

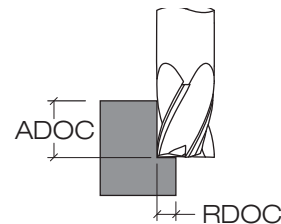
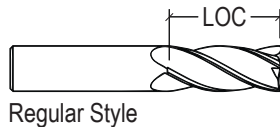
## Feed Rate Guide: REGULAR STYLE

Material Guide	STEEL				STAINLESS STEEL				CAST IRON		HI-TEMP ALLOYS	
	10xx 11xx 12xx 12Lxx 15xx	13xx 41xx 43xx 86xx 92xx 93xx Chromoly	A2 H13 A3 M1 D2 O-1 H11 S-7 NAK 55	P20 P21 S-136 PX5 NAK 80	410 430F 416 440C 420	303 320 304 304L 316 316L 321 347 Kovar Invar 36	13-8 15-5 17-4 Carpenter Custom 465 Invar	Grey GG-10 GG-15 GG-20/25 GG-30/35 GG-40	Ductile (Nodular) Malleable GGG-40 GGG-50 GGG-60 GGG-70	Inconel 718 Inconel 600 Rene 100 Rene 41 A286 Haynes Waspalloy H-188 Hastalloy Hast-X Mar-M Stellite AirResist Monel	Ti6Al4V (grades 5-38)	
<b>Surface Feet per Minute (SFM)</b>												
SFM	< 42 Rc	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	
	≥ 42 Rc	360 - 440	200 - 400	200 - 300	200 - 300	270 - 330	160 - 300	130 - 250	300 - 450	200 - 320	70 - 110	
<b>Feed per Tooth (FPT)</b>												
1/8	Slot	.0006 - .0008	.0005 - .0007	.0005 - .0006	.0005 - .0006	.0005 - .0007	.0005 - .0006	.0005 - .0006	.0006 - .0008	.0005 - .0006	.0003 - .0004	
	HR	.0008 - .0010	.0007 - .0008	.0006 - .0008	.0006 - .0007	.0007 - .0008	.0006 - .0008	.0006 - .0007	.0008 - .0010	.0007 - .0008	.0004 - .0004	
1/4	Slot	.0013 - .0015	.0011 - .0013	.0010 - .0012	.0009 - .0011	.0011 - .0013	.0010 - .0012	.0009 - .0011	.0013 - .0015	.0010 - .0013	.0006 - .0007	
	HR	.0016 - .0019	.0014 - .0017	.0013 - .0015	.0011 - .0014	.0014 - .0017	.0013 - .0015	.0011 - .0014	.0016 - .0019	.0013 - .0016	.0007 - .0009	
3/8	Slot	.0019 - .0023	.0016 - .0020	.0015 - .0018	.0014 - .0017	.0016 - .0020	.0015 - .0018	.0014 - .0017	.0019 - .0023	.0016 - .0019	.0009 - .0011	
	HR	.0024 - .0029	.0020 - .0025	.0019 - .0023	.0017 - .0021	.0020 - .0025	.0019 - .0023	.0017 - .0021	.0024 - .0029	.0020 - .0024	.0011 - .0013	
1/2	Slot	.0025 - .0031	.0022 - .0026	.0020 - .0025	.0018 - .0022	.0022 - .0026	.0020 - .0025	.0018 - .0022	.0025 - .0031	.0021 - .0026	.0012 - .0015	
	HR	.0032 - .0039	.0027 - .0033	.0025 - .0031	.0023 - .0028	.0027 - .0033	.0025 - .0031	.0023 - .0028	.0032 - .0039	.0026 - .0032	.0014 - .0018	
5/8	Slot	.0032 - .0039	.0027 - .0033	.0025 - .0031	.0023 - .0028	.0027 - .0033	.0025 - .0031	.0023 - .0028	.0032 - .0039	.0026 - .0032	.0014 - .0018	
	HR	.0039 - .0048	.0034 - .0041	.0032 - .0039	.0028 - .0034	.0034 - .0041	.0032 - .0039	.0028 - .0034	.0039 - .0048	.0033 - .0040	.0018 - .0022	
3/4	Slot	.0038 - .0046	.0032 - .0040	.0030 - .0037	.0027 - .0033	.0032 - .0040	.0030 - .0037	.0027 - .0033	.0038 - .0046	.0031 - .0038	.0017 - .0021	
	HR	.0047 - .0058	.0041 - .0050	.0038 - .0046	.0034 - .0041	.0041 - .0050	.0038 - .0046	.0034 - .0041	.0047 - .0058	.0039 - .0048	.0022 - .0026	
1	Slot	.0059 - .0072	.0051 - .0062	.0047 - .0058	.0042 - .0052	.0051 - .0062	.0047 - .0058	.0042 - .0052	.0059 - .0072	.0049 - .0060	.0027 - .0033	
	HR	.0063 - .0077	.0054 - .0066	.0050 - .0062	.0045 - .0055	.0054 - .0066	.0050 - .0062	.0045 - .0055	.0063 - .0077	.0052 - .0064	.0029 - .0035	



## Depth of Cut Guide: REGULAR STYLE

Length of Cut (LOC)	Slotting (S)	Heavy Roughing (HR)	Light Roughing (LR)
	≤ Regular LOC	ADOC = up to 50% of dia.	ADOC = up to 1.5 x dia. RDOC = 30% to 50% of dia.
> Regular LOC	We recommend using reduced neck (RN) tooling for long reach	ADOC = up to 1 x dia. RDOC = 20% to 30% of dia.	ADOC = up to 2 x dia. RDOC = 10% to 15% of dia.



