



Specializing in High Performance Solid Carbide End Mills.



Made in the U.S.A. 

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PROMAX Premier

Universal

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PROMAX Premium

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Design-Rite XL

































General Purpose Aluminum

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General Purpose Universal

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Design-Rite XL Feeds & Speeds **pg. 115**

Best Used In Material	    
Number Of Flutes	     
End Mill Corner / End Style	   
Application Uses	        
Geometry Information	       

PROMAX COATINGS

All materials are not alike, that's why PROMAX Tools developed 3 lines of carbide end mills. Using the latest in carbide tool technology and various grades of carbide, PROMAX engineered the right geometries to produce maximum metal removal for all of your applications.

TiCN
(Titanium Carbonitride)



This multipurpose gradient coating is used for milling in general purpose applications in which interrupted cutting is encountered as it has a higher edge stability than TiCN-grey. It is also ideal where high feed and speed rates are desirable.

AlTiN
(Aluminum Titanium Nitride)



Our AlTiN is a monoblock and gradient, multilayer coating designed specifically for use on carbide end mills. Use when machining Cast Iron and Steel work pieces as it has excellent oxidation resistance allowing for high speeds in semi-dry or dry machining operations where increased heat is generated.

ZrN
(Zirconium Nitride)



This monolayer coating effectively reduces built-up edges when machining aluminum and titanium alloys. Recommended when machining medical grade materials and in other high heat resistant applications. Also for use in machining Steels, Alloyed Steels, Superalloys, Aluminium > 12% Si, Aluminium < 12% Si, Copper, Bronze and Brass Plastics.

nACRo®
(Aluminum-Chromium-Silicon)



The latest generation in tool coatings, nACRo®, has a nanocomposite structure that has increased hardness for scratch and higher heat resistance. Add to these qualities increased tool life and decreased tool changes, this coating will maximize machine time in "tough" difficult to cut materials including Steels, Hardened Steels, Alloyed Steels, and Superalloys. nACRo® coated tools have been proven to reduce production time by up to 30%.

"FEEL THE EDGE"

PROMAX's EDGE PREP is standard on many of our End Mills. This process allows you to forgo the tedious and long break-in periods needed on most tools in order to receive the most production out of your tool. Combining our edge prep with our superior coatings and the results are clear – longer running tools with fewer tool changes per run equaling significant cost effectiveness.

PROMAX CUSTOMER SERVICE

At PROMAX, we will provide the highest quality cutting tools to best suit your application. In addition, our customers receive both an excellent tool and the knowledge and assistance of our Technical Support and other departments. PROMAX Tools is built on the foundation that customer service is just as important as the product being sold. Our customers receive the answers they seek and the information they need in a more timely manner. You can feel comfortable knowing that quality products and customer satisfaction are at the center of every decision PROMAX Tools makes.

Call the knowledgeable PROMAX Tech Line at 800-878-0502 for all of your cutting tool needs and questions.

LIMITED WARRANTY

PROMAX Tools warrants each new product manufactured and sold by PROMAX or one of our authorized dealers against defects in workmanship and/or materials. Our obligation is limited to the repair or replacement of defective products. At our discretion, we may refund the purchase price of a defective product. This warranty does not cover products that are damaged as a result of negligence or misuse including improper operating conditions and machine set up or any items that have been repaired or altered. This warranty excludes all other warranties, expressed or implied, including any implied warranties of merchant ability or fitness for a particular purpose. In no event will PROMAX be liable for any incidental, special or consequential damages of any nature.

RETURN POLICY

Returned products must be accompanied by a PROMAX Tools authorized Returned Goods Authorization number (RGA). Warranty claims should be made through the distributor from whom the product was purchased. Distributors may call PROMAX at 1-800-878-0502 to receive an RGA number. Returned goods may be subject to a restocking fee. Special, modified, non-catalog or altered tools are not acceptable for return.

TEST TOOL POLICY

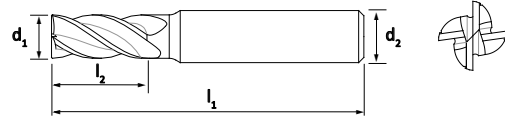
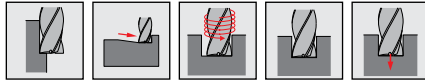
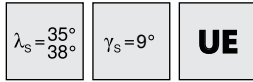
Take the PROMAX Challenge: Throw it on the spindle and prove it to yourself. Higher production rates and longer tool life are your goals and ours. PROMAX Tools will authorize a test tool credit only when the proper procedures of the existing GUARANTEED TEST TOOL ORDER (GTO) are followed. For details on this program, please call our TECH LINE at 1-800-878-0502.

SAFETY PRECAUTIONS

Carbide cutting tools can break or shatter under improper or severe use. Always wear the proper personal protective equipment when performing metal cutting operations. Carbide cutting tools have sharp edges. Use caution while handling cutting tools to avoid injury.



*For more information on our Policies and Precautions, please visit our website at www.promaxtools.com

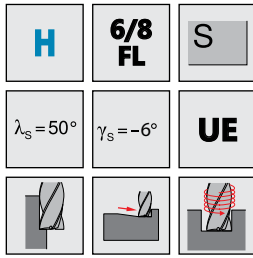
**Tolerances**

Shank: 1/8" - 1" = -.0001/- .0004
 Cutting Dia: 1/8" - 1" = +.000/- .002
 Chamfer: 1/8" - 1" = +/- .002

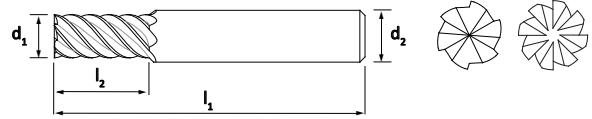
d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	C Chamfer	Flute	AlTiN	nACRo®
1/8	1/8	3/8	1 - 1/2	0.006	4	US451002	US451003
5/32	3/16	1/2	2	0.006	4	US451005	US451006
5/32	3/16	3/8	2	0.006	4	US451008	US451009
3/16	3/16	5/8	2	0.006	4	US451011	US451012
3/16	3/16	3/8	2	0.006	4	US451014	US451015
7/32	1/4	3/4	2 - 1/2	0.006	4	US451017	US451018
7/32	1/4	3/8	2	0.006	4	US451020	US451021
1/4	1/4	3/4	2 - 1/2	0.010	4	US451023	US451024
1/4	1/4	3/8	2	0.010	4	US451026	US451027
1/4	1/4	1 - 1/4	3	0.010	4	US451029	US451030
5/16	5/16	3/4	2 - 1/2	0.010	4	US451032	US451033
5/16	5/16	1/2	2 - 1/2	0.010	4	US451035	US451036
3/8	3/8	7/8	3	0.010	4	US451038	US451039
3/8	3/8	5/8	2 - 1/2	0.010	4	US451041	US451042
3/8	3/8	1 - 1/2	4	0.010	4	US451044	US451045
7/16	7/16	1	2 - 3/4	0.014	4	US451047	US451048
1/2	1/2	1 - 1/4	3 - 1/2	0.014	4	US451050	US451051
1/2	1/2	5/8	2 - 1/2	0.014	4	US451053	US451054
1/2	1/2	2	4	0.014	4	US451056	US451057
5/8	5/8	1 - 1/4	3 - 1/2	0.014	4	US451059	US451060
5/8	5/8	7/8	3	0.014	4	US451062	US451063
5/8	5/8	2 - 1/2	5	0.014	4	US451065	US451066
3/4	3/4	1 - 5/8	4	0.014	4	US451068	US451069
3/4	3/4	2 - 1/2	5	0.014	4	US451071	US451072
1	1	1 - 1/2	4	0.014	4	US451074	US451075
1	1	2 - 3/4	6	0.014	4	US451077	US451078

Feeds & Speeds Available on Page 18
Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•	•	•	•			•	

**Tolerances**

Shank: $1/8'' - 3/4'' = -.0001/-0.0004$
 Cutting Dia: $1/8'' - 3/4'' = +.000/-0.002$



d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	Flute	nACRo®
1/8	1/8	3/8	2	6	US367002
3/16	3/16	7/16	2	6	US367004
3/16	3/16	5/8	2 - 1/2	6	US367006
1/4	1/4	1/2	2	6	US367008
1/4	1/4	11/16	2 - 1/2	6	US367010
5/16	5/16	3/4	2 - 1/2	6	US367012
5/16	5/16	1	3	6	US367014
3/8	3/8	7/8	3	6	US367016
3/8	3/8	1 - 1/8	3 - 1/2	6	US367018
1/2	1/2	1 - 1/4	3 - 1/2	6	US367020
1/2	1/2	4	1 - 1/2	6	US367022
5/8	5/8	1 - 1/4	3 - 1/2	8	US367024
5/8	5/8	1 - 7/8	5	8	US367026
3/4	3/4	1 - 1/2	4	8	US367028
3/4	3/4	2 - 1/4	5	8	US367030

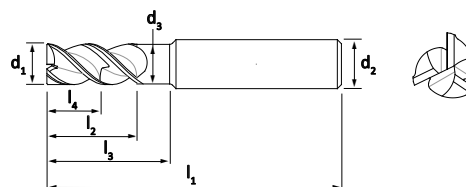
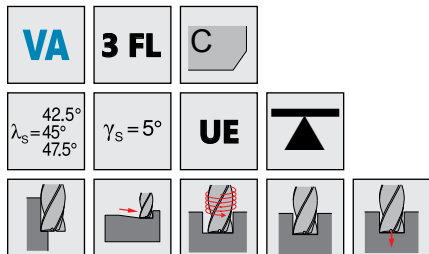
Feeds & Speeds Available on Page 19

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•	•								

Series US340

3 Flute Stainless Steel



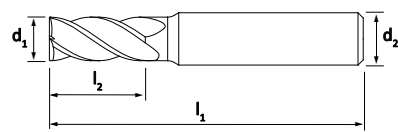
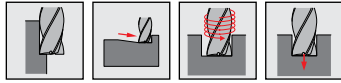
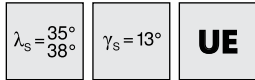
Tolerances
 Shank: 1/8" - 3/4" = -.0001/- .0004
 Cutting Dia: 1/8" - 3/4" = +.000/- .002
 Chamfer: 1/8" - 3/4" = +/- .002

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₄ TCL	l ₁ OAL	l ₃ LOR	d ₃ Neck Dia	C Chamfer	Flute	AlTiN	nACRo®
1/8	1/8	3/8	0.163	2 - 1/4	1/2	0.120	0.006	3	US340002	US340003
3/16	3/16	7/16	0.243	2 - 1/2	11/16	0.180	0.006	3	US340012	US340014
3/16	3/16	5/8	0.243	2 - 1/2	1	0.180	0.006	3	US340007	US340009
3/16	3/16	3/8	0.206	2 - 1/2	5/8	0.180	0.006	3	US340013	US340015
3/16	3/16	5/8	0.243	2 - 1/2			0.006	3	US340006	US340008
1/4	1/4	1/2	0.325	2 - 1/2	3/4	0.240	0.010	3	US340024	US340026
1/4	1/4	3/4	0.325	2 - 1/2	1	0.240	0.010	3	US340019	US340021
1/4	1/4	3/8	0.275	2 - 1/2	5/8	0.240	0.010	3	US340025	US340027
1/4	1/4	3/4	0.325	2 - 1/2			0.010	3	US340018	US340020
5/16	5/16	3/4	0.406	2 - 1/2	1	0.300	0.010	3	US340030	US340032
5/16	5/16	1/2	0.343	2 - 1/2	3/4	0.300	0.010	3	US340035	US340036
5/16	5/16	15/16	0.406	2 - 1/2			0.010	3	US340031	US340033
3/8	3/8	7/8	0.487	2 - 1/2	1 - 1/8	0.360	0.010	3	US340045	US340047
3/8	3/8	1 - 3/16	0.487	3	1 - 1/2	0.360	0.010	3	US340040	US340042
3/8	3/8	1/2	0.412	2 - 1/2	7/8	0.360	0.010	3	US340046	US340048
3/8	3/8	1 - 3/16	0.487	3			0.010	3	US340039	US340041
1/2	1/2	1	0.650	3	1 - 3/8	0.480	0.010	3	US340057	US340059
1/2	1/2	1 - 1/2	0.650	4	1 - 7/8	0.480	0.010	3	US340052	US340054
1/2	1/2	5/8	0.550	3	1	0.480	0.010	3	US340058	US340060
1/2	1/2	1 - 1/2	0.650	4			0.010	3	US340051	US340053
5/8	5/8	1 - 1/4	0.812	3 - 1/2	1 - 5/8	0.600	0.010	3	US340069	US340071
5/8	5/8	1 - 5/8	0.812	4	2 - 1/4	0.600	0.010	3	US340064	US340066
5/8	5/8	7/8	0.687	3 - 1/2	1 - 1/4	0.600	0.010	3	US340070	US340072
5/8	5/8	1 - 5/8	0.812	4			0.010	3	US340063	US340065
3/4	3/4	1 - 1/2	0.975	4	1	0.720	0.010	3	US340081	US340083
3/4	3/4	2 - 3/8	0.975	6	2 - 7/8	0.720	0.010	3	US340076	US340078
3/4	3/4	1	0.825	4	1 - 1/2	0.720	0.010	3	US340082	US340084
3/4	3/4	2 - 3/8	0.975	6			0.010	3	US340075	US340077

Feeds & Speeds Available on Page 21

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●			●	●	●	●			●	

**Tolerances**

Shank: 3/16" - 3/4" = -.0001/- .0004
 Cutting Dia: 3/16" - 3/4" = +.000/- .002
 Chamfer: 3/16" - 3/4" = +/- .002

