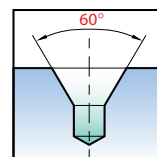


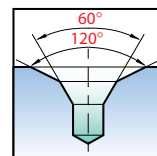
RECOMMENDATIONS FOR THE USE OF NC AND CENTER DRILLS

60° angle
standard center.



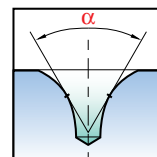
Form A

*The protective chamfer guarantees the center
from any risk of blows and deformation.
The 120° splay makes it easier to seize parts
between points on machine with automatic feed.*



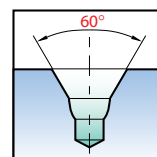
Form B

*The radius eliminates the risk of breakage,
provides an exact bearing,
saves as a protective chamfer.*



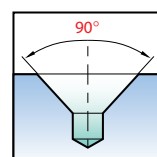
Form R

*The bulge reinforces the point, increases
the chips removal, makes the
lubrication of the drill easier.*



Form W

90° angle center.



MATERIAL	
STEEL:-	< 81 Rc (B)
	< 24 Rc (C)
	24 - 32 Rc
	32 - 41 Rc
Stainless Steel/Titanium	
Inconel/Nimonic/Waspaloy	
Brass/Copper	
Copper Alloys/Bronze	
Aluminum	
Hardened Aluminum < 6% Si	
Cast Aluminum > 6% Si	
Thermoplastics	

HSS						
SFM	FEED inch/rev					
	2mm 5/64	3mm 1/8	6mm 1/4	10mm 3/8	16mm 5/8	
99 - 148						
82 - 99	.0020	.0024	.0031	.0059	.0079	
49 - 82						
33 - 49	.0012	.0016	.0024	.0039	.0059	
20 - 33						
16 - 20	.0008	.0012	.0020	.0028	.0039	
132 - 197						
99 - 132	.0020	.0028	.0035	.0059	.0079	
494 - 658	.0031	.0039	.0079	.0157	.0197	
197 - 329	.0024	.0031	.0039	.0059	.0098	
132 - 197						
329 - 428	.0031	.0035	.0079	.0138	.0157	

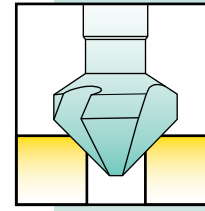
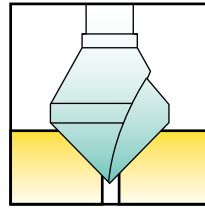
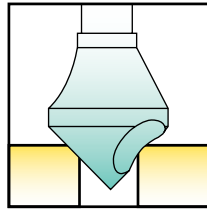
TIN						
SFM	FEED inch/rev					
	2mm 5/64	3mm 1/8	6mm 1/4	10mm 3/8	16mm 5/8	
197 - 296						
165 - 230	.0031	.0035	.0047	.0098	.0118	
115 - 148						
82 - 99	.0020	.0024	.0035	.0055	.0087	
39 - 53						
33 - 43	.0016	.0020	.0028	.0039	.0059	
362 - 428						
263 - 362	.0028	.0035	.0055	.0106	.0142	
1152 - 1481	.0047	.0055	.0118	.0217	.0256	
395 - 592	.0031	.0039	.0059	.0118	.0157	
263 - 395						
658 - 855	.0047	.0055	.0118	.0217	.0256	

MATERIAL	
STEEL:-	< 81 Rc (B)
	< 24 Rc (C)
	24 - 32 Rc
	32 - 41 Rc
Stainless Steel/Titanium	
Inconel/Nimonic/Waspaloy	
Brass/Copper	
Copper Alloys/Bronze	
Aluminum	
Hardened Aluminum < 6% Si	
Cast Aluminum > 6% Si	
Thermoplastics	