Key: LOC - Length of Cut    ADOC - Axial Depth of Cut  
RDOC - Radial Depth of Cut

Please visit our Technical Section on Pages 98-135 for further assistance.




# HXVR & HXVR-RN Speed & Feed

## Feed Rate Guide: REGULAR STYLE & REDUCED NECK STYLE

Material Guide	STEEL				HARD STEEL	STAINLESS STEEL				CAST IRON		HI-TEMP ALLOYS	
	10xx 11xx 12xx 12Lxx 15xx	13xx 41xx 43xx 86xx 92xx 93xx Chromoly	A2 H13 A3 M1 D2 O-1 H11 S-7 NAK 55	P20 P21 S-136 PX5 NAK 80	Steel Grades > 50Rc.	410 430F 416 440C 420	303 320 304 304L 316 316L 321 347 Kovar Invar 36	13-8 15-5 17-4 Carpenter Custom 465 Invar	Grey GG-10 GG-15 GG-20/25 GG-30/35 GG-40	Ductile (Nodular) Malleable GGG-40 GGG-50 GGG-60 GGG-70	Inconel 718 Inconel 600 Rene 100 Rene 41 A286 Haynes Waspalloy H-188 Hastalloy Hast-X Mar-M Stellite AirResist Monel	Ti61AL4V (grades 5-38)	
<b>Surface Feet per Minute (SFM)</b>													
	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	
SFM	< 42 Rc ≥ 42 Rc	360 - 440 270 - 330	200 - 400 210 - 250	200 - 300 190 - 230	200 - 300 170 - 210	80 - 100	270 - 330 210 - 250	160 - 300 170 - 210	130 - 250 140 - 170	300 - 450 230 - 290	200 - 320 160 - 200	70 - 110 50 - 60	160 - 220 140 - 170
<b>Feed per Tooth (FPT)</b>													
	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	
1/4	Slot HR LR	.0013 - .0015 .0016 - .0019 .0020 - .0024	.0011 - .0013 .0014 - .0017 .0017 - .0021	.0010 - .0012 .0013 - .0015 .0016 - .0019	.0009 - .0011 .0011 - .0014 .0014 - .0017	.0009 - .0011 .0011 - .0013 .0014 - .0017	.0011 - .0013 .0014 - .0017 .0017 - .0021	.0010 - .0012 .0013 - .0015 .0016 - .0019	.0009 - .0011 .0011 - .0014 .0014 - .0017	.0013 - .0015 .0016 - .0019 .0020 - .0024	.0010 - .0013 .0013 - .0016 .0016 - .0020	.0006 - .0007 .0007 - .0009 .0009 - .0011	.0008 - .0010 .0010 - .0012 .0012 - .0015
3/8	Slot HR LR	.0019 - .0023 .0024 - .0029 .0030 - .0036	.0016 - .0020 .0020 - .0025 .0025 - .0031	.0015 - .0018 .0019 - .0023 .0024 - .0029	.0014 - .0017 .0017 - .0021 .0021 - .0026	.0013 - .0016 .0016 - .0020 .0020 - .0025	.0017 - .0021 .0020 - .0025 .0025 - .0031	.0016 - .0020 .0019 - .0023 .0024 - .0029	.0015 - .0018 .0017 - .0021 .0021 - .0026	.0019 - .0023 .0020 - .0024 .0024 - .0029	.0016 - .0019 .0020 - .0024 .0024 - .0030	.0009 - .0011 .0011 - .0013 .0013 - .0016	.0012 - .0015 .0015 - .0018 .0019 - .0023
1/2	Slot HR LR	.0025 - .0031 .0032 - .0039 .0039 - .0048	.0022 - .0026 .0027 - .0033 .0034 - .0041	.0020 - .0025 .0025 - .0031 .0032 - .0039	.0018 - .0022 .0023 - .0028 .0028 - .0034	.0017 - .0021 .0022 - .0026 .0027 - .0033	.0022 - .0026 .0027 - .0033 .0034 - .0041	.0020 - .0025 .0025 - .0031 .0032 - .0039	.0018 - .0022 .0023 - .0028 .0028 - .0034	.0025 - .0031 .0032 - .0039 .0039 - .0048	.0021 - .0026 .0026 - .0032 .0033 - .0040	.0012 - .0014 .0014 - .0018 .0018 - .0022	.0016 - .0019 .0020 - .0024 .0025 - .0030
5/8	Slot HR LR	.0032 - .0039 .0039 - .0048 .0049 - .0060	.0027 - .0033 .0034 - .0041 .0042 - .0052	.0025 - .0031 .0032 - .0039 .0039 - .0048	.0023 - .0028 .0028 - .0034 .0035 - .0043	.0022 - .0026 .0027 - .0033 .0034 - .0041	.0027 - .0033 .0034 - .0041 .0042 - .0052	.0032 - .0039 .0039 - .0048 .0049 - .0060	.0023 - .0028 .0028 - .0034 .0035 - .0043	.0032 - .0039 .0039 - .0048 .0049 - .0060	.0026 - .0032 .0033 - .0040 .0041 - .0050	.0014 - .0018 .0018 - .0022 .0023 - .0028	.0020 - .0024 .0025 - .0030 .0031 - .0038
3/4	Slot HR LR	.0038 - .0046 .0047 - .0058 .0059 - .0072	.0032 - .0040 .0041 - .0050 .0051 - .0062	.0030 - .0037 .0038 - .0046 .0047 - .0058	.0027 - .0033 .0034 - .0041 .0042 - .0052	.0026 - .0032 .0032 - .0040 .0041 - .0050	.0032 - .0040 .0041 - .0050 .0051 - .0062	.0030 - .0037 .0038 - .0046 .0047 - .0058	.0027 - .0033 .0033 - .0040 .0042 - .0052	.0038 - .0046 .0047 - .0058 .0059 - .0072	.0031 - .0038 .0039 - .0048 .0049 - .0060	.0017 - .0021 .0022 - .0026 .0027 - .0033	.0024 - .0029 .0030 - .0036 .0037 - .0045
1	Slot HR LR	.0050 - .0062 .0063 - .0077 .0079 - .0096	.0043 - .0053 .0054 - .0066 .0068 - .0083	.0040 - .0049 .0050 - .0062 .0063 - .0077	.0036 - .0044 .0045 - .0055 .0056 - .0069	.0035 - .0042 .0043 - .0053 .0054 - .0066	.0043 - .0053 .0054 - .0066 .0067 - .0083	.0040 - .0049 .0050 - .0062 .0063 - .0077	.0036 - .0044 .0045 - .0055 .0056 - .0069	.0050 - .0062 .0063 - .0077 .0079 - .0096	.0042 - .0051 .0052 - .0064 .0065 - .0080	.0023 - .0028 .0029 - .0035 .0036 - .0044	.0032 - .0039 .0040 - .0048 .0050 - .0061






