



H.E.ROUNDS™

MILLING PRODUCTS

Series 47D RC S5
5-Flutes, variable pitch
2xD thru 4xD
43° Helix
Grade IN2006

Diameters
.250", .375", .500",
.625", .750", 1.000"

Corner Radii
Sharp
.015, .030, .060, .090, .125, .250

Materials & Applications

- Titanium, Inconel, Hi Temp, Ferrous Alloys
- Roughing & Finishing Applications
- Excels in High Efficiency Machining
- Excellent under poor cutting conditions



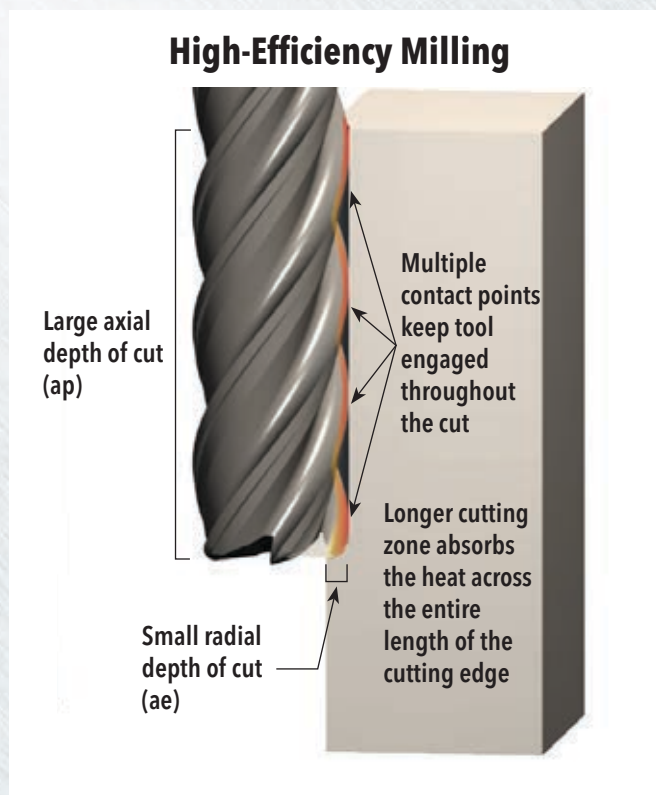
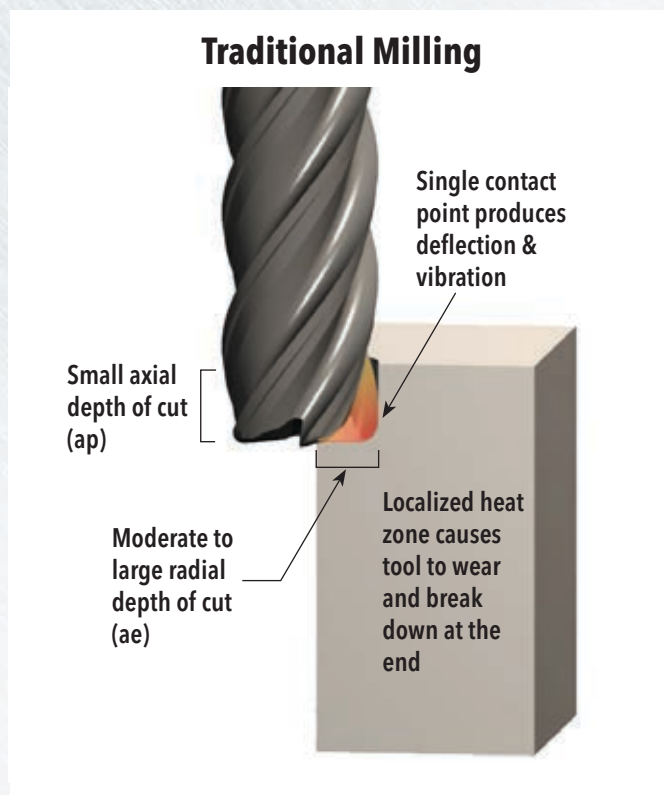
High-Efficiency Solid Carbide End Mills for Titanium, Inconel, Hi Temp & Ferrous Alloys

Ingersoll is pleased to introduce a line of inch-based solid carbide end mills targeting High-Efficiency machining, aiming to lower cycle times in Titanium, Hi-Temp Alloys and other ferrous materials. These 5-flute, variable pitch end mills excel when applying a high axial cutting depth with a lower radial engagement, which dissipates heat through the entire tool instead of within a localized area. A new, extremely tough grade of carbide offers maximum protection against edge chipping and provides consistent tool life, while a new coating protects the cutting edge from breaking down at elevated cutting speeds.

