SPEEDS AND FEEDS FOR CARBIDE ENDMILLS

MATERIAL	SPEED SURFACE FEET PER MINUTE		ENDMILL DIAMETER FEED PER TOOTH (INCHES) UP TO 1/4"	UP TO 1/2"	UP TO 1"
ALUMINUM / ALUMINUM ALLOYS	600-1300		.0002 - .002	.002 - .004	.004 - .008
BRASS / SOFT BRONZE	400-700		.0005 - .002	.002 - .003	.003 - .005
BRONZE / HIGH TENSILE	250-400		.001 - .002	.002 - .003	.004 - .006
COPPER / COPPER ALLOYS	350-900		.0005 - .002	0.002	.002 - .006
IRON-CAST (SOFT)	200-500		.0005 - .002	.002 - .003	.003 - .006
IRON-CAST (HARD)	100-450		.0003 - .001	.0008 - .002	.003 - .005
IRON-DUCTILE	80-400		.0002 - .001	.001 - .002	.002 - .006
IRON MALLEABLE	250-600		.001 - .002	.001 - .003	.003 - .008
MAGNESIUM / MAGNESIUM ALLOYS	800-1400		.0005 - .002	.002 - .004	.004 - .010
MOLYBDENUM	800-1100		.001 - .002	.002 - .004	.004 - .008
MONEL / HIGH NICKEL STEEL	150-300		.0002 - .001	.001 - .002	.002 - .004
NICKEL BASE HI-TEMP ALLOYS	20-130		.0003 - .0008	.0008 - .001	.001 - .002
PLASTICS	600-1200		.0006 - .003	.003 - .006	.006 - .015
PLASTICS-GLASS FILLED	300-800		.0006 - .003	.003 - .004	.004 - .012
REFRACTORY ALLOYS	80-400		.0002 - .001	0.001	.001 - .002
STEEL-LOW CARBON	250-550		.0002 - .001	.001 - .003	.003 - .007
STEEL-MEDIUM CARBON	100-250		.0004 - .0015	.0015 - .002	.002 - .005
STEEL-UP TO Rc35	150-250		.0005 - .001	.001 - .002	.002 - .003
STEEL-Rc35 - Rc50	80-150		.0003 - .0007	.0007 - .001	.002 - .003
STEEL-Rc50 - Rc60	25-120		.0002 - .0005	.0005 - .001	.001 - .003
STEEL-MOLD	200-350		.0002 - .001	.001 - .002	.002 - .006
STEEL-TOOL	100-300		.0002 - .001	.001 - .002	.002 - .006
STAINLESS STEEL-SOFT	250-400		.0002 - .001	.001 - .002	.002 - .006
STAINLESS STEEL-HARD	50-250		.0002 - .001	.001 - .002	.001 - .005
TITANIUM-SOFT	120-350		.0002 - .001	.001 - .002	.002 - .006
TITANIUM-HARD	30-150		.0002 - .0005	.0005 - .001	.001 - .004

PLUNGE OPERATIONS: REDUCE FEED PER TOOTH 50-65%
SLOTTING APPLICATIONS: SURFACE SPEEDS (SFM) SHOULD BE REDUCED APPROXIMATELY 20% OF THE LOWEST VALUE
LIGHT RADIAL: DEPTHS OF CUT, THE HIGHER OF THE RECOMMENDED SURFACE SPEEDS (SFM) SHOULD BE USED
GREATER RADIAL: DEPTHS OF CUT (MORE THAN .5 X DIAMETER) THE LOWER RANGE OF SURFACE SPEEDS (SFM) SHOULD BE USED
AXIAL DEPTH OF CUT: RECOMMENDATIONS ARE NOT TO EXCEED 1-1/2 TIMES THE DIAMETER. IF THIS CONDITION EXISTS, *CONVENTIAL MILLING* SHOULD BE USED AND FEED PER TOOTH SHOULD BE REDUCED BY 50%

PLEASE NOTE: THE ABOVE RECOMMENDATIONS SHOULD BE CONSIDERED ONLY AS A STARTING POINT; "FINE TUNING" MAY BE REQUIRED IN ORDER TO MAXIMIZE PERFORMANCE