### Depth of Cut Guide: REGULAR STYLE

	<i>Slotting (S)</i> 	<i>Heavy Roughing (HR)</i> 	<i>Light Roughing (LR)</i> 
Length of Cut (LOC) ≤ Regular <b>LOC</b>	ADOC (4 flute) = up to 1 x dia. ADOC (5 flute) = up to 50% of dia.	ADOC = up to 1.5 x dia. RDOC (4 flute) = 35% to 50% of dia. RDOC (5 flute) = 25% to 35% of dia.	ADOC = LOC RDOC = 15% to 25% of dia.
Length of Cut (LOC) > Regular <b>LOC</b>	Not Recommended - Utilize necked down tooling if long reach is needed	ADOC = up to 1x dia. RDOC (4 flute) = 25% to 35% of dia. RDOC (5 flute) = 15% to 25% of dia.	ADOC = up to 1.5 x dia. RDOC = 10% to 15% of dia.



### Depth of Cut Guide: REDUCED NECK STYLE

	<i>Slotting (S)</i> 	<i>Heavy Roughing (HR)</i> 	<i>Light Roughing (LR)</i> 
Length Below Shank (LBS) ≤ Regular <b>LBS</b>	ADOC (4 flute) = up to 50% of dia. ADOC (5 flute) = up to 33% of dia.	ADOC = 1.0 to 1.5 x dia. RDOC (4 flute) = 30% to 40% of dia. RDOC (5 flute) = 20% to 30% of dia.	ADOC = LOC RDOC = 15% to 25% of dia.
Length Below Shank (LBS) > Regular <b>LBS</b>	ADOC (4 flute) = up to 33% of dia. ADOC (5 flute) = up to 20% of dia.	ADOC = up to 1x dia. RDOC (4 flute) = 20% to 30% of dia. RDOC (5 flute) = 10% to 20% of dia.	ADOC = up to 1.5x dia. RDOC = 10% to 15% of dia.

Please visit our Technical Section on Pages 98-135 for further assistance.

