





# HX2 END MILLS

Designed specifically for  
Steel <HRc40, Stainless  
Steel and Titanium



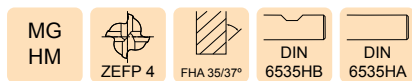
## 4-FLUTE END MILLS

Code	Item	Description	Page No.
<b>136123</b> <b>136323</b>		<b>Short Length</b> 4 Flute $\varnothing$ 3.0mm - 20.0mm	<b>P.3</b>
<b>137123</b> <b>137323</b>		<b>Short Length</b> 4 Flute Corner Radius $\varnothing$ 3.0mm - 20.0mm	<b>P.4</b>
<b>138123</b> <b>138323</b>		<b>Standard Length</b> 4 Flute $\varnothing$ 3.0mm - 25.0mm	<b>P.5</b>
<b>139123</b> <b>139323</b>		<b>Standard Length</b> 4 Flute Corner Radius $\varnothing$ 3.0mm - 20.0mm	<b>P.6</b>
<b>146323</b>		<b>Extended Neck</b> 4 Flute $\varnothing$ 3.0mm - 20.0mm	<b>P.7</b>
<b>134323</b>		<b>Standard Length</b> 4 Flute Ball Nose $\varnothing$ 3.0mm - 25.0mm	<b>P.8</b>

## 5-FLUTE END MILLS

<b>135323</b>		<b>Standard Length</b> 5 Flute $\varnothing$ 6.0mm - 25.0mm	<b>P.9</b>
		<b>Cutting Data</b>	<b>P.10-13</b>

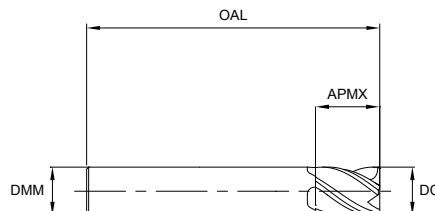
## SHORT LENGTH



## Series No. 136123, 136323

► cutting conditions : p.11

Minimized tool deflection  
Corner protected  
Reduced tool vibration



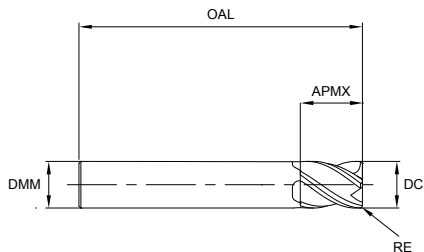
FLATTED SHANK ORDCODE	PLAIN SHANK ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	O/ALL LENGTH OAL
1361230300	1363230300	3.0	6	7.0	54
1361230400	1363230400	4.0	6	8.0	54
1361230500	1363230500	5.0	6	10.0	54
1361230600	1363230600	6.0	6	10.0	54
1361230800	1363230800	8.0	8	12.0	58
1361231000	1363231000	10.0	10	14.0	66
1361231200	1363231200	12.0	12	16.0	73
1361231400	1363231400	14.0	14	18.0	75
1361231600	1363231600	16.0	16	22.0	82
1361231800	1363231800	18.0	18	24.0	84
1361232000	1363232000	20.0	20	26.0	92

Mill Dia. Tolerance TCDC (mm)	Shank Dia. Tolerance TCDMM
0.00 / -0.03	h6

ISO	P			M		K		N				S		H		
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary ○ Secondary	○	○		●	○	○	○						○	●		



## SHORT LENGTH, CORNER RADIUS



MG HM	ZEFP 4	RE	FHA 35/37°	DIN 6535HB	DIN 6535HA
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Series No. 137123, 137323

► cutting conditions : p.11

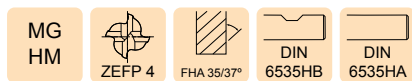
Minimized tool deflection  
Corner protected  
Reduced tool vibration

FLATTED SHANK ORDCODE	PLAIN SHANK ORDCODE	DIAMETER DC	CORNER RADIUS RE	SHANK DIAMETER DMM	LENGTH OF CUT APMX	O/ALL LENGTH OAL
1371230300	1373230300	3.0	0.3	6	7.0	54
1371230400	1373230400	4.0	0.3	6	8.0	54
1371230500	1373230500	5.0	0.3	6	10.0	54
1371230600	1373230600	6.0	0.5	6	10.0	54
1371230800	1373230800	8.0	0.5	8	12.0	58
1371231000	1373231000	10.0	0.5	10	14.0	66
1371231200	1373231200	12.0	0.7	12	16.0	73
1371231400	1373231400	14.0	0.7	14	18.0	75
1371231600	1373231600	16.0	1.0	16	22.0	82
1371231800	1373231800	18.0	1.0	18	24.0	84
1371232000	1373232000	20.0	1.0	20	26.0	92