SPEEDS AND FEEDS FOR BORING TOOLS

MATERIAL	TYPE	SPEED SURFACE FEET PER MINUTE	FEED INCHES PER REVOLUTION	DEPTH OF CUT: INSERT BARS SERIES 16THRU 18 PAGE 45 THRU 48	DEPTH OF CUT: SOLID CARBIDE BARS OUR SERIES 10 PAGE 2	DEPTH OF CUT: TIN COATED SOLID CARBIDE BARS OUR SERIES 11 PAGE 3
PLASTIC	TEFLON	500-600	.003 - .006	.007	.012	.016
	NYLON	700-800	.001 - .003	.007	.012	.016
	PHENOLIC	700-800	.001 - .003	.007	.012	.016
	GLASS FILLED	700-800	.001 - .003	.005	.012	.016
MAGNESIUM	AZ,AM,EZ,ZE,HK	750-1500	.005 - .012	.008	.012	.016
ALUMINUM	2021 THRU 6061	700-1400	.005 - .012	.008	.014	.018
COPPER	101-707	600-800	.003 - .005	.008	.014	.016
	834-978	600-800	.003 - .005	.008	.014	.016
BRASS		350-400	.001 - .003	.006	.011	.012
BRONZE		300-400	.001 - .002	.006	.011	.012
CAST IRON	GRAY	250-350	.004 - .010	.007	.007	.009
	DUCTILE	250-350	.004 - .010	.007	.007	.009
	MALLEABLE	250-350	.004 - .010	.007	.007	.009
STEEL	1005-1029	100-300	.003 - .007	.007	.014	.016
	1030-1055	100-300	.003 -.007	.007	.014	.016
	1060-1095	150-400	.003 - .005	.007	.014	.016
	10L45-10L50	300-500	.004 - .006	.007	.014	.016
	12L13-12L15	300-500	.003 - .005	.007	.014	.016
	41L30-41L50	200-400	.003 - .005	.007	.014	.016
	4140-4150	150-400	.003 - .005	.007	.014	.016
	4140 (35 HRC)	90-125	.001 - .004	.004	.007	.008
	8617-8622	100-300	.002 - .004	.007	.006	.007
	M1-M6	150-250	.003 - .008	.006	.005	.006
	H10-H19	150-250	.003 - .007	.006	.005	.006
	D2-D7	150-250	.004 - .010	.006	.005	.006
	A2-A9, 01-07	150-250	.003 - .008	.006	.005	.006
	W1, W2	150-250	.003 - .008	.006	.006	.007
	M-50, 52100	300-400	.004 - .010	.007	.006	.007
TITANIUM	TI-9AI-6V	90-250	.001 - .003	.005	.008	.011
STAINLESS	201-385	100-250	.001 - .004	.005	.008	.012
	405-446	100-250	.001 - .004	.005	.008	.012
	15-5PH,16-6PH,14-4PH	300-400	.002 - .004	.005	.008	.012
NICKEL	NICKEL 200-230	100-250	.002 - .005	.004	.007	.009
MONEL		80-120	.001 - .003	.004	.007	.009
INCONEL		80-120	.001 - .003	.004	.007	.009
WASPALOY		80-120	.001 - .003	.004	.007	.009
HASTELLOY		80-120	.001 - .003	.004	.007	.009

NOTE: ALL SPEEDS AND FEEDS LISTED HERE ARE PROVIDED FOR REFERENCE ONLY.