# HSV-4, HSV-RN-4 Speed & Feed

## Feed Rate Guide: REGULAR STYLE & REDUCED NECK STYLE

Material Guide	STEEL				STAINLESS STEEL				CAST IRON		HI-TEMP ALLOYS	
	10xx 11xx 12xx 12Lxx 15xx	13xx 41xx 43xx 86xx 92xx 93xx Chromoly	A2 H13 A3 M1 D2 O-1 H11 S-7 NAK 55	P20 P21 S-136 PX5 NAK 80	410 430F 416 440C 420	303 320 304 304L 316 316L 321 347 Kovar Invar 36	13-8 15-5 17-4 Carpenter Custom 465 Invar	Grey GG-10 GG-15 GG-20/25 GG-30/35 GG-40	Ductile (Nodular) Malleable GGG-40 GGG-50 GGG-60 GGG-70	Inconel 718 Inconel 600 Rene 100 Rene 41 A286 Haynes Waspalloy H-188 Hastalloy Hast-X Mar-M Stellite AirResist Monel	Ti6Al4V (grades 5-38)	
Surface Feet per Minute (SFM)												
SFM	< 42 Rc	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	
	≥ 42 Rc	320 - 480	200 - 400	200 - 300	200 - 300	200 - 300	160 - 300	130 - 250	300 - 450	200 - 320	70 - 110	160 - 220
Feed per Tooth (FPT)												
1/8	Slot	.0006 - .0008	.0005 - .0007	.0005 - .0006	.0004 - .0006	.0005 - .0007	.0005 - .0006	.0004 - .0006	.0006 - .0008	.0005 - .0007	.0003 - .0004	.0004 - .0005
	HR	.0007 - .0010	.0006 - .0009	.0006 - .0008	.0005 - .0007	.0006 - .0009	.0006 - .0008	.0005 - .0007	.0007 - .0010	.0006 - .0008	.0003 - .0005	.0005 - .0006
1/4	Slot	.0012 - .0016	.0010 - .0014	.0010 - .0013	.0009 - .0012	.0010 - .0014	.0010 - .0013	.0009 - .0012	.0012 - .0016	.0010 - .0013	.0005 - .0007	.0007 - .0010
	HR	.0015 - .0020	.0013 - .0017	.0012 - .0016	.0011 - .0014	.0013 - .0017	.0012 - .0016	.0011 - .0014	.0015 - .0020	.0012 - .0017	.0007 - .0009	.0009 - .0013
3/8	Slot	.0018 - .0024	.0015 - .0021	.0014 - .0019	.0013 - .0017	.0015 - .0021	.0014 - .0019	.0013 - .0017	.0018 - .0024	.0015 - .0020	.0008 - .0011	.0011 - .0015
	HR	.0022 - .0030	.0019 - .0026	.0018 - .0024	.0016 - .0022	.0019 - .0026	.0018 - .0024	.0016 - .0022	.0022 - .0030	.0018 - .0025	.0010 - .0014	.0014 - .0019
1/2	Slot	.0024 - .0032	.0020 - .0028	.0019 - .0026	.0017 - .0023	.0020 - .0028	.0019 - .0026	.0017 - .0023	.0024 - .0032	.0020 - .0027	.0011 - .0015	.0015 - .0020
	HR	.0030 - .0040	.0026 - .0035	.0024 - .0032	.0021 - .0029	.0026 - .0035	.0024 - .0032	.0021 - .0029	.0030 - .0040	.0025 - .0033	.0014 - .0018	.0019 - .0025
5/8	Slot	.0037 - .0050	.0032 - .0043	.0030 - .0040	.0027 - .0036	.0032 - .0043	.0030 - .0040	.0027 - .0036	.0037 - .0050	.0031 - .0042	.0017 - .0023	.0023 - .0032
	HR	.0046 - .0063	.0040 - .0054	.0037 - .0050	.0033 - .0045	.0040 - .0054	.0037 - .0050	.0033 - .0045	.0046 - .0063	.0039 - .0052	.0021 - .0029	.0029 - .0040
3/4	Slot	.0033 - .0044	.0028 - .0038	.0026 - .0035	.0023 - .0032	.0028 - .0038	.0026 - .0035	.0023 - .0032	.0033 - .0044	.0027 - .0037	.0015 - .0020	.0021 - .0028
	HR	.0036 - .0048	.0031 - .0041	.0029 - .0039	.0026 - .0035	.0031 - .0041	.0029 - .0039	.0026 - .0035	.0036 - .0048	.0030 - .0040	.0016 - .0022	.0022 - .0030
1	Slot	.0048 - .0064	.0041 - .0055	.0038 - .0052	.0034 - .0046	.0041 - .0055	.0038 - .0052	.0034 - .0046	.0048 - .0064	.0039 - .0053	.0022 - .0029	.0030 - .0040
	HR	.0060 - .0081	.0051 - .0069	.0048 - .0064	.0043 - .0058	.0051 - .0069	.0048 - .0064	.0043 - .0058	.0060 - .0081	.0049 - .0067	.0027 - .0037	.0037 - .0051
Finish	LR	.0074 - .0101	.0064 - .0086	.0060 - .0081	.0053 - .0072	.0064 - .0086	.0060 - .0081	.0053 - .0072	.0074 - .0101	.0062 - .0083	.0034 - .0046	.0047 - .0063
	Finish	.0052 - .0071	.0045 - .0061	.0042 - .0057	.0037 - .0051	.0045 - .0061	.0042 - .0057	.0037 - .0051	.0052 - .0071	.0043 - .0059	.0024 - .0032	.0033 - .0045

4-FLUTE



### Depth of Cut Guide: REGULAR STYLE

Length of Cut (LOC)	Slotting (S)	Heavy Roughing (HR)	Light Roughing (LR)	Finishing (F)
	≤ Regular LOC	ADOC = up to 50% x dia.	ADOC = up to 1.5 x dia. RDOC = 30% to 50% of dia.	ADOC = LOC RDOC = 15% to 25% of dia.
> Regular LOC	We recommend using reduced neck (RN) tooling for long reach	ADOC = up to 1 x dia. RDOC = 20% to 30% of dia.	ADOC = up to 2 x dia. RDOC = 10% to 15% of dia.	ADOC = up to 3 x dia. RDOC = 3% to 5% of dia.



### Depth of Cut Guide: REDUCED NECK STYLE

Length Below Shank (LBS)	Slotting (S)	Heavy Roughing (HR)	Light Roughing (LR)	Finishing (F)
	≤ Regular LBS	ADOC = up to 50% of dia.	ADOC = up to 1 x dia. RDOC = 30% to 50% of dia.	ADOC = LOC RDOC = 15% to 25% of dia.
> Regular LBS	ADOC = up to 25% of dia.	ADOC = up to 40% of dia. RDOC = 15% to 25% of dia.	ADOC = up to 75% of dia. RDOC = 10% to 15% of dia.	ADOC = up to 1x dia. RDOC = 3% to 5% of dia.

Please visit our Technical Section on Pages 98-135 for further assistance.