Mill Dia. Tolerance <b>TDCD (mm)</b>	Shank Dia. Tolerance <b>TCDMM</b>
0.00 / -0.03	h6

ISO	P			M		K		N					S		H	
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary ○ Secondary	○	○		●	○	○	○						○	●		

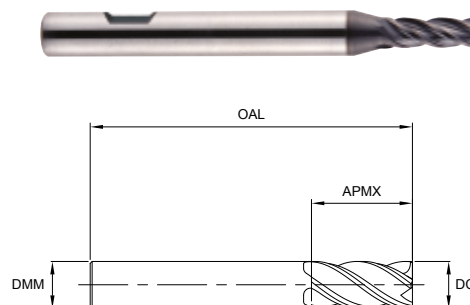
## STANDARD LENGTH



Series No. 138123, 138323

► cutting conditions : p.11

Minimized tool deflection  
Corner protected  
Reduced tool vibration



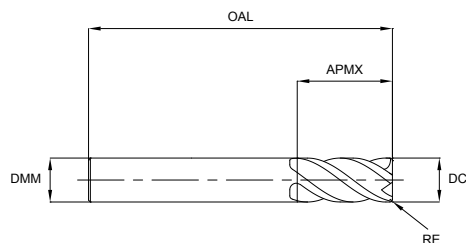
FLATTED SHANK ORDCODE	PLAIN SHANK ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	O/ALL LENGTH OAL
1381230300	1383230300	3.0	6	8.0	57
1381230400	1383230400	4.0	6	11.0	57
1381230500	1383230500	5.0	6	13.0	57
1381230600	1383230600	6.0	6	13.0	57
1381230800	1383230800	8.0	8	19.0	63
1381231000	1383231000	10.0	10	22.0	72
1381231200	1383231200	12.0	12	26.0	83
1381231400	1383231400	14.0	14	26.0	83
1381231600	1383231600	16.0	16	32.0	92
1381231800	1383231800	18.0	18	32.0	92
1381232000	1383232000	20.0	20	38.0	104
1381232500	1383232500	25.0	25	38.0	108

Mill Dia. Tolerance TDCD (mm)	Shank Dia. Tolerance TCDMM
0.00 / -0.03	h6

ISO	P			M		K		N					S		H	
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary ○ Secondary	○	○		●	○	○	○						○	●		



## STANDARD LENGTH, CORNER RADIUS



MG HM	ZEFP 4	RE	FHA 35/37°	DIN 6535HB	DIN 6535HA
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Series No. 139123, 139323

► cutting conditions : p.11

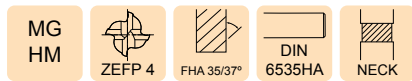
Minimized tool deflection  
Corner protected  
Reduced tool vibration

FLATTED SHANK ORDCODE	PLAIN SHANK ORDCODE	DIAMETER DC	CORNER RADIUS RE	SHANK DIAMETER DMM	LENGTH OF CUT APMX	O/ALL LENGTH OAL
1391230300	1393230300	3.0	0.3	6	8.0	57
1391230400	1393230400	4.0	0.3	6	11.0	57
1391230500	1393230500	5.0	0.3	6	13.0	57
1391230600	1393230600	6.0	0.5	6	13.0	57
1391230800	1393230800	8.0	0.5	8	19.0	63
1391231000	1393231000	10.0	0.5	10	22.0	72
1391231200	1393231200	12.0	0.7	12	26.0	83
1391231400	1393231400	14.0	0.7	14	26.0	83
1391231600	1393231600	16.0	1.0	16	32.0	92
1391231800	1393231800	18.0	1.0	18	32.0	92
1391232000	1393232000	20.0	1.0	20	38.0	104

Mill Dia. Tolerance <b>TCDC (mm)</b>	Shank Dia. Tolerance <b>TCDMM</b>
0.00 / -0.03	h6

ISO	P			M		K		N					S		H	
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary	○	○		●	○	○	○						○	●		
○ Secondary																