Features & Benefits:

- 5-flutes and a very strong core provides increased metal removal rates
- Ideal under severe cutting conditions; Very tough submicron substrate eliminates chipping at the cutting edge
- PVD-TiAlCrN coating reduces cutting temperatures and protects the substrate from breakdown, allowing higher cutting speeds to be utilized
- Excels in Titanium and Inconel
- Also suitable for steel, particularly at higher feed rates
- First choice for High Efficiency Machining
- Runs very well on CAT40, CAT50 & HSK spindles

HE•ROUNDS™ PRINCIPLES OF HIGH EFFICIENCY MILLING

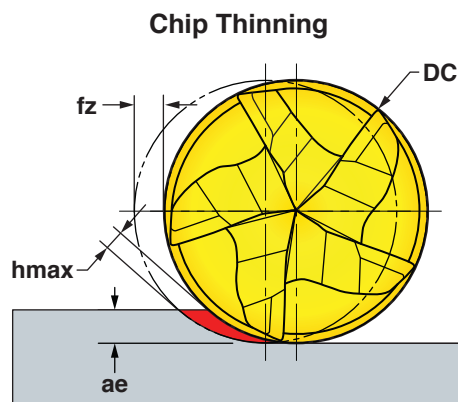


The lighter radial depths of cut permit more shallow flutes to exist on the tool, since the chips are much thinner and are easily evacuated. By reducing the flute depth, the core of the end mill is larger, providing more stiffness and less bending force when fully engaged at large axial cutting depths.



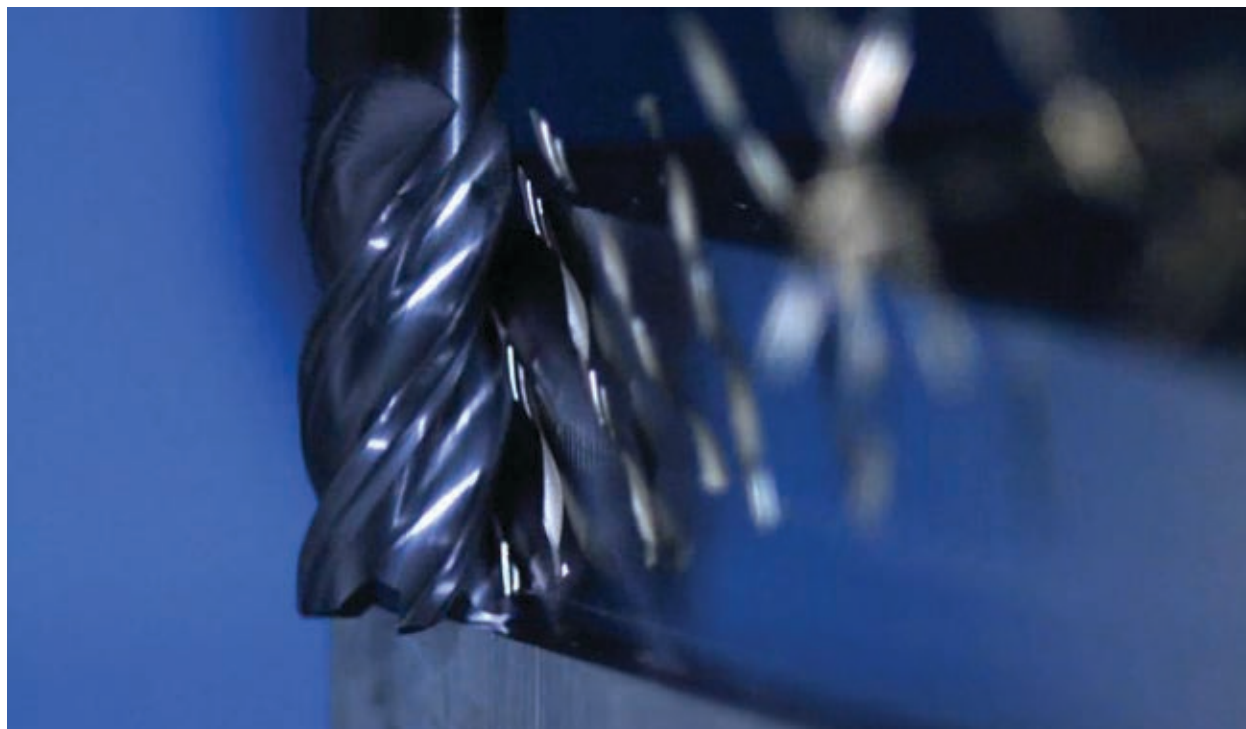
- Larger core promotes rigidity
- Shallow flutes provide more strength behind the cutting edge while still allowing adequate space for chip evacuation
- Variable pitch flutes with an aggressive 43° helix angle that provides multi-edge engagement and stability during the cut
- Recommended radial stepover ranges from 6% to 15% depending on work piece material. Refer to last page of this document for more detail