# HEV-5, HEV-RN-5 Speed & Feed

## Feed Rate Guide: REGULAR STYLE & REDUCED NECK STYLE

Material Guide	STEEL				HARD STEEL	STAINLESS STEEL			CAST IRON		HI-TEMP ALLOYS		
	10xx 11xx 12xx 12Lxx 15xx	13xx 41xx 43xx 86xx 92xx 93xx Chromoly	A2 H13 A3 M1 D2 O-1 H11 S-7 NAK 55	P20 P21 S-136 PX5 NAK 80	Steel Grades > 50Rc.	410 430F 416 440C 420	303 320 304 304L 316 316L 321 347 Kovar Invar 36	13-8 15-5 17-4 Carpenter Custom 465 Invar	Grey GG-10 GG-15 GG-20/25 GG-30/35 GG-40	Ductile (Nodular) Malleable GGG-40 GGG-50 GGG-60 GGG-70	Inconel 718 Inconel 600 Rene 100 Rene 41 A286 Haynes Waspalloy H-188 Hastalloy Hast-X Mar-M AirResist Monel	Ti61AL4V (grades 5-38)	
Surface Feet per Minute (SFM)													
SFM	low - high		low - high		low - high		low - high		low - high		low - high		
	< 42 Rc	320 - 480	200 - 400	200 - 300	200 - 300	90 - 140	200 - 300	160 - 300	130 - 250	300 - 450	200 - 320	70 - 110	160 - 220
	≥ 42 Rc	160 - 240	120 - 160	110 - 150	100 - 140		110 - 175	110 - 160	90 - 130	170 - 220	90 - 180	60 - 80	100 - 150
Feed per Tooth (FPT)													
1/8	Slot	.0006 - .0008	.0005 - .0007	.0005 - .0006	.0004 - .0006	.0004 - .0006	.0005 - .0007	.0005 - .0006	.0004 - .0006	.0006 - .0008	.0005 - .0007	.0003 - .0004	.0004 - .0005
	HR	.0007 - .0010	.0006 - .0009	.0006 - .0008	.0005 - .0007	.0005 - .0007	.0006 - .0009	.0006 - .0009	.0006 - .0009	.0007 - .0010	.0007 - .0010	.0007 - .0010	.0007 - .0010
1/4	Slot	.0012 - .0016	.0010 - .0014	.0010 - .0013	.0009 - .0012	.0008 - .0011	.0010 - .0014	.0010 - .0013	.0009 - .0012	.0012 - .0016	.0010 - .0013	.0005 - .0007	.0007 - .0010
	HR	.0015 - .0020	.0013 - .0017	.0012 - .0016	.0011 - .0014	.0010 - .0014	.0013 - .0017	.0012 - .0016	.0011 - .0014	.0015 - .0020	.0012 - .0017	.0007 - .0009	.0009 - .0013
3/8	Slot	.0018 - .0024	.0015 - .0021	.0014 - .0019	.0013 - .0017	.0012 - .0017	.0015 - .0021	.0014 - .0019	.0013 - .0017	.0018 - .0024	.0015 - .0020	.0008 - .0011	.0011 - .0015
	HR	.0022 - .0030	.0019 - .0026	.0018 - .0024	.0016 - .0022	.0015 - .0021	.0019 - .0026	.0018 - .0024	.0016 - .0022	.0022 - .0030	.0018 - .0025	.0010 - .0014	.0014 - .0019
1/2	Slot	.0024 - .0032	.0020 - .0028	.0019 - .0026	.0017 - .0023	.0016 - .0022	.0020 - .0028	.0019 - .0026	.0017 - .0023	.0024 - .0032	.0020 - .0027	.0011 - .0015	.0015 - .0020
	HR	.0030 - .0040	.0026 - .0035	.0024 - .0032	.0021 - .0029	.0020 - .0028	.0026 - .0035	.0024 - .0032	.0021 - .0029	.0030 - .0040	.0025 - .0033	.0014 - .0018	.0019 - .0025
5/8	Slot	.0030 - .0040	.0026 - .0035	.0024 - .0032	.0021 - .0029	.0020 - .0028	.0026 - .0035	.0024 - .0032	.0021 - .0029	.0030 - .0040	.0025 - .0033	.0014 - .0018	.0019 - .0025
	HR	.0037 - .0050	.0032 - .0043	.0030 - .0040	.0027 - .0036	.0026 - .0035	.0032 - .0043	.0030 - .0040	.0027 - .0036	.0037 - .0050	.0031 - .0042	.0017 - .0023	.0023 - .0032
3/4	Slot	.0036 - .0048	.0031 - .0041	.0029 - .0039	.0026 - .0035	.0024 - .0033	.0031 - .0041	.0029 - .0039	.0026 - .0035	.0036 - .0048	.0030 - .0040	.0016 - .0022	.0022 - .0030
	HR	.0045 - .0060	.0038 - .0052	.0036 - .0048	.0032 - .0043	.0031 - .0041	.0038 - .0052	.0036 - .0048	.0032 - .0043	.0045 - .0060	.0037 - .0050	.0020 - .0028	.0028 - .0038
1	Slot	.0048 - .0064	.0041 - .0055	.0038 - .0052	.0034 - .0046	.0033 - .0044	.0041 - .0055	.0038 - .0052	.0034 - .0046	.0048 - .0064	.0039 - .0053	.0022 - .0029	.0030 - .0040
	HR	.0060 - .0081	.0051 - .0069	.0048 - .0064	.0043 - .0058	.0041 - .0055	.0051 - .0069	.0048 - .0064	.0043 - .0058	.0060 - .0081	.0049 - .0067	.0027 - .0037	.0037 - .0051
1 1/4	Slot	.0055 - .0074	.0047 - .0063	.0044 - .0059	.0039 - .0053	.0038 - .0051	.0047 - .0063	.0044 - .0059	.0039 - .0053	.0055 - .0074	.0045 - .0061	.0025 - .0034	.0034 - .0047
	HR	.0068 - .0093	.0059 - .0079	.0055 - .0074	.0049 - .0066	.0047 - .0063	.0059 - .0079	.0055 - .0074	.0049 - .0066	.0068 - .0093	.0057 - .0077	.0031 - .0042	.0043 - .0058