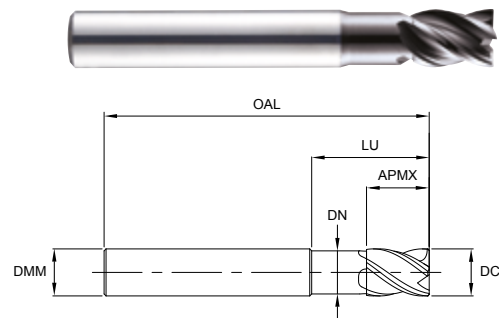
## EXTENDED NECK



## Series No. 146323

► cutting conditions : p.11

Minimized tool deflection  
Corner protected  
Reduced tool vibration



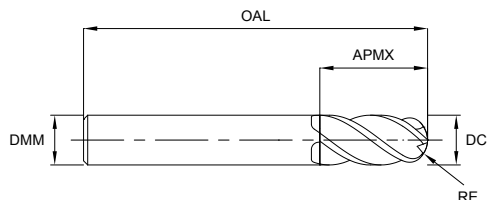
EUROPACODE ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	EFFECTIVE LENGTH LU	O/ALL LENGTH OAL	NECK DIAMETER DN
1463230400	4.0	6	8.0	15.0	57	3.7
1463239014	4.0	6	8.0	22.0	63	3.7
1463239015	5.0	6	10.0	27.0	67	4.7
1463230600	6.0	6	10.0	15.0	57	5.5
1463239001	6.0	6	10.0	20.0	62	5.5
1463239002	6.0	6	10.0	32.0	74	5.5
1463230800	8.0	8	12.0	20.0	63	7.5
1463239003	8.0	8	12.0	30.0	73	7.5
1463239004	8.0	8	12.0	46.0	90	7.5
1463231000	10.0	10	14.0	25.0	72	9.2
1463239005	10.0	10	14.0	35.0	82	9.2
1463239006	10.0	10	14.0	55.0	102	9.2
1463231200	12.0	12	16.0	30.0	83	11
1463239007	12.0	12	16.0	40.0	93	11
1463239008	12.0	12	16.0	64.0	117	11
1463231600	16.0	16	22.0	38.0	92	15
1463239009	16.0	16	22.0	55.0	109	15
1463239010	16.0	16	22.0	87.0	141	15
1463232000	20.0	20	26.0	50.0	104	19
1463239011	20.0	20	26.0	70.0	124	19
1463239012	20.0	20	26.0	110.0	164	19

Mill Dia. Tolerance TCDC (mm)	Shank Dia. Tolerance TCDMM
0.00 / -0.03	h6

ISO	P			M		K		N					S		H	
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary ○ Secondary	○	○		●	○	○	○						○	●		



## BALL NOSE



Series No. 134323

► cutting conditions : p.12

Minimized tool deflection  
Reduced tool vibration

EUROPA CODE ORDCODE	DIAMETER DC	RADIUS RE	SHANK DIAMETER DMM	LENGTH OF CUT APMX	O/ALL LENGTH OAL
1343230300	3.0	1.5	6	8.0	57
1343230400	4.0	2.0	6	11.0	57
1343230500	5.0	2.5	6	13.0	57
1343230600	6.0	3.0	6	13.0	57
1343230800	8.0	4.0	8	19.0	63
1343231000	10.0	5.0	10	22.0	72
1343231200	12.0	6.0	12	26.0	83
1343231600	16.0	8.0	16	32.0	92
1343232000	20.0	10.0	20	38.0	104
1343232500	25.0	12.5	25	38.0	108

Mill Dia. Tolerance TCDC (mm)	Shank Dia. Tolerance TCDMM
0.00 / -0.03	h6

ISO	P			M		K		N				S		H		
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary ○ Secondary	○	○		●	○	○	○						○	●		



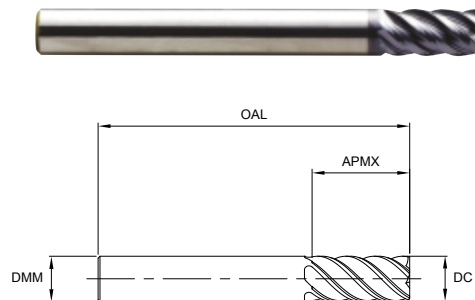
## 5 FL STANDARD LENGTH



## Series No. 135323

► cutting conditions : p.13

Minimized tool deflection  
Corner protected  
Reduced tool vibration



EUROPA CODE ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	O/ALL LENGTH OAL
1353230600	6.0	6	13.0	57
1353230800	8.0	8	19.0	63
1353231000	10.0	10	22.0	72
1353231200	12.0	12	26.0	83
1353231400	14.0	14	26.0	83
1353231600	16.0	16	32.0	92
1353231800	18.0	18	32.0	92
1353232000	20.0	20	38.0	104
1353232500	25.0	25	38.0	108

