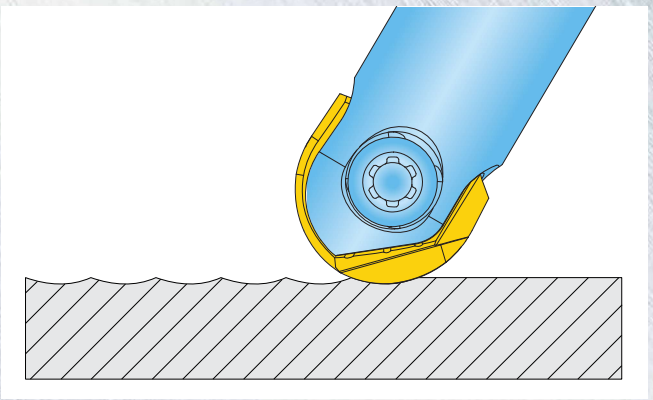
OPERATING GUIDELINES

FinishBall - Series 12A9, 12A5, 12A8 Material		Brinnell Hardness	SFM	Feed per Insert	IN2005	IN2006	IN2504	IN2530	IN055	Coolant
Aluminum	6061-T6, 7075-T6	-	1000 - 8000	.003 - .006	2				1	Yes
Cast Iron	Gray	150 - 250	500 - 1200	.002 - .006	1					No
	Nodular		400 - 800							
Steel	Low Carbon 1018, 8620	150 - 250	600 - 1200	.002 - .006	1					No
	High Carbon F-6180	250 - 400*	400 - 600	.002 - .005	3	2	1			
	Alloyed Steel 4140	150 - 300	400 - 800		1	2				
	Tool Steel P20 - H13	Up to 460*			3	2	1			
Stainless Steel	300 Series, 304, 316	-	400 - 800	.002 - .005	2	3		1		No
	400 Series 15-5 PH, 17-4 PH	Up to 320	500-1000							
	13-8 PH	-	200 - 400							Yes
Nickel Alloys	Inconel 600, 706, 718, 903, Hastelloy	75-120	75-120	.002 - .004	2	3		1		Yes
Titanium	6AL-4V	-	80 - 150	.002 - .005	2	3		1		Yes

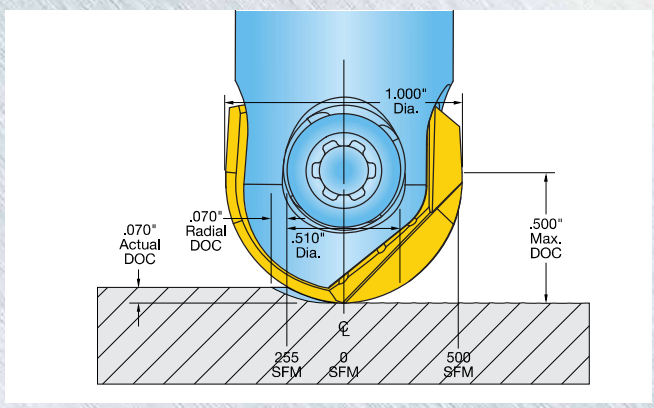
*58 Rc & Above use **IN2504**

Note: Feed and speed recommendations are starting operating parameters. They are only guidelines from which further optimization should take place. Operating parameters are influenced by many machining variables. These variables may cause for reductions in feeds and speed or dramatic increases. Additionally, DOC and WOC may need to be revised to optimize the tools performance.

PROGRAMMING TIPS



"Sturz" milling, or tilting the axis of the spindle to move the axial center of a ball nose end mill out of the cut, greatly reduces the cutting forces being generated on the nose insert. This shift also relocates the weakest cutting edge geometry out of the way. When allowable in an application "Sturz" milling substantially increases tool life and the quality of finish.



In this example, the SFM is 500 with a 1.000" ball nose diameter. The effective cutting diameter is .510", at which point, the SFM is 255. The RPM must be increased to 3745 in order to achieve 500 SFM at the .510" effective cutting diameter.

Programming Tips:

- Minimize tool stick out (shortest L/D ratio allowable)
- Use tool holders that offer the least amount runout.
- Maximize rigidity for the work piece and tool setup.
- Use free flowing toolpath that promotes constant chip load
- Avoid cutting conditions that create large radial milling engagements
- Always climb cut
- Use good stock entry techniques (arc-in, ramping)
- Use correct insert geometry and grade

To calculate effective diameter:

$$D_t = 2 \times \sqrt{R^2 - (R - D)^2}$$

D_t = True Cutting Diameter (in.)
R = Radius (in.)
D = Depth of Cut (in.)