Futura						
SFM	FEED inch/rev					
	2mm 5/64	3mm 1/8	6mm 1/4	10mm 3/8	16mm 5/8	
296 - 395						
247 - 329	.0039	.0047	.0063	.0118	.0177	
165 - 214						
99 - 214	.0028	.0031	.0047	.0071	.0110	
59 - 79						
49 - 66	.0020	.0024	.0039	.0055	.0079	
428 - 494						
362 - 428	.0039	.0047	.0071	.0142	.0197	
1645 - 2300	.0063	.0071	.0157	.0295	.0354	
592 - 823	.0039	.0047	.0071	.0142	.0197	
395 - 559						
987 - 1316	.0063	.0071	.0157	.0295	.0354	

CARBIDE						
SFM	FEED inch/rev					
	2mm 5/64	3mm 1/8	6mm 1/4	10mm 3/8	16mm 5/8	
362 - 461						
296 - 362	.0047	.0055	.0079	.0138	.0217	
197 - 263						
115 - 165	.0035	.0039	.0055	.0087	.0094	
72 - 99						
63 - 82	.0031	.0028	.0047	.0067	.0094	
494 - 592						
428 - 494	.0047	.0055	.0087	.0173	.0240	
1974 - 2632	.0039	.0087	.0193	.0354	.0374	
658 - 987	.0047	.0055	.0087	.0173	.0240	
461 - 658						
1217 - 1579	.0079	.0087	.0193	.0354	.0374	

RECOMMENDATIONS OF USING



DEBURRING
COUNTERSINKING

MATERIAL		0 flute				single flute				3 flute			
		SFM	#1	#3	#4	SFM	#1	#3	#4	SFM	#1	#3	#4
STEELS	<81 Rc (8)	115-148 IPM RPM	10.8 1250	5.4 625	3.5 430	115-148 IPM RPM	10.8 1250	5.4 625	3.5 420	56-72 IPM RPM	8.3 620	3.9 310	3.0 210
STEELS	<24 Rc (C)	66-99 IPM RPM	5.4 800	2.7 400	1.8 260	66-99 IPM RPM	5.4 800	2.7 400	1.8 260	33-49 IPM RPM	5.9 480	3.0 240	2.0 160
STEELS	24-32 Rc	49-66 IPM RPM	2.7 520	1.3 260	0.9 180	49-66 IPM RPM	2.7 520	1.3 260	0.9 180	26-39 IPM RPM	3.9 380	2.0 190	1.4 130
STEELS	32-41 Rc	39-49 IPM RPM	1.8 380	1.0 200	0.7 140	39-49 IPM RPM	1.8 380	1.0 200	0.7 140	20-26 IPM RPM	1.3 320	0.6 160	0.4 110
STAINLESS STEEL													
CAST IRON						66-132 IPM RPM	5.9 1200	5.1 550	3.9 430	49-82 IPM RPM	3.1 630	2.4 320	2.0 210
ALUMINUM		165-197 IPM RPM	15.7 1600	7.9 800	5.9 600	65-197 IPM RPM	15.7 1600	7.9 800	5.9 600	115-148 IPM RPM	14.8 1250	7.5 625	5.1 430
BRASS-BRONZE						99-132 IPM RPM	11.8 1200	5.9 600	3.5 370	66-99 IPM RPM	9.4 800	4.7 400	3.1 260
COPPER		66-99 IPM RPM	7.9 800	3.9 400	2.6 260	66-99 IPM RPM	7.9 800	3.9 400	2.6 260				
LAMINATE						165-329 IPM RPM	63.0 3200	31.5 1600	19.7 1000	115-230 IPM RPM	28.3 1600	14.2 800	9.4 530
PLASTICS		165-329 IPM RPM	63.0 3200	31.5 1600	19.7 1000	165-329 IPM RPM	63.0 3200	31.5 1600	19.7 1000	115-230 IPM RPM	28.3 1600	14.2 800	9.4 530

MINIATURE MILLING: RECOMMENDATIONS OF USING

- Endmills with long neck, extra long neck, and deep machining:- reduce the speed, while maintaining the suggested feed.
- Superficial work:- increase the speed, while maintaining the suggested feed.