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	C Chamfer	Flute	AlTiN	nACRo®
3/16	3/16	7/16	2	0.006	4	US445002	US445003
1/4	1/4	1/2	2 - 1/2	0.010	4	US445005	US445006
5/16	5/16	3/4	2 - 1/2	0.010	4	US445008	US445009
3/8	3/8	7/8	3	0.010	4	US445011	US445012
7/16	7/16	1	2 - 3/4	0.014	4	US445014	US445015
1/2	1/2	1 - 1/4	3 - 1/2	0.014	4	US445017	US445018
5/8	5/8	1 - 1/2	4	0.014	4	US445020	US445021
3/4	3/4	1 - 5/8	4	0.014	4	US445023	US445024

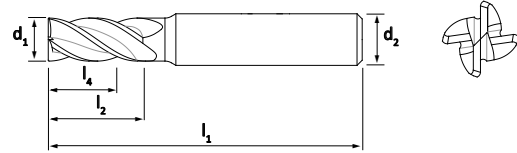
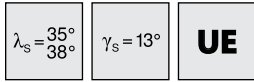
Feeds & Speeds Available on Page 20

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•			•				

Series US456

4 Flute Titanium



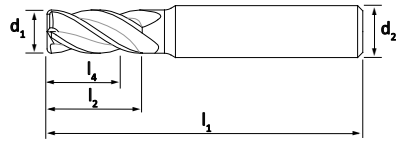
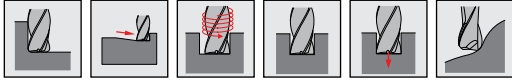
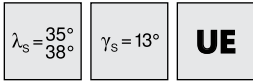
Tolerances
 Shank: 1/8" - 1" = -.0001/- .0004
 Cutting Dia: 1/8" - 1" = +.000/- .002
 Radius: 1/8" - 1" = +/- .001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₄ TCL	l ₁ OAL	R Radius	Flute	nACRo®	ZrN
1/8	1/8	3/8	0.300	1 - 1/2	0.004	4	US456002	US456003
3/16	3/16	5/8	0.512	2	0.004	4	US456005	US456006
1/4	1/4	3/4	0.600	2 - 1/2	0.008	4	US456008	US456009
1/4	1/4	3/8	0.275	2	0.008	4	US456011	US456012
1/4	1/4	1 - 1/4	1.100	3	0.008	4	US456014	US456015
5/16	5/16	3/4	0.562	2 - 1/2	0.008	4	US456017	US456018
3/8	3/8	7/8	0.650	3	0.008	4	US456020	US456021
3/8	3/8	5/8	0.412	2 - 1/2	0.008	4	US456023	US456024
3/8	3/8	1 - 1/2	1.275	4	0.008	4	US456026	US456027
7/16	7/16	1	0.737	2 - 3/4	0.008	4	US456029	US456030
1/2	1/2	1 - 1/4	0.950	3 - 1/2	0.012	4	US456032	US456033
1/2	1/2	5/8	0.550	2 - 1/2	0.012	4	US456035	US456036
1/2	1/2	2	1.700	4	0.012	4	US456038	US456039
5/8	5/8	1 - 1/4	0.687	3 - 1/2	0.012	4	US456041	US456042
5/8	5/8	2 - 1/2	2.125	5	0.012	4	US456044	US456045
3/4	3/4	1 - 5/8	0.825	4	0.012	4	US456047	US456048
3/4	3/4	2 - 1/2	2.050	5	0.012	4	US456050	US456051
1	1	1 - 1/2	1.100	4	0.012	4	US456053	US456054

Feeds & Speeds Available on Page 22

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
				•	•					



Tolerances

Shank: 1/8" - 1" = -.0001/- .0004
 Cutting Dia: 1/8" - 1" = +.000/- .002
 Radius: Radius < 0.060 = +/- .001
 Radius ≥ 0.060 = +/- .0015

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₄ TCL	l ₁ OAL	R Radius	Flute	nACRo®	ZrN
1/8	1/8	3/8	0.300	1 - 1/2	0.010	4	US457002	US457003
1/8	1/8	3/8	0.300	1 - 1/2	0.015	4	US457035	US457036
1/8	1/8	3/8	0.300	1 - 1/2	0.020	4	US457071	US457072
3/16	3/16	3/8	0.206	2	0.010	4	US457008	US457009
3/16	3/16	3/8	0.206	2	0.015	4	US457041	US457042
3/16	3/16	3/8	0.206	2	0.020	4	US457077	US457078
3/16	3/16	5/8	0.512	2	0.010	4	US457005	US457006
3/16	3/16	5/8	0.512	2	0.015	4	US457038	US457039
3/16	3/16	5/8	0.512	2	0.020	4	US457074	US457075
1/4	1/4	3/8	0.275	2	0.010	4	US457014	US457015
1/4	1/4	3/8	0.275	2	0.015	4	US457047	US457048
1/4	1/4	3/8	0.275	2	0.020	4	US457083	US457084
1/4	1/4	3/8	0.275	2	0.030	4	US457113	US457114
1/4	1/4	3/4	0.600	2 - 1/2	0.010	4	US457011	US457012
1/4	1/4	3/4	0.600	2 - 1/2	0.015	4	US457044	US457045
1/4	1/4	3/4	0.600	2 - 1/2	0.020	4	US457080	US457081
1/4	1/4	3/4	0.600	2 - 1/2	0.030	4	US457110	US457111
1/4	1/4	1 - 1/4	1.100	3	0.010	4	US457017	US457018
1/4	1/4	1 - 1/4	1.100	3	0.015	4	US457050	US457051
1/4	1/4	1 - 1/4	1.100	3	0.020	4	US457086	US457087
1/4	1/4	1 - 1/4	1.100	3	0.030	4	US457116	US457117
5/16	5/16	3/4	0.562	2 - 1/2	0.015	4	US457053	US457054
5/16	5/16	3/4	0.562	2 - 1/2	0.020	4	US457089	US457090
5/16	5/16	3/4	0.562	2 - 1/2	0.030	4	US457119	US457120
3/8	3/8	5/8	0.412	2 - 1/2	0.010	4	US457023	US457024
3/8	3/8	5/8	0.412	2 - 1/2	0.015	4	US457059	US457060
3/8	3/8	5/8	0.412	2 - 1/2	0.020	4	US457095	US457096
3/8	3/8	5/8	0.412	2 - 1/2	0.030	4	US457125	US457126
3/8	3/8	7/8	0.650	3	0.010	4	US457020	US457021
3/8	3/8	7/8	0.650	3	0.015	4	US457056	US457057
3/8	3/8	7/8	0.650	3	0.020	4	US457092	US457093
3/8	3/8	7/8	0.650	3	0.030	4	US457122	US457123

Additional Sizes On Page 13

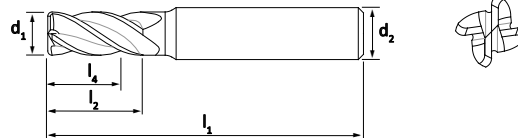
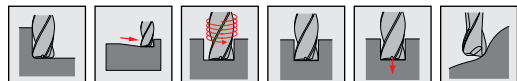
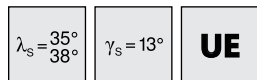
Feeds & Speeds Available on Page 22

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
				●	●					

Series US457

4 Flute Titanium Corner Radius



Tolerances
 Shank: 1/8" - 1" = -.0001/-0.0004
 Cutting Dia: 1/8" - 1" = +.000/-0.002
 Radius: Radius < 0.060 = +/-0.001
 Radius ≥ 0.060 = +/-0.0015

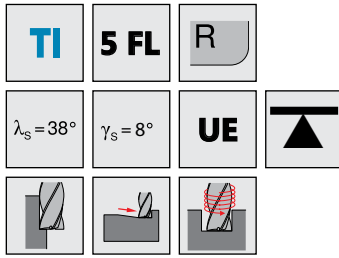
d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₄ TCL	l ₁ OAL	R Radius	Flute	nACRo®	ZrN
3/8	3/8	1 - 1/2	1.275	4	0.010	4	US457026	US457027
3/8	3/8	1 - 1/2	1.275	4	0.015	4	US457062	US457063
3/8	3/8	1 - 1/2	1.275	4	0.020	4	US457098	US457099
3/8	3/8	1 - 1/2	1.275	4	0.030	4	US457128	US457129
7/16	7/16	1	0.737	2 - 3/4	0.020	4	US457101	US457102
1/2	1/2	5/8	0.550	2 - 1/2	0.010	4	US457032	US457033
1/2	1/2	5/8	0.550	2 - 1/2	0.015	4	US457068	US457069
1/2	1/2	5/8	0.550	2 - 1/2	0.020	4	US457107	US457108
1/2	1/2	5/8	0.550	2 - 1/2	0.030	4	US457134	US457135
1/2	1/2	5/8	0.550	2 - 1/2	0.060	4	US457161	US457162
1/2	1/2	1 - 1/4	0.950	3 - 1/2	0.010	4	US457029	US457030
1/2	1/2	1 - 1/4	0.950	3 - 1/2	0.015	4	US457065	US457066
1/2	1/2	1 - 1/4	0.950	3 - 1/2	0.020	4	US457104	US457105
1/2	1/2	1 - 1/4	0.950	3 - 1/2	0.030	4	US457131	US457132
1/2	1/2	1 - 1/4	0.950	3 - 1/2	0.060	4	US457158	US457159
5/8	5/8	7/8	0.687	3	0.030	4	US457140	US457141
5/8	5/8	7/8	0.687	3	0.060	4	US457167	US457168
5/8	5/8	1 - 1/4	0.687	3 - 1/2	0.030	4	US457137	US457138
5/8	5/8	1 - 1/4	0.687	3 - 1/2	0.060	4	US457164	US457165
5/8	5/8	2 - 1/2	2.125	5	0.030	4	US457143	US457144
5/8	5/8	2 - 1/2	2.125	5	0.060	4	US457170	US457171
3/4	3/4	1 - 5/8	0.825	4	0.030	4	US457146	US457147
3/4	3/4	1 - 5/8	0.825	4	0.060	4	US457173	US457174
3/4	3/4	1 - 5/8	0.825	4	0.125	4	US457185	US457186
3/4	3/4	2 - 1/2	2.050	5	0.030	4	US457149	US457150
3/4	3/4	2 - 1/2	2.050	5	0.060	4	US457176	US457177
1	1	1 - 1/2	1.100	4	0.030	4	US457152	US457153
1	1	1 - 1/2	1.100	4	0.060	4	US457179	US457180
1	1	1 - 1/2	1.100	4	0.125	4	US457188	US457189
1	1	2 - 3/4	2.150	6	0.030	4	US457155	US457156
1	1	2 - 3/4	2.150	6	0.060	4	US457182	US457183
1	1	2 - 3/4	2.150	6	0.125	4	US457191	US457192

Additional Sizes On Page 12

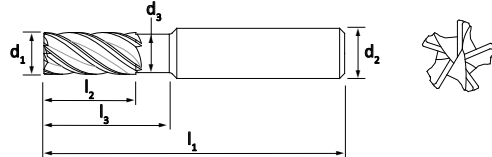
Feeds & Speeds Available on Page 22

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
				●	●					

**Tolerances**

Shank: 1/8" - 3/4" = -.0001/- .0004
 Cutting Dia: 1/8" - 3/4" = +.000/- .002
 Radius: 1/8" - 3/4" = +/- .002



d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	l_3 LOR	d_3 Neck Dia	R Radius	Flute	nACRo®
1/8	1/8	3/8	2	1/2	0.120	0.004	5	US556002
3/16	3/16	7/16	2	5/8	0.180	0.004	5	US556004
1/4	1/4	1/2	2 - 1/2	3/4	0.240	0.008	5	US556006
5/16	5/16	3/4	2 - 1/2	1	0.300	0.008	5	US556008
3/8	3/8	7/8	3	1 - 1/8	0.360	0.008	5	US556010
7/16	7/16	1	2 - 3/4	1 - 3/8	0.420	0.008	5	US556012
1/2	1/2	1 - 1/4	3 - 1/2	1 - 1/2	0.480	0.012	5	US556014
5/8	5/8	1 - 1/4	3 - 1/2	1 - 5/8	0.600	0.012	5	US556016
3/4	3/4	1 - 5/8	4	2	0.720	0.012	5	US556018

Feeds & Speeds Available on Page 22
Application Range:

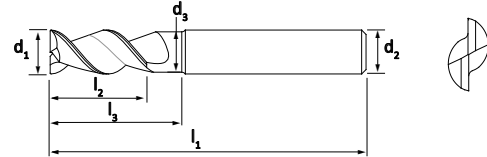
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
			•	•	•					

Series US220

2 Flute Aluminum



$\lambda_s = 50^\circ$ $\gamma_s = 7^\circ$



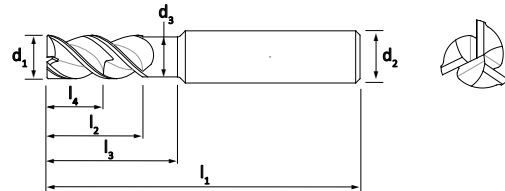
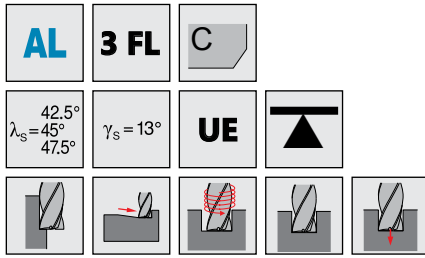
Tolerances
 Shank: $1/8'' - 3/4'' = -.0001/-0.0004$
 Cutting Dia: $1/8'' - 3/4'' = +.000/-0.002$
 Chamfer: $1/8'' - 3/4'' = +/-0.002$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	l_3 LOR	d_3 Neck Dia	C Chamfer	Flute	Uncoated
1/8	1/8	3/8	2	3/4	0.120	0.006	2	US220001
3/16	3/16	7/16	2	3/4	0.180	0.006	2	US220002
1/4	1/4	1/2	2 - 1/2	13/16	0.240	0.006	2	US220003
5/16	5/16	3/4	3	1	0.300	0.006	2	US220004
3/8	3/8	7/8	3	1 - 1/8	0.360	0.006	2	US220005
1/2	1/2	1 - 1/4	3 - 1/2	1 - 5/8	0.480	0.006	2	US220006
5/8	5/8	1 - 1/4	4	1 - 7/8	0.600	0.006	2	US220007
3/4	3/4	1 - 1/2	5	2 - 1/4	0.720	0.006	2	US220008

