

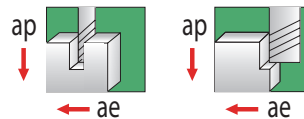
GARR TOOL High Performance Milling Guide for VRX

NOTE - DATA DOES NOT REFLECT CHIP THINNING.

SPINDLE INTERFACE MUST BE SCRUTINIZED WHEN USING 5/8" DIAMETER AND LARGER END MILLS

ISO Material	HRC	SFM (Vc)	CHIPLOAD PER TOOTH (Fz)									
			1/16"	1/8"	3/16"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
COBALT BASE ALLOYS												
Haynes 25/188, Stellite 21, Cobalt Chrome	< 40	75 - 150	.0003"-.0006"	.0004"-.0007"	.0005"-.0008"	.0007"-.0012"	.0008"-.0015"	.0010"-.0019"	.0014"-.0024"	.0016"-.0030"	.0020"-.0038"	.0028"-.0048"
	> 40	60 - 125	.0003"-.0005"	.0003"-.0006"	.0004"-.0007"	.0006"-.0010"	.0007"-.0013"	.0009"-.0017"	.0012"-.0020"	.0014"-.0026"	.0018"-.0034"	.0024"-.0040"
NICKEL BASE ALLOYS												
Inconel-625/718, Waspalloy, Invar, Rene, Hastelloy, Monel	< 40	75 - 150	.0003"-.0006"	.0004"-.0007"	.0005"-.0008"	.0007"-.0012"	.0008"-.0015"	.0010"-.0019"	.0014"-.0024"	.0016"-.0030"	.0020"-.0038"	.0028"-.0048"
	> 40	60 - 125	.0003"-.0005"	.0003"-.0006"	.0004"-.0007"	.0006"-.0010"	.0007"-.0013"	.0009"-.0017"	.0012"-.0020"	.0014"-.0026"	.0018"-.0034"	.0024"-.0040"
IRON BASE ALLOYS												
A286, Discaloy, Haynes 556, Carpenter 22, Greek Ascology	< 40	75 - 150	.0003"-.0006"	.0004"-.0007"	.0005"-.0008"	.0007"-.0012"	.0008"-.0015"	.0010"-.0019"	.0014"-.0024"	.0016"-.0030"	.0020"-.0038"	.0028"-.0048"
	> 40	60 - 125	.0003"-.0005"	.0003"-.0006"	.0004"-.0007"	.0006"-.0010"	.0007"-.0013"	.0009"-.0017"	.0012"-.0020"	.0014"-.0026"	.0018"-.0034"	.0024"-.0040"
TITANIUM ALLOYS												
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25N-4Zr-2Mo-Si 5553 / Beta Titanium		175 - 300	.0003"-.0006"	.0004"-.0007"	.0005"-.0008"	.0007"-.0014"	.0008"-.0017"	.0010"-.0021"	.0014"-.0028"	.0016"-.0034"	.0020"-.0042"	.0028"-.0056"
		125 - 225	.0003"-.0006"	.0003"-.0007"	.0004"-.0008"	.0007"-.0012"	.0008"-.0015"	.0010"-.0019"	.0014"-.0024"	.0016"-.0030"	.0020"-.0038"	.0028"-.0048"
STAINLESS STEELS												
13/8, 15/5, 17-4, pH Types 300 Series, 304L, Nitronic 50, Duplex, Super-Austenitic 400 Series - 403, 405, 420, 455	< 40	175 - 300	.0003"-.0006"	.0004"-.0007"	.0005"-.0008"	.0007"-.0012"	.0008"-.0015"	.0010"-.0019"	.0014"-.0024"	.0016"-.0030"	.0020"-.0038"	.0028"-.0048"
	> 40	150 - 225	.0003"-.0005"	.0003"-.0006"	.0004"-.0007"	.0006"-.0010"	.0007"-.0013"	.0009"-.0017"	.0012"-.0020"	.0014"-.0026"	.0018"-.0034"	.0022"-.0040"
	< 40	200 - 325	.0003"-.0006"	.0004"-.0007"	.0005"-.0008"	.0007"-.0012"	.0008"-.0015"	.0010"-.0019"	.0014"-.0024"	.0016"-.0030"	.0020"-.0038"	.0028"-.0048"
	> 40	175 - 250	.0003"-.0005"	.0003"-.0006"	.0004"-.0007"	.0006"-.0011"	.0007"-.0014"	.0009"-.0018"	.0012"-.0022"	.0014"-.0028"	.0018"-.0036"	.0024"-.0044"
	< 40	225 - 350	.0003"-.0006"	.0004"-.0007"	.0005"-.0008"	.0007"-.0013"	.0008"-.0016"	.0010"-.0020"	.0014"-.0026"	.0016"-.0032"	.0024"-.0043"	.0028"-.0052"
	> 40	175 - 250	.0003"-.0005"	.0003"-.0006"	.0004"-.0007"	.0006"-.0011"	.0007"-.0014"	.0009"-.0018"	.0012"-.0022"	.0014"-.0028"	.0018"-.0036"	.0024"-.0044"
HIGH STRENGTH TOOL STEELS												
A2, D2, P20, H13, S7, O1	< 40	175 - 300	.0004"-.0007"	.0005"-.0008"	.0006"-.0010"	.0008"-.0013"	.0009"-.0016"	.0011"-.0020"	.0016"-.0026"	.0018"-.0032"	.0022"-.0040"	.0032"-.0052"
	> 40	125 - 275	.0003"-.0005"	.0003"-.0005"	.0005"-.0008"	.0007"-.0010"	.0008"-.0013"	.0010"-.0017"	.0014"-.0020"	.0016"-.0026"	.0020"-.0034"	.0028"-.0040"
MEDIUM ALLOY TOOL STEELS												
4140, 4340, 52100, 6150, 8620	< 40	250 - 400	.0004"-.0007"	.0005"-.0008"	.0006"-.0010"	.0008"-.0014"	.0009"-.0017"	.0011"-.0021"	.0016"-.0026"	.0018"-.0034"	.0022"-.0042"	.0032"-.0056"
	> 40	225 - 300	.0003"-.0005"	.0003"-.0005"	.0005"-.0008"	.0007"-.0011"	.0008"-.0014"	.0010"-.0018"	.0014"-.0022"	.0016"-.0028"	.0020"-.0036"	.0028"-.0044"
CARBON STEELS												
1000's - 1018, 1020, 12L14	< 40	300 - 425	.0004"-.0007"	.0005"-.0008"	.0006"-.0010"	.0008"-.0015"	.0009"-.0018"	.0011"-.0022"	.0016"-.0030"	.0018"-.0036"	.0022"-.0044"	.0032"-.0060"
CAST MATERIAL												
Ductile Iron Gray Iron		300 - 425	.0004"-.0007"	.0005"-.0008"	.0006"-.0010"	.0009"-.0016"	.0010"-.0019"	.0012"-.0023"	.0018"-.0032"	.0020"-.0038"	.0024"-.0046"	.0036"-.0064"
		325 - 475	.0005"-.0008"	.0007"-.0010"	.0007"-.0012"	.0010"-.0017"	.0011"-.0020"	.0013"-.0024"	.0020"-.0034"	.0022"-.0040"	.0026"-.0048"	.0040"-.0068"

	Slotting Pocket Milling	Profiling Side Milling
Axial (ap)	up to 1.5xD	up to 2xD
Radial (ae)	1xD	5% - 15% of Dia.



NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

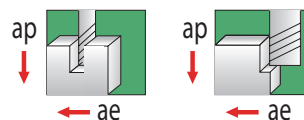
GARR TOOL High Performance Milling Guide for VRX

NOTE - DATA DOES NOT REFLECT CHIP THINNING.