HEOROUNDS™ CHIP THINNING



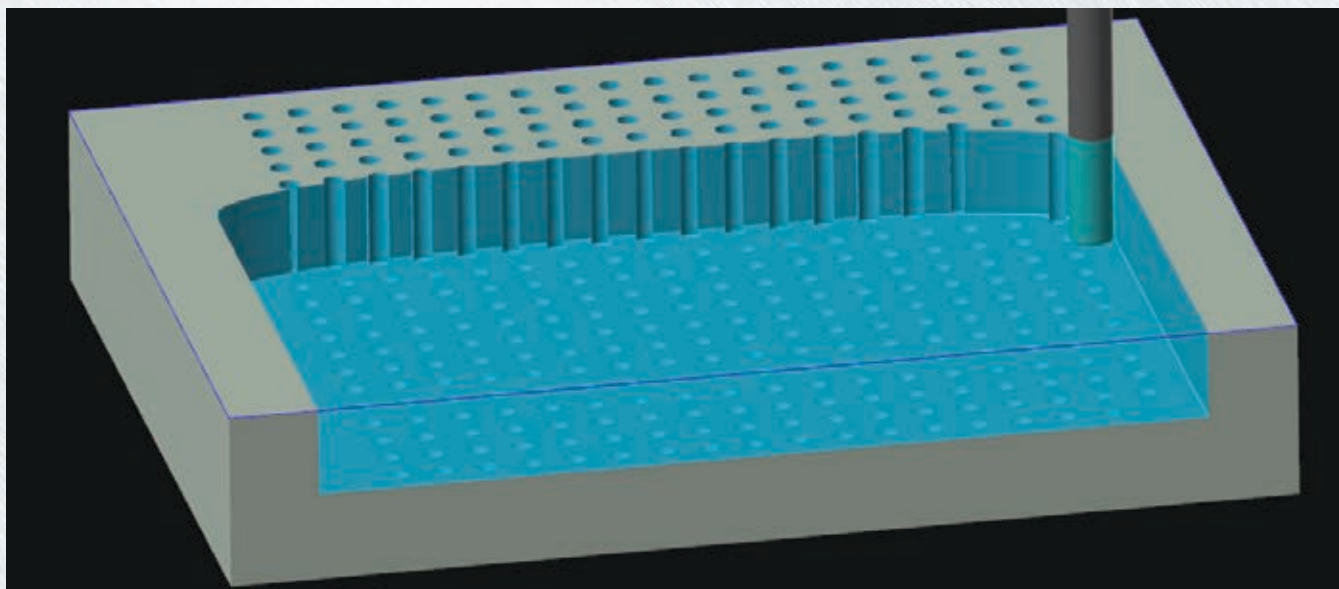
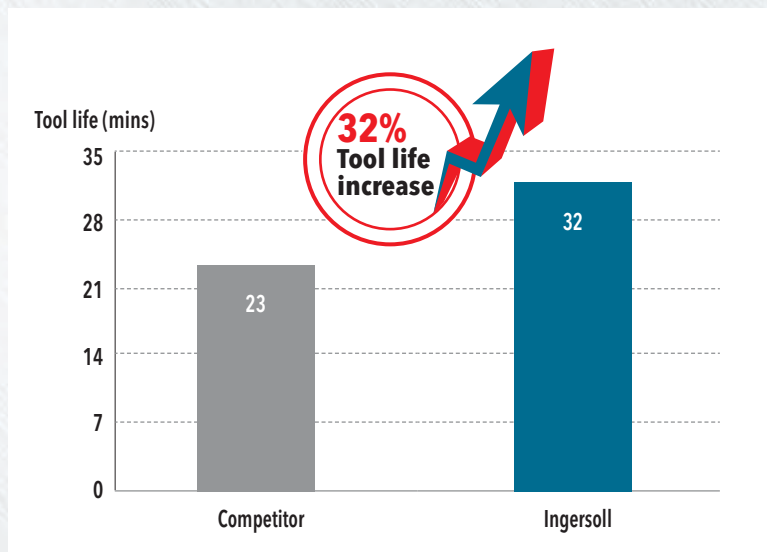
Due to the lower radial engagement, chip thinning is accentuated, and a much higher feed-per-tooth (f_z) can be applied in order to arrive at the true chip thickness (h_{max}).