Feeds & Speeds Available on Page 23

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
							•	•	•	



Tolerances
 Shank: 1/8" - 3/4" = -.0001/-0.0004
 Cutting Dia: 1/8" - 3/4" = +.000/-0.002
 Chamfer: 1/8" - 3/4" = +/-0.002

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₄ TCL	l ₁ OAL	l ₃ LOR	d ₃ Neck Dia	C Chamfer	Flute	Uncoated	ZrN
1/8	1/8	5/16	0.406	2 - 1/4	1/2	0.120	0.006	3	US360001	US360002
1/8	1/8	1/4		3	3/4	0.120	0.006	3	US360003	US360004
5/32	3/16	7/16	0.568	2 - 1/2	3/4	0.150	0.006	3	US360005	US360006
5/32	3/16	1/4		3	1	0.150	0.006	3	US360007	US360008
3/16	3/16	1/2	0.650	2 - 1/2	3/4	0.180	0.006	3	US360009	US360010
3/16	3/16	5/16		3	1 - 1/4	0.180	0.006	3	US360011	US360012
1/4	1/4	1/2	0.650	2 - 1/2	3/4	0.240	0.010	3	US360013	US360014
1/4	1/4	1/2	0.650	3	1 - 5/8	0.240	0.010	3	US360017	US360018
1/4	1/4	3/8		3	1 - 5/8	0.240	0.010	3	US360015	US360016
5/16	5/16	3/4	0.975	2 - 1/2	1	0.300	0.010	3	US360019	US360020
5/16	5/16	3/4	0.975	4	2 - 1/2	0.300	0.010	3	US360023	US360024
5/16	5/16	1/2		4	2 - 1/2	0.300	0.010	3	US360021	US360022
3/8	3/8	7/8	1.137	3	1 - 1/8	0.360	0.010	3	US360025	US360026
3/8	3/8	7/8	1.137	4	2 - 1/4	0.360	0.010	3	US360029	US360030
3/8	3/8	5/8		4	2 - 1/4	0.360	0.010	3	US360027	US360028
7/16	7/16	1	1.300	2 - 3/4	1 - 1/4	0.420	0.010	3	US360031	US360032
1/2	1/2	1	1.300	3 - 1/2	1 - 3/8	0.480	0.010	3	US360033	US360034
1/2	1/2	1	1.300	5	2 - 7/8	0.480	0.010	3	US360037	US360038
1/2	1/2	3/4		5	2 - 7/8	0.480	0.010	3	US360035	US360036
5/8	5/8	1 - 1/4	1.625	3 - 1/2	1 - 5/8	0.600	0.010	3	US360039	US360040
5/8	5/8	1 - 1/4	1.625	6	4	0.600	0.010	3	US360043	US360044
5/8	5/8	1		6	4	0.600	0.010	3	US360041	US360042
3/4	3/4	1 - 5/8	2.112	4	2 - 1/8	0.720	0.010	3	US360045	US360046
3/4	3/4	1 - 1/4		6	4	0.720	0.010	3	US360047	US360048

Feeds & Speeds Available on Page 22

Application Range:

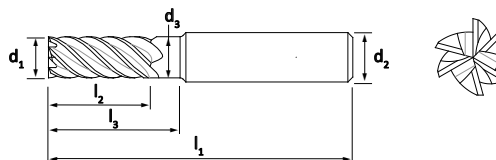
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
							•	•	•	

Series US376

6 Flute Aluminum



AL	6 FL	S
$\lambda_s = 43.5^\circ$ 46.5°	$\gamma_s = 21^\circ$	UE



Tolerances
 Shank: $1/4'' - 1'' = -.0001/- .0004$
 Cutting Dia: $1/4'' - 1'' = +.000/- .002$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	l_3 LOR	d_3 Neck Dia	Flute	Uncoated	ZrN
1/4	1/4	5/8	2 - 1/2	7/8	0.240	6	US376001	US376002
1/4	1/4	5/8	3	1 - 5/8	0.240	6	US376003	US376004
5/16	4/93	3/4	2 - 1/2	1	0.300	6	US376005	US376006
5/16	5/16	3/4	4	2 - 3/8	0.300	6	US376007	US376008
3/8	3/8	1	3	1 - 1/4	0.360	6	US376009	US376010
3/8	3/8	1	4	2 - 1/4	0.360	6	US376011	US376012
1/2	1/2	1 - 1/4	3 - 1/2	1 - 1/2	0.480	6	US376013	US376014
1/2	1/2	1 - 1/4	5	3	0.480	6	US376015	US376016
1/2	1/2	1 - 7/8	5			6	US376017	US376018
5/8	5/8	1 - 1/4	3 - 1/2	1 - 1/2	0.600	6	US376019	US376020
5/8	5/8	1 - 1/4	6	3 - 5/8	0.600	6	US376021	US376022
5/8	5/8	2 - 1/2	6			6	US376023	US376024
3/4	3/4	1 - 5/8	4	2	0.720	6	US376025	US376026
3/4	3/4	1 - 5/8	6	3 - 5/8	0.720	6	US376027	US376028
1	1	2	6	3 - 7/8	0.960	6	US376029	US376030

Feeds & Speeds Available on Page 23

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
							•	•	•	

Universal - US451										
Material Designation		SFM [ft/min]	ae max [inch]	ap max [inch]	Chip Load Per Tooth [Inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	853	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	> 500 N/mm ²	787	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Construction Steel	Non-Alloy < 500 N/mm ²	820	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Non-Alloy > 500 N/mm ²	755	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Alloy	722	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Cementation Steel	< 150 HB	689	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	150-200 HB	656	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	> 200 HB	623	1xØ	1xØ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Nitriding Steel	< 1000 N/mm ²	623	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	> 1000 N/mm ²	558	1xØ	1xØ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	656	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Non-Alloy 800-1000 N/mm ²	623	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Alloy < 800 N/mm ²	623	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Alloy 800-1000 N/mm ²	591	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Alloy 1000-1300 N/mm ²	558	1xØ	1xØ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	Alloy 1300-1600 N/mm ²	492	1xØ	1xØ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Non-Alloy Tool Steel	General	607	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	591	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Low Alloy < 1200 N/mm ²	558	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Low Alloy < 1500 N/mm ²	492	1xØ	1xØ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	High Alloy Annealed < 1000 N/mm ²	525	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	High Alloy Hardened < 1300 N/mm ²	459	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Tool Steel for Warm Processing	Low Alloy < 1200 N/mm ²	656	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Low Alloy < 1500 N/mm ²	591	1xØ	1xØ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	High Alloy Annealed < 1000 N/mm ²	492	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	High Alloy Hardened < 1300 N/mm ²	459	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	High Alloy Hardened < 1600 N/mm ²	427	1xØ	1xØ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Stainless Steel	Ferric	328	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	Martensitic	262	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	Austenitic A5 < 40%	328	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	Austenitic A5 > 40%	328	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	Sulphured	361	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
High Temperature Alloy	Fe-Alloy	98	1xØ	0.5xØ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
	Ni-Alloy not hardened	98	1xØ	0.5xØ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
	Ni-Alloy hardened	98	1xØ	0.5xØ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
	Co-Alloy	98	1xØ	0.5xØ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
Cast Iron	Non-Alloy	656	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Low-Alloy	525	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	High-Alloy	394	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Stainless Cast Steel	Ferric/Martensitic	328	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	Austentic	328	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	656	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Non-Alloy > 180 HB	591	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Alloy	525	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Spheroidal Cast Iron	High Alloy	394	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Non-Alloy < 180 HB	623	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Non-Alloy > 180 HB	558	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
White Malleable Cast Iron	Alloy	492	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	< 180 HB	591	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Black Malleable Cast Iron	> 180 HB	525	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	< 180 HB	591	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Copper	> 180 HB	525	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Non-Alloy	919	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Wrought Alloy Non-Hardened	787	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Wrought Alloy Hardened	656	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	CuNi-Alloy	787	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	CuNiZn-Alloy Long-Chipping	656	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
CuZn (Brass)	CuNiZn-Alloy Short-Chipping	787	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Long-Chipping	984	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
CuSn (Bronze)	Short-Chipping	1148	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Long-Chipping	787	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
CuAlFe (Ampco)	Short-Chipping	919	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Long-Chipping	459	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
Titanium	Short-Chipping	525	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Non-Alloy	295	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Alloyed-Annealed	262	1xØ	1xØ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	Alloyed-Hardened	164	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035

Hardened Steel - US367										
Material Designation		SFM [ft/min]	ae max [inch]	ap max [inch]	Chip Load Per Tooth [Inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Spring Steel	Annealed < 250 HB	427	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	Natural Hard 250-350 HB	394	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	Feader Hard 1200-1600 N/mm ²	377	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
Nitriding Steel	> 1000 N/mm ²	394	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
Quenched & Tempered Steel	Alloy 1000-1300 N/mm ²	394	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	Alloy 1300-1600 N/mm ²	361	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
Non-Alloy Tool Steel	General	443	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	427	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	Low Alloy < 1200 N/mm ²	394	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	Low Alloy < 1500 N/mm ²	361	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	High Alloy Annealed < 1000 N/mm ²	328	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	High Alloy Hardened < 1300 N/mm ²	295	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
Tool Steel for Warm Processing	Low Alloy < 1200 N/mm ²	394	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	Low Alloy < 1500 N/mm ²	361	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	High Alloy Annealed < 1000 N/mm ²	328	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	High Alloy Hardened < 1300 N/mm ²	295	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	High Alloy Hardened < 1600 N/mm ²	279	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
Hardened Tool Steel	< 55 HRC	262	0.05x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	55-58 HRC	230	0.03x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	58-60 HRC	197	0.03x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	60-62 HRC	148	0.03x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049
	62-64 HRC	115	0.03x ϕ	1.5x ϕ	0.0016	0.0018	0.0024	0.0028	0.0039	0.0049

Hardened Steel - US453										
Material Designation		SFM [ft/min]	ae max [inch]	ap max [inch]	Chip Load Per Tooth [Inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Spring Steel	Annealed < 250 HB	525	1x ϕ	1x ϕ	0.0006	0.0012	0.0016	0.0020	0.0024	0.0030
	Natural Hard 250-350 HB	443	1x ϕ	1x ϕ	0.0006	0.0012	0.0016	0.0020	0.0024	0.0030
	Feader Hard 1200-1600 N/mm ²	328	1x ϕ	1x ϕ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
Nitriding Steel	> 1000 N/mm ²	525	1x ϕ	1x ϕ	0.0006	0.0012	0.0016	0.0020	0.0024	0.0030
Quenched & Tempered Steel	Alloy 800-1000 N/mm ²	525	1x ϕ	1x ϕ	0.0006	0.0012	0.0016	0.0020	0.0024	0.0030
	Alloy 1000-1300 N/mm ²	443	1x ϕ	1x ϕ	0.0006	0.0012	0.0016	0.0020	0.0024	0.0030
	Alloy 1300-1600 N/mm ²	377	1x ϕ	1x ϕ	0.0006	0.0012	0.0016	0.0020	0.0024	0.0030
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	525	1x ϕ	1x ϕ	0.0006	0.0012	0.0016	0.0020	0.0024	0.0030
	Low Alloy < 1200 N/mm ²	377	1x ϕ	1x ϕ	0.0006	0.0012	0.0016	0.0020	0.0024	0.0030
	Low Alloy < 1500 N/mm ²	295	1x ϕ	1x ϕ	0.0006	0.0012	0.0016	0.0020	0.0024	0.0030
	High Alloy Annealed < 1000 N/mm ²	443	1x ϕ	1x ϕ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
	High Alloy Hardened < 1300 N/mm ²	427	1x ϕ	1x ϕ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
Tool Steel for Warm Processing	Low Alloy < 1200 N/mm ²	410	1x ϕ	1x ϕ	0.0006	0.0012	0.0016	0.0020	0.0024	0.0030
	Low Alloy < 1500 N/mm ²	377	1x ϕ	1x ϕ	0.0006	0.0012	0.0016	0.0020	0.0024	0.0030
	High Alloy Annealed < 1000 N/mm ²	443	1x ϕ	1x ϕ	0.0006	0.0012	0.0016	0.0020	0.0024	0.0030
	High Alloy Hardened < 1300 N/mm ²	410	1x ϕ	1x ϕ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
	High Alloy Hardened < 1600 N/mm ²	377	1x ϕ	1x ϕ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
Hardened Tool Steel	< 55 HRC	164	1x ϕ	1x ϕ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
	55-58 HRC	115	1x ϕ	0.5x ϕ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
	58-60 HRC	82	1x ϕ	0.5x ϕ	0.0003	0.0004	0.0008	0.0012	0.0016	0.0020
	60-62 HRC	66	1x ϕ	0.5x ϕ	0.0003	0.0004	0.0008	0.0012	0.0016	0.0020
	62-64 HRC	49	1x ϕ	0.5x ϕ	0.0003	0.0004	0.0008	0.0012	0.0016	0.0020

* Feeds and Speeds are starting points for Overall Lengths of 3" and shorter.
For End Mills with Overall Lengths over 3" decrease the Feeds and Speeds.