SPINDLE INTERFACE MUST BE SCRUTINIZED WHEN USING 16mm DIAMETER AND LARGER END MILLS

	ISO Material	HRC	M/Min. (Vc)	CHIPLOAD PER TOOTH (Fz)									
				1.5mm	3.0mm	5.0mm	6.0mm	8.0mm	10.0mm	12.0mm	16.0mm	20.0mm	25.0mm
S	COBALT BASE ALLOYS												
	Haynes 25/188, Stellite 21, Cobalt Chrome	<40 >40	25 - 45 20 - 40	.008 - .015 .008 - .012	.010 - .018 .008 - .015	.013 - .020 .010 - .018	.018 - .030 .015 - .025	.020 - .038 .018 - .033	.025 - .048 .023 - .043	.036 - .061 .030 - .051	.041 - .076 .036 - .066	.051 - .097 .046 - .086	.071 - .122 .061 - .102
	NICKEL BASE ALLOYS												
	Inconel-625/718, Waspalloy, Invar, Rene, Hastelloy, Monel	<40 >40	25 - 45 20 - 40	.008 - .015 .008 - .012	.010 - .018 .008 - .015	.013 - .020 .010 - .018	.018 - .030 .015 - .025	.020 - .038 .018 - .033	.025 - .048 .023 - .043	.036 - .061 .030 - .051	.041 - .076 .036 - .066	.051 - .097 .046 - .086	.071 - .122 .061 - .102
	IRON BASE ALLOYS												
	A286, Dicaloy, Haynes 556, Carpenter 22, Greek Ascolloy	<40 >40	25 - 45 20 - 40	.008 - .015 .008 - .012	.010 - .018 .008 - .015	.013 - .020 .010 - .018	.018 - .030 .015 - .025	.020 - .038 .018 - .033	.025 - .048 .023 - .043	.036 - .061 .030 - .051	.041 - .076 .036 - .066	.051 - .097 .046 - .086	.071 - .122 .061 - .102
TITANIUM ALLOYS													
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25Ni-4Zr-2Mo-Si		55 - 90	.008 - .015	.010 - .018	.013 - .020	.018 - .036	.020 - .043	.025 - .053	.036 - .071	.041 - .086	.051 - .107	.071 - .142	
5553 / Beta Titanium		40 - 70	.008 - .015	.008 - .018	.010 - .020	.018 - .030	.020 - .038	.025 - .048	.036 - .061	.041 - .076	.051 - .097	.071 - .122	
M	STAINLESS STEELS												
	13/8, 15/5, 17-4, pH Types	<40 >40	55 - 90 45 - 70	.008 - .015 .008 - .013	.010 - .018 .008 - .015	.013 - .020 .010 - .018	.018 - .030 .015 - .025	.020 - .038 .018 - .033	.025 - .048 .023 - .043	.036 - .061 .030 - .051	.041 - .076 .036 - .066	.051 - .097 .046 - .086	.071 - .122 .056 - .102
	300 Series, 304L, Nitronic 50, Duplex, Super-Austenitic	<40 >40	60 - 100 55 - 75	.008 - .015 .008 - .013	.010 - .018 .008 - .015	.013 - .020 .010 - .018	.018 - .030 .015 - .028	.020 - .038 .018 - .036	.025 - .048 .023 - .046	.036 - .061 .030 - .056	.041 - .076 .036 - .071	.051 - .097 .046 - .091	.071 - .122 .061 - .112
	400 Series - 403, 405, 420, 455	<40 >40	70 - 110 55 - 75	.008 - .015 .008 - .013	.010 - .018 .008 - .015	.013 - .020 .010 - .018	.018 - .033 .015 - .028	.020 - .041 .018 - .036	.025 - .051 .023 - .046	.036 - .066 .030 - .056	.041 - .081 .036 - .071	.061 - .109 .046 - .091	.071 - .132 .061 - .112
P	HIGH STRENGTH TOOL STEELS												
	A2, D2, P20, H13, S7, O1	<40 >40	55 - 90 40 - 85	.010 - .018 .008 - .013	.013 - .020 .008 - .013	.015 - .025 .013 - .020	.020 - .033 .018 - .025	.023 - .041 .020 - .033	.028 - .051 .025 - .043	.041 - .066 .036 - .051	.046 - .081 .041 - .066	.056 - .102 .051 - .086	.081 - .132 .071 - .102
	MEDIUM ALLOY TOOL STEELS												
4140, 4340, 52100, 6150, 8620	<40 >40	75 - 120 70 - 90	.010 - .018 .008 - .013	.013 - .020 .008 - .013	.015 - .025 .013 - .020	.020 - .036 .018 - .028	.023 - .043 .020 - .036	.028 - .053 .025 - .046	.041 - .071 .036 - .056	.046 - .086 .041 - .071	.056 - .107 .051 - .091	.081 - .142 .071 - .112	
CARBON STEELS													
1000's - 1018, 1020, 12L14	<40	90 - 130	.010 - .018	.013 - .020	.015 - .025	.020 - .038	.023 - .046	.028 - .056	.041 - .076	.046 - .091	.056 - .112	.081 - .152	
K	CAST MATERIAL												
	Ductile Iron		90 - 130	.010 - .018	.013 - .020	.015 - .025	.023 - .041	.025 - .048	.030 - .058	.046 - .081	.051 - .097	.061 - .117	.091 - .163
Gray Iron		100 - 145	.013 - .020	.018 - .025	.018 - .030	.025 - .043	.028 - .051	.033 - .061	.051 - .086	.056 - .102	.066 - .122	.102 - .173	

	Slotting Pocket Milling	Profiling Side Milling
Axial (ap)	up to 1.5xD	up to 2xD
Radial (ae)	1xD	5% - 15% of Dia.



NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

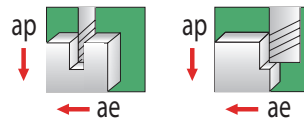
GARR TOOL High Performance Milling Guide for V4

NOTE - DATA DOES NOT REFLECT CHIP THINNING.

SPINDLE INTERFACE MUST BE SCRUTINIZED WHEN USING 5/8" DIAMETER AND LARGER END MILLS

ISO Material	HRC	SFM (Vc)	CHIPLOAD PER TOOTH (Fz)						
			1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
S									
COBALT BASE ALLOYS									
Haynes 25/188, Stellite 21, Cobalt Chrome	< 40	90 - 185	.0008" - .0015"	.0009" - .0018"	.0011" - .0022"	.0016" - .0030"	.0018" - .0036"	.0022" - .0044"	.0032" - .0060"
	> 40	75 - 150	.0006" - .0013"	.0007" - .0016"	.0009" - .0020"	.0012" - .0026"	.0014" - .0032"	.0018" - .0040"	.0024" - .0052"
NICKEL BASE ALLOYS									
Inconel-625/718, Waspaloy, Invar, Rene, Hastelloy, Monel	< 40	90 - 185	.0008" - .0015"	.0009" - .0018"	.0011" - .0022"	.0016" - .0030"	.0018" - .0036"	.0022" - .0044"	.0032" - .0060"
	> 40	75 - 150	.0006" - .0013"	.0007" - .0016"	.0009" - .0020"	.0012" - .0026"	.0014" - .0032"	.0018" - .0040"	.0024" - .0052"
IRON BASE ALLOYS									
A286, Discaloy, Haynes 556, Carpenter 22, Greek Ascology	< 40	90 - 185	.0008" - .0015"	.0009" - .0018"	.0011" - .0022"	.0016" - .0030"	.0018" - .0036"	.0022" - .0044"	.0032" - .0060"
	> 40	75 - 150	.0006" - .0013"	.0007" - .0016"	.0009" - .0020"	.0012" - .0026"	.0014" - .0032"	.0018" - .0040"	.0024" - .0052"
TITANIUM ALLOYS									
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25N-4Zr-2Mo-Si		200 - 375	.0009" - .0017"	.0010" - .0020"	.0012" - .0024"	.0018" - .0034"	.0020" - .0040"	.0024" - .0048"	.0036" - .0068"
		150 - 280	.0009" - .0015"	.0010" - .0018"	.0012" - .0022"	.0018" - .0030"	.0020" - .0036"	.0024" - .0044"	.0032" - .0060"
M									
STAINLESS STEELS									
13/8, 15/5, 17-4, pH Types	< 40	225 - 375	.0008" - .0015"	.0009" - .0018"	.0011" - .0022"	.0016" - .0030"	.0018" - .0036"	.0022" - .0044"	.0032" - .0060"
	> 40	175 - 275	.0006" - .0013"	.0007" - .0016"	.0009" - .0020"	.0012" - .0026"	.0014" - .0032"	.0018" - .0040"	.0024" - .0052"
300 Series, 304L, Nitronic 50, Duplex, Super-Austenitic	< 40	250 - 400	.0008" - .0016"	.0009" - .0018"	.0011" - .0022"	.0016" - .0030"	.0018" - .0036"	.0022" - .0044"	.0032" - .0060"
	> 40	175 - 275	.0006" - .0013"	.0007" - .0016"	.0009" - .0020"	.0012" - .0026"	.0014" - .0032"	.0018" - .0040"	.0024" - .0052"
400 Series - 403, 405, 420, 455	< 40	225 - 425	.0008" - .0016"	.0009" - .0019"	.0011" - .0023"	.0016" - .0032"	.0018" - .0038"	.0022" - .0046"	.0032" - .0064"
	> 40	175 - 325	.0006" - .0014"	.0007" - .0017"	.0009" - .0021"	.0012" - .0028"	.0014" - .0034"	.0018" - .0042"	.0024" - .0056"
P									
HIGH STRENGTH TOOL STEELS									
A2, D2, P20, H13, S7, O1	< 40	225 - 400	.0008" - .0016"	.0011" - .0019"	.0013" - .0023"	.0016" - .0032"	.0022" - .0038"	.0026" - .0056"	.0040" - .0064"
	> 40	150 - 325	.0006" - .0013"	.0010" - .0016"	.0012" - .0020"	.0012" - .0026"	.0020" - .0032"	.0024" - .0040"	.0036" - .0052"
MEDIUM ALLOY TOOL STEELS									
4140, 4340, 52100, 6150, 8620	< 40	350 - 500	.0008" - .0017"	.0011" - .0020"	.0013" - .0024"	.0016" - .0034"	.0022" - .0040"	.0026" - .0048"	.0040" - .0068"
	> 40	250 - 375	.0006" - .0014"	.0010" - .0017"	.0012" - .0020"	.0012" - .0028"	.0020" - .0034"	.0024" - .0040"	.0036" - .0056"
CARBON STEELS									
1000's - 1018, 1020, 12L14	< 40	375 - 600	.0010" - .0018"	.0011" - .0021"	.0013" - .0025"	.0020" - .0036"	.0022" - .0042"	.0026" - .0050"	.0040" - .0072"
K									
CAST MATERIAL									
Ductile Iron		350 - 525	.0010" - .0018"	.0013" - .0022"	.0015" - .0026"	.0020" - .0036"	.0026" - .0044"	.0030" - .0052"	.0040" - .0072"
Gray Iron		450 - 590	.0011" - .0020"	.0014" - .0023"	.0016" - .0027"	.0022" - .0040"	.0028" - .0046"	.0032" - .0054"	.0044" - .0080"