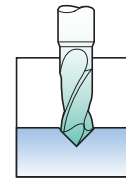
MINIATURE END MILLS

Material	Diameter(mm)	SFM	RPM	Inch/tooth	IPM
Steels 24-40Rc	0.5	132	25480	.000004	2.0
	1	132	12740	.0001	2.0
	1.5	132	8490	.0001	2.0
	2	132	6370	.0002	2.0
	3	132	4250	.0002	2.0
Steel 41Rc- 45Rc	0.5	82	15920	.000004	1.2
	1	82	7960	.0001	1.2
	1.5	82	5310	.0001	1.2
	2	82	3980	.0002	1.2
	3	82	2650	.0002	1.2
Steels >45Rc TiAlN coated tools only	0.5	132	25480	.000004	2.0
	1	132	12740	.0001	2.0
	1.5	132	8490	.0001	2.0
	2	132	6370	.0002	2.0
	3	132	4250	.0002	2.0

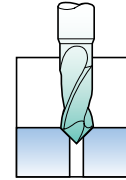
Material	Diameter(mm)	SFM	RPM	Inch/tooth	IPM
Plastics with glass or carbon filters	0.5	263	50960	.000004	20.1
	1	263	25480	.0002	20.1
	1.5	263	16990	.0006	20.1
	2	263	12740	.0008	20.1
	3	263	8490	.0012	20.1
Aluminum and other plastics	0.5	494	95540	.0002	37.8
	1	658	63690	.0005	60.2
	1.5	658	42460	.0007	60.2
	2	658	31850	.0009	60.2
	3	658	21230	.0014	60.2
Copper	0.5	263	50960	.0002	24.0
Brass	1	263	25480	.0005	24.0
Bronze	1.5	263	16990	.0007	24.0
and Steels	2	263	12740	.0009	24.0
<24 Rc	3	263	8490	.0014	24.0

MULTI-V : RECOMMENDATIONS OF USING

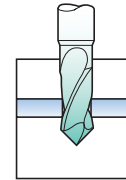
MATERIAL	SPEED SFM	diameter			FEED inches/rev.			
		3mm-3/16"	5mm-1/4"	10mm-5/16"	12mm-1/2"	16mm-5/8"	20mm	
Steel < 81 Rc (B)	230-247	RPM IPM inch/tooth	6400 12.6 .002	4000 12.6 .0031	2500 13.8 .0055	1900 14.2 .0075	1500 14.2 .0094	1300 14.3 .0110
Steel < 24 Rc (C)	132-197	RPM IPM inch/tooth	4000 7.9 .002	2600 8.2 .0031	1600 8.8 .0055	1200 9.4 .0075	900 8.9 .0094	850 9.4 .0110
Steels 24-32 Rc Cast Iron ≤ 180 HB (Grey Cast Iron)	115-132	RPM IPM inch/tooth	3200 5.7 .0018	2200 6.1 .0028	1400 6.6 .0047	1000 7.1 .0071	850 7.4 .0087	680 7.5 .0110
Steels 32-41 Rc Cast Iron ≥ 180 HB Stainless Steels	99-115	RPM IPM inch/tooth	2800 5.0 .0018	1800 5.0 .0028	1100 5.2 .0047	800 5.4 .0067	650 5.6 .0087	550 5.6 .0102
Titanium Alloys	82-99	RPM IPM inch/tooth	2200 3.5 .0016	1600 3.8 .0024	900 3.9 .0043	660 4.1 .0063	500 4.3 .0087	480 4.7 .0098
Ni Co Alloys Inconel-Nimonic-Waspaloy	66	RPM IPM inch/tooth	1800 2.8 .0016	1100 2.6 .0024	700 3.0 .0043	500 3.1 .0063	400 3.1 .0079	320 3.1 .0098
Copper alloys Bronze	165-395	RPM IPM inch/tooth	5000 19.7 .0039	3500 20.7 .0059	2200 21.7 .0098	1900 22.4 .0118	1700 23.4 .0138	1400 24.8 .0177
Aluminum	494	RPM IPM inch/tooth	10000 19.7 .0020	6300 22.3 .0035	4000 23.6 .0059	3200 25.2 .0079	2500 26.6 .0106	2000 27.6 .0138
Thermoplastics	494	RPM IPM inch/tooth	7300 14.4 .002	4600 16.3 .0035	2800 20.9 .0075	2900 22.8 .0079	2300 24.4 .0106	1900 26.2 .0138