5-FLUTE



### Depth of Cut Guide: REGULAR STYLE

	Slotting (S)	Heavy Roughing (HR)	Light Roughing (LR)	Finishing (F)
Length of Cut (LOC) ≤ Regular LOC	ADOC = up to 50% x dia.	ADOC = up to 1.5 x dia. RDOC = 30% to 50% of dia.	ADOC = LOC RDOC = 15% to 25% of dia.	ADOC = LOC RDOC = 3% to 5% of dia.
Length of Cut (LOC) > Regular LOC	We recommend using reduced neck (RN) tooling for long reach	ADOC = up to 1 x dia. RDOC = 20% to 30% of dia.	ADOC = up to 2 x dia. RDOC = 10% to 15% of dia.	ADOC = up to 3 x dia. RDOC = 3% to 5% of dia.



### Depth of Cut Guide: REDUCED NECK STYLE

	Slotting (S)	Heavy Roughing (HR)	Light Roughing (LR)	Finishing (F)
Length Below Shank (LBS) ≤ Regular LBS	ADOC = up to 50% of dia.	ADOC = up to 1 x dia. RDOC = 30% to 50% of dia.	ADOC = LOC RDOC = 15% to 25% of dia.	ADOC = LOC RDOC = 3% to 5% of dia.
Length Below Shank (LBS) > Regular LBS	ADOC = up to 25% of dia.	ADOC = up to 40% of dia. RDOC = 15% to 25% of dia.	ADOC = up to 75% of dia. RDOC = 10% to 15% of dia.	ADOC = up to 1x dia. RDOC = 3% to 5% of dia.

Please visit our Technical Section on Pages 98-135 for further assistance.

# HSF-7 Speed & Feed

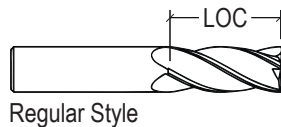
## Feed Rate Guide: REGULAR STYLE

Material Guide	STEEL					HARD STEEL	STAINLESS STEEL				CAST IRON		HI-TEMP ALLOYS		
	10xx 11xx 12xx 12Lxx 15xx	13xx 41xx 43xx 86xx 92xx 93xx Chromoly	A2 H13 A3 M1 D2 O-1 H11 S-7 NAK 55	P20 P21 S-136 PX5 NAK 80		Steel Grades > 50Rc.	410 430F 416 440C 420	303 320 304 304L 316 316L 321 347 Kovar Invar 36	13-8 15-5 17-4 Carpenter Custom 465 Invar	Grey GG-10 GG-15 GG-20/25 GG-30/35 GG-40	Ductile (Nodular) Malleable GGG-40 GGG-50 GGG-60 GGG-70	Inconel 718 Inconel 600 Rene 100 Rene 41 A286 Haynes Waspalloy H-188 Hastalloy Hast-X Mar-M Stellite AirResist Monel	Ti6Al4V (grades 5-38)		
Surface Feet per Minute (SFM)															
SFM		low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	
	< 42 Rc	320 - 480	200 - 400	200 - 300	200 - 300	90 - 140	200 - 300	160 - 300	130 - 250	300 - 450	200 - 320	70 - 110	160 - 220		
≥ 42 Rc	160 - 240	120 - 160	110 - 150	100 - 140		110 - 175	110 - 160	90 - 130	170 - 220	90 - 180	60 - 80	100 - 150			
Feed per Tooth (FPT)															
1/4	LR	.0019 - .0025	.0016 - .0022	.0015 - .0020	.0013 - .0018	.0013 - .0017	.0016 - .0022	.0015 - .0020	.0013 - .0018	.0019 - .0025	.0015 - .0021	.0009 - .0012	.0012 - .0016		
	Finish	.0013 - .0018	.0011 - .0015	.0010 - .0014	.0009 - .0013	.0009 - .0012	.0011 - .0015	.0010 - .0014	.0009 - .0013	.0013 - .0018	.0011 - .0015	.0006 - .0008	.0008 - .0011		
3/8	LR	.0028 - .0038	.0024 - .0032	.0022 - .0030	.0020 - .0027	.0019 - .0026	.0024 - .0032	.0022 - .0030	.0020 - .0027	.0028 - .0038	.0023 - .0031	.0013 - .0017	.0018 - .0024		
	Finish	.0020 - .0027	.0017 - .0023	.0016 - .0021	.0014 - .0019	.0013 - .0018	.0017 - .0023	.0016 - .0021	.0014 - .0019	.0020 - .0027	.0016 - .0022	.0009 - .0012	.0012 - .0017		
1/2	LR	.0037 - .0050	.0032 - .0043	.0030 - .0040	.0027 - .0036	.0026 - .0035	.0032 - .0043	.0030 - .0040	.0027 - .0036	.0037 - .0050	.0031 - .0042	.0017 - .0023	.0023 - .0032		
	Finish	.0026 - .0035	.0022 - .0030	.0021 - .0028	.0019 - .0025	.0018 - .0024	.0022 - .0030	.0021 - .0028	.0019 - .0025	.0026 - .0035	.0022 - .0029	.0012 - .0016	.0016 - .0022		
5/8	LR	.0046 - .0063	.0040 - .0054	.0037 - .0050	.0033 - .0045	.0032 - .0043	.0040 - .0054	.0037 - .0050	.0033 - .0045	.0046 - .0063	.0039 - .0052	.0021 - .0029	.0029 - .0040		
	Finish	.0033 - .0044	.0028 - .0038	.0026 - .0035	.0023 - .0032	.0022 - .0030	.0028 - .0038	.0026 - .0035	.0023 - .0032	.0033 - .0044	.0027 - .0037	.0015 - .0020	.0021 - .0028		
3/4	LR	.0056 - .0075	.0048 - .0065	.0045 - .0060	.0040 - .0054	.0038 - .0052	.0048 - .0065	.0045 - .0060	.0040 - .0054	.0056 - .0075	.0046 - .0063	.0026 - .0035	.0035 - .0047		
	Finish	.0039 - .0053	.0034 - .0046	.0031 - .0043	.0028 - .0038	.0027 - .0036	.0034 - .0046	.0031 - .0043	.0028 - .0038	.0039 - .0053	.0033 - .0044	.0018 - .0024	.0025 - .0033		
1	LR	.0074 - .0101	.0064 - .0086	.0060 - .0081	.0053 - .0072	.0051 - .0069	.0064 - .0086	.0060 - .0081	.0053 - .0072	.0074 - .0101	.0062 - .0083	.0034 - .0046	.0047 - .0063		
	Finish	.0052 - .0071	.0045 - .0061	.0042 - .0057	.0037 - .0051	.0036 - .0049	.0045 - .0061	.0042 - .0057	.0037 - .0051	.0052 - .0071	.0043 - .0059	.0024 - .0032	.0033 - .0045		
1 1/4	LR	.0086 - .0116	.0073 - .0099	.0068 - .0093	.0061 - .0083	.0059 - .0079	.0073 - .0099	.0068 - .0093	.0061 - .0083	.0086 - .0116	.0071 - .0096	.0039 - .0053	.0054 - .0073		
	Finish	.0060 - .0081	.0052 - .0070	.0048 - .0065	.0043 - .0058	.0041 - .0056	.0052 - .0070	.0048 - .0065	.0043 - .0058	.0060 - .0081	.0050 - .0068	.0028 - .0037	.0038 - .0051		