	Slotting Pocket Milling	Profiling Side Milling
Axial (ap)	up to 1.5xD	up to 2xD
Radial (ae)	1xD	5% - 15% of Dia.



NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

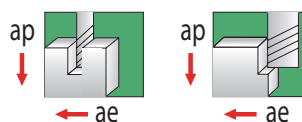
GARR TOOL High Performance Milling Guide for V4

NOTE - DATA DOES NOT REFLECT CHIP THINNING.

SPINDLE INTERFACE MUST BE SCRUTINIZED WHEN USING 16mm DIAMETER AND LARGER END MILLS

ISO Material	HRC	M/Min. (Vc)	CHIPLOAD PER TOOTH (Fz)						
			6.0mm	8.0mm	10.0mm	12.0mm	16.0mm	20.0mm	25.0mm
S									
COBALT BASE ALLOYS									
Haynes 25/188, Stellite 21, Cobalt Chrome	< 40 > 40	27 - 57 25 - 45	.020 - .038 .015 - .033	.023 - .046 .018 - .041	.028 - .056 .023 - .051	.041 - .076 .030 - .066	.046 - .091 .036 - .081	.056 - .112 .046 - .102	.081 - .152 .061 - .132
NICKEL BASE ALLOYS									
Inconel-625/718, Waspaloy, Invar, Rene, Hastelloy, Monel	< 40 > 40	27 - 57 25 - 45	.020 - .038 .015 - .033	.023 - .046 .018 - .041	.028 - .056 .023 - .051	.041 - .076 .030 - .066	.046 - .091 .036 - .081	.056 - .112 .046 - .102	.081 - .152 .061 - .132
IRON BASE ALLOYS									
A286, Discaloy, Haynes 556, Carpenter 22, Greek Ascology	< 40 > 40	27 - 57 25 - 45	.020 - .038 .015 - .033	.023 - .046 .018 - .041	.028 - .056 .023 - .051	.041 - .076 .030 - .066	.046 - .091 .036 - .081	.056 - .112 .046 - .102	.081 - .152 .061 - .132
TITANIUM ALLOYS									
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25N-4Zr-2Mo-Si		60 - 115	.023 - .043	.025 - .051	.030 - .061	.046 - .086	.051 - .102	.061 - .122	.091 - .173
5553 / Beta Titanium		45 - 85	.023 - .038	.025 - .046	.030 - .056	.046 - .076	.051 - .091	.061 - .112	.081 - .152
M									
STAINLESS STEELS									
13/8, 15/5, 17-4, pH Types	< 40 > 40	70 - 115 55 - 85	.020 - .038 .015 - .033	.023 - .046 .018 - .041	.028 - .056 .023 - .051	.041 - .076 .030 - .066	.046 - .091 .036 - .081	.056 - .112 .046 - .102	.081 - .152 .061 - .132
300 Series, 304L, Nitronic 50, Duplex, Super-Austenitic	< 40 > 40	75 - 120 55 - 85	.020 - .038 .015 - .033	.023 - .046 .018 - .041	.028 - .056 .023 - .051	.041 - .076 .030 - .066	.046 - .091 .036 - .081	.056 - .112 .046 - .102	.081 - .152 .061 - .132
400 Series - 403, 405, 420, 455	< 40 > 40	70 - 130 55 - 100	.020 - .041 .015 - .036	.023 - .048 .018 - .043	.028 - .058 .023 - .053	.041 - .081 .030 - .071	.046 - .097 .036 - .086	.056 - .117 .046 - .107	.081 - .163 .061 - .142
P									
HIGH STRENGTH TOOL STEELS									
A2, D2, P20, H13, S7, O1	< 40 > 40	70 - 120 45 - 100	.020 - .041 .015 - .033	.028 - .048 .025 - .041	.033 - .058 .030 - .051	.041 - .081 .030 - .066	.056 - .097 .051 - .081	.066 - .142 .061 - .102	.102 - .163 .091 - .132
MEDIUM ALLOY TOOL STEELS									
4140, 4340, 52100, 6150, 8620	< 40 > 40	110 - 150 75 - 115	.020 - .043 .015 - .036	.028 - .051 .025 - .043	.033 - .061 .030 - .051	.041 - .086 .030 - .071	.056 - .102 .051 - .086	.066 - .122 .061 - .102	.102 - .173 .091 - .142
CARBON STEELS									
1000's - 1018, 1020, 12L14	< 40	115 - 180	.025 - .046	.028 - .053	.033 - .064	.051 - .091	.056 - .107	.066 - .127	.102 - .183
K									
CAST MATERIAL									
Ductile Iron		110 - 160	.025 - .046	.033 - .056	.038 - .066	.051 - .091	.066 - .112	.076 - .132	.102 - .183
Gray Iron		135 - 180	.028 - .051	.036 - .058	.041 - .069	.056 - .102	.071 - .117	.081 - .137	.112 - .203

	Slotting Pocket Milling	Profiling Side Milling
Axial (ap)	up to 1.5xD	up to 2xD
Radial (ae)	1xD	5% - 15% of Dia.



NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

GARR TOOL High Performance Milling Guide for V5, V5C (HIGH EFFICIENCY MILLING)

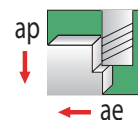
TECHNICAL

NOTE - DATA DOES NOT REFLECT CHIP THINNING.