90°-120°
CENTERING - SPOTTING

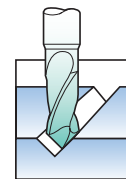


60°-90°-120°
CHAMFERING



90°-120°
DRILLING

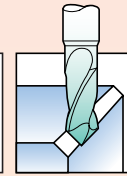
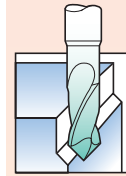
MATERIAL	SPEED SFM	FEED inches/rev.						
		diameter 3mm-3/16"	5mm-1/4"	10mm-5/16"	12mm-1/2"	16mm-5/8"	20mm	
Steel < 81 Rc (B)	230-247	RPM IPM inch/tooth	6800 2.6 .0002	4300 2.6 .0003	2650 2.8 .0006	2000 3.0 .0007	1500 3.0 .0010	1200 3.0 .0012
Steel < 24 Rc (C)	132-197	RPM IPM inch/tooth	5400 2.2 .0002	3500 2.2 .0003	2100 2.3 .0006	1600 2.4 .0007	1200 2.4 .0010	1000 2.4 .0012
Steels 24-32 Rc Cast Iron ≤180 HB (Grey Cast Iron)	115-132	RPM IPM inch/tooth	3600 1.1 .0002	2300 1.1 .0002	1400 1.3 .0005	1000 1.4 .0007	800 1.4 .0008	630 1.4 .0011
Steels 32-41 Rc Cast Iron >180 HB Stainless Steels	99-115	RPM IPM inch/tooth	3000 1.0 .0002	2000 1.0 .0002	1200 1.2 .0005	900 1.2 .0006	700 1.2 .0008	550 1.2 .0011
Titanium Alloys	82-99	RPM IPM inch/tooth	2200 0.7 .0002	1600 0.8 .0002	1000 0.8 .0004	760 0.8 .0005	600 0.9 .0007	400 0.9 .0011
Ni Co Alloys Inconel-Nimonic-Waspaloy	66	RPM IPM inch/tooth	1800 0.4 .0001	1100 0.5 .0002	700 0.6 .0004	500 0.6 .0005	400 0.6 .0007	320 0.6 .0010
Copper alloys Bronze	165-395	RPM IPM inch/tooth	7000 4.4 .0003	6000 4.7 .0004	3500 4.7 .0007	3200 5.0 .0008	2200 5.2 .0012	1750 5.5 .0016
Aluminum	494	RPM IPM inch/tooth	13000 7.9 .0003	8600 8.7 .0005	5300 9.4 .0009	4000 9.4 .0012	3000 9.8 .0017	2400 9.8 .0020
Thermoplastics	494	RPM IPM inch/tooth	13000 10.2 .0004	8600 10.2 .0006	5300 10.4 .0010	4000 10.6 .0013	3000 10.6 .0018	2400 10.6 .0022



