Cutting Data

for TBNR Ball Nose Cutters

ANSI ISO 513	Cutting Data for TBNR Milling Cutters				COATED						UNCOATED					
	Cutter			Nominal Dia. d1	TN7525 TN6525			TN7535 TN6540			TTM			TTR		
					feed per tooth *(inch)											
	TBNR			.625 + .750	.0039	**.0055**	.0063	.0039	**.0055**	.0063	.0032	**.0047**	.0055	.0039	**.0055**	.0063
	Roughing ae ≥ 40% of d1 (cutter dia.) effective number of teeth z = 1			1.000 - 1.500	.0047	**.0071**	.0087	.0047	**.0071**	.0087	.0039	**.0063**	.0079	.0047	**.0071**	.0087
				2.000	.0059	**.0091**	.0110	.0059	**.0091**	.0110	.0047	**.0079**	.0099	.0059	**.0091**	.0110
P	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)										
	Carbon steel, Unalloyed steel, cast steel and free cutting steel	< 0.25% C	annealed	125	1	1045	**820**	720	1310	**850**	720	720	**635**	590	590	**590**	390
		≥ 0.25% C	annealed	190	2	820	**655**	590	655	**590**	490	520	**425**	390	425	**425**	295
		< 0.55% C	heat-treated	250	3	620	**490**	425	590	**520**	425	425	**325**	295	360	**360**	225
		≥ 0.55% C	annealed	220	4	685	**555**	490	620	**555**	455	455	**360**	325	390	**390**	260
			heat-treated	300	5	555	**490**	410	410	**425**	360	360	**295**	260	295	**295**	195
	Low alloy steel and cast steel		annealed	200	6	820	**655**	590	655	**590**	490	520	**425**	390	425	**425**	295
			heat-treated	275	7	620	**490**	425	555	**455**	390	390	**325**	295	325	**325**	225
			heat-treated	300	8	520	**425**	325	455	**390**	325	325	**260**	225	260	**260**	180
			heat-treated	350	9	360	**295**	260	325	**275**	225	295	**195**	130	225	**225**	130
	High alloy steel, cast steel & tool steel		annealed	200	10	685	**555**	490	620	**520**	455	455	**360**	325	390	**390**	260
			heat-treated	325	11	360	**295**	260	325	**275**	225	295	**195**	130	225	**225**	130
	400 series stainless		FE / MA	200	12	750	**590**	520	655	**590**	490	490	**390**	360	425	**425**	260
			MA	240	13.1	625	**490**	425	555	**455**	390	425	**325**	295	360	**360**	225
			MA / PH	330	13.2	325	**260**	225	260	**225**	195	210	**160**	145	180	**180**	110
						COATED						UNCOATED					
M	Cutter			Nominal Dia. d1	TN7525 TN6525			TN7535 TN6540			TTM			TTR		
					feed per tooth *(inch)											
	TBNR			.625 + .750	.0039	**.0055**	.0063	.0039	**.0055**	.0063	.0032	**.0047**	.0055	.0039	**.0055**	.0063
	Roughing ae ≥ 40% of d1 (cutter dia.) effective number of teeth z = 1			1.000 - 1.500	.0047	**.0071**	.0087	.0047	**.0071**	.0087	.0039	**.0063**	.0079	.0047	**.0071**	.0087
				2.000	.0059	**.0091**	.0110	.0059	**.0091**	.0110	.0047	**.0079**	.0099	.0059	**.0091**	.0110
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)										
	300 Series		AU	180	14.1	850	**720**	490	785	**655**	455	390	**325**	260	325	**260**	210
	Stainless		DU	230	14.2	720	**290**	425	620	**605**	410	325	**295**	195	295	**245**	195
	Duplex		S-AU	200	14.3	555	**455**	325	455	**440**	310	275	**225**	160	245	**180**	130
	Stainless		AU-PH	330	14.4	425	**360**	245	390	**325**	225	195	**160**	130	160	**130**	95
						COATED			UNCOATED								
K	Cutter			Nominal Dia. d1	TN2510			THM								
					feed per tooth *(inch)											
	TBNR			.625 + .750	.0039	**.0055**	.0087	.0039	**.0059**	.0071						
	Roughing ae ≥ 40% of d1 (cutter dia.) effective number of teeth z = 1			1.000 - 1.500	.0047	**.0063**	.0099	.0047	**.0075**	.0095						
				2.000	.0059	**.0079**	.0018	.0059	**.0099**	.0126						
	Work Material		Condition	Hardness HB	Mat. Gr.	vc *(sfm)										
	Grey cast iron		ferrit./pearl.	180	15	1210	**885**	720	520	**390**	325						
			pearlitic	260	16	980	**685**	590	390	**295**	260						
	Nodular cast iron		ferritic	160	17	950	**720**	555	455	**340**	295						
			pearlitic	250	18	850	**490**	360	325	**225**	195						
	Malleable cast iron		ferritic	130	19	1015	**620**	325	455	**295**	260						
			pearlitic	230	20	785	**520**	360	360	**225**	195						