$$\frac{RPM = SFM \times 12}{(\P) \times DIAMETER}$$

SPEEDS AND FEEDS FOR GROOVING TOOLS

MATERIAL	TYPE	SPEED SURFACE FEET PER MINUTE	FEED Inches per revolution CARBIDE INSERT OUR SERIES 26 PAGE 53	FEED Inches per revolution SOLID CARBIDE OUR SERIES 20 PAGE 10	FEED Inches per revolution TIN COATED SOLID CARBIDE OUR SERIES 22 PAGE 11
PLASTIC	TEFLON	350-400	.003 - .006	.007	.012
	NYLON	350-600	.001 - .003	.007	.012
	PHENOLIC	500-600	.001 - .003	.007	.012
	GLASS FILLED	250-300	.001 - .003	.005	.012
MAGNESIUM	AZ,AM,EZ,ZE,HK	850-1000	.005 - .012	.008	.012
ALUMINUM	2021 THRU 6061	900-1000	.005 - .012	.008	.014
COPPER	101-707	150-170	.003 - .005	.008	.014
	834-978	500-600	.003 - .005	.008	.014
BRASS		200-250	.001 - .003	.006	.011
BRONZE		200-250	.001 - .002	.006	.011
CAST IRON	GRAY	120-350	.004 - .010	.007	.007
	DUCTILE	70-350	.004 - .010	.007	.007
	MALLEABLE	75-550	.004 - .010	.007	.007
STEEL	1005-1029	250-450	.003 - .007	.007	.014
	1030-1055	110-370	.003 -.007	.007	.014
	1060-1095	90-250	.003 - .005	.007	.014
	10L45-10L50	130-450	.004 - .006	.007	.014
	12L13-12L15	550-600	.003 - .005	.007	.014
	41L30-41L50	65-350	.003 - .005	.007	.014
	4140-4150	65-400	.003 - .005	.007	.014
	4140 (35 HRc)	190-200	.001 - .004	.004	.007
	8617-8622	100-400	.002 - .004	.007	.006
	M1-M6	150-200	.003 - .008	.006	.005
	H10-H19	65-250	.003 - .007	.006	.005
	D2-D7	150-200	.004 - .010	.006	.005
	A2-A9, 01-07	150-250	.003 - .008	.006	.005
	W1, W2	150-250	.003 - .008	.006	.006
	M-50, 52100	60-300	.004 - .010	.007	.006
TITANIUM	TI-9AI-6V	90-100	.001 - .003	.005	.008
STAINLESS	201-385	200-280	.001 - .004	.005	.008
	405-446	250-300	.001 - .004	.005	.008
	15-5PH,16-6PH,14-4PH	100-200	.002 - .004	.005	.008
NICKEL	NICKEL 200-230	200-250	.002 - .005	.004	.007
MONEL		100-150	.001 - .003	.004	.007
INCONEL		40-50	.001 - .003	.004	.007
WASPALOY		70-100	.001 - .003	.004	.007
HASTELLOY		70-90	.001 - .003	.004	.007

NOTE: ALL SPEEDS AND FEEDS LISTED HERE ARE PROVIDED FOR REFERENCE ONLY.

$$\frac{RPM = SFM \times 12}{(\P) \times DIAMETER}$$

SPEEDS AND FEEDS FOR KEY CUTTERS

MATERIAL	TYPE	SPEED SURFACE FEET PER MINUTE
PLASTIC	TEFLON	200
	NYLON	200
	PHENOLIC	180
	GLASS FILLED	150
MAGNESIUM	AZ,AM,EZ,ZE,HK	300
ALUMINUM	2021 THRU 6061	300
COPPER	101-707	100
	834-978	200
BRASS		250
BRONZE		230
CAST IRON	GRAY	180
	DUCTILE	140
	MALLEABLE	100
STEEL	1005-1029	180
	1030-1055	180
	1060-1095	170
	10L45-10L50	165
	12L13-12L15	160
	41L30-41L50	150
	4140-4150	140
	4140 (35 HRc)	130
	8617-8622	120
	M1-M6	110
	H10-H19	100
	D2-D7	90
	A2-A9, 01-07	80
	W1, W2	70
	M-50, 52100	60
TITANIUM	TI-9AI-6V	90
STAINLESS	201-385	100
	405-446	110
	15-5PH,16-6PH,14-4PH	120
NICKEL	NICKEL 200-230	80
MONEL		80
INCONEL		80
WASPALOY		80
HASTELLOY		80

FORMULA FOR COMPUTING SPINDLE SPEED IS.

*SURFACE FEET PER MINUTE FACTOR X 4 = ? *

? DIVIDED BY DIAMETER OF CUTTER =____RPM

EXAMPLE CUTTING ALUMINUM WITH A 3/4" KEY CUTTER

300 X 4 = 1200 divided by .750 = 1600 RPM

surface feet *MULTIPLIER* *cutter diameter*

FORMULA FOR COMPUTING TABLE SPEED IS.

.001 X NUMBER OF TEETH IN CUTTER X RPM

EXAMPLE CUTTING ALUMINUM WITH A 3/4" KEY CUTTER

.001 X 10 X 1600 = 16

MULTIPLIER *NUMBER OF TEETH* *RPM* *INCHES PER MINUTE*

NOTE: ALL SPEEDS AND FEEDS LISTED HERE ARE PROVIDED FOR REFERENCE ONLY.