SPINDLE INTERFACE MUST BE SCRUTINIZED WHEN USING 5/8" DIAMETER AND LARGER END MILLS

ISO Material	HRC	SFM (Vc)	CHIPLOAD PER TOOTH (Fz)						
			1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
S									
COBALT BASE ALLOYS									
Haynes 25/188, Stellite 21, Cobalt Chrome	< 40 > 40	105 - 220 90 - 180	.0009" - .0016" .0007" - .0014"	.0010" - .0019" .0008" - .0017"	.0012" - .0023" .0010" - .0021"	.0018" - .0032" .0014" - .0028"	.0020" - .0038" .0016" - .0034"	.0024" - .0046" .0020" - .0042"	.0036" - .0064" .0028" - .0056"
NICKEL BASE ALLOYS									
Inconel-625/718, Waspaloy, Invar, Rene, Hastelloy, Monel	< 40 > 40	105 - 220 90 - 180	.0009" - .0016" .0007" - .0014"	.0010" - .0019" .0008" - .0017"	.0012" - .0023" .0010" - .0021"	.0018" - .0032" .0014" - .0028"	.0020" - .0038" .0016" - .0034"	.0024" - .0046" .0020" - .0042"	.0036" - .0064" .0028" - .0056"
IRON BASE ALLOYS									
A286, Discaloy, Haynes 556, Carpenter 22, Greek Ascology	< 40 > 40	105 - 220 90 - 180	.0009" - .0016" .0007" - .0014"	.0010" - .0019" .0008" - .0017"	.0012" - .0023" .0010" - .0021"	.0018" - .0032" .0014" - .0028"	.0020" - .0038" .0016" - .0034"	.0024" - .0046" .0020" - .0042"	.0036" - .0064" .0028" - .0056"
TITANIUM ALLOYS									
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25N-4Zr-2Mo-Si		240 - 450	.0010" - .0018"	.0011" - .0021"	.0013" - .0025"	.0020" - .0036"	.0022" - .0042"	.0026" - .0050"	.0040" - .0072"
5553 / Beta Titanium		180 - 340	.0010" - .0016"	.0011" - .0019"	.0013" - .0023"	.0020" - .0032"	.0022" - .0038"	.0026" - .0046"	.0040" - .0064"
M									
STAINLESS STEELS									
13/8, 15/5, 17-4, pH Types	< 40 > 40	300 - 450 210 - 330	.0009" - .0016" .0007" - .0014"	.0010" - .0019" .0008" - .0017"	.0012" - .0023" .0010" - .0021"	.0018" - .0032" .0014" - .0028"	.0020" - .0038" .0016" - .0034"	.0024" - .0046" .0020" - .0042"	.0036" - .0064" .0028" - .0056"
300 Series, 304L, Nitronic 50, Duplex, Super-Austenitic	< 40 > 40	300 - 480 210 - 330	.0009" - .0016" .0007" - .0014"	.0010" - .0019" .0008" - .0017"	.0012" - .0023" .0010" - .0021"	.0018" - .0032" .0014" - .0028"	.0020" - .0038" .0016" - .0034"	.0024" - .0046" .0020" - .0042"	.0036" - .0064" .0028" - .0056"
400 Series - 403, 405, 420, 455	< 40 > 40	270 - 510 210 - 390	.0009" - .0017" .0007" - .0015"	.0010" - .0020" .0008" - .0018"	.0012" - .0024" .0010" - .0022"	.0018" - .0034" .0014" - .0030"	.0020" - .0040" .0016" - .0036"	.0024" - .0048" .0020" - .0044"	.0036" - .0068" .0028" - .0060"
P									
HIGH STRENGTH TOOL STEELS									
A2, D2, P20, H13, S7, O1	< 40 > 40	270 - 480 180 - 390	.0009" - .0017" .0007" - .0014"	.0010" - .0020" .0008" - .0017"	.0012" - .0024" .0010" - .0021"	.0018" - .0034" .0014" - .0028"	.0020" - .0040" .0016" - .0034"	.0024" - .0048" .0020" - .0042"	.0036" - .0068" .0028" - .0056"
MEDIUM ALLOY TOOL STEELS									
4140, 4340, 52100, 6150, 8620	< 40 > 40	420 - 600 300 - 450	.0009" - .0018" .0007" - .0015"	.0010" - .0021" .0008" - .0018"	.0012" - .0025" .0010" - .0022"	.0018" - .0036" .0014" - .0030"	.0020" - .0042" .0016" - .0036"	.0024" - .0050" .0020" - .0044"	.0036" - .0072" .0028" - .0060"
CARBON STEELS									
1000's - 1018, 1020, 12L14	< 40	450 - 720	.0011" - .0019"	.0012" - .0022"	.0014" - .0026"	.0022" - .0038"	.0024" - .0044"	.0028" - .0052"	.0044" - .0076"
K									
CAST MATERIAL									
Ductile Iron		420 - 630	.0011" - .0019"	.0012" - .0022"	.0014" - .0026"	.0022" - .0038"	.0024" - .0044"	.0028" - .0052"	.0044" - .0076"
Gray Iron		540 - 710	.0012" - .0021"	.0013" - .0024"	.0015" - .0028"	.0024" - .0042"	.0026" - .0048"	.0030" - .0056"	.0048" - .0084"

	Profile/Trochoidal Milling
Axial (ap)	up to 2xD
Radial (ae)	5% - 15% of Dia.



NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

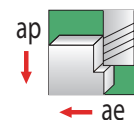
GARR TOOL High Performance Milling Guide for V5, V5C (HIGH EFFICIENCY MILLING)

NOTE - DATA DOES NOT REFLECT CHIP THINNING.

SPINDLE INTERFACE MUST BE SCRUTINIZED WHEN USING 16mm DIAMETER AND LARGER END MILLS

ISO Material	HRC	M/Min. (Vc)	CHIPLOAD PER TOOTH (Fz)						
			6.0mm	8.0mm	10.0mm	12.0mm	16.0mm	20.0mm	25.0mm
S									
COBALT BASE ALLOYS									
Haynes 25/188, Stellite 21, Cobalt Chrome	< 40 > 40	30 - 70 27 - 55	.023 - .041 .018 - .036	.025 - .048 .020 - .043	.030 - .058 .025 - .053	.046 - .081 .036 - .071	.051 - .097 .041 - .086	.061 - .117 .051 - .107	.091 - .163 .071 - .142
NICKEL BASE ALLOYS									
Inconel-625/718, Waspaloy, Invar, Rene, Hastelloy, Monel	< 40 > 40	30 - 70 27 - 55	.023 - .041 .018 - .036	.025 - .048 .020 - .043	.030 - .058 .025 - .053	.046 - .081 .036 - .071	.051 - .097 .041 - .086	.061 - .117 .051 - .107	.091 - .163 .071 - .142
IRON BASE ALLOYS									
A286, Dicaloy, Haynes 556, Carpenter 22, Greek Ascology	< 40 > 40	30 - 70 27 - 55	.023 - .041 .018 - .036	.025 - .048 .020 - .043	.030 - .058 .025 - .053	.046 - .081 .036 - .071	.051 - .097 .041 - .086	.061 - .117 .051 - .107	.091 - .163 .071 - .142
TITANIUM ALLOYS									
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25N-4Zr-2Mo-Si		75 - 135	.025 - .046	.028 - .053	.033 - .064	.051 - .091	.056 - .107	.066 - .127	.102 - .183
5553 / Beta Titanium		55 - 105	.025 - .041	.028 - .048	.033 - .058	.051 - .081	.056 - .097	.066 - .117	.102 - .163
M									
STAINLESS STEELS									
13/8, 15/5, 17-4, pH Types	< 40 > 40	90 - 135 65 - 100	.023 - .041 .018 - .036	.025 - .048 .020 - .043	.030 - .058 .025 - .053	.046 - .081 .036 - .071	.051 - .097 .041 - .086	.061 - .117 .051 - .107	.091 - .163 .071 - .142
300 Series, 304L, Nitronic 50, Duplex, Super-Austenitic	< 40 > 40	90 - 145 65 - 100	.023 - .041 .018 - .036	.025 - .048 .020 - .043	.030 - .058 .025 - .053	.046 - .081 .036 - .071	.051 - .097 .041 - .086	.061 - .117 .051 - .107	.091 - .163 .071 - .142
400 Series - 403, 405, 420, 455	< 40 > 40	85 - 155 65 - 120	.023 - .043 .018 - .038	.025 - .051 .020 - .046	.030 - .061 .025 - .056	.046 - .086 .036 - .076	.051 - .102 .041 - .091	.061 - .122 .051 - .112	.091 - .173 .071 - .152
P									
HIGH STRENGTH TOOL STEELS									
A2, D2, P20, H13, S7, O1	< 40 > 40	85 - 145 55 - 120	.023 - .043 .018 - .036	.025 - .051 .020 - .043	.030 - .061 .025 - .053	.046 - .086 .036 - .071	.051 - .102 .041 - .086	.061 - .122 .051 - .107	.091 - .173 .071 - .142
MEDIUM ALLOY TOOL STEELS									
4140, 4340, 52100, 6150, 8620	< 40 > 40	130 - 180 90 - 135	.023 - .046 .018 - .038	.025 - .053 .020 - .046	.030 - .064 .025 - .056	.046 - .091 .036 - .076	.051 - .107 .041 - .091	.061 - .127 .051 - .112	.091 - .183 .071 - .152
CARBON STEELS									
1000's - 1018, 1020, 12L14	< 40	135 - 220	.028 - .048	.030 - .056	.036 - .066	.056 - .097	.061 - .112	.071 - .132	.112 - .193
K									
CAST MATERIAL									
Ductile Iron		130 - 190	.028 - .048	.030 - .056	.036 - .066	.056 - .097	.061 - .112	.071 - .132	.112 - .193
Gray Iron		170 - 215	.030 - .053	.033 - .061	.038 - .071	.061 - .107	.066 - .122	.076 - .142	.122 - .213

	Profile/Trochoidal Milling
Axial (ap)	up to 2xD
Radial (ae)	5% - 15% of Dia.



NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

GARR TOOL High Performance Milling Guide for VRX-6 (HIGH EFFICIENCY MILLING)

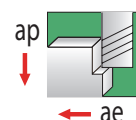
TECHNICAL

NOTE - DATA DOES NOT REFLECT CHIP THINNING.

SPINDLE INTERFACE MUST BE SCRUTINIZED WHEN USING 5/8" DIAMETER AND LARGER END MILLS

	ISO Material	HRC	SFM (Vc)	CHIPLOAD PER TOOTH (Fz)						
				1/4"	3/8"	1/2"	5/8"	3/4"	1"	
S	COBALT BASE ALLOYS									
	Haynes 25/188, Stellite 21, Cobalt Chrome	< 40	115 - 230	.006" - .012"	.006" - .014"	.011" - .023"	.011" - .023"	.012" - .028"	.022" - .046"	
		> 40	95 - 190	.004" - .010"	.005" - .013"	.008" - .020"	.009" - .021"	.010" - .026"	.016" - .040"	
	NICKEL BASE ALLOYS									
	Inconel-625/718, Waspaloy, Invar, Rene, Hastelloy, Monel	< 40	115 - 230	.006" - .013"	.008" - .016"	.012" - .024"	.012" - .025"	.016" - .032"	.024" - .048"	
		> 40	95 - 190	.003" - .007"	.007" - .015"	.008" - .020"	.011" - .022"	.014" - .030"	.016" - .040"	
	IRON BASE ALLOYS									
	A286, Discaloy, Haynes 556, Carpenter 22, Greek Ascology	< 40	115 - 230	.006" - .012"	.008" - .014"	.011" - .023"	.012" - .024"	.016" - .028"	.022" - .046"	
		> 40	95 - 190	.003" - .007"	.005" - .013"	.007" - .019"	.010" - .022"	.010" - .026"	.014" - .038"	
	TITANIUM ALLOYS									
Commercially Pure, 6Al-4V, Astmn 1/2/3, 6Al-25N-4Zr-2Mo-Si 5553 / Beta Titanium		250 - 470	.010" - .015"	.015" - .025"	.020" - .030"	.025" - .035"	.030" - .050"	.040" - .060"		
		185 - 350	.008" - .014"	.012" - .022"	.016" - .028"	.023" - .034"	.024" - .044"	.032" - .056"		
M	STAINLESS STEELS									
	13/8, 15/5, 17-4, pH Types	< 40	280 - 470	.008" - .015"	.010" - .017"	.016" - .030"	.018" - .031"	.020" - .034"	.032" - .060"	
		> 40	215 - 345	.006" - .013"	.009" - .016"	.012" - .026"	.013" - .028"	.018" - .032"	.024" - .052"	
	300 Series, 304L, Nitronic 50, Duplex, Super-Austenitic	< 40	310 - 500	.008" - .015"	.010" - .017"	.016" - .030"	.017" - .028"	.020" - .034"	.032" - .060"	
		> 40	215 - 345	.006" - .013"	.008" - .015"	.012" - .026"	.014" - .024"	.016" - .030"	.022" - .038"	
	400 Series - 403, 405, 420, 455	< 40	280 - 530	.008" - .016"	.010" - .018"	.016" - .032"	.020" - .035"	.020" - .036"	.032" - .064"	
> 40		215 - 405	.006" - .014"	.009" - .017"	.012" - .028"	.013" - .030"	.018" - .034"	.024" - .056"		
P	HIGH STRENGTH TOOL STEELS									
	A2, D2, P20, H13, S7, O1	< 40	280 - 500	.008" - .015"	.013" - .023"	.018" - .029"	.024" - .034"	.034" - .044"	.036" - .048"	
		> 40	185 - 410	.006" - .013"	.012" - .020"	.014" - .022"	.020" - .028"	.024" - .032"	.030" - .040"	
	MEDIUM ALLOY TOOL STEELS									
	4140, 4340, 52100, 6150, 8620	< 40	435 - 625	.010" - .016"	.013" - .024"	.018" - .029"	.024" - .034"	.034" - .044"	.036" - .048"	
		> 40	310 - 470	.007" - .012"	.012" - .020"	.014" - .022"	.020" - .028"	.024" - .032"	.030" - .040"	
CARBON STEELS										
1000's - 1018, 1020, 12L14	< 40	465 - 750	.010" - .017"	.013" - .025"	.018" - .029"	.024" - .034"	.034" - .044"	.036" - .048"		
K	CAST MATERIAL									
	Ductile Iron		435 - 660	.012" - .019"	.015" - .026"	.024" - .038"	.026" - .050"	.030" - .052"	.048" - .076"	
	Gray Iron		560 - 740	.013" - .021"	.016" - .027"	.026" - .042"	.028" - .052"	.032" - .064"	.052" - .084"	

	Profile/Trochoidal Milling
Axial (ap)	up to 2xD
Radial (ae)	5% - 15% of Dia.



NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

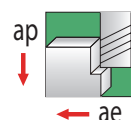
GARR TOOL High Performance Milling Guide for VRX-6 (HIGH EFFICIENCY MILLING)

NOTE - DATA DOES NOT REFLECT CHIP THINNING.

SPINDLE INTERFACE MUST BE SCRUTINIZED WHEN USING 16mm DIAMETER AND LARGER END MILLS

ISO Material	HRC	M/Min. (Vc)	CHIPLOAD PER TOOTH (Fz)						
			6.0mm	8.0mm	10.0mm	12.0mm	16.0mm	20.0mm	25.0mm
S									
COBALT BASE ALLOYS									
Haynes 25/188, Stellite 21, Cobalt Chrome	< 40	35 - 70	.015 - .030	.015 - .033	.015 - .036	.028 - .058	.028 - .058	.030 - .071	.056 - .117
	> 40	30 - 57	.010 - .025	.010 - .030	.013 - .033	.020 - .051	.023 - .053	.025 - .066	.041 - .102
NICKEL BASE ALLOYS									
Inconel-625/718, Waspaloy, Invar, Rene, Hastelloy, Monel	< 40	35 - 70	.015 - .033	.020 - .035	.020 - .041	.030 - .061	.030 - .064	.041 - .081	.061 - .122
	> 40	30 - 57	.008 - .018	.013 - .028	.018 - .038	.020 - .051	.028 - .056	.036 - .076	.041 - .102
IRON BASE ALLOYS									
A286, Discaloy, Haynes 556, Carpenter 22, Greek Ascology	< 40	35 - 70	.015 - .030	.020 - .033	.020 - .036	.028 - .058	.030 - .061	.041 - .071	.056 - .117
	> 40	30 - 57	.008 - .018	.010 - .025	.013 - .033	.018 - .048	.025 - .056	.025 - .066	.036 - .097
TITANIUM ALLOYS									
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25Ni-4Zr-2Mo-Si		75 - 140	.025 - .038	.030 - .050	.038 - .064	.051 - .076	.064 - .089	.076 - .127	.102 - .152
		57 - 110	.020 - .036	.025 - .046	.030 - .056	.041 - .071	.058 - .086	.061 - .112	.081 - .142
M									
STAINLESS STEELS									
13/8, 15/5, 17-4, pH Types	< 40	85 - 140	.020 - .038	.023 - .040	.025 - .043	.041 - .076	.046 - .079	.051 - .086	.081 - .152
	> 40	65 - 105	.015 - .033	.020 - .038	.023 - .041	.030 - .066	.033 - .071	.046 - .081	.061 - .132
300 Series, 304L, Nitronic 50, Duplex, Super-Austenitic	< 40	95 - 150	.020 - .038	.023 - .040	.025 - .043	.041 - .076	.043 - .071	.051 - .086	.081 - .152
	> 40	65 - 105	.015 - .033	.018 - .035	.020 - .038	.030 - .066	.036 - .061	.041 - .076	.056 - .097
400 Series - 403, 405, 420, 455	< 40	85 - 160	.020 - .041	.023 - .043	.025 - .046	.041 - .081	.051 - .089	.051 - .091	.081 - .163
	> 40	65 - 125	.015 - .036	.020 - .040	.023 - .043	.030 - .071	.033 - .076	.046 - .086	.061 - .142
P									
HIGH STRENGTH TOOL STEELS									
A2, D2, P20, H13, S7, O1	< 40	85 - 150	.020 - .038	.025 - .048	.033 - .058	.046 - .061	.061 - .086	.086 - .112	.091 - .122
	> 40	57 - 125	.015 - .033	.022 - .042	.030 - .051	.041 - .056	.051 - .071	.061 - .081	.076 - .102
MEDIUM ALLOY TOOL STEELS									
4140, 4340, 52100, 6150, 8620	< 40	130 - 190	.025 - .041	.029 - .051	.033 - .061	.046 - .061	.061 - .086	.086 - .112	.091 - .122
	> 40	95 - 140	.018 - .030	.025 - .041	.030 - .051	.041 - .056	.051 - .071	.061 - .081	.076 - .102
CARBON STEELS									
1000's - 1018, 1020, 12L14	< 40	140 - 230	.025 - .043	.029 - .053	.033 - .064	.046 - .061	.061 - .086	.086 - .112	.091 - .122
K									
CAST MATERIAL									
Ductile Iron		130 - 200	.030 - .048	.034 - .056	.038 - .066	.061 - .097	.066 - .127	.076 - .132	.122 - .193
Gray Iron		170 - 225	.033 - .053	.037 - .061	.041 - .069	.066 - .107	.071 - .132	.081 - .163	.132 - .213