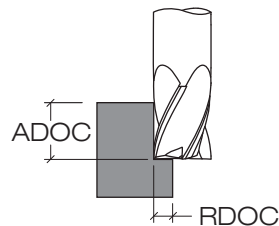


## Depth of Cut Guide: REGULAR STYLE

		Light Roughing (LR)	Finishing (F)
Length of Cut (LOC)	≤ Regular <b>LOC</b>	ADOC = LOC RDOC = 15% to 20% of dia.	ADOC = LOC RDOC = 3% to 5% of dia.
	> Regular <b>LOC</b>	ADOC = up to 2 x dia. RDOC = 10% to 15% of dia.	ADOC = up to 2x dia. RDOC = 3% to 5% of dia.



Regular Style



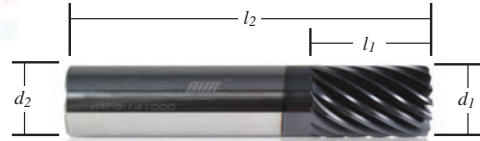
Key: LOC - Length of Cut    ADOC - Axial Depth of Cut  
RDOC - Radial Depth of Cut

Please visit our Technical Section on Pages 98-135 for further assistance.

# HXF



- ▶ Non-variable pitch
- ▶ Provides a 2x productivity increase over similar 4-fluted tools
- ▶ An excellent choice in light profiling and finishing applications
- ▶ Proven with VoluMill tool paths
- ▶ Good results in all ferrous materials and Titanium up to 65 Rc



HXF (Aplus Coated)		STEEL	STAINLESS STEEL	CAST IRON	HI-TEMP ALLOYS	HARDENED STEEL		
(d <sub>1</sub> ) Cutting Dia.	(d <sub>2</sub> ) Shank Dia.	(l <sub>1</sub> ) LOC	(l <sub>2</sub> ) OAL	No. of Flutes	.020	Corner Radius .030	.060	Tool Description
1/4	1/4	3/8	2	7	36016			HXF-S-070250-R.020
	1/4	3/4	2-1/2	7	36031			HXF-R-070250-R.020
3/8	3/8	1/2	2	7	36046			HXF-S-070375-R.020
	3/8	1	3	7	36061			HXF-R-070375-R.020
1/2	1/2	5/8	2-1/2	8		36076		HXF-S-080500-R.030
	1/2	1	3	8		36091		HXF-SR-080500-R.030
	1/2	1-1/4	3	8		36106		HXF-R-080500-R.030
5/8	5/8	3/4	3	10			36121	HXF-S-100625-R.060
	5/8	1-5/8	3-1/2	10			36136	HXF-R-100625-R.060
3/4	3/4	1	3	12			36151	HXF-S-120750-R.060
	3/4	1-5/8	4	12			36166	HXF-R-120750-R.060
1	1	1-1/4	4	14			36181	HXF-S-141000-R.060
	1	2	4-1/2	14			36196	HXF-R-141000-R.060

**Speed & Feed on page 92.**

MULTI

APPROPRIATE MACHINING OPERATIONS FOR HXF

TOOL TOLERANCES

Cutting Diameter: +.000 / -.002  
 Shank Diameter: -.0001 / -.0004 (ISO h6)  
 Corner Radius: +/- .002

Runout (T.I.R.): .0005 max.  
 Overall Length: +/- 1/16"  
 Length of Cut: +.032 / -.000