Furthermore, the heat generated by the cutting action is dispersed across the entire length of the cutting edge and end mill body. The end result is a very strong tool that allows high feed rates to be applied, resulting in impressive material removal rates and longer tool life even under difficult machining conditions.



HEOROUNDS™ CASE STUDY

	Ingersoll	Ingersoll
Material	Titanium 6Al4V	
Workpiece	9"L x 12"W x 2"D with 255 pre-drilled .25" thru holes	
Operation	Shouldering/Peeling, Severe Interruptions	
Tool	.500" Dia, 2xD, 5-Flute	47D-5010S4RC03S5 IN2006 (.500", 2xD, 5-Flute)
Cutting Speed (sfm)	400	450
Feed	f (ipt)	0.0035
	F (ipm)	54
ap - Depth of Cut (inch)	0.900	0.900
ae: Width of Cut (inch)	0.040	0.040
Tool Life	Maximum 22 mins	1 complete part (31 mins)





HEOROUNDS™ SERIES 47D/47J_RC S5 (5-FLUTE)

5 FLUTE ENDMILLS, 43° HELIX, VARIABLE PITCH



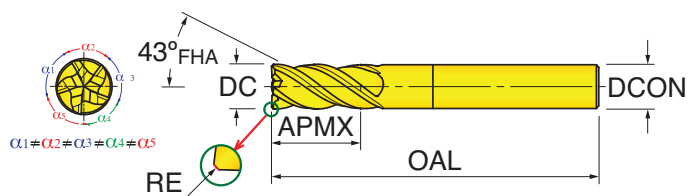
Shoulder



Ramping



Helical Interp.