	Profile/Trochoidal Milling
Axial (ap)	up to 2xD
Radial (ae)	5% - 15% of Dia.



NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

GARR TOOL High Performance Milling Guide for VX-7, VX-7C (HIGH EFFICIENCY MILLING)

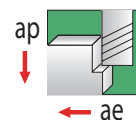
TECHNICAL

NOTE - DATA DOES NOT REFLECT CHIP THINNING.

SPINDLE INTERFACE MUST BE SCRUTINIZED WHEN USING 5/8" DIAMETER AND LARGER END MILLS

ISO Material	HRC	SFM (Vc)	CHIPLOAD PER TOOTH (Fz)				
			3/8"	1/2"	5/8"	3/4"	1"
COBALT BASE ALLOYS							
Haynes 25/188, Stellite 21, Cobalt Chrome	< 40	120 - 240	.0013" - .0026"	.0019" - .0036"	.0021" - .0043"	.0026" - .0052"	.0038" - .0072"
	> 40	100 - 195	.0010" - .0024"	.0014" - .0031"	.0017" - .0038"	.0020" - .0048"	.0028" - .0062"
NICKEL BASE ALLOYS							
Inconel-625/718, Waspaloy, Invar, Rene, Hastelloy, Monel	< 40	120 - 240	.0013" - .0026"	.0019" - .0036"	.0021" - .0043"	.0026" - .0052"	.0038" - .0072"
	> 40	100 - 195	.0010" - .0024"	.0014" - .0031"	.0017" - .0038"	.0020" - .0048"	.0028" - .0062"
IRON BASE ALLOYS							
A286, Discaloy, Haynes 556, Carpenter 22, Greek Ascology	< 40	120 - 240	.0013" - .0026"	.0019" - .0036"	.0021" - .0043"	.0026" - .0052"	.0038" - .0072"
	> 40	100 - 195	.0010" - .0024"	.0014" - .0031"	.0017" - .0038"	.0020" - .0048"	.0028" - .0062"
TITANIUM ALLOYS							
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25N-4Zr-2Mo-Si		260 - 490	.0014" - .0028"	.0021" - .0040"	.0026" - .0048"	.0028" - .0056"	.0042" - .0080"
		195 - 365	.0014" - .0026"	.0021" - .0036"	.0026" - .0043"	.0028" - .0052"	.0042" - .0072"
5553 / Beta Titanium							
			.0014" - .0026"	.0021" - .0036"	.0026" - .0043"	.0028" - .0052"	.0042" - .0072"
STAINLESS STEELS							
13/8, 15/5, 17-4, pHTypes	< 40	290 - 490	.0013" - .0026"	.0019" - .0036"	.0022" - .0043"	.0026" - .0052"	.0038" - .0072"
	> 40	225 - 360	.0010" - .0024"	.0014" - .0031"	.0017" - .0039"	.0020" - .0048"	.0028" - .0062"
300 Series, 304L, Nitronic 50, Duplex, Super-Austenitic	< 40	325 - 520	.0013" - .0026"	.0019" - .0036"	.0022" - .0043"	.0026" - .0052"	.0038" - .0072"
	> 40	225 - 360	.0010" - .0024"	.0014" - .0031"	.0017" - .0039"	.0020" - .0048"	.0028" - .0062"
400 Series - 403, 405, 420, 455	< 40	290 - 555	.0013" - .0028"	.0019" - .0038"	.0022" - .0046"	.0026" - .0056"	.0038" - .0076"
	> 40	225 - 425	.0010" - .0025"	.0014" - .0034"	.0017" - .0041"	.0020" - .0050"	.0028" - .0068"
HIGH STRENGTH TOOL STEELS							
A2, D2, P20, H13, S7, O1	< 40	290 - 520	.0016" - .0028"	.0024" - .0038"	.0026" - .0046"	.0032" - .0056"	.0048" - .0076"
	> 40	195 - 425	.0014" - .0024"	.0022" - .0031"	.0024" - .0038"	.0028" - .0048"	.0044" - .0062"
MEDIUM ALLOY TOOL STEELS							
4140, 4340, 52100, 6150, 8620	< 40	455 - 650	.0016" - .0029"	.0024" - .0040"	.0026" - .0048"	.0032" - .0058"	.0048" - .0080"
	> 40	325 - 490	.0014" - .0024"	.0022" - .0033"	.0024" - .0040"	.0028" - .0048"	.0044" - .0066"
CARBON STEELS							
1000's - 1018, 1020, 12L14	< 40	490 - 780	.0016" - .0030"	.0024" - .0043"	.0026" - .0050"	.0032" - .0060"	.0048" - .0086"
CAST MATERIAL							
Ductile Iron		455 - 685	.0018" - .0031"	.0029" - .0046"	.0031" - .0053"	.0036" - .0062"	.0058" - .0092"
Gray Iron		585 - 770	.0019" - .0032"	.0031" - .0048"	.0034" - .0055"	.0038" - .0064"	.0062" - .0096"

	Profile/Trochoidal Milling
Axial (ap)	up to 2xD
Radial (ae)	5% - 15% of Dia.



NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

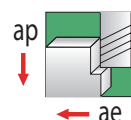
GARR TOOL High Performance Milling Guide for VX-7, VX-7C (HIGH EFFICIENCY MILLING)

NOTE - DATA DOES NOT REFLECT CHIP THINNING.