Mill Dia. Tolerance TDCD (mm)	Shank Dia. Tolerance TCDMM
0.00 / -0.03	h6

ISO	P			M		K		N					S		H	
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary ○ Secondary	○	○		●	○	○	○						○	●		



# **HX2**

# **CUTTING DATA**



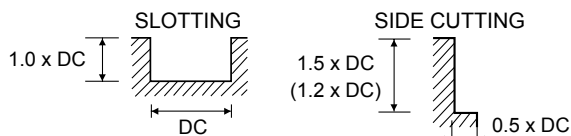
## CUTTING DATA

136123,136323,137123,137323,138123,138323,139123,139323, 146323 (4 Fl Square End)

VDI MATERIAL GROUP	HRc	Size (mm)													
		3.0	4.0	5.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	25.0		
<b>P</b>	1-5 Non-alloy Steel	<25	$v_c$ (m/min)	125	125	125	125	125	140	140	140	140	140	140	140
			$n$	13475	10105	8085	6735	5050	4455	3710	3180	2785	2475	2225	1780
			$f_z$	0.005	0.008	0.011	0.016	0.027	0.039	0.047	0.049	0.053	0.059	0.065	0.063
	$f$ (mm/min)	275	330	340	435	555	690	695	620	590	585	580	450		
	6-9 Low alloy Steel	25-35	$v_c$ (m/min)	125	125	125	125	125	140	140	140	140	140	140	
			$n$	13475	10105	8085	6735	5050	4455	3710	3180	2785	2475	2225	1780
$f_z$			0.005	0.008	0.011	0.016	0.027	0.039	0.047	0.049	0.053	0.059	0.065	0.063	
$f$ (mm/min)	275	330	340	435	555	690	695	620	590	585	580	450			
<b>M</b>	12-13 Ferritic/ Martensitic Stainless Steel	$v_c$ (m/min)	135	135	135	135	135	135	135	135	135	135	135		
		$n$	14260	10750	8655	7130	5345	4275	3565	3055	2670	2375	2140	1710	
		$f_z$	0.004	0.006	0.009	0.013	0.022	0.034	0.04	0.043	0.045	0.05	0.055	0.056	
	$f$ (mm/min)	205	255	310	360	465	585	565	520	480	475	470	380		
	14 Austenitic Stainless Steel	$v_c$ (m/min)	95	95	95	95	95	95	95	95	95	95	95		
		$n$	10185	7600	6110	5095	3820	3055	2545	2180	1910	1695	1525	1215	
$f_z$		0.005	0.008	0.013	0.018	0.028	0.048	0.056	0.06	0.063	0.07	0.077	0.078		
$f$ (mm/min)	195	250	310	360	435	590	565	520	480	475	470	380			
<b>K</b>	15-20 Cast Iron	$v_c$ (m/min)	125	125	125	125	125	140	140	140	140	140	140		
		$n$	13475	10105	8085	6735	5050	4455	3710	3180	2785	2475	2225	1780	
		$f_z$	0.005	0.008	0.011	0.016	0.027	0.039	0.047	0.049	0.053	0.059	0.065	0.063	
		$f$ (mm/min)	275	330	370	435	555	690	695	620	590	585	580	450	
<b>S</b>	31-35 HRSA Fe & Ni/Co Based	$v_c$ (m/min)	25	25	25	25	25	25	25	25	25	25	25		
		$n$	2715	2005	1630	1355	1015	815	675	580	505	450	405	320	
		$f_z$	0.005	0.007	0.012	0.018	0.031	0.018	0.056	0.06	0.064	0.069	0.077	0.086	
	$f$ (mm/min)	55	55	80	95	125	155	150	140	130	125	125	110		
	36-37 Titanium/ Titanium Alloys	$v_c$ (m/min)	95	95	95	95	95	95	95	95	95	95	95		
		$n$	10185	7600	6110	5095	3820	3055	2545	2180	1910	1695	1525	1215	
$f_z$		0.005	0.008	0.013	0.018	0.028	0.048	0.056	0.06	0.063	0.07	0.077	0.078		
$f$ (mm/min)	195	250	310	360	435	590	565	520	480	475	470	380			