Part Number	DC Cutting Dia.	RE Corner Radius	APMX Depth of Cut Max.	OAL Overall Length	ZE Eff. Flutes	FHA Flute Helix Angle	DCON Shank Dia.	RPMX Ramp Angle Max.
47J-2507R6RC00 S5	0.250	0.000	0.750	2.5	5	43	0.250	3
47J-2510R6RC00 S5	0.250	0.000	1.000	3.0	5	43	0.250	3
47D-2507R6RC01 S5	0.250	0.015	0.750	2.5	5	43	0.250	3
47D-2510R6RC01 S5	0.250	0.015	1.000	3.0	5	43	0.250	3
47D-2507R6RC03 S5	0.250	0.030	0.750	2.5	5	43	0.250	3
47D-2510R6RC03 S5	0.250	0.030	1.000	3.0	5	43	0.250	3
47D-2507R6RC06 S5	0.250	0.060	0.750	2.5	5	43	0.250	3
47D-2510R6RC06 S5	0.250	0.060	1.000	3.0	5	43	0.250	3
47J-3710R8RC00 S5	0.375	0.000	1.000	2.5	5	43	0.375	3
47J-3711R8RC00 S5	0.375	0.000	1.125	3.0	5	43	0.375	3
47D-3710R8RC01 S5	0.375	0.015	1.000	2.5	5	43	0.375	3
47D-3711R8RC01 S5	0.375	0.015	1.125	3.0	5	43	0.375	3
47D-3710R8RC03 S5	0.375	0.030	1.000	2.5	5	43	0.375	3
47D-3711R8RC03 S5	0.375	0.030	1.125	3.0	5	43	0.375	3
47D-3710R8RC06 S5	0.375	0.060	1.000	2.5	5	43	0.375	3
47D-3711R8RC06 S5	0.375	0.060	1.125	3.0	5	43	0.375	3
47J-5010S4RC00 S5	0.500	0.000	1.000	3.0	5	43	0.500	3
47J-5013S4RC00 S5	0.500	0.000	1.375	3.0	5	43	0.500	3
47J-5016S4RC00 S5	0.500	0.000	1.625	4.0	5	43	0.500	3
47J-5020S4RC00 S5	0.500	0.000	2.000	4.0	5	43	0.500	3
47D-5010S4RC03 S5	0.500	0.030	1.000	3.0	5	43	0.500	3
47D-5013S4RC03 S5	0.500	0.030	1.375	3.0	5	43	0.500	3
47D-5016S4RC03 S5	0.500	0.030	1.625	4.0	5	43	0.500	3
47D-5020S4RC03 S5	0.500	0.030	2.000	4.0	5	43	0.500	3
47D-5010S4RC06 S5	0.500	0.060	1.000	3.0	5	43	0.500	3
47D-5013S4RC06 S5	0.500	0.060	1.375	3.0	5	43	0.500	3
47D-5016S4RC06 S5	0.500	0.060	1.625	4.0	5	43	0.500	3
47D-5020S4RC06 S5	0.500	0.060	2.000	4.0	5	43	0.500	3
47D-5013S4RC09 S5	0.500	0.090	1.375	3.0	5	43	0.500	3
47D-5020S4RC09 S5	0.500	0.090	2.000	4.0	5	43	0.500	3
47D-5010S4RC12 S5	0.500	0.125	1.000	3.0	5	43	0.500	3
47D-5013S4RC12 S5	0.500	0.125	1.375	3.0	5	43	0.500	3



HEOROUNDS™ SERIES 47D/47J_RC S5 (5-FLUTE) (CONT.)

5 FLUTE ENDMILLS, 43° HELIX, VARIABLE PITCH



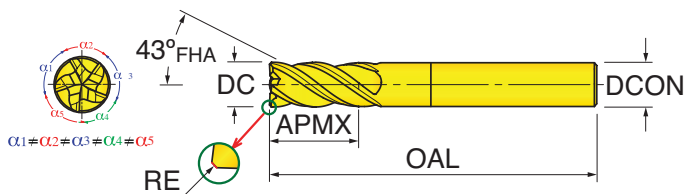
Shoulder



Ramping



Helical Interp.