SPINDLE INTERFACE MUST BE SCRUTINIZED WHEN USING 16mm DIAMETER AND LARGER END MILLS

ISO Material	HRC	M/Min. (Vc)	CHIPLOAD PER TOOTH (Fz)					
			8.0mm	10.0mm	12.0mm	16.0mm	20.0mm	25.0mm
COBALT BASE ALLOYS								
Haynes 25/188, Stellite 21, Cobalt Chrome	< 40	35 - 75	.024 - .046	.033 - .066	.048 - .091	.053 - .109	.066 - .132	.097 - .183
	> 40	30 - 60	.018 - .040	.025 - .061	.036 - .079	.043 - .097	.051 - .122	.071 - .157
NICKEL BASE ALLOYS								
Inconel-625/718, Waspaloy, Invar, Rene, Hastelloy, Monel	< 40	35 - 75	.024 - .046	.033 - .066	.048 - .091	.053 - .109	.066 - .132	.097 - .183
	> 40	30 - 60	.018 - .040	.025 - .061	.036 - .079	.043 - .097	.051 - .122	.071 - .157
IRON BASE ALLOYS								
A286, Discaloy, Haynes 556, Carpenter 22, Greek Ascology	< 40	35 - 75	.024 - .046	.033 - .066	.048 - .091	.053 - .109	.066 - .132	.097 - .183
	> 40	30 - 60	.018 - .040	.025 - .061	.036 - .079	.043 - .097	.051 - .122	.071 - .157
TITANIUM ALLOYS								
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25N-4Zr-2Mo-Si 5553 / Beta Titanium		80 - 150	.026 - .051	.036 - .071	.053 - .102	.066 - .122	.071 - .142	.107 - .203
		60 - 110	.026 - .046	.036 - .066	.053 - .091	.066 - .109	.071 - .132	.107 - .183
STAINLESS STEELS								
13/8, 15/5, 17-4, pH Types	< 40	90 - 150	.024 - .046	.033 - .066	.048 - .091	.056 - .109	.066 - .132	.097 - .183
	> 40	70 - 110	.018 - .040	.025 - .061	.036 - .079	.043 - .099	.051 - .122	.071 - .157
300 Series, 304L, Nitronic 50, Duplex, Super-Austenitic	< 40	100 - 160	.024 - .052	.033 - .066	.048 - .091	.056 - .109	.066 - .132	.097 - .183
	> 40	70 - 110	.018 - .040	.025 - .061	.036 - .079	.043 - .099	.051 - .122	.071 - .157
400 Series - 403, 405, 420, 455	< 40	90 - 170	.024 - .051	.033 - .071	.048 - .097	.056 - .117	.066 - .142	.097 - .193
	> 40	70 - 130	.018 - .043	.025 - .064	.036 - .086	.043 - .104	.051 - .127	.071 - .173
HIGH STRENGTH TOOL STEELS								
A2, D2, P20, H13, S7, O1	< 40	90 - 160	.032 - .051	.041 - .071	.061 - .097	.066 - .117	.081 - .142	.122 - .193
	> 40	60 - 130	.026 - .040	.036 - .061	.056 - .079	.061 - .097	.071 - .122	.112 - .157
MEDIUM ALLOY TOOL STEELS								
4140, 4340, 52100, 6150, 8620	< 40	140 - 200	.032 - .053	.041 - .074	.061 - .102	.066 - .122	.081 - .147	.122 - .203
	> 40	100 - 150	.026 - .040	.036 - .061	.056 - .084	.061 - .102	.071 - .122	.112 - .168
CARBON STEELS								
1000's - 1018, 1020, 12L14	< 40	150 - 240	.032 - .053	.041 - .076	.061 - .109	.066 - .127	.081 - .152	.122 - .218
CAST MATERIAL								
Ductile Iron		140 - 210	.035 - .057	.046 - .079	.074 - .117	.079 - .135	.091 - .157	.147 - .234
Gray Iron		180 - 235	.036 - .060	.048 - .081	.079 - .122	.086 - .140	.097 - .163	.157 - .244

	Profile/Trochoidal Milling
Axial (ap)	up to 2xD
Radial (ae)	5% - 15% of Dia.



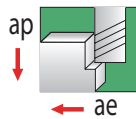
NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

GARR TOOL Milling Guide for TMS / TMR (HIGH EFFICIENCY MILLING)

NOTE - CHIP THINNING CALCULATION ALREADY APPLIED

**CHIPLOAD PER TOOTH (Fz) AT 2% RADIAL ENGAGEMENT (USING PROGRAMMED CALCULATION - SEE PAGE 304)
SPINDLE INTERFACE MUST BE SCRUTINIZED WHEN USING 5/8" DIAMETER AND LARGER END MILLS**

ISO Material	SFM (Vc)	CHIPLOAD PER TOOTH (Fz)							
		1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"	
S	TITANIUM ALLOYS								
	6Al-4V	250 - 400	.0020" - .0042"	.0030" - .0052"	.0035" - .0065"	.0043" - .0078"	.0052" - .0095"	.0065" - .0115"	.0080" - .0143"
	5553	150 - 250	.0015" - .0028"	.0018" - .0035"	.0025" - .0043"	.0030" - .0055"	.0035" - .0065"	.0042" - .0080"	.0052" - .0095"
M	STAINLESS STEELS								
	Free Machining (303)	300 - 400	.0020" - .0042"	.0027" - .0052"	.0035" - .0065"	.0043" - .0078"	.0052" - .0095"	.0065" - .0115"	.0080" - .0143"
	Austenitic (304 / 304L)	225 - 350	.0017" - .0035"	.0025" - .0043"	.0030" - .0052"	.0035" - .0065"	.0043" - .0078"	.0052" - .0095"	.0065" - .0115"
	Martensitic (17-4 / 416)	200 - 250	.0015" - .0028"	.0018" - .0035"	.0025" - .0043"	.0030" - .0055"	.0035" - .0065"	.0042" - .0080"	.0052" - .0095"
P	MEDIUM ALLOY TOOL STEELS								
	8620	250 - 400	.0017" - .0035"	.0025" - .0043"	.0030" - .0052"	.0035" - .0065"	.0043" - .0078"	.0052" - .0095"	.0065" - .0115"
	4140, D2, S7	250 - 350	.0015" - .0028"	.0018" - .0035"	.0025" - .0043"	.0030" - .0055"	.0035" - .0065"	.0042" - .0080"	.0052" - .0095"
	CARBON STEELS								
	1000 Series, A36, 12L14	300 - 500	.0020" - .0042"	.0027" - .0052"	.0035" - .0065"	.0043" - .0078"	.0052" - .0095"	.0065" - .0115"	.0080" - .0143"
	CAST STEELS								
Steel	250 - 350	.0020" - .0042"	.0027" - .0052"	.0035" - .0065"	.0043" - .0078"	.0052" - .0095"	.0065" - .0115"	.0080" - .0143"	
K	CAST MATERIAL								
	Ductile Iron	250 - 350	.0020" - .0042"	.0027" - .0052"	.0035" - .0065"	.0043" - .0078"	.0052" - .0095"	.0065" - .0115"	.0080" - .0143"
	Gray Iron	250 - 350	.0020" - .0042"	.0027" - .0052"	.0035" - .0065"	.0043" - .0078"	.0052" - .0095"	.0065" - .0115"	.0080" - .0143"
N	NON-FERROUS								
	Aluminum (6061-T6)	300 - 500	.0020" - .0042"	.0027" - .0052"	.0035" - .0065"	.0043" - .0078"	.0052" - .0095"	.0065" - .0115"	.0080" - .0143"
	Copper, Brass	175 - 350	.0017" - .0042"	.0025" - .0052"	.0030" - .0065"	.0035" - .0078"	.0043" - .0095"	.0052" - .0115"	.0065" - .0143"



ap = full flute length
ae = 2%

NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

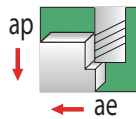
GARR TOOL Milling Guide for TMS / TMR (HIGH EFFICIENCY MILLING)

NOTE - CHIP THINNING CALCULATION ALREADY APPLIED

CHIPLOAD PER TOOTH (Fz) AT 2% RADIAL ENGAGEMENT (USING PROGRAMMED CALCULATION - SEE PAGE 305)

SPINDLE INTERFACE MUST BE SCRUTINIZED WHEN USING 16mm DIAMETER AND LARGER END MILLS

ISO Material	M/Min. (Vc)	CHIPLOAD PER TOOTH (Fz)								
		6.0mm	8.0mm	10.0mm	12.0mm	16.0mm	20.0mm	25.0mm		
S	TITANIUM ALLOYS									
	6Al-4V	98 - 157	.051 - .107	.076 - .132	.089 - .165	.109 - .198	.132 - .241	.165 - .292	.132 - .363	
	5553	59 - 98	.038 - .071	.046 - .089	.064 - .109	.076 - .140	.089 - .165	.107 - .203	.132 - .241	
M	STAINLESS STEELS									
	Free Machining (303)	118 - 157	.051 - .107	.069 - .132	.089 - .165	.109 - .198	.132 - .241	.165 - .292	.132 - .363	
	Austenitic (304 / 304L)	89 - 138	.043 - .089	.064 - .109	.076 - .132	.089 - .165	.109 - .198	.132 - .241	.165 - .292	
	Martensitic (17-4 / 416)	79 - 98	.038 - .071	.046 - .089	.064 - .109	.076 - .140	.089 - .165	.107 - .203	.132 - .241	
P	MEDIUM ALLOY TOOL STEELS									
	8620	98 - 157	.043 - .089	.064 - .109	.076 - .132	.089 - .165	.109 - .198	.132 - .241	.165 - .292	
	4140, D2, S7	98 - 138	.038 - .071	.046 - .089	.064 - .109	.076 - .140	.089 - .165	.107 - .203	.132 - .241	
	CARBON STEELS									
	1000 Series, A36, 12L14	118 - 197	.051 - .107	.069 - .132	.089 - .165	.109 - .198	.132 - .241	.165 - .292	.203 - .363	
	CAST STEELS									
	Steel	98 - 138	.051 - .107	.069 - .132	.089 - .165	.109 - .198	.132 - .241	.165 - .292	.203 - .363	
K	CAST MATERIAL									
	Ductile Iron	98 - 138	.051 - .107	.069 - .132	.089 - .165	.109 - .198	.132 - .241	.165 - .292	.203 - .363	
	Gray Iron	98 - 138	.051 - .107	.069 - .132	.089 - .165	.109 - .198	.132 - .241	.165 - .292	.203 - .363	
N	NON-FERROUS									
	Aluminum (6061-T6)	90 - 150	.050 - .105	.075 - .130	.090 - .165	.105 - .200	.130 - .240	.165 - .292	.203 - .363	
	Copper, Brass	60 - 110	.043 - .105	.064 - .130	.076 - .165	.089 - .200	.109 - .240	.132 - .292	.165 - .363	