Stainless Steel - US445										
Material Designation	SFM [ft/min]	ae max [inch]	ap max [inch]	Chip Load Per Tooth [Inch]						
				1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"	
Machining Steel	> 500 N/mm ²	787	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Construction Steel	Non-Alloy < 500 N/mm ²	820	0.8x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Non-Alloy > 500 N/mm ²	755	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Cementation Steel	Alloy	722	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	< 150 HB	689	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	150-200 HB	656	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Nitriding Steel	> 200 HB	623	0.8x ϕ	1x ϕ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	< 1000 N/mm ²	623	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Quenched & Tempered Steel	> 1000 N/mm ²	558	0.8x ϕ	1x ϕ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	Non-Alloy < 800 N/mm ²	656	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Non-Alloy Tool Steel	Non-Alloy 800-1000 N/mm ²	623	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	Alloy < 800 N/mm ²	623	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	Alloy 800-1000 N/mm ²	591	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	Alloy 1000-1300 N/mm ²	558	0.8x ϕ	1x ϕ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	Alloy 1300-1600 N/mm ²	492	0.8x ϕ	1x ϕ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
General	607	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039	
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	591	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	Low Alloy < 1200 N/mm ²	558	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	Low Alloy < 1500 N/mm ²	492	0.8x ϕ	1x ϕ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	High Alloy Annealed < 1000 N/mm ²	525	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	High Alloy Hardened < 1300 N/mm ²	459	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Tool Steel for Warm Processing	Low Alloy < 1200 N/mm ²	656	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	Low Alloy < 1500 N/mm ²	591	0.8x ϕ	1x ϕ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	High Alloy Annealed < 1000 N/mm ²	492	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	High Alloy Hardened < 1300 N/mm ²	459	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	High Alloy Hardened < 1600 N/mm ²	427	0.8x ϕ	1x ϕ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
Stainless Steel	Ferric	328	0.8x ϕ	1x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	Martensitic	262	0.8x ϕ	1x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	Austenitic A5 < 40%	328	0.8x ϕ	1x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	Austenitic A5 > 40%	328	0.8x ϕ	1x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	Sulphured	361	0.8x ϕ	1x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
Cast Iron	Non-Alloy	656	0.8x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Low-Alloy	525	0.8x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	High-Alloy	394	0.8x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Stainless Cast Steel	Ferric/Martensitic	328	0.8x ϕ	1x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	Austenitic	328	0.8x ϕ	1x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	656	0.8x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Non-Alloy > 180 HB	591	0.8x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Alloy	525	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	High Alloy	394	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Spheroidal Cast Iron	Non-Alloy < 180 HB	623	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	Non-Alloy > 180 HB	558	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	Alloy	492	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
White Malleable Cast Iron	< 180 HB	591	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	> 180 HB	525	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Black Malleable Cast Iron	< 180 HB	591	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	> 180 HB	525	0.8x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039

* Feeds and Speeds are starting points for Overall Lengths of 3" and shorter.
For End Mills with Overall Lengths over 3" decrease the Feeds and Speeds.

Stainless Steel - US340										
Material Designation		SFM [ft/min]	ae max [inch]	ap max [inch]	Chip Load Per Tooth [Inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	853	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	> 500 N/mm ²	787	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Construction Steel	Non-Alloy < 500 N/mm ²	820	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Non-Alloy > 500 N/mm ²	755	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Alloy	722	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Cementation Steel	< 150 HB	689	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	150-200 HB	656	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	> 200 HB	623	1xØ	1xØ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Nitriding Steel	< 1000 N/mm ²	623	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	> 1000 N/mm ²	558	1xØ	1xØ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	656	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Non-Alloy 800-1000 N/mm ²	623	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Alloy < 800 N/mm ²	623	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Alloy 800-1000 N/mm ²	591	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Alloy 1000-1300 N/mm ²	558	1xØ	1xØ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
Stainless Steel	Ferric	328	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	Martensitic	262	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	Austenitic A5 < 40%	328	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	Austenitic A5 > 40%	328	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	Sulphured	361	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
High Temperature Alloy	Fe-Alloy	82	1xØ	0.5xØ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
	Ni-Alloy not hardened	82	1xØ	0.5xØ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
	Ni-Alloy hardened	82	1xØ	0.5xØ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
	Co-Alloy	82	1xØ	0.5xØ	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024
Cast Iron	Non-Alloy	656	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Low-Alloy	525	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	High-Alloy	394	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Stainless Cast Steel	Ferric/Martensitic	328	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
	Austentic	328	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035
Cast iron with Lamellar Graphite	Non-Alloy < 180 HB	656	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Non-Alloy > 180 HB	591	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Alloy	525	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	High Alloy	394	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Spheroidal Cast Iron	Non-Alloy < 180 HB	623	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Non-Alloy > 180 HB	558	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Alloy	492	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
White Malleable Cast Iron	< 180 HB	591	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	> 180 HB	525	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Black Malleable Cast Iron	< 180 HB	591	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	> 180 HB	525	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
Copper	Non-Alloy	919	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Wrought Alloy Non-Hardened	787	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Wrought Alloy Hardened	656	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	CuNi-Alloy	787	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	CuNiZn-Alloy Long-Chipping	656	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	CuNiZn-Alloy Short-Chipping	787	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
CuZn (Brass)	Long-Chipping	984	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Short-Chipping	1148	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
CuSn (Bronze)	Long-Chipping	787	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Short-Chipping	919	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
CuAlFe (Ampco)	Long-Chipping	459	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Short-Chipping	525	1xØ	1xØ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
Titanium	Non-Alloy	295	1xØ	1xØ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Alloyed-Annealed	262	1xØ	1xØ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039
	Alloyed-Hardened	164	1xØ	1xØ	0.0005	0.0010	0.0016	0.0020	0.0028	0.0035

* Feeds and Speeds are starting points for Overall Lengths of 3" and shorter.
For End Mills with Overall Lengths over 3" decrease the Feeds and Speeds.

Titanium - US456 / US457										
Material Designation		SFM [ft/min]	ae max [inch]	ap max [inch]	Chip Load Per Tooth [Inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
High Temperature Alloy	Fe-Alloy	180	1x ϕ	0.5x ϕ	0.0008	0.0016	0.0020	0.0024	0.0028	0.0031
	Ni-Alloy not hardened	180	1x ϕ	0.5x ϕ	0.0008	0.0016	0.0020	0.0024	0.0028	0.0031
	Ni-Alloy hardened	180	1x ϕ	0.5x ϕ	0.0008	0.0016	0.0020	0.0024	0.0028	0.0031
	Co-Alloy	180	1x ϕ	0.5x ϕ	0.0008	0.0016	0.0020	0.0024	0.0028	0.0031
Titanium	Non-Alloy	394	1x ϕ	0.5x ϕ	0.0010	0.0018	0.0028	0.0039	0.0047	0.0055
	Alloyed-Annealed	328	1x ϕ	0.5x ϕ	0.0008	0.0016	0.0024	0.0031	0.0039	0.0047
	Alloyed-Hardened	262	1x ϕ	0.5x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031	0.0039

Titanium - US556									
Material Designation		SFM [ft/min]	ae max [inch]	ap max [inch]	Chip Load Per Tooth [Inch]				
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"
Stainless Steel	Ferric	328	0.5x ϕ	1x ϕ	0.0005	0.0010	0.0016	0.0020	0.0028
	Martensitic	262	0.5x ϕ	1x ϕ	0.0005	0.0010	0.0016	0.0020	0.0028
	Austenitic A5 < 40%	328	0.5x ϕ	1x ϕ	0.0005	0.0010	0.0016	0.0020	0.0028
	Austenitic A5 > 40%	328	0.5x ϕ	1x ϕ	0.0005	0.0010	0.0016	0.0020	0.0028
	Sulphured	361	0.5x ϕ	1x ϕ	0.0005	0.0010	0.0016	0.0020	0.0028
High Temperature Alloy	Fe-Alloy	180	0.5x ϕ	1x ϕ	0.0008	0.0016	0.0020	0.0024	0.0028
	Ni-Alloy not hardened	180	0.5x ϕ	1x ϕ	0.0008	0.0016	0.0020	0.0024	0.0028
	Ni-Alloy hardened	180	0.5x ϕ	1x ϕ	0.0008	0.0016	0.0020	0.0024	0.0028
	Co-Alloy	180	0.5x ϕ	1x ϕ	0.0008	0.0016	0.0020	0.0024	0.0028
Stainless Cast Steel	Ferric/Martensitic	328	0.5x ϕ	1x ϕ	0.0005	0.0010	0.0016	0.0020	0.0028
	Austentic	328	0.5x ϕ	1x ϕ	0.0005	0.0010	0.0016	0.0020	0.0028
Titanium	Non-Alloy	394	0.5x ϕ	1x ϕ	0.0010	0.0018	0.0028	0.0039	0.0047
	Alloyed-Annealed	328	0.5x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0039
	Alloyed-Hardened	262	0.5x ϕ	1x ϕ	0.0006	0.0012	0.0020	0.0024	0.0031

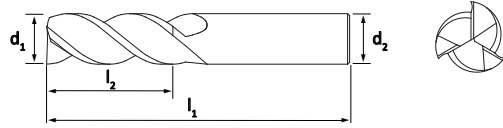
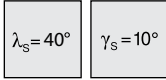
Aluminum - US360										
Material Designation		SFM [ft/min]	ae max [inch]	ap max [inch]	Chip Load Per Tooth [Inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Aluminium	Non-Alloy	1968	1x ϕ	1x ϕ	0.0014	0.0024	0.0028	0.0035	0.0047	0.0055
	Wrought Alloy Non-Hardened	1968	1x ϕ	1x ϕ	0.0014	0.0024	0.0028	0.0035	0.0047	0.0055
	Wrought Alloy Hardened	1968	1x ϕ	1x ϕ	0.0014	0.0024	0.0028	0.0035	0.0047	0.0055
	Casting Alloy < 6% Si	1575	1x ϕ	1x ϕ	0.0014	0.0024	0.0028	0.0035	0.0047	0.0055
	Casting Alloy 6-12% Si	1181	1x ϕ	1x ϕ	0.0012	0.0020	0.0028	0.0047	0.0067	0.0083
	Casting Alloy > 6% Si	787	1x ϕ	1x ϕ	0.0012	0.0020	0.0028	0.0047	0.0067	0.0083
Magnesium	Wrought Alloy	722	1x ϕ	1x ϕ	0.0012	0.0020	0.0028	0.0047	0.0067	0.0083
	Casting Alloy	656	1x ϕ	1x ϕ	0.0012	0.0020	0.0028	0.0047	0.0067	0.0083
Copper	Non-Alloy	558	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	Wrought Alloy Non-Hardened	509	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	Wrought Alloy Hardened	394	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	CuNi-Alloy	492	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	CuNiZn-Alloy Long-Chipping	394	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	CuNiZn-Alloy Short-Chipping	492	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
CuZn (Brass)	Long-Chipping	591	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	Short-Chipping	787	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
CuSn (Bronze)	Long-Chipping	492	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	Short-Chipping	558	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
CuAlFe (Ampco)	Long-Chipping	180	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	Short-Chipping	230	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055

* Feeds and Speeds are starting points for Overall Lengths of 3" and shorter.
For End Mills with Overall Lengths over 3" decrease the Feeds and Speeds.

Aluminum - US376										
Material Designation		SFM [ft/min]	ae max [inch]	ap max [inch]	Chip Load Per Tooth [Inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Aluminium	Non-Alloy	1640	0.05x ϕ	2x ϕ	0.0008	0.0016	0.0020	0.0024	0.0028	0.0031
	Wrought Alloy Non-Hardened	1640	0.05x ϕ	2x ϕ	0.0008	0.0016	0.0020	0.0024	0.0028	0.0031
	Wrought Alloy Hardened	1640	0.05x ϕ	2x ϕ	0.0008	0.0016	0.0020	0.0024	0.0028	0.0031
	Casting Alloy < 6% Si	1312	0.05x ϕ	2x ϕ	0.0008	0.0016	0.0020	0.0024	0.0028	0.0031
	Casting Alloy 6-12% Si	984	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	Casting Alloy > 6% Si	689	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
Magnesium	Wrought Alloy	656	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	Casting Alloy	558	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
Copper	Non-Alloy	492	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	Wrought Alloy Non-Hardened	459	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	Wrought Alloy Hardened	361	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	CuNi-Alloy	427	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	CuNiZn-Alloy Long-Chipping	361	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	CuNiZn-Alloy Short-Chipping	427	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
CuZn (Brass)	Long-Chipping	492	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	Short-Chipping	689	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
CuSn (Bronze)	Long-Chipping	427	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	Short-Chipping	459	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
CuAlFe (Ampco)	Long-Chipping	197	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028
	Short-Chipping	230	0.05x ϕ	2x ϕ	0.0006	0.0008	0.0012	0.0020	0.0024	0.0028

Aluminum - US220										
Material Designation		SFM [ft/min]	ae max [inch]	ap max [inch]	Chip Load Per Tooth [Inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Aluminium	Non-Alloy	1968	1x ϕ	1x ϕ	0.0016	0.0024	0.0031	0.0059	0.0079	0.0089
	Wrought Alloy Non-Hardened	1968	1x ϕ	1x ϕ	0.0016	0.0024	0.0031	0.0059	0.0079	0.0089
	Wrought Alloy Hardened	1968	1x ϕ	1x ϕ	0.0016	0.0024	0.0031	0.0059	0.0079	0.0089
	Casting Alloy < 6% Si	1575	1x ϕ	1x ϕ	0.0016	0.0024	0.0031	0.0059	0.0079	0.0089
	Casting Alloy 6-12% Si	1181	1x ϕ	1x ϕ	0.0012	0.0020	0.0028	0.0047	0.0067	0.0083
	Casting Alloy > 6% Si	787	1x ϕ	1x ϕ	0.0012	0.0020	0.0028	0.0047	0.0067	0.0083
Magnesium	Wrought Alloy	722	1x ϕ	1x ϕ	0.0012	0.0020	0.0028	0.0047	0.0067	0.0083
	Casting Alloy	656	1x ϕ	1x ϕ	0.0012	0.0020	0.0028	0.0047	0.0067	0.0083
Copper	Non-Alloy	558	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	Wrought Alloy Non-Hardened	509	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	Wrought Alloy Hardened	394	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	CuNi-Alloy	492	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	CuNiZn-Alloy Long-Chipping	394	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	CuNiZn-Alloy Short-Chipping	492	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
CuZn (Brass)	Long-Chipping	591	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	Short-Chipping	787	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
CuSn (Bronze)	Long-Chipping	492	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	Short-Chipping	558	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
CuAlFe (Ampco)	Long-Chipping	180	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055
	Short-Chipping	230	1x ϕ	1x ϕ	0.0008	0.0016	0.0024	0.0031	0.0047	0.0055

* Feeds and Speeds are starting points for Overall Lengths of 3" and shorter.
For End Mills with Overall Lengths over 3" decrease the Feeds and Speeds.