SPEEDS AND FEEDS FOR GROOVING TOOLS

MATERIAL	TYPE	SPEED SURFACE FEET PER MINUTE	FEED Inches per revolution CARBIDE INSERT OUR SERIES 26 PAGE 53	FEED Inches per revolution SOLID CARBIDE OUR SERIES 20 PAGE 10	FEED Inches per revolution TIN COATED SOLID CARBIDE OUR SERIES 22 PAGE 11
PLASTIC	TEFLON	350-400	.003 - .006	.007	.012
	NYLON	350-600	.001 - .003	.007	.012
	PHENOLIC	500-600	.001 - .003	.007	.012
	GLASS FILLED	250-300	.001 - .003	.005	.012
MAGNESIUM	AZ,AM,EZ,ZE,HK	850-1000	.005 - .012	.008	.012
ALUMINUM	2021 THRU 6061	900-1000	.005 - .012	.008	.014
COPPER	101-707	150-170	.003 - .005	.008	.014
	834-978	500-600	.003 - .005	.008	.014
BRASS		200-250	.001 - .003	.006	.011
BRONZE		200-250	.001 - .002	.006	.011
CAST IRON	GRAY	120-350	.004 - .010	.007	.007
	DUCTILE	70-350	.004 - .010	.007	.007
	MALLEABLE	75-550	.004 - .010	.007	.007
STEEL	1005-1029	250-450	.003 - .007	.007	.014
	1030-1055	110-370	.003 -.007	.007	.014
	1060-1095	90-250	.003 - .005	.007	.014
	10L45-10L50	130-450	.004 - .006	.007	.014
	12L13-12L15	550-600	.003 - .005	.007	.014
	41L30-41L50	65-350	.003 - .005	.007	.014
	4140-4150	65-400	.003 - .005	.007	.014
	4140 (35 HRc)	190-200	.001 - .004	.004	.007
	8617-8622	100-400	.002 - .004	.007	.006
	M1-M6	150-200	.003 - .008	.006	.005
	H10-H19	65-250	.003 - .007	.006	.005
	D2-D7	150-200	.004 - .010	.006	.005
	A2-A9, 01-07	150-250	.003 - .008	.006	.005
	W1, W2	150-250	.003 - .008	.006	.006
	M-50, 52100	60-300	.004 - .010	.007	.006
TITANIUM	TI-9AI-6V	90-100	.001 - .003	.005	.008
STAINLESS	201-385	200-280	.001 - .004	.005	.008
	405-446	250-300	.001 - .004	.005	.008
	15-5PH,16-6PH,14-4PH	100-200	.002 - .004	.005	.008
NICKEL	NICKEL 200-230	200-250	.002 - .005	.004	.007
MONEL		100-150	.001 - .003	.004	.007
INCONEL		40-50	.001 - .003	.004	.007
WASPALOY		70-100	.001 - .003	.004	.007
HASTELLOY		70-90	.001 - .003	.004	.007

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$$\frac{RPM = SFM \times 12}{(\P) \times DIAMETER}$$

SPEEDS AND FEEDS FOR KEY CUTTERS

MATERIAL	TYPE	SPEED SURFACE FEET PER MINUTE
PLASTIC	TEFLON	200
	NYLON	200
	PHENOLIC	180
	GLASS FILLED	150
MAGNESIUM	AZ,AM,EZ,ZE,HK	300
ALUMINUM	2021 THRU 6061	300
COPPER	101-707	100
	834-978	200
BRASS		250
BRONZE		230
CAST IRON	GRAY	180
	DUCTILE	140
	MALLEABLE	100
STEEL	1005-1029	180
	1030-1055	180
	1060-1095	170
	10L45-10L50	165
	12L13-12L15	160
	41L30-41L50	150
	4140-4150	140
	4140 (35 HRc)	130
	8617-8622	120
	M1-M6	110
	H10-H19	100
	D2-D7	90
	A2-A9, 01-07	80
	W1, W2	70
	M-50, 52100	60
TITANIUM	TI-9AI-6V	90
STAINLESS	201-385	100
	405-446	110
	15-5PH,16-6PH,14-4PH	120
NICKEL	NICKEL 200-230	80
MONEL		80
INCONEL		80
WASPALOY		80
HASTELLOY		80

FORMULA FOR COMPUTING SPINDLE SPEED IS.

SURFACE FEET PER MINUTE FACTOR X 4 = ?

? DIVIDED BY DIAMETER OF CUTTER = ____ RPM

EXAMPLE CUTTING ALUMINUM WITH A 3/4" KEY CUTTER

300 X 4 = 1200 divided by .750 = 1600 RPM

surface feet — *MULTIPLIER* — *cutter diameter*

FORMULA FOR COMPUTING TABLE SPEED IS.

.001 X NUMBER OF TEETH IN CUTTER X RPM

EXAMPLE CUTTING ALUMINUM WITH A 3/4" KEY CUTTER

.001 X 10 X 1600 = 16

MULTIPLIER — *NUMBER OF TEETH* — *RPM* — *INCHES PER MINUTE*

NOTE: ALL SPEEDS AND FEEDS LISTED HERE ARE PROVIDED FOR REFERENCE ONLY.