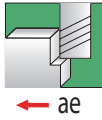


ap = full flute length
ae = 2%

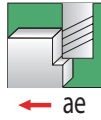
NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

Chip Thinning Calculations for TMS / TMR End Mills

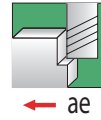
ae = 3%



ae = 2%



ae = 1%



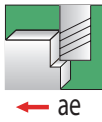
3% Radial Engagement (.03 x d)	
Actual (CPT)	Programmed (CPT)
.0002"	.0005"
.0003"	.0010"
.0005"	.0015"
.0007"	.0020"
.0009"	.0025"
.0010"	.0030"
.0012"	.0035"
.0014"	.0040"
.0015"	.0045"
.0017"	.0050"
.0019"	.0055"
.0020"	.0060"
.0022"	.0065"
.0024"	.0070"
.0026"	.0075"
.0027"	.0080"
.0029"	.0085"
.0031"	.0090"
.0032"	.0095"
.0034"	.0100"
.0036"	.0105"
.0037"	.0110"
.0039"	.0115"
.0041"	.0120"
.0043"	.0125"
.0044"	.0130"
.0046"	.0135"
.0048"	.0140"
.0049"	.0145"
.0051"	.0150"
.0053"	.0155"
.0054"	.0160"
.0056"	.0165"
.0058"	.0170"
.0060"	.0175"
.0061"	.0180"
.0063"	.0185"
.0065"	.0190"
.0066"	.0195"
.0068"	.0200"

2% Radial Engagement (.02 x d)	
Actual (CPT)	Programmed (CPT)
.0001"	.0005"
.0003"	.0010"
.0004"	.0015"
.0006"	.0020"
.0007"	.0025"
.0008"	.0030"
.0010"	.0035"
.0011"	.0040"
.0013"	.0045"
.0014"	.0050"
.0015"	.0055"
.0017"	.0060"
.0018"	.0065"
.0020"	.0070"
.0021"	.0075"
.0022"	.0080"
.0024"	.0085"
.0025"	.0090"
.0027"	.0095"
.0028"	.0100"
.0029"	.0105"
.0031"	.0110"
.0032"	.0115"
.0034"	.0120"
.0035"	.0125"
.0036"	.0130"
.0038"	.0135"
.0039"	.0140"
.0041"	.0145"
.0042"	.0150"
.0043"	.0155"
.0045"	.0160"
.0046"	.0165"
.0048"	.0170"
.0049"	.0175"
.0050"	.0180"
.0052"	.0185"
.0053"	.0190"
.0055"	.0195"
.0056"	.0200"

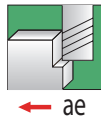
1% Radial Engagement (.01 x d)	
Actual (CPT)	Programmed (CPT)
.0001"	.0005"
.0002"	.0010"
.0003"	.0015"
.0004"	.0020"
.0005"	.0025"
.0006"	.0030"
.0007"	.0035"
.0008"	.0040"
.0009"	.0045"
.0010"	.0050"
.0011"	.0055"
.0012"	.0060"
.0013"	.0065"
.0014"	.0070"
.0015"	.0075"
.0016"	.0080"
.0017"	.0085"
.0018"	.0090"
.0019"	.0095"
.0020"	.0100"
.0021"	.0105"
.0022"	.0110"
.0023"	.0115"
.0024"	.0120"
.0025"	.0125"
.0026"	.0130"
.0027"	.0135"
.0028"	.0140"
.0029"	.0145"
.0030"	.0150"
.0031"	.0155"
.0032"	.0160"
.0033"	.0165"
.0034"	.0170"
.0035"	.0175"
.0036"	.0180"
.0037"	.0185"
.0038"	.0190"
.0039"	.0195"
.0040"	.0200"

Chip Thinning Calculations for TMS / TMR End Mills

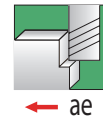
ae = 3%



ae = 2%



ae = 1%



3% Radial Engagement (.03 x d)	
Actual (CPT)	Programmed (CPT)
.0043mm	.0127mm
.0086mm	.0254mm
.0130mm	.0381mm
.0173mm	.0508mm
.0216mm	.0635mm
.0259mm	.0762mm
.0302mm	.0889mm
.0345mm	.1016mm
.0389mm	.1143mm
.0432mm	.1270mm
.0475mm	.1397mm
.0518mm	.1524mm
.0561mm	.1651mm
.0605mm	.1778mm
.0648mm	.1905mm
.0691mm	.2032mm
.0734mm	.2159mm
.0777mm	.2286mm
.0820mm	.2413mm
.0864mm	.2540mm
.0907mm	.2667mm
.0950mm	.2794mm
.0993mm	.2921mm
.1036mm	.3048mm
.1080mm	.3175mm
.1123mm	.3302mm
.1166mm	.3429mm
.1209mm	.3556mm
.1252mm	.3683mm
.1295mm	.3810mm
.1339mm	.3937mm
.1382mm	.4064mm
.1425mm	.4191mm
.1468mm	.4318mm
.1511mm	.4445mm
.1554mm	.4572mm
.1598mm	.4699mm
.1641mm	.4826mm
.1684mm	.4953mm
.1727mm	.5080mm

2% Radial Engagement (.02 x d)	
Actual (CPT)	Programmed (CPT)
.0036mm	.0127mm
.0071mm	.0254mm
.0107mm	.0381mm
.0142mm	.0508mm
.0178mm	.0635mm
.0213mm	.0762mm
.0249mm	.0889mm
.0284mm	.1016mm
.0320mm	.1143mm
.0356mm	.1270mm
.0391mm	.1397mm
.0427mm	.1524mm
.0462mm	.1651mm
.0498mm	.1778mm
.0533mm	.1905mm
.0569mm	.2032mm
.0605mm	.2159mm
.0640mm	.2286mm
.0676mm	.2413mm
.0711mm	.2540mm
.0747mm	.2667mm
.0782mm	.2794mm
.0818mm	.2921mm
.0853mm	.3048mm
.0889mm	.3175mm
.0925mm	.3302mm
.0960mm	.3429mm
.0996mm	.3556mm
.1031mm	.3683mm
.1067mm	.3810mm
.1102mm	.3937mm
.1138mm	.4064mm
.1173mm	.4191mm
.1209mm	.4318mm
.1245mm	.4445mm
.1280mm	.4572mm
.1316mm	.4699mm
.1351mm	.4826mm
.1387mm	.4953mm
.1422mm	.5080mm

1% Radial Engagement (.01 x d)	
Actual (CPT)	Programmed (CPT)
.0025mm	.0127mm
.0051mm	.0254mm
.0076mm	.0381mm
.0102mm	.0508mm
.0127mm	.0635mm
.0152mm	.0762mm
.0178mm	.0889mm
.0203mm	.1016mm
.0229mm	.1143mm
.0254mm	.1270mm
.0279mm	.1397mm
.0305mm	.1524mm
.0330mm	.1651mm
.0356mm	.1778mm
.0381mm	.1905mm
.0406mm	.2032mm
.0432mm	.2159mm
.0457mm	.2286mm
.0483mm	.2413mm
.0508mm	.2540mm
.0533mm	.2667mm
.0559mm	.2794mm
.0584mm	.2921mm
.0610mm	.3048mm
.0635mm	.3175mm
.0660mm	.3302mm
.0686mm	.3429mm
.0711mm	.3556mm
.0737mm	.3683mm
.0762mm	.3810mm
.0787mm	.3937mm
.0813mm	.4064mm
.0838mm	.4191mm
.0864mm	.4318mm
.0889mm	.4445mm
.0914mm	.4572mm
.0940mm	.4699mm
.0965mm	.4826mm
.0991mm	.4953mm
.1016mm	.5080mm