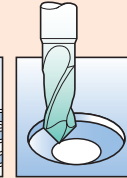
90°-120°
V - GROOVING

MULTI-V : RECOMMENDATIONS OF USING

MATERIAL	SPEED SFM		FEED inches/rev.					
			diameter 3mm-3/16"	5mm-1/4"	10mm-5/16"	12mm-1/2"	16mm-5/8"	20mm
Steel < 81 Rc (B)	230-247	RPM IPM inch/tooth	6800 4.3 .0003	4300 4.7 .0006	2650 5.1 .0010	2000 5.9 .0016	1500 6.1 .0020	1200 6.1 .0026
Steel < 24 Rc (C)	132-197	RPM IPM inch/tooth	5400 3.3 .0003	3500 3.5 .0005	2100 4.1 .0010	1600 4.7 .0016	1200 4.9 .0020	1000 4.9 .0024
Steels < 24-32 Rc Cast Iron ≤180 HB (Grey Cast Iron)	115-132	RPM IPM inch/tooth	3600 2.3 .0003	2300 2.4 .0005	1400 2.8 .0010	1000 3.1 .0016	800 3.1 .0020	630 3.1 .0024
Steels 32-41 Rc Cast Iron ≥180 HB Stainless Steels	99-115	RPM IPM inch/tooth	3000 1.8 .0003	2000 2.0 .0005	1200 2.4 .0010	900 2.6 .0014	700 2.6 .0020	550 2.6 .0024
Titanium Alloys	82-99	RPM IPM inch/tooth	2200 1.4 .0003	1600 1.6 .0005	1000 2.0 .0010	760 2.2 .0014	600 2.2 .0018	400 2.2 .0028
Ni Co Alloys Inconel-Nimonic-Waspaloy	66	RPM IPM inch/tooth	1800 1.0 .0003	1100 1.0 .0004	700 1.4 .0010	500 1.4 .0014	400 1.6 .0020	320 1.6 .0024
Copper alloys Bronze	165-395	RPM IPM inch/tooth	10000 7.9 .0004	7000 8.3 .0006	3600 8.5 .0012	2500 8.9 .0018	2300 9.1 .0020	1800 9.2 .0026
Aluminum	494	RPM IPM inch/tooth	13000 8.3 .0003	8600 8.9 .0005	5300 12.6 .0012	4000 14.2 .0018	3000 11.8 .0020	2400 12.2 .0026
Thermoplastics	494	RPM IPM inch/tooth	13000 12.2 .0005	8600 10.2 .0006	5300 14.6 .0014	4000 15.7 .0020	3000 12.6 .0020	2400 13.0 .0028

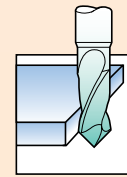


60°-90°-120°
LONGITUDINAL
CHAMFERS



90°-120°
INTERPOLATION
DRILLING

40°-60°
ENGRAVING



60°-90°-120°
CONTOURING

MULTI-FUNCTION TOOLS

REAMERS: RECOMMENDATIONS OF USING

Material to Machine	Speed SFM		Feed inches/rev.							
	Carbide	Cobalt	Diameter in mm							
			2	6	10	15	20	25	30	40
Steels < 81 Rc (B)	82-132	49-72	.0059	.0059	.0098	.0098	.0118	.0138	.0146	.0177
Steels < 24 Rc (C)	66-82	39-56	.0039	.0047	.0071	.0071	.0098	.0118	.0139	.0157
Steels 24-32 Rc	39-59	23-33	.0031	.0039	.0071	.0059	.0087	.0098	.0118	.0138
Steels 32-41 Rc	33-49	16-23	.0031	.0035	.0059	.0079	.0098	.0106	.0118	.0138
Stainless Steel	23-39	10-16	.0028	.0039	.0047	.0059	.0079	.0098	.0098	.0118
Inconel/Waspaloy	20-33	7-10	.0028	.0039	.0047	.0059	.0079	.0098	.0098	.0118
Cast Iron ≤180 HB (Grey)	99-132	20-49	.0039	.0047	.0079	.0079	.0098	.0118	.0118	.0118
Cast Iron > 180 HB	26-49	13-16	.0028	.0039	.0059	.0071	.0079	.0079	.0098	.0098
Copper	82-99	39-66	.0047	.0071	.0079	.0098	.0118	.0118	.0138	.0157
Brass	115-132	66-99	.0079	.0087	.0118	.0138	.0157	.0157	.0177	.0197
Bronze	66-82	39-56	.0059	.0071	.0087	.0138	.0146	.0146	.0177	.0197
Aluminum	132-197	82-115	.0059	.0071	.0098	.0118	.0138	.0138	.0157	.0177