Tolerances

Shank: 1/8" - 1" = -.0001/-0.0004
 Cutting Dia: 1/8" - 1" = +.000/-0.002

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	l ₃ LOR	d ₃ Neck Dia	Flutes	AlTiN	ZrN
1/8	1/8	1/4	1-1/2			3	109-00824	109-00826
1/8	1/8	1/2	1-1/2			3	109-00814	109-00816
5/32	3/16	1/2	2			3	109-01014	109-01016
5/32	3/16	3/8	2			3	109-01024	109-01026
3/16	3/16	3/8	2			3	109-01224	109-01226
3/16	3/16	5/8	2			3	109-01214	109-01216
7/32	1/4	3/4	2-1/2			3	109-01414	109-01416
7/32	1/4	3/8	2			3	109-01424	109-01426
1/4	1/4	3/8	2			3	109-01624	109-01626
1/4	1/4	3/4	2-1/2			3	109-01614	109-01616
1/4	1/4	1-1/4	3			3	109-01634	109-01636
1/4	1/4	1-1/2	3-1/2			3	109-01644	109-01646
1/4	1/4	3/4	4	2-1/8	0.240	3	109-01664	109-01666
9/32	5/16	1/2	2-1/2			3	109-01824	109-01826
9/32	5/16	3/4	2-1/2			3	109-01814	109-01816
5/16	5/16	1/2	2-1/2			3	109-02024	109-02026
5/16	5/16	3/4	2-1/2			3	109-02014	109-02016
3/8	3/8	5/8	2			3	109-02424	109-02426
3/8	3/8	7/8	2-1/2			3	109-02414	109-02416
3/8	3/8	1-1/2	3-1/2			3	109-02434	109-02436
3/8	3/8	2	4			3	109-02444	109-02446
3/8	3/8	1	6	2-3/8	0.360	3	109-02464	109-02466
7/16	7/16	1	2-3/4			3	109-02814	109-02816
1/2	1/2	5/8	2-1/2			3	109-03224	109-03226
1/2	1/2	1-1/4	3			3	109-03214	109-03216
1/2	1/2	1-1/2	3-1/2			3	109-03234	109-03236
1/2	1/2	2	4			3	109-03244	109-03246
9/16	9/16	1-1/4	3-1/2			3	109-03614	109-03616
5/8	5/8	7/8	3			3	109-04024	109-04026
5/8	5/8	1-1/4	3-1/2			3	109-04014	109-04016
5/8	5/8	1-3/4	4			3	109-04034	109-04036
5/8	5/8	2-1/2	5			3	109-04044	109-04046
3/4	3/4	1	3			3	109-04824	109-04826
3/4	3/4	1-5/8	4			3	109-04814	109-04816
3/4	3/4	2-1/2	5			3	109-04834	109-04836
3/4	3/4	3-1/4	6			3	109-04844	109-04846
1	1	1-3/4	4			3	109-06414	109-06416
1	1	2-3/4	5			3	109-06434	109-06436
1	1	3-3/8	6			3	109-06444	109-06446

Feeds & Speeds Available on Page 57

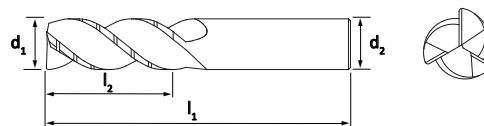
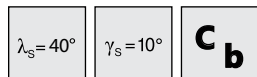
Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
							●	●	●	

Series 119

3 Flute Aluminum Rougher Finisher

PROMAX
TOOLS



Tolerances

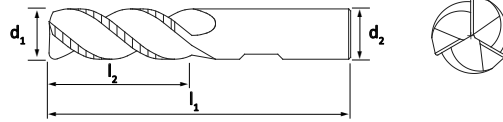
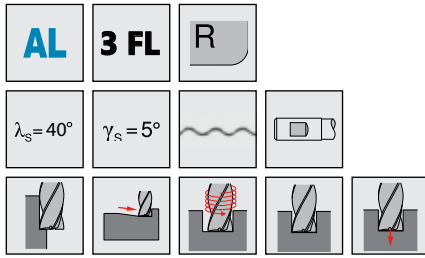
Shank: 1/8" - 1" = -.0001/- .0004
 Cutting Dia: 1/8" - 1" = +.000/- .002
 Radius: 1/8" - 1" = +.002/- .001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	AlTiN	ZrN
1/8	1/8	1/4	1-1/2	0.010	3	119-00824	119-00826
1/8	1/8	1/2	1-1/2	0.010	3	119-00814	119-00816
5/32	3/16	3/8	2	0.010	3	119-01024	119-01026
5/32	3/16	1/2	2	0.010	3	119-01014	119-01016
3/16	3/16	3/8	2	0.010	3	119-01224	119-01226
3/16	3/16	5/8	2	0.010	3	119-01214	119-01216
7/32	1/4	3/8	2	0.020	3	119-01424	119-01426
7/32	1/4	3/4	2-1/2	0.020	3	119-01414	119-01416
1/4	1/4	3/8	2	0.020	3	119-01624	119-01626
1/4	1/4	3/4	2-1/2	0.020	3	119-01614	119-01616
1/4	1/4	1-1/4	3	0.020	3	119-01634	119-01636
1/4	1/4	1-1/2	3-1/2	0.020	3	119-01644	119-01646
9/32	5/16	1/2	2-1/2	0.020	3	119-01824	119-01826
9/32	5/16	3/4	2-1/2	0.020	3	119-01814	119-01816
5/16	5/16	1/2	2-1/2	0.020	3	119-02024	119-02026
5/16	5/16	3/4	2-1/2	0.020	3	119-02014	119-02016
11/32	3/8	5/8	2	0.020	3	119-02224	119-02226
11/32	3/8	7/8	2-1/2	0.020	3	119-02214	119-02216
3/8	3/8	5/8	2	0.020	3	119-02424	119-02426
3/8	3/8	7/8	2-1/2	0.020	3	119-02414	119-02416
3/8	3/8	1-1/2	3-1/2	0.020	3	119-02434	119-02436
3/8	3/8	2	4	0.020	3	119-02444	119-02446
7/16	7/16	1	2-3/4	0.020	3	119-02814	119-02816
1/2	1/2	5/8	2-1/2	0.020	3	119-03224	119-03226
1/2	1/2	1-1/4	3	0.020	3	119-03214	119-03216
1/2	1/2	1-1/2	3-1/2	0.020	3	119-03234	119-03236
1/2	1/2	2	4	0.020	3	119-03244	119-03246
9/16	9/16	1-1/4	3-1/2	0.030	3	119-03614	119-03616
5/8	5/8	7/8	3	0.030	3	119-04024	119-04026
5/8	5/8	1-1/4	3-1/2	0.030	3	119-04014	119-04016
5/8	5/8	1-3/4	4	0.030	3	119-04034	119-04036
5/8	5/8	2-1/2	5	0.030	3	119-04044	119-04046
3/4	3/4	1	3	0.030	3	119-04824	119-04826
3/4	3/4	1-5/8	4	0.030	3	119-04814	119-04816
3/4	3/4	2-1/2	5	0.030	3	119-04834	119-04836
3/4	3/4	3-1/4	6	0.030	3	119-04844	119-04846
1	1	1-3/4	4	0.030	3	119-06414	119-06416
1	1	2-3/4	5	0.030	3	119-06434	119-06436
1	1	3-3/8	6	0.030	3	119-06444	119-06446

Feeds & Speeds Available on Page 57

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
							•	•	•	



Tolerances
 Shank: 3/16" - 1" = -.0001/-0.0004
 Cutting Dia: 3/16" - 1" = +.000/-0.002
 Radius: 3/16" - 1" = +/-0.005

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	AlTiN	ZrN
3/16	3/16	3/8	2	0.030	3	102-01224	102-01226
3/16	3/16	5/8	2	0.030	3	102-01214	102-01216
1/4	1/4	3/8	2	0.045	3	102-01624	102-01626
1/4	1/4	3/4	2-1/2	0.045	3	102-01614	102-01616
5/16	5/16	1/2	2-1/2	0.045	3	102-02024	102-02026
5/16	5/16	3/4	2-1/2	0.045	3	102-02014	102-02016
3/8	3/8	5/8	2	0.060	3	102-02424	102-02426
3/8	3/8	7/8	2-1/2	0.060	3	102-02414	102-02416
7/16	7/16	1	2-3/4	0.060	3	102-02814	102-02816
1/2	1/2	5/8	2-1/2	0.060	3	102-03224	102-03226
1/2	1/2	1-1/4	3	0.060	3	102-03214	102-03216
1/2	1/2	1-1/2	3-1/2	0.060	3	102-03234	102-03236
9/16	9/16	1-1/4	3-1/2	0.060	3	102-03614	102-03616
5/8	5/8	1-1/4	3-1/2	0.060	3	102-04014	102-04016
3/4	3/4	1-5/8	4	0.060	3	102-04814	102-04816
3/4	3/4	2-1/4	5	0.060	3	102-04834	102-04836
1	1	1-3/4	4	0.060	3	102-06414	102-06416
1	1	2-5/8	5	0.060	3	102-06434	102-06436

Feeds & Speeds Available on Page 57

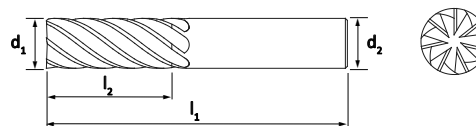
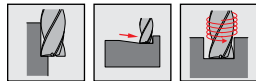
Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
							•	•	•	

Series 160 7 Flute Universal



$\lambda_s = 37.5^\circ$ $\gamma_s = 10^\circ$



Tolerances
Shank: $1/4'' - 1'' = -.0001/-0.0004$
Cutting Dia: $1/4'' - 1'' = +.000/-0.002$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	l_3 LOR	d_3 Neck Dia	Flutes	nACRo®
1/4	1/4	3/4	2-1/2			7	160-01615
3/8	3/8	7/8	2-1/2			7	160-02415
3/8	3/8	1-1/4	3			7	160-02445
3/8	3/8	1/2	6	3-1/8	0.360	7	160-02485
1/2	1/2	1-1/4	3			7	160-03215
1/2	1/2	1-5/8	4			7	160-03245
1/2	1/2	5/8	6	3-1/8	0.480	7	160-03275
5/8	5/8	1-5/8	3-1/2			7	160-04015
5/8	5/8	2-1/8	4			7	160-04045
5/8	5/8	3/4	6	3 1/8	0.600	7	160-04075
3/4	3/4	1-5/8	4			7	160-04815
3/4	3/4	2-1/4	5			7	160-04845
3/4	3/4	1	6	3-1/8	0.720	7	160-04875
1	1	2	4			7	160-06415
1	1	2-5/8	5			7	160-06445

Feeds & Speeds Available on Page 58

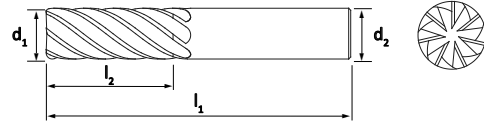
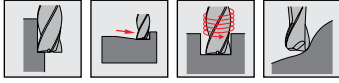
PROMAX PREMIUM

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•	•	•	•				



$\lambda_s = 37.5^\circ$ $\gamma_s = 10^\circ$



Tolerances

Shank: 1/4" - 1" = -.0001/- .0004
 Cutting Dia: 1/4" - 1" = +.000/- .002
 Radius: 1/4" - 1" = +/- .001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	l ₃ LOR	d ₃ Neck Dia	R Radius	Flutes	nACRo®
1/4	1/4	3/4	2-1/2			0.020	7	161-31615
1/4	1/4	3/4	2-1/2			0.030	7	161-41615
1/4	1/4	1-1/8	3			0.020	7	161-31645
1/4	1/4	3/8	4	2-1/2	0.240	0.020	7	161-31675
1/4	1/4	3/8	4	2-1/2	0.240	0.030	7	161-41675
3/8	3/8	7/8	2-1/2			0.020	7	161-32415
3/8	3/8	7/8	2-1/2			0.030	7	161-42415
3/8	3/8	1-1/4	3			0.020	7	161-32445
3/8	3/8	1-1/4	3			0.030	7	161-42445
3/8	3/8	1/2	6	3-1/8	0.360	0.020	7	161-32485
1/2	1/2	1-1/4	3			0.020	7	161-33215
1/2	1/2	1-1/4	3			0.030	7	161-43215
1/2	1/2	1-5/8	4			0.020	7	161-33245
1/2	1/2	1-5/8	4			0.030	7	161-43245
1/2	1/2	5/8	6	3-1/8	0.480	0.020	7	161-33275
1/2	1/2	5/8	6	3-1/8	0.480	0.030	7	161-43275
5/8	5/8	1-5/8	3-1/2			0.030	7	161-44015
5/8	5/8	2-1/8	4			0.030	7	161-44045
5/8	5/8	3/4	6	3-1/8	0.600	0.030	7	161-44075
3/4	3/4	1-5/8	4			0.030	7	161-44815
3/4	3/4	2-1/4	5			0.030	7	161-44845
3/4	3/4	1	6	3-1/8	0.720	0.030	7	161-44875
1	1	2-5/8	5			0.030	7	161-46445