* vc for TN450 = 0.8 Vc for TN7525

* fz for TN450 = fz for TN7525

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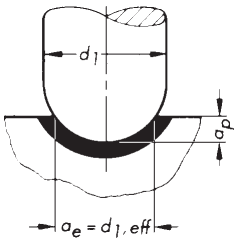
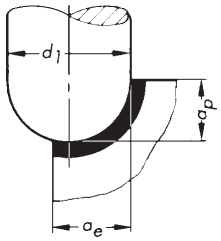
	Cutter		Nominal Dia. d1	THM		
				feed per tooth *(inch)		
	TBNR		.625 + .750	.0039	**.0059**	.0071
	Roughing ae ≥ 40% of d1 (cutter dia.) effective number of teeth z = 1		1.000 - 1.500	.0047	**.0075**	.0095
			2.000	.0059	**.0099**	.0126
N	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)		
	Wrought	Non AG	60	21	3280	**2360**	1965
		AG	100	22	1640	**2460**	980
	Cast aluminum alloys	Non Ag	75	23	3280	**2460**	1965
	Si ≤ 12%	AG	90	24	2620	**1965**	1640
	Si ≥ 12%		130	27	1310	**820**	655
	Copper & Copper alloys Pb > 1%		110	28	980	**590**	455
				UNCOATED		
S	Cutter		Nominal Dia. d1	THM		
				feed per tooth *(inch)		
	TBNR		.625 + .750	.0032	**.0047**	.0055
	Roughing ae ≥ 40% of d1 (cutter dia.) effective number of teeth z = 1		1.000 - 1.500	.0039	**.0059**	.0071
			2.000	.0047	**.0071**	.0087
	Work Material	Condition	Hardness HB	Mat. Gr.	vc *(sfm)		
	High Temp	G	200	31	120	**95**	80
	Alloy FE	AG	280	32	95	**75**	65
	High Temp	G	250	33	75	**60**	50
	Alloy	AG	350	34	65	**45**	40
	Ni / Co	GO	320	35	65	**45**	40
	Titanium alloys			36	260	**160**	130
	TiAL6V4	AG		37	225	**150**	110

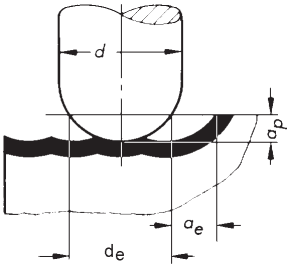
Slotting



Shoulder / Peripheral Milling



Copy / Line by Line Milling



Depth of cut TBNR:

max. ap ≅ 35% of d^1 in slotting

≅ 90% of d^1 in shoulder & copy milling

Spindle speed: $RPM = \frac{SFPM * 3.82}{d^{1eff}}$

Cutter diameter: In the case of depths of cut ap < 50% of d^1, the cutting diameter to be used when calculating spindle speed and feed is smaller than the cutter diameter d^1.

The effective cutting diameter can be read from the table below:

Effective Cutter Diameters						
Depth of cut ap	Effective cutter diameter d^1eff for cutter nominal diameter d^1					
	.625"	.750"	1.00"	1.25"	1.50"	2.00"
.010"	.157	.172	.199	.223	.244	.282
.020"	.220	.242	.280	.314	.344	.398
.030"	.267	.294	.341	.383	.420	.486
.040"	.306	.337	.392	.440	.483	.560
.050"	.339	.374	.436	.490	.539	.624
.075"	.406	.450	.527	.594	.654	.760
.100"	.458	.510	.600	.678	.748	.872
.125"	.500	.559	.661	.750	.829	.968
.250"	.612	.707	.866	1.000	1.118	1.323
.375"	---	.750	.968	1.146	1.299	1.561
.500"	---	---	1.000	1.225	1.414	1.732
.625"	---	---	---	1.250	1.479	1.854
.750"	---	---	---	---	1.500	1.936
1.00"	---	---	---	---	---	2.000

Correction Factors				
For stepovers of ≤ 40%, the cutting data should be corrected as follows				
Ratio ae : d^1	5%	10%	20%	40%
Feed factor	3	2	1.5	1
SFPM factor	1.5	1.4	1.3	1.2

Notes: * When using short TBNR cutters, select feed approximately 20% higher (factor 1.2).

In copy or line by line milling with smaller widths of cut, higher cutting data are possible. (see correction factors)