Part Number	DC Cutting Dia.	RE Corner Radius	APMX Depth of Cut Max.	OAL Overall Length	ZE Eff. Flutes	FHA Flute Helix Angle	DCON Shank Dia.	RPMX Ramp Angle Max.
47D-5016S4RC12 S5	0.500	0.125	1.625	4.0	5	43	0.500	3
47D-5020S4RC12 S5	0.500	0.125	2.000	4.0	5	43	0.500	3
47J-6216S6RC00 S5	0.625	0.000	1.625	3.5	5	43	0.625	3
47J-6221S6RC00 S5	0.625	0.000	2.125	4.0	5	43	0.625	3
47D-6216S6RC03 S5	0.625	0.030	1.625	3.5	5	43	0.625	3
47D-6221S6RC03 S5	0.625	0.030	2.125	4.0	5	43	0.625	3
47D-6216S6RC06 S5	0.625	0.060	1.625	3.5	5	43	0.625	3
47D-6221S6RC06 S5	0.625	0.060	2.125	4.0	5	43	0.625	3
47D-6216S6RC09 S5	0.625	0.090	1.625	3.5	5	43	0.625	3
47D-6221S6RC12 S5	0.625	0.125	1.625	3.5	5	43	0.625	3
47D-6221S6RC12 S5	0.625	0.125	2.125	4.0	5	43	0.625	3
47J-7516S7RC00 S5	0.750	0.000	1.625	4.0	5	43	0.750	3
47J-7525S7RC00 S5	0.750	0.000	2.500	5.0	5	43	0.750	3
47J-7530S7RC00 S5	0.750	0.000	3.000	6.0	5	43	0.750	3
47D-7516S7RC03 S5	0.750	0.030	1.625	4.0	5	43	0.750	3
47D-7525S7RC03 S5	0.750	0.030	2.500	5.0	5	43	0.750	3
47D-7530S7RC03 S5	0.750	0.030	3.000	6.0	5	43	0.750	3
47D-7516S7RC06 S5	0.750	0.060	1.625	4.0	5	43	0.750	3
47D-7525S7RC06 S5	0.750	0.060	2.500	5.0	5	43	0.750	3
47D-7530S7RC06 S5	0.750	0.060	3.000	6.0	5	43	0.750	3
47D-7516S7RC09 S5	0.750	0.090	1.625	4.0	5	43	0.750	3
47D-7525S7RC09 S5	0.750	0.090	2.500	5.0	5	43	0.750	3
47D-7516S7RC12 S5	0.750	0.125	1.625	4.0	5	43	0.750	3
47D-7525S7RC12 S5	0.750	0.125	2.500	5.0	5	43	0.750	3
47D-7530S7RC12 S5	0.750	0.125	3.000	6.0	5	43	0.750	3
47D-7516S7RC18 S5	0.750	0.188	1.625	4.0	5	43	0.750	3
47D-7525S7RC18 S5	0.750	0.188	2.500	5.0	5	43	0.750	3
47D-7516S7RC25S5	0.750	0.250	1.625	4.0	5	43	0.750	3
47D-7525S7RC25 S5	0.750	0.250	2.500	5.0	5	43	0.750	3
47JE1020S1RC00 S5	1.000	0.000	2.000	4.5	5	43	1.000	3
47JE1025S1RC00 S5	1.000	0.000	2.500	5.0	5	43	1.000	3
47JE1031S1RC00 S5	1.000	0.000	3.125	6.0	5	43	1.000	3



HEOROUNDS™ SERIES 47D/47J_RC S5 (5-FLUTE) (CONT.)

5 FLUTE ENDMILLS, 43° HELIX, VARIABLE PITCH



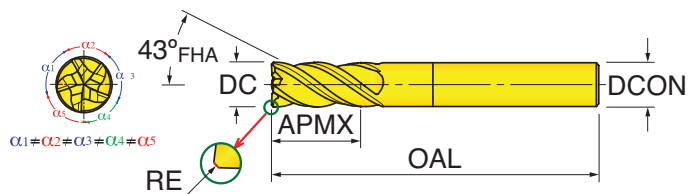
Shoulder



Ramping



Helical Interp.



Part Number	DC Cutting Dia.	RE Corner Radius	APMX Depth of Cut Max.	OAL Overall Length	ZEFF Eff. Flutes	FHA Flute Helix Angle	DCON Shank Dia.	RPMX Ramp Angle Max.
47JE1040S1RC00 S5	1.000	0.000	4.000	7.0	5	43	1.000	3
47DE1020S1RC03 S5	1.000	0.030	2.000	4.5	5	43	1.000	3
47DE1025S1RC03 S5	1.000	0.030	2.500	5.0	5	43	1.000	3
47DE1031S1RC03 S5	1.000	0.030	3.125	6.0	5	43	1.000	3
47DE1040S1RC03 S5	1.000	0.030	4.000	7.0	5	43	1.000	3
47DE1020S1RC06 S5	1.000	0.060	2.000	4.5	5	43	1.000	3
47DE1025S1RC06 S5	1.000	0.060	2.500	5.0	5	43	1.000	3
47DE1031S1RC06 S5	1.000	0.060	3.125	6.0	5	43	1.000	3
47DE1040S1RC06 S5	1.000	0.060	4.000	7.0	5	43	1.000	3
47DE1020S1RC09 S5	1.000	0.090	2.000	4.5	5	43	1.000	3
47DE1020S1RC12 S5	1.000	0.125	2.000	4.5	5	43	1.000	3
47DE1025S1RC12 S5	1.000	0.125	2.500	5.0	5	43	1.000	3
47DE1031S1RC12 S5	1.000	0.125	3.125	6.0	5	43	1.000	3
47DE1040S1RC12 S5	1.000	0.125	4.000	7.0	5	43	1.000	3
47DE1020S1RC18 S5	1.000	0.188	2.000	4.5	5	43	1.000	3
47DE1025S1RC18 S5	1.000	0.188	2.500	5.0	5	43	1.000	3
47DE1020S1RC25 S5	1.000	0.250	2.000	4.5	5	43	1.000	3
47DE1025S1RC25 S5	1.000	0.250	2.500	5.0	5	43	1.000	3