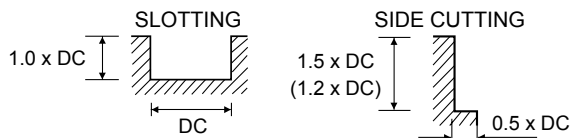
MATERIAL GROUPS P, M, K

1.2 x DC axial cutting depth should be applied for short length tools above  $\varnothing 8\text{mm}$

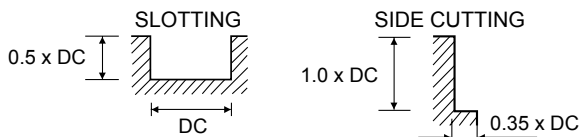


MATERIAL GROUPS S36-37

1.2 x DC axial cutting depth should be applied for short length tools above  $\varnothing 8\text{mm}$



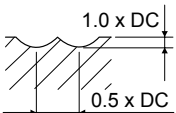
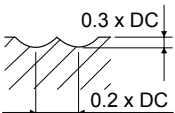
MATERIAL GROUPS S31-35



## CUTTING DATA

134323 (4 Flute Ball Nose)															
VDI MATERIAL GROUP	HRC	Size (mm)													
		3.0	4.0	5.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	25.0		
P	1-5 Non-alloy Steel	<25	$v_c$ (m/min)	135	135	135	135	135	135	135	135	135	135	135	135
			n	14324	10740	8590	7460	5370	4290	3580	3070	2680	2380	2140	1710
			$f_z$	0.025	0.025	0.03	0.038	0.06	0.06	0.07	0.075	0.075	0.08	0.09	0.099
	f (mm/min)	1430	1070	1030	1140	1280	1030	1000	920	800	760	770	680		
	6-9 Low alloy Steel	25-35	$v_c$ (m/min)	135	135	135	135	135	135	135	135	135	135	135	135
			n	14324	10740	8590	7460	5370	4290	3580	3070	2680	2380	2140	1710
$f_z$			0.025	0.025	0.03	0.038	0.06	0.06	0.07	0.075	0.075	0.08	0.09	0.099	
f (mm/min)	1430	1070	1030	1140	1280	1030	1000	920	800	760	770	680			
M	12-13 Ferritic/ Martensitic Stainless Steel	$v_c$ (m/min)	70	70	70	70	70	70	70	70	70	70	70	70	
		n	7420	5570	4450	3710	2780	2220	1850	1590	1390	1230	1110	890	
		$f_z$	0.015	0.015	0.025	0.03	0.04	0.045	0.05	0.054	0.054	0.059	0.059	0.059	
	f (mm/min)	440	330	440	440	440	400	370	340	300	290	260	210		
	14 Austenitic Stainless Steel	$v_c$ (m/min)	75	75	75	75	75	75	75	75	75	75	75	75	
		n	8220	6160	4930	4110	3080	2460	2050	1700	1540	1370	1230	980	
$f_z$		0.02	0.02	0.025	0.041	0.045	0.05	0.055	0.06	0.06	0.064	0.065	0.069		
f (mm/min)	650	490	490	670	550	490	450	400	370	350	320	270			
K	15-20 Cast Iron	$v_c$ (m/min)	135	135	135	135	135	135	135	135	135	135	135	135	
		n	14324	10740	8590	7460	5370	4290	3580	3070	2680	2380	2140	1710	
		$f_z$	0.025	0.025	0.03	0.038	0.06	0.06	0.07	0.075	0.075	0.08	0.09	0.099	
		f (mm/min)	1430	1070	1030	1140	1280	1030	1000	920	800	760	770	680	
S	31-35 HRSA Fe & Ni/Co Based	$v_c$ (m/min)	30	30	30	30	30	30	30	30	30	30	30	30	
		n	3180	2380	1910	1590	1190	950	790	680	590	530	470	380	
		$f_z$	0.011	0.011	0.01	0.016	0.025	0.026	0.038	0.04	0.047	0.052	0.053	0.053	
	f (mm/min)	140	100	80	100	120	100	120	115	110	110	100	80		
	36-37 Titanium/ Titanium Alloys	$v_c$ (m/min)	55	55	55	55	55	55	55	55	55	55	55	55	
		n	5830	4370	3500	2910	2180	1750	1450	1250	1090	970	870	700	
$f_z$		0.012	0.012	0.015	0.02	0.03	0.03	0.04	0.042	0.044	0.049	0.06	0.068		
f (mm/min)	280	210	210	230	260	210	230	210	190	190	210	190			

