.00003	.00004	.00005	.00008	.00011	.00013	.00016	.00019	.00022	.00027	.00032	
Austenitic Stainless Steel	Nitronic 50, Nitronic 60, 301, 303, 304, 304L, Incoloy 27-7MO, 316, 316L, 321, 347	29-37 Rc (279-344 HBn)	450	Full Plunge	.00009	.00012	.00014	.00019	.00028	.00038	.00047	.00057	.00066	.00076	.00095	.00113	
				Finishing	.00013	.00017	.00020	.00027	.00041	.00054	.00068	.00082	.00095	.00109	.00136	.00163	
Martensitic & Ferritic Stainless Steel	403, 410, 416, 420, 440, 430, 446	29-37 Rc (279-344 HBn)	200	Full Plunge	.00009	.00011	.00013	.00017	.00026	.00035	.00043	.00052	.00060	.00069	.00086	.00104	
				Finishing	.00012	.00016	.00018	.00025	.00037	.00050	.00062	.00075	.00087	.00099	.00124	.00149	
		38-45 Rc (353-421 HBn)	100	Full Plunge	.00004	.00005	.00006	.00009	.00013	.00017	.00022	.00026	.00030	.00035	.00043	.00052	
				Finishing	.00006	.00008	.00009	.00013	.00019	.00025	.00031	.00038	.00044	.00050	.00063	.00075	
PH Stainless Steel	15-5, 17-4, Carpenter 450, Carpenter 465	29-37 Rc (279-344 HBn)	150	Full Plunge	.00005	.00007	.00008	.00011	.00016	.00022	.00027	.00032	.00038	.00043	.00054	.00065	
				Finishing	.00008	.00010	.00012	.00016	.00023	.00031	.00039	.00047	.00054	.00062	.00078	.00093	
		38-45 Rc (353-421 HBn)	90	Full Plunge	.00003	.00003	.00004	.00005	.00008	.00011	.00013	.00016	.00019	.00022	.00027	.00032	
				Finishing	.00004	.00005	.00006	.00008	.00012	.00016	.00020	.00023	.00027	.00031	.00039	.00047	
Nickel Alloy	Hastelloy C-22, Inconel 625, Waspaloy, René 41, Inconel 718, Incoloy 20	29-37 Rc (279-344 HBn)	70	Full Plunge	.00005	.00007	.00008	.00011	.00016	.00022	.00027	.00032	.00038	.00043	.00054	.00065	
				Finishing	.00008	.00010	.00012	.00016	.00023	.00031	.00039	.00047	.00054	.00062	.00078	.00093	
		38-45 Rc (353-421 HBn)	50	Full Plunge	.00003	.00003	.00004	.00005	.00008	.00011	.00013	.00016	.00019	.00022	.00027	.00032	
				Finishing	.00004	.00005	.00006	.00008	.00012	.00016	.00020	.00023	.00027	.00031	.00039	.00047	
Titanium Alloy	Ti 3Al-2.5V, Ti 6Al-4V, Ti 10V-2Fe-3Al	29-37 Rc (279-344 HBn)	150	Full Plunge	.00005	.00007	.00008	.00011	.00016	.00022	.00027	.00032	.00038	.00043	.00054	.00065	
				Finishing	.00008	.00010	.00012	.00016	.00023	.00031	.00039	.00047	.00054	.00062	.00078	.00093	
		38-45 Rc (353-421 HBn)	75	Full Plunge	.00003	.00003	.00004	.00005	.00008	.00011	.00013	.00016	.00019	.00022	.00027	.00032	
				Finishing	.00004	.00005	.00006	.00008	.00012	.00016	.00020	.00023	.00027	.00031	.00039	.00047	
Wrought Aluminum Alloy	2014, 5062, 6061, 7050, 7075, 7475	$\leq 28$ Rc ( $\leq 271$ HBn)	1000	Full Plunge	.00027	.00034	.00041	.00055	.00082	.00110	.00137	.00165	.00192	.00220	.00275	.00330	
				Finishing	.00043	.00054	.00065	.00087	.00130	.00174	.00217	.00261	.00304	.00348	.00435	.00521	
				800	Full Plunge	.00025	.00031	.00037	.00050	.00074	.00099	.00124	.00149	.00173	.00198	.00248	.00297
Cast Aluminum Alloy	319.0, 328.0, 355.0, 360.0, 380.0, 383.0, 390.0, 520.0, 535.0	$\leq 28$ Rc ( $\leq 271$ HBn)	750	Full Plunge	.00027	.00034	.00041	.00055	.00082	.00110	.00137	.00165	.00192	.00220	.00275	.00330	
				Finishing	.00043	.00054	.00065	.00087	.00130	.00174	.00217	.00261	.00304	.00348	.00435	.00521	
	3% - 5% Si (3XX, A3XX, C3XX, 4XX, A4XX, B4XX)	750	Full Plunge	.00025	.00031	.00037	.00050	.00074	.00099	.00124	.00149	.00173	.00198	.00248	.00297		
			700	Full Plunge	.00025	.00031	.00037	.00050	.00074	.00099	.00124	.00149	.00173	.00198	.00248	.00297	
	5% - 8% Si (3XX, A3XX, C3XX, 4XX, A4XX, B4XX)	650	Full Plunge	.00025	.00031	.00037	.00050	.00074	.00099	.00124	.00149	.00173	.00198	.00248	.00297		
			Finishing	.00039	.00049	.00058	.00078	.00117	.00156	.00195	.00235	.00273	.00313	.00391	.00469		
8% - 12% Si (3XX, A3XX, C3XX, 4XX, A4XX, B4XX)	475	Full Plunge	.00025	.00031	.00037	.00050	.00074	.00099	.00124	.00149	.00173	.00198	.00248	.00297			
		Finishing	.00039	.00049	.00058	.00078	.00117	.00156	.00195	.00235	.00273	.00313	.00391	.00469			
Copper Alloy	Cu-ETP, CuBe2, CuZn30, CuZn36Pb3, CuZn10, CuSn5	$\leq 28$ Rc ( $\leq 271$ HBn)	225-500	Full Plunge	.00022	.00027	.00033	.00044	.00066	.00088	.00110	.00132	.00154	.00176	.00220	.00264	
				Finishing	.00034	.00043	.00052	.00070	.00104	.00139	.00174	.00209	.00243	.00278	.00348	.00417	
Magnesium Alloys		$\leq 28$ Rc ( $\leq 271$ HBn)	1500	Full Plunge	.00027	.00034	.00041	.00055	.00082	.00110	.00137	.00165	.00192	.00220	.00275	.00330	
				800	Finishing	.00043	.00054	.00065	.00087	.00130	.00174	.00217	.00261	.00304	.00348	.00435	.00521
Zinc Alloys				800	Finishing	.00043	.00054	.00065	.00087	.00130	.00174	.00217	.00261	.00304	.00348	.00435	.00521

**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  $\leq 28$  Rc, chip loads can be increased 10%-20%.

If you require additional information, Valor Holemaking has a team of technical experts available to assist you through even the most challenging applications. Please contact us at **866-840-1505** or [Valortech@harveyperformance.com](mailto:Valortech@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.