HEOROUNDS™ OPERATING GUIDELINES

ISO	Material	Condition	Hardness (Hb)	Cutting Speed Vc (sfm)	Max. % Stepover @2x Dia. Loc.	Suggested IPT (per Diameter)					
						.250"	.375"	.500"	.625"	.750"	1.000"
P	Low-Carbon Steels	1018, 1108, 1117, A36, 12L14, 1200's, 1500's	<300	600-900	15%	.0024	.0035	.0043	.0053	.0066	.0091
	Medium & High-Carbon Steels	1000-1200 Series	>285	500-800	12%	.0023	.0033	.0043	.0051	.0063	.0084
	Alloy Steels	4130, 4140, 5140, 6150, 8620,	<330	400-900	10%	.0023	.0032	.0043	.0050	.0062	.0082
	Tool Steel	A2, P20, S7, H13, L6	<300	450-650	9%	.0021	.0031	.0042	.0049	.0056	.0072
M	Ferritic, Martensitic & PH Stainless Steels	400'S, 15-5, 17-4, Custom 400'S	>300	300-500	9%	.0020	.0033	.0041	.0050	.0059	.0076
	Austenitic Stainless Steels & Cast Stainless Steels	310, 314, 316	<300	350-500	9%	.0024	.0035	.0046	.0057	.0066	.0088
	Duplex Steels (Austenitic & Ferritic)	255, 323, 329, 2202, 2205, 2304	<310	350-500	8%	.0025	.0037	.0049	.0063	.0075	.0102
K	Cast Iron - Nodular High Strength	32510, 40010, 5005, 70003, 90001	>300	300-400	8%	.0011	.0015	.0021	.0026	.0031	.0044
S	Iron-Based, Heat-Resistant Alloys	A-286, INVAR, Discaloy, Incaloy 800-802, Nitronic	>200	200-425	8%	.0022	.0029	.0039	.0050	.0055	.0065
	Cobalt-Based, Heat-Resistant Alloys	Haynes 25, Haynes 188, Stellite, MAR-M302	>180	100-225	7%	.0027	.0038	.0048	.0059	.0067	.0091
	Nickel-Based, Heat-Resistant Alloys	HAST-C, Rene 41, Waspalloy, Monel, Nimonic, UDIMET	>180	65-150	7%	.0018	.0024	.0033	.0043	.0053	.0069
	Titanium	Ti6AL4V	>270	325-450	9%	.0026	.0031	.0043	.0051	.0058	.0073
		Titanium 10-2-3	<390	250-400	7%	.0027	.0034	.0048	.0059	.0069	.0093
H	Hardened Tool Steels	D2, H13, S7	>360	325-525	7%	.0022	.0029	.0035	.0043	.0049	.0067
			>420	300-400	7%	.002	.0027	.0031	.0037	.0045	.0059
			>485	225-300	6%	.0017	.0023	.0027	.0034	.0042	.0059
			>560	180-275	6%	.0013	.0019	.0027	.0034	.004	0.0051

Note: Feed and speed recommendations are starting operating parameters. They are only guidelines from which further optimization should take place. Operating parameters are influenced by many machining variables. These variables may cause for reductions in feeds and speed or dramatic increases.