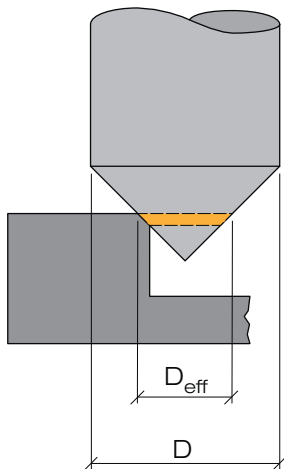
# HCM60, HCM90, HCM120 Speed & Feed

## Feed Rate Guide (Ferrous Materials): CHAMFER MILLS - Aplus Coated

Material Guide	STEEL				HARD STEEL	STAINLESS STEEL				CAST IRON		HI-TEMP ALLOYS	
	10xx 11xx 12xx 12Lxx 15xx	13xx 41xx 43xx 86xx 92xx 93xx Chromoly	A2 H13 A3 M1 D2 O-1 H11 S-7 NAK 55	P20 P21 S-136 PX5 NAK 80	Steel Grades > 50Rc.	410 430F 416 440C 420	303 320 304 304L 316 316L 321 347 Kovar Invar 36	13-8 15-5 17-4 Carpenter Custom 465 Invar	Grey GG-10 GG-15 GG-20/25 GG-30/35 GG-40	Ductile (Nodular) Malleable GGG-40 GGG-50 GGG-60 GGG-70	Inconel 718 Inconel 600 Rene 100 Rene 41 A286 Haynes Waspalloy H-188 Hastalloy Hast-X Mar-M Stellite AirResist Monel	Ti61AL4V (grades 5-38)	
<b>Surface Feet per Minute (SFM)</b>													
		low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high	low - high
SFM	< 42 Rc	320 - 480	200 - 300	180 - 260	180 - 260	90 - 140	200 - 300	160 - 240	130 - 200	280 - 420	190 - 280	120 - 180	200 - 300
	≥ 42 Rc	160 - 240	100 - 150	100 - 140	100 - 140		110 - 170	120 - 180	90 - 130	170 - 260	90 - 130	60 - 80	100 - 150
<b>Feed per Tooth (FPT)</b>													
D <sub>eff</sub>													
< .125	.0009 - .0013	.0008 - .0011	.0007 - .0010	.0007 - .0009	.0006 - .0009	.0008 - .0011	.0007 - .0010	.0007 - .0009	.0009 - .0013	.0008 - .0010	.0004 - .0006	.0006 - .0008	
.125 - .374	.0019 - .0025	.0016 - .0022	.0015 - .0020	.0013 - .0018	.0013 - .0017	.0016 - .0022	.0015 - .0020	.0013 - .0018	.0019 - .0025	.0015 - .0021	.0009 - .0012	.0012 - .0016	
.375 - .499	.0028 - .0038	.0024 - .0032	.0022 - .0030	.0020 - .0027	.0019 - .0026	.0024 - .0032	.0022 - .0030	.0020 - .0027	.0028 - .0038	.0023 - .0031	.0013 - .0017	.0018 - .0024	
.500 - .624	.0037 - .0050	.0032 - .0043	.0030 - .0040	.0027 - .0036	.0026 - .0035	.0032 - .0043	.0030 - .0040	.0027 - .0036	.0037 - .0050	.0031 - .0042	.0017 - .0023	.0023 - .0032	
.625 - .749	.0046 - .0063	.0040 - .0054	.0037 - .0050	.0033 - .0045	.0032 - .0043	.0040 - .0054	.0037 - .0050	.0033 - .0045	.0046 - .0063	.0039 - .0052	.0021 - .0029	.0029 - .0040	
.750 - .999	.0056 - .0075	.0048 - .0065	.0045 - .0060	.0040 - .0054	.0038 - .0052	.0048 - .0065	.0045 - .0060	.0040 - .0054	.0056 - .0075	.0046 - .0063	.0026 - .0035	.0035 - .0047	
≥ 1.0	.0074 - .0101	.0064 - .0086	.0060 - .0081	.0053 - .0072	.0051 - .0069	.0064 - .0086	.0060 - .0081	.0053 - .0072	.0074 - .0101	.0062 - .0083	.0034 - .0046	.0047 - .0063	

## Feed Rate Guide (Non-Ferrous Materials): CHAMFER MILLS - Uncoated

Material Guide	SFM <sup>†</sup>	Feed per Tooth (FPT)								
		D <sub>eff</sub>	<.125	.125 - .374	.375 - .499	.500 - .624	.625 - .749	.750 - .999	≥ 1.0"	
			low - high	low - high	low - high	low - high	low - high	low - high	low - high	
Wrought	2024 2219 5052 7050 6061 7075	1600 - 2400	Rough	.0015 - .0020	.0029 - .0040	.0044 - .0059	.0059 - .0079	.0073 - .0099	.0088 - .0119	.0117 - .0158
			Finish	.0009 - .0012	.0018 - .0024	.0026 - .0036	.0035 - .0047	.0044 - .0059	.0053 - .0071	.0070 - .0095
Cast	A242 A319 A356 A390 A320 A520 A535 A713	720 - 1080	Rough	.0011 - .0014	.0021 - .0029	.0032 - .0043	.0043 - .0058	.0053 - .0072	.0064 - .0086	.0085 - .0115
			Finish	.0007 - .0010	.0014 - .0019	.0022 - .0029	.0029 - .0039	.0036 - .0049	.0043 - .0058	.0057 - .0078



### Technical Tip:

When chamfering and using less than the major cutting diameter (D) of the tool, ensure your speed and feed is based upon the effective cutting diameter (D<sub>eff</sub>) actually being used.

### Finish Requirement:

Many different factors can affect chamfer finish but some common ways to increase part finish is:

- Utilizing 4 flute tools
- Decreasing feed
- Increasing speed