Feeds & Speeds Available on Page 58

Application Range:

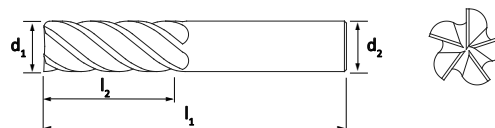
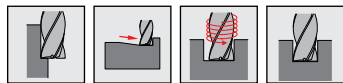
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•	•	•	•				

Series 112

5 Flute Universal



$\lambda_s = 40^\circ$ $\gamma_s = 10^\circ$



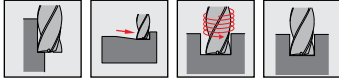
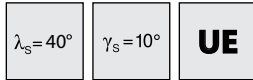
Tolerances
 Shank: $1/8'' - 1'' = -.0001/- .0004$
 Cutting Dia: $1/8'' - 1'' = +.000/- .002$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	Flutes	TiCN	AlTiN	nACRo®
1/8	1/8	1/4	1-1/2	5	112-00822	112-00824	112-00825
1/8	1/8	1/2	1-1/2	5	112-00812	112-00814	112-00815
5/32	3/16	3/8	2	5	112-01022	112-01024	112-01025
5/32	3/16	1/2	2	5	112-01012	112-01014	112-01015
3/16	3/16	3/8	2	5	112-01222	112-01224	112-01225
3/16	3/16	5/8	2	5	112-01212	112-01214	112-01215
7/32	1/4	3/4	2-1/2	5	112-01412	112-01414	112-01415
1/4	1/4	3/8	2	5	112-01622	112-01624	112-01625
1/4	1/4	3/4	2-1/2	5	112-01612	112-01614	112-01615
5/16	5/16	1/2	2-1/2	5	112-02022	112-02024	112-02025
5/16	5/16	3/4	2-1/2	5	112-02012	112-02014	112-02015
3/8	3/8	5/8	2	5	112-02422	112-02424	112-02425
3/8	3/8	7/8	2-1/2	5	112-02412	112-02414	112-02415
3/8	3/8	1-1/2	3-1/2	5	112-02432	112-02434	112-02435
7/16	7/16	1	2-3/4	5	112-02812	112-02814	112-02815
1/2	1/2	5/8	2-1/2	5	112-03222	112-03224	112-03225
1/2	1/2	1-1/4	3	5	112-03212	112-03214	112-03215
1/2	1/2	1-1/2	3-1/2	5	112-03232	112-03234	112-03235
1/2	1/2	2	4	5	112-03242	112-03244	112-03245
9/16	9/16	1-1/4	3-1/2	5	112-03612	112-03614	112-03615
5/8	5/8	7/8	3	5	112-04022	112-04024	112-04025
5/8	5/8	1-1/4	3-1/2	5	112-04012	112-04014	112-04015
5/8	5/8	1-3/4	4	5	112-04032	112-04034	112-04035
3/4	3/4	1	3	5	112-04822	112-04824	112-04825
3/4	3/4	1-5/8	4	5	112-04812	112-04814	112-04815
3/4	3/4	2-1/2	5	5	112-04832	112-04834	112-04835
3/4	3/4	3-1/4	6	5	112-04842	112-04844	112-04845
1	1	1-3/4	4	5	112-06412	112-06414	112-06415
1	1	2-3/4	5	5	112-06432	112-06434	112-06435
1	1	3-3/8	6	5	112-06442	112-06444	112-06445

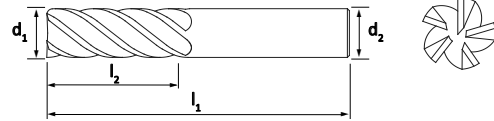
Feeds & Speeds Available on Page 59

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•	•	•	•				

**Tolerances**

Shank: 1/8" - 1" = -.0001/- .0004
 Cutting Dia: 1/8" - 1" = +.000/- .002



d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	AlTiN	nACRo®
1/8	1/8	1/2	1-1/2	5	158-00814	158-00815
5/32	3/16	1/2	2	5	158-01014	158-01015
3/16	3/16	3/8	2	5	158-01224	158-01225
3/16	3/16	5/8	2	5	158-01214	158-01215
7/32	1/4	3/4	2-1/2	5	158-01414	158-01415
1/4	1/4	3/8	2	5	158-01624	158-01625
1/4	1/4	3/4	2-1/2	5	158-01614	158-01615
1/4	1/4	1-1/4	3	5	158-01634	158-01635
5/16	5/16	3/4	2-1/2	5	158-02014	158-02015
3/8	3/8	5/8	2	5	158-02424	158-02425
3/8	3/8	7/8	2-1/2	5	158-02414	158-02415
3/8	3/8	1-1/2	3-1/2	5	158-02434	158-02435
7/16	7/16	1	2-3/4	5	158-02814	158-02815
1/2	1/2	5/8	2-1/2	5	158-03224	158-03225
1/2	1/2	1-1/4	3	5	158-03214	158-03215
1/2	1/2	1-1/2	3-1/2	5	158-03234	158-03235
1/2	1/2	2	4	5	158-03244	158-03245
9/16	9/16	1-1/4	3-1/2	5	158-03614	158-03615
5/8	5/8	7/8	3	5	158-04024	158-04025
5/8	5/8	1-1/4	3-1/2	5	158-04014	158-04015
5/8	5/8	1-3/4	4	5	158-04034	158-04035
5/8	5/8	2-1/2	5	5	158-04044	158-04045
3/4	3/4	1	3	5	158-04824	158-04825
3/4	3/4	1-5/8	4	5	158-04814	158-04815
3/4	3/4	2-1/2	5	5	158-04834	158-04835
3/4	3/4	3-1/4	6	5	158-04844	158-04845
1	1	1-3/4	4	5	158-06414	158-06415
1	1	2-3/4	5	5	158-06434	158-06435
1	1	3-3/8	6	5	158-06444	158-06445

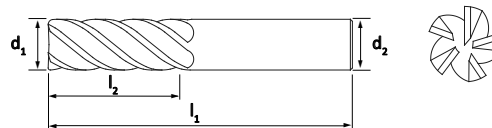
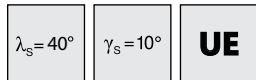
Feeds & Speeds Available on Page 60

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•	•	•	•				

Series 159

5 Flute Universal Corner Radius



Tolerances
 Shank: 1/8" - 1" = -.0001/- .0004
 Cutting Dia: 1/8" - 1" = +.000/- .002
 Radius: 1/8" - 1" = +/- .001

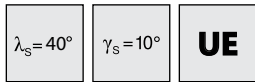
d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	nACRo®
1/8	1/8	1/2	1-1/2	0.010	5	159-10815
1/8	1/8	1/2	1-1/2	0.015	5	159-20815
5/32	3/16	1/2	2	0.010	5	159-11015
3/16	3/16	3/8	2	0.010	5	159-11225
3/16	3/16	3/8	2	0.020	5	159-31225
3/16	3/16	5/8	2	0.010	5	159-11215
3/16	3/16	5/8	2	0.020	5	159-31215
7/32	1/4	3/4	2-1/2	0.015	5	159-21415
1/4	1/4	3/8	2	0.010	5	159-11625
1/4	1/4	3/8	2	0.015	5	159-21625
1/4	1/4	3/8	2	0.020	5	159-31625
1/4	1/4	3/8	2	0.030	5	159-41625
1/4	1/4	3/4	2-1/2	0.010	5	159-11615
1/4	1/4	3/4	2-1/2	0.015	5	159-21615
1/4	1/4	3/4	2-1/2	0.020	5	159-31615
1/4	1/4	3/4	2-1/2	0.030	5	159-41615
1/4	1/4	1-1/4	3	0.030	5	159-41635
5/16	5/16	3/4	2-1/2	0.015	5	159-22015
3/8	3/8	5/8	2	0.010	5	159-12425
3/8	3/8	5/8	2	0.015	5	159-22425
3/8	3/8	5/8	2	0.020	5	159-32425
3/8	3/8	5/8	2	0.030	5	159-42425
3/8	3/8	7/8	2-1/2	0.010	5	159-12415
3/8	3/8	7/8	2-1/2	0.015	5	159-22415
3/8	3/8	7/8	2-1/2	0.020	5	159-32415
3/8	3/8	7/8	2-1/2	0.030	5	159-42415
3/8	3/8	1-1/2	3-1/2	0.010	5	159-12435
3/8	3/8	1-1/2	3-1/2	0.015	5	159-22435
3/8	3/8	1-1/2	3-1/2	0.030	5	159-42435
1/2	1/2	5/8	2-1/2	0.010	5	159-13225
1/2	1/2	5/8	2-1/2	0.015	5	159-23225
1/2	1/2	5/8	2-1/2	0.020	5	159-33225
1/2	1/2	5/8	2-1/2	0.030	5	159-43225
1/2	1/2	5/8	2-1/2	0.060	5	159-63225
1/2	1/2	1-1/4	3	0.010	5	159-13215

Additional Sizes On Page 32

Feeds & Speeds Available on Page 60

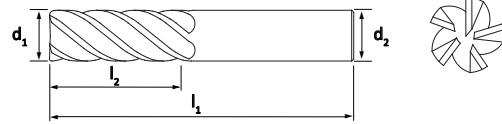
Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•	•	•	•				



Tolerances

Shank: 1/8" - 1" = -.0001/- .0004
 Cutting Dia: 1/8" - 1" = +.000/- .002
 Radius: 1/8" - 1" = +/- .001



d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	nACRo®
1/2	1/2	1-1/4	3	0.015	5	159-23215
1/2	1/2	1-1/4	3	0.020	5	159-33215
1/2	1/2	1-1/4	3	0.030	5	159-43215
1/2	1/2	1-1/4	3	0.060	5	159-63215
1/2	1/2	2	4	0.030	5	159-43245
1/2	1/2	2	4	0.060	5	159-63245
5/8	5/8	7/8	3	0.030	5	159-44025
5/8	5/8	7/8	3	0.060	5	159-64025
5/8	5/8	1-1/4	3-1/2	0.030	5	159-44015
5/8	5/8	2-1/2	5	0.030	5	159-44045
5/8	5/8	2-1/2	5	0.060	5	159-64045
3/4	3/4	1	3	0.030	5	159-44825
3/4	3/4	1-5/8	4	0.030	5	159-44815
3/4	3/4	2-1/2	5	0.030	5	159-44835
3/4	3/4	2-1/2	5	0.060	5	159-64835
1	1	1-3/4	4	0.030	5	159-46415
1	1	2-3/4	5	0.030	5	159-46435
1	1	2-3/4	5	0.060	5	159-66435
1	1	3-3/8	6	0.030	5	159-46445

Additional Sizes On Page 31

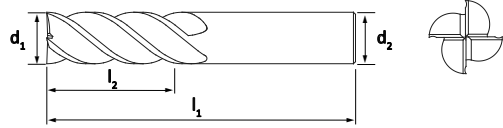
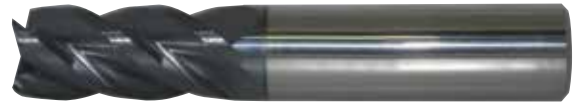
Feeds & Speeds Available on Page 60

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•	•	•	•				



$\lambda_s = 40^\circ$ $\gamma_s = 10^\circ$



Tolerances

Shank: 1/32" - 1" = -.0001/-0.0004
 Cutting Dia: 1/32" - 7/64" = +/- .0005
 1/8" - 1" = +.000/-0.002