<p>MATERIAL GROUPS P, M, K, S36-37</p> 	<p>MATERIAL GROUP S31-35</p> 
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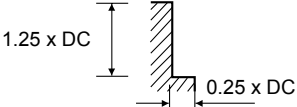
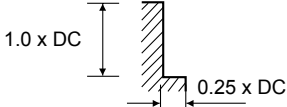
Recommended cutting depths are **maximum** depths, and **speeds and feeds are a starting point** based on these depths.  
 All recommendations are based on ideal machining conditions. Adjustments may need to be made according to your set-up.  
**For long series and long necked tools** it may be necessary to reduce feed rate by up to 50%.

$v_c$  - cutting speed (m/min)  
 n - RPM (rev/min)  
 $f_z$  - feed per tooth (mm)  
 f - feed rate (mm/min)  
 $a_p$  - axial depth of cut  
 $a_e$  - radial depth of cut

## CUTTING DATA

135323 (5 Flute)													
VDI MATERIAL GROUP		HRc		Size (mm)									
				6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	25.0	
P	1-5	Non-alloy Steel	<25	$v_c$ (m/min)	135	135	135	135	135	135	135	135	135
				n	7270	5450	4290	3630	3110	2720	2390	2180	1720
				$f_z$	0.034	0.038	0.06	0.063	0.069	0.076	0.082	0.089	0.09
		f (mm/min)	1240	1040	1030	1150	1080	1040	980	970	770		
	6-9	Low alloy Steel	25-35	$v_c$ (m/min)	135	135	135	135	135	135	135	135	135
				n	7270	5450	4290	3630	3110	2720	2390	2180	1720
$f_z$				0.034	0.038	0.06	0.063	0.069	0.076	0.082	0.089	0.09	
	f (mm/min)	1240	1040	1030	1150	1080	1040	980	970	770			
M	12-13	Ferritic/ Martensitic Stainless Steel		$v_c$ (m/min)	115	115	115	115	115	115	115	115	
				n	6060	4540	3630	3030	2600	2270	2030	1810	1460
				$f_z$	0.03	0.032	0.038	0.063	0.065	0.069	0.072	0.076	0.077
		f (mm/min)	920	720	690	960	850	780	730	690	560		
	14	Austenitic Stainless Steel		$v_c$ (m/min)	105	105	105	105	105	105	105	105	105
				n	5660	4240	3390	3830	2420	2120	1850	1690	1340
$f_z$				0.03	0.032	0.038	0.043	0.064	0.068	0.072	0.076	0.077	
	f (mm/min)	860	670	640	820	770	720	670	640	510			
K	15-20	Cast Iron		$v_c$ (m/min)	135	135	135	135	135	135	135	135	
				n	7270	5450	4360	3630	3110	2720	2390	2180	1720
				$f_z$	0.034	0.038	0.05	0.063	0.069	0.076	0.082	0.089	0.09
				f (mm/min)	1240	1040	1100	1150	1080	1040	980	970	770
S	31-35	HRSA Fe & Ni/Co Based		$v_c$ (m/min)	25	25	25	25	25	25	25	25	
				n	1450	1090	870	720	620	540	440	430	320
				$f_z$	0.017	0.02	0.025	0.036	0.045	0.048	0.054	0.06	0.062
		f (mm/min)	120	110	110	130	140	130	120	130	100		
	36-37	Titanium/ Titanium Alloys		$v_c$ (m/min)	85	85	85	85	85	85	85	85	85
				n	4440	3330	2660	220	1900	1660	1500	1330	1080
$f_z$				0.03	0.031	0.038	0.05	0.057	0.063	0.069	0.075	0.078	
	f (mm/min)	670	520	500	560	540	520	510	500	420			

MATERIAL GROUPS P, M, K, S36-37	MATERIAL GROUP S31-35
	

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 All recommendations are based on ideal machining conditions. Adjustments may need to be made according to your set-up.  
**For long series and long necked tools** it may be necessary to reduce feed rate by up to 50%.

$v_c$  - cutting speed (m/min)  
 n - RPM (rev/min)  
 $f_z$  - feed per tooth (mm)  
 f - feed rate (mm/min)  
 $a_p$  - axial depth of cut  
 $a_e$  - radial depth of cut