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	TiCN	AlTiN
1/32	1/8	3/32	1-1/2	4	111-00212	111-00214
3/64	1/8	9/64	1-1/2	4	111-00312	111-00314
1/16	1/8	1/8	1-1/2	4	111-00422	111-00424
1/16	1/8	3/16	1-1/2	4	111-00412	111-00414
5/64	1/8	1/4	1-1/2	4	111-00512	111-00514
3/32	1/8	3/16	1-1/2	4	111-00622	111-00624
3/32	1/8	9/32	1-1/2	4	111-00612	111-00614
7/64	1/8	3/16	1-1/2	4	111-00722	111-00724
7/64	1/8	3/8	1-1/2	4	111-00712	111-00714
1/8	1/8	1/4	1-1/2	4	111-00822	111-00824
1/8	1/8	1/2	1-1/2	4	111-00812	111-00814
5/32	3/16	3/8	2	4	111-01022	111-01024
5/32	3/16	1/2	2	4	111-01012	111-01014
3/16	3/16	3/8	2	4	111-01222	111-01224
3/16	3/16	5/8	2	4	111-01212	111-01214
7/32	1/4	3/4	2-1/2	4	111-01412	111-01414
1/4	1/4	3/8	2	4	111-01622	111-01624
1/4	1/4	3/4	2-1/2	4	111-01612	111-01614
1/4	1/4	1-1/4	3	4	111-01632	111-01634
1/4	1/4	1-1/2	3-1/2	4	111-01642	111-01644
1/4	1/4	3/8	4	4	111-01662	111-01664
5/16	5/16	1/2	2-1/2	4	111-02022	111-02024
5/16	5/16	3/4	2-1/2	4	111-02012	111-02014
5/16	5/16	7/16	4	4	111-02062	111-02064
3/8	3/8	5/8	2	4	111-02422	111-02424
3/8	3/8	7/8	2-1/2	4	111-02412	111-02414
3/8	3/8	1-1/2	3-1/2	4	111-02432	111-02434
3/8	3/8	2	4	4	111-02442	111-02444
3/8	3/8	1/2	6	4	111-02472	111-02474
7/16	7/16	1	2-3/4	4	111-02812	111-02814
1/2	1/2	5/8	2-1/2	4	111-03222	111-03224
1/2	1/2	1-1/4	3	4	111-03212	111-03214
1/2	1/2	1-1/2	3-1/2	4	111-03232	111-03234
1/2	1/2	2	4	4	111-03242	111-03244
1/2	1/2	5/8	6	4	111-03272	111-03274
9/16	9/16	1-1/4	3-1/2	4	111-03612	111-03614
5/8	5/8	7/8	3	4	111-04022	111-04024
5/8	5/8	1-1/4	3-1/2	4	111-04012	111-04014
5/8	5/8	1-3/4	4	4	111-04032	111-04034
5/8	5/8	2-1/2	5	4	111-04042	111-04044
3/4	3/4	1-5/8	4	4	111-04812	111-04814
3/4	3/4	2-1/2	5	4	111-04832	111-04834
3/4	3/4	3-1/4	6	4	111-04842	111-04844
1	1	1-3/4	4	4	111-06412	111-06414
1	1	2-3/4	5	4	111-06432	111-06434

Application Range:

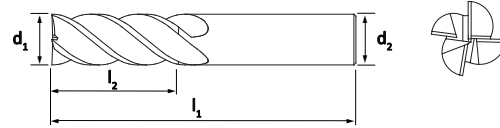
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●			●	●	●	●			●	

Series 155 4 Flute Universal



UN **4 FL** **S**

$\lambda_s = 40^\circ$ $\gamma_s = 10^\circ$ **UE**



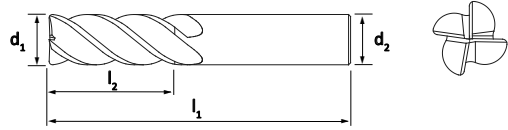
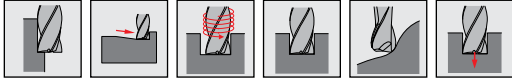
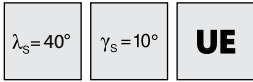
Tolerances
Shank: $1/8'' - 1'' = -.0001/-0.0004$
Cutting Dia: $1/8'' - 1'' = +.000/-0.002$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	l_3 LOR	d_3 Neck Dia	Flutes	AlTiN	nACRo®
1/8	1/8	1/4	1-1/2			4	155-00824	155-00825
1/8	1/8	1/2	1-1/2			4	155-00814	155-00815
5/32	3/16	3/8	2			4	155-01024	155-01025
5/32	3/16	1/2	2			4	155-01014	155-01015
3/16	3/16	3/8	2			4	155-01224	155-01225
3/16	3/16	5/8	2			4	155-01214	155-01215
7/32	1/4	3/8	2			4	155-01424	155-01425
7/32	1/4	3/4	2-1/2			4	155-01414	155-01415
1/4	1/4	3/8	2			4	155-01624	155-01625
1/4	1/4	3/4	2-1/2			4	155-01614	155-01615
1/4	1/4	3/4	4	2-1/8	0.240	4	155-01664	155-01665
1/4	1/4	1-1/4	5			4	155-01634	155-01635
5/16	5/16	1/2	2-1/2			4	155-02024	155-02025
5/16	5/16	3/4	2-1/2			4	155-02014	155-02015
3/8	3/8	5/8	2			4	155-02424	155-02425
3/8	3/8	7/8	2-1/2			4	155-02414	155-02415
3/8	3/8	1-1/2	3-1/2			4	155-02434	155-02435
3/8	3/8	7/8	4	2-3/8	0.360	4	155-02464	155-02465
3/8	3/8	7/8	6	3-3/8	0.360	4	155-02474	155-02475
7/16	7/16	1	2-3/4			4	155-02814	155-02815
1/2	1/2	5/8	2-1/2			4	155-03224	155-03225
1/2	1/2	1-1/4	3			4	155-03214	155-03215
1/2	1/2	2	4			4	155-03244	155-03245
1/2	1/2	1	6	2-3/8	0.480	4	155-03264	155-03265
1/2	1/2	1	6	3-3/8	0.480	4	155-03274	155-03275
9/16	9/16	1-1/4	3-1/2			4	155-03614	155-03615
5/8	5/8	7/8	3			4	155-04024	155-04025
5/8	5/8	1-1/4	3-1/2			4	155-04014	155-04015
5/8	5/8	2-1/2	5			4	155-04044	155-04045
3/4	3/4	1	3			4	155-04824	155-04825
3/4	3/4	1-5/8	4			4	155-04814	155-04815
3/4	3/4	2-1/2	5			4	155-04834	155-04835
1	1	1-3/4	4			4	155-06414	155-06415
1	1	2-3/4	5			4	155-06434	155-06435
1	1	3-3/8	6			4	155-06444	155-06445

Feeds & Speeds Available on Page 62 - 63

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●		●	●	●	●				



Tolerances

Shank: 1/8" - 1" = -.0001/- .0004
 Cutting Dia: 1/8" - 1" = +.000/- .002
 Radius: 1/8" - 1" = +/- .001

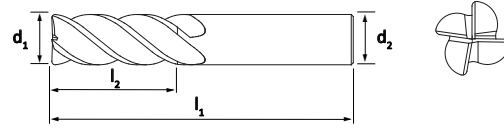
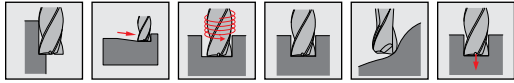
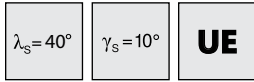
d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	l ₃ LOR	d ₃ Neck Dia	R Radius	Flutes	AlTiN	nACRo®
1/8	1/8	1/4	1-1/2			0.010	4	156-10824	156-10825
1/8	1/8	1/4	1-1/2			0.020	4	156-30824	156-30825
1/8	1/8	1/2	1-1/2			0.010	4	156-10814	156-10815
1/8	1/8	1/2	1-1/2			0.015	4	156-20814	156-20815
1/8	1/8	1/2	1-1/2			0.020	4	156-30814	156-30815
5/32	3/16	3/8	2			0.010	4	156-11024	156-11025
5/32	3/16	3/8	2			0.015	4	156-21024	156-21025
5/32	3/16	3/8	2			0.020	4	156-31024	156-31025
5/32	3/16	1/2	2			0.010	4	156-11014	156-11015
5/32	3/16	1/2	2			0.015	4	156-21014	156-21015
5/32	3/16	1/2	2			0.020	4	156-31014	156-31015
3/16	3/16	3/8	2			0.010	4	156-11224	156-11225
3/16	3/16	3/8	2			0.020	4	156-31224	156-31225
3/16	3/16	5/8	2			0.010	4	156-11214	156-11215
3/16	3/16	5/8	2			0.020	4	156-31214	156-31215
7/32	1/4	3/8	2			0.020	4	156-31424	156-31425
7/32	1/4	3/4	2-1/2			0.015	4	156-21414	156-21415
7/32	1/4	3/4	2-1/2			0.020	4	156-31414	156-31415
1/4	1/4	3/8	2			0.010	4	156-11624	156-11625
1/4	1/4	3/8	2			0.015	4	156-21624	156-21625
1/4	1/4	3/8	2			0.020	4	156-31624	156-31625
1/4	1/4	3/8	2			0.030	4	156-41624	156-41625
1/4	1/4	3/4	2-1/2			0.010	4	156-11614	156-11615
1/4	1/4	3/4	2-1/2			0.015	4	156-21614	156-21615
1/4	1/4	3/4	2-1/2			0.020	4	156-31614	156-31615
1/4	1/4	3/4	2-1/2			0.030	4	156-41614	156-41615
1/4	1/4	1-1/4	3			0.010	4	156-11634	156-11635
1/4	1/4	1-1/4	3			0.015	4	156-21634	156-21635
1/4	1/4	1-1/4	3			0.020	4	156-31634	156-31635
1/4	1/4	1-1/4	3			0.030	4	156-41634	156-41635
1/4	1/4	3/4	4	2 1/8	0.240	0.015	4	156-21664	156-21665
1/4	1/4	3/4	4	2 1/8	0.240	0.020	4	156-31664	156-31665
1/4	1/4	3/4	4	2 1/8	0.240	0.030	4	156-41664	156-41665
9/32	5/16	3/4	2-1/2			0.020	4	156-31814	156-31815
5/16	5/16	1/2	2-1/2			0.020	4	156-32024	156-32025
5/16	5/16	3/4	2-1/2			0.030	4	156-42014	156-42015
3/8	3/8	5/8	2			0.010	4	156-12424	156-12425
3/8	3/8	5/8	2			0.015	4	156-22424	156-22425
3/8	3/8	5/8	2			0.020	4	156-32424	156-32425
3/8	3/8	5/8	2			0.030	4	156-42424	156-42425
3/8	3/8	7/8	2-1/2			0.010	4	156-12414	156-12415
3/8	3/8	7/8	2-1/2			0.020	4	156-32414	156-32415
3/8	3/8	7/8	2-1/2			0.030	4	156-42414	156-42415
3/8	3/8	1-1/2	3-1/2			0.010	4	156-12434	156-12435
3/8	3/8	1-1/2	3-1/2			0.020	4	156-32434	156-32435

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•	•	•	•				

Series 156

4 Flute Universal Corner Radius



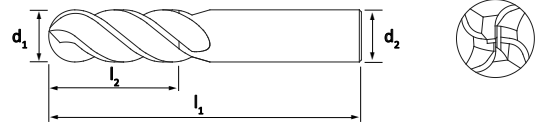
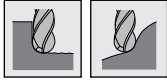
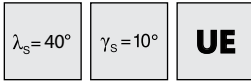
Tolerances
 Shank: 1/8" - 1" = -.0001/- .0004
 Cutting Dia: 1/8" - 1" = +.000/- .002
 Radius: 1/8" - 1" = +/- .001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	l ₃ LOR	d ₃ Neck Dia	R Radius	Flutes	AlTiN	nACRo®
3/8	3/8	1-1/2	3-1/2			0.030	4	156-42434	156-42435
3/8	3/8	7/8	4	2 3/8	0.360	0.030	4	156-42464	156-42465
7/16	7/16	5/8	2-3/4			0.020	4	156-32824	156-32825
7/16	7/16	1	2-3/4			0.020	4	156-32814	156-32815
1/2	1/2	5/8	2-1/2			0.010	4	156-13224	156-13225
1/2	1/2	5/8	2-1/2			0.015	4	156-23224	156-23225
1/2	1/2	5/8	2-1/2			0.020	4	156-33224	156-33225
1/2	1/2	5/8	2-1/2			0.030	4	156-43224	156-43225
1/2	1/2	5/8	2-1/2			0.060	4	156-63224	156-63225
1/2	1/2	1-1/4	3			0.010	4	156-13214	156-13215
1/2	1/2	1-1/4	3			0.015	4	156-23214	156-23215
1/2	1/2	1-1/4	3			0.020	4	156-33214	156-33215
1/2	1/2	1-1/4	3			0.030	4	156-43214	156-43215
1/2	1/2	1-1/4	3			0.060	4	156-63214	156-63215
1/2	1/2	2	4			0.020	4	156-33244	156-33245
1/2	1/2	2	4			0.030	4	156-43244	156-43245
1/2	1/2	2	4			0.060	4	156-63244	156-63245
1/2	1/2	1	6	2 3/8	0.480	0.030	4	156-43264	156-43265
9/16	9/16	1-1/4	3-1/2			0.030	4	156-43614	156-43615
5/8	5/8	7/8	3			0.030	4	156-44024	156-44025
5/8	5/8	1-1/4	3-1/2			0.010	4	156-14014	156-14015
5/8	5/8	1-1/4	3-1/2			0.030	4	156-44014	156-44015
5/8	5/8	1-1/4	3-1/2			0.060	4	156-64014	156-64015
5/8	5/8	2-1/2	5			0.030	4	156-44044	156-44045
5/8	5/8	2-1/2	5			0.060	4	156-64044	156-64045
5/8	5/8	1-1/4	6	2 3/8	0.600	0.030	4	156-44064	156-44065
3/4	3/4	1	3			0.010	4	156-14824	156-14825
3/4	3/4	1	3			0.030	4	156-44824	156-44825
3/4	3/4	1	3			0.060	4	156-64824	156-64825
3/4	3/4	1-5/8	4			0.010	4	156-14814	156-14815
3/4	3/4	1-5/8	4			0.020	4	156-34814	156-34815
3/4	3/4	1-5/8	4			0.030	4	156-44814	156-44815
3/4	3/4	1-5/8	4			0.060	4	156-64814	156-64815
3/4	3/4	1-5/8	4			0.125	4	156-84814	156-84815
3/4	3/4	2-1/2	5			0.030	4	156-44834	156-44835
3/4	3/4	2-1/2	5			0.060	4	156-64834	156-64835
3/4	3/4	1-5/8	6	2 1/2	0.720	0.030	4	156-44864	156-44865
1	1	1-3/4	4			0.030	4	156-46414	156-46415
1	1	1-3/4	4			0.060	4	156-66414	156-66415
1	1	2-3/4	5			0.030	4	156-46434	156-46435
1	1	2-3/4	5			0.060	4	156-66434	156-66435
1	1	3-3/8	6			0.030	4	156-46444	156-46445
1	1	3-3/8	6			0.060	4	156-66444	156-66445

Feeds & Speeds Available on Page 62 - 63

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●		●	●	●	●				

**Tolerances**

Shank: 1/8" - 1" = -.0001/-.0004
 Cutting Dia: 1/8" - 1" = +.000/- .002
 Ball Radius: 1/8" - 1" = +/- .001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	l ₃ LOR	d ₃ Neck Dia	R Radius	Flutes	AlTiN	nACRo®
1/8	1/8	1/4	1-1/2			0.063	4	157-00824	157-00825
1/8	1/8	1/2	1-1/2			0.063	4	157-00814	157-00815
5/32	3/16	1/2	2			0.078	4	157-01014	157-01015
3/16	3/16	3/8	2			0.094	4	157-01224	157-01225
3/16	3/16	5/8	2			0.094	4	157-01214	157-01215
7/32	1/4	3/8	2			0.109	4	157-01424	157-01425
7/32	1/4	3/4	2-1/2			0.109	4	157-01414	157-01415
1/4	1/4	3/8	2			0.125	4	157-01624	157-01625
1/4	1/4	3/4	2-1/2			0.125	4	157-01614	157-01615
1/4	1/4	3/4	4	2-1/8	0.240	0.125	4	157-01664	157-01665
5/16	5/16	1/2	2-1/2			0.156	4	157-02024	157-02025
5/16	5/16	3/4	2-1/2			0.156	4	157-02014	157-02015
3/8	3/8	5/8	2			0.188	4	157-02424	157-02425
3/8	3/8	7/8	2-1/2			0.188	4	157-02414	157-02415
3/8	3/8	7/8	4	2-3/8	0.360	0.188	4	157-02464	157-02465
1/2	1/2	5/8	2-1/2			0.250	4	157-03224	157-03225
1/2	1/2	1	3			0.250	4	157-03214	157-03215
1/2	1/2	1	6	2-3/8	0.480	0.250	4	157-03264	157-03265
1/2	1/2	1	6	3-3/8	0.480	0.250	4	157-03274	157-03275
9/16	9/16	1-1/4	3-1/2			0.281	4	157-03614	157-03615
5/8	5/8	1-1/4	3-1/2			0.313	4	157-04014	157-04015
5/8	5/8	1-1/4	6	3-3/8	0.600	0.313	4	157-04074	157-04075
3/4	3/4	1-5/8	4			0.375	4	157-04814	157-04815
1	1	1-3/4	4			0.500	4	157-06414	157-06415
1	1	2-3/4	5			0.500	4	157-06434	157-06435
1	1	1-7/8	6	3-3/8	0.960	0.500	4	157-06474	157-06475

Feeds & Speeds Available on Page 63 - 64
Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•	•	•	•				

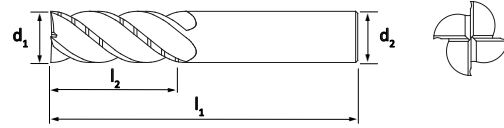
Series 190

4 Flute Universal Multi-Geometry



UN **4 FL** **S**

$\lambda_s = 40^\circ$ $\gamma_s = 10^\circ$ **Cb**



Tolerances
 Shank: $3/16'' - 1'' = -.0001/- .0004$
 Cutting Dia: $3/16'' - 1'' = +.000/- .002$

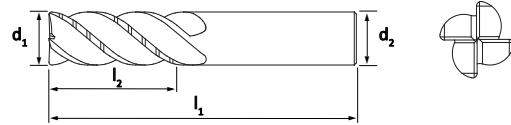
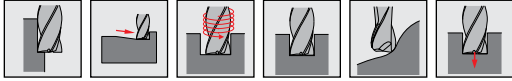
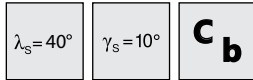
d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	l_3 LOR	d_3 Neck Dia	Flutes	AlTiN	nACRo®
3/16	3/16	5/8	2			4	190-01214	190-01215
1/4	1/4	3/8	2			4	190-01624	190-01625
1/4	1/4	3/4	2-1/2			4	190-01614	190-01615
5/16	5/16	3/4	2-1/2			4	190-02014	190-02015
3/8	3/8	5/8	2			4	190-02424	190-02425
3/8	3/8	7/8	2-1/2			4	190-02414	190-02415
3/8	3/8	7/8	4	2-1/8	0.360	4	190-02464	190-02465
1/2	1/2	5/8	2-1/2			4	190-03224	190-03225
1/2	1/2	1-1/4	3			4	190-03214	190-03215
1/2	1/2	2	4			4	190-03234	190-03235
1/2	1/2	1	6	2-3/8	0.480	4	190-03264	190-03265
5/8	5/8	7/8	3			4	190-04024	190-04025
5/8	5/8	1-1/4	3-1/2			4	190-04014	190-04015
3/4	3/4	1	3			4	190-04824	190-04825
3/4	3/4	1-5/8	4			4	190-04814	190-04815
1	1	1-3/4	4			4	190-06414	190-06415

Feeds & Speeds Available on Page 64

PROMAX PREMIUM

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•			•	•	•	•				

**Tolerances**

Shank: 3/16" - 1" = -.0001/-0.0004
 Cutting Dia: 3/16" - 1" = +.000/-0.002
 Radius: 3/16" - 1" = +.002/-0.001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	AlTiN	nACRo®
3/16	3/16	5/8	2	0.010	4	191-11214	191-11215
1/4	1/4	3/4	2-1/2	0.020	4	191-31614	191-31615
5/16	5/16	3/4	2-1/2	0.020	4	191-32014	191-32015
5/16	5/16	3/4	2-1/2	0.030	4	191-42014	191-42015
3/8	3/8	7/8	2-1/2	0.020	4	191-32414	191-32415
3/8	3/8	7/8	2-1/2	0.030	4	191-42414	191-42415
1/2	1/2	5/8	2-1/2	0.020	4	191-33224	191-33225
1/2	1/2	5/8	2-1/2	0.030	4	191-43224	191-43225
1/2	1/2	1-1/4	3	0.020	4	191-33214	191-33215
1/2	1/2	1-1/4	3	0.030	4	191-43214	191-43215
1/2	1/2	2	4	0.020	4	191-33234	191-33235
1/2	1/2	2	4	0.030	4	191-43234	191-43235
5/8	5/8	1-1/4	3-1/2	0.030	4	191-44014	191-44015
3/4	3/4	1-5/8	4	0.030	4	191-44814	191-44815
1	1	1-3/4	4	0.030	4	191-46414	191-46415

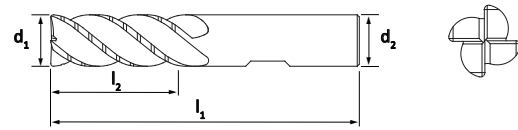
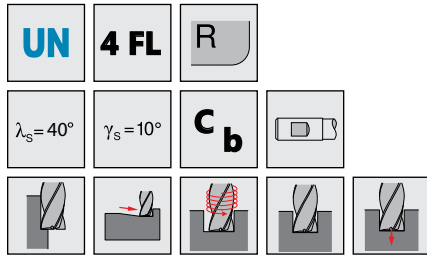
Feeds & Speeds Available on Page 64
Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•			•	•	•	•				

Series 120

4 Flute Universal Rougher-Finisher

PROMAX
TOOLS



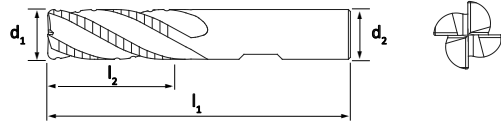
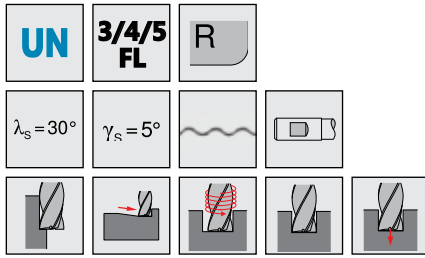
Tolerances
 Shank: 1/8" - 1" = -.0001/-0.0004
 Cutting Dia: 1/8" - 1" = +.000/-0.003
 Radius: 1/8" - 1" = +.002/-0.001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	l ₃ LOR	d ₃ Neck Dia	R Radius	Flutes	TiCN	AlTiN	nACRo®
1/8	1/8	1/4	1-1/2			0.010	4	120-00822	120-00824	120-00825
1/8	1/8	1/2	1-1/2			0.010	4	120-00812	120-00814	120-00815
5/32	3/16	3/8	2			0.010	4	120-01022	120-01024	120-01025
5/32	3/16	1/2	2			0.010	4	120-01012	120-01014	120-01015
3/16	3/16	3/8	2			0.010	4	120-01222	120-01224	120-01225
3/16	3/16	5/8	2			0.010	4	120-01212	120-01214	120-01215
7/32	1/4	3/8	2			0.020	4	120-01422	120-01424	120-01425
7/32	1/4	3/4	2-1/2			0.020	4	120-01412	120-01414	120-01415
1/4	1/4	3/8	2			0.020	4	120-01622	120-01624	120-01625
1/4	1/4	3/4	2-1/2			0.020	4	120-01612	120-01614	120-01615
1/4	1/4	1-1/4	3			0.020	4	120-01632	120-01634	120-01635
1/4	1/4	1-1/2	3-1/2			0.020	4	120-01642	120-01644	120-01645
1/4	1/4	3/4	4	2-1/8	0.240	0.020	4	120-01662	120-01664	120-01665
9/32	5/16	1/2	2-1/2			0.020	4	120-01822	120-01824	120-01825
9/32	5/16	3/4	2-1/2			0.020	4	120-01812	120-01814	120-01815
5/16	5/16	1/2	2-1/2			0.020	4	120-02022	120-02024	120-02025
5/16	5/16	3/4	2-1/2			0.020	4	120-02012	120-02014	120-02015
11/32	3/8	5/8	2			0.020	4	120-02222	120-02224	120-02225
11/32	3/8	7/8	2-1/2			0.020	4	120-02212	120-02214	120-02215
3/8	3/8	5/8	2			0.020	4	120-02422	120-02424	120-02425
3/8	3/8	7/8	2-1/2			0.020	4	120-02412	120-02414	120-02415
3/8	3/8	1-1/2	3-1/2			0.020	4	120-02432	120-02434	120-02435
3/8	3/8	7/8	4	2-1/8	0.360	0.020	4	120-02462	120-02464	120-02465
3/8	3/8	2	4			0.020	4	120-02442	120-02444	120-02445
3/8	3/8	7/8	6	3-3/8	0.360	0.020	4	120-02472	120-02474	120-02475
7/16	7/16	1	2-3/4			0.020	4	120-02812	120-02814	120-02815
1/2	1/2	5/8	2-1/2			0.020	4	120-03222	120-03224	120-03225
1/2	1/2	1-1/4	3			0.020	4	120-03212	120-03214	120-03215
1/2	1/2	1-1/2	3-1/2			0.020	4	120-03232	120-03234	120-03235
1/2	1/2	2	4			0.020	4	120-03242	120-03244	120-03245
1/2	1/2	1	6	2-3/8	0.480	0.020	4	120-03262	120-03264	120-03265
1/2	1/2	1	6	3-3/8	0.480	0.020	4	120-03272	120-03274	120-03275
9/16	9/16	1-1/4	3-1/2			0.030	4	120-03612	120-03614	120-03615
5/8	5/8	7/8	3			0.030	4	120-04022	120-04024	120-04025
5/8	5/8	1-1/4	3-1/2			0.030	4	120-04012	120-04014	120-04015
5/8	5/8	1-3/4	4			0.030	4	120-04032	120-04034	120-04035
5/8	5/8	2-1/2	5			0.030	4	120-04042	120-04044	120-04045
3/4	3/4	1	3			0.030	4	120-04822	120-04824	120-04825
3/4	3/4	1-5/8	4			0.030	4	120-04812	120-04814	120-04815
3/4	3/4	1-5/8	6	2-1/2	0.720	0.030	4	120-04862	120-04864	120-04865
1	1	1-3/4	4			0.030	4	120-06412	120-06414	120-06415

Feeds & Speeds Available on Page 65

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●		●	●	●	●				



Tolerances
 Shank: 3/16" - 1" = -.0001/-0.0004
 Cutting Dia: 3/16" - 1" = +.000/-0.005
 Radius: 3/16" - 1" = +/-0.005

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	TiCN	AlTiN
3/16	3/16	3/8	2	0.030	3	100-01222	100-01224
3/16	3/16	5/8	2	0.030	3	100-01212	100-01214
1/4	1/4	3/8	2	0.045	4	100-01622	100-01624
1/4	1/4	3/4	2-1/2	0.045	4	100-01612	100-01614
5/16	5/16	1/2	2-1/2	0.045	4	100-02022	100-02024
5/16	5/16	3/4	2-1/2	0.045	4	100-02012	100-02014
3/8	3/8	5/8	2	0.060	4	100-02422	100-02424
3/8	3/8	7/8	2-1/2	0.060	4	100-02412	100-02414
7/16	7/16	1	2-3/4	0.060	4	100-02812	100-02814
1/2	1/2	5/8	2-1/2	0.060	4	100-03222	100-03224
1/2	1/2	1-1/4	3	0.060	4	100-03212	100-03214
1/2	1/2	1-1/2	3-1/2	0.060	4	100-03232	100-03234
9/16	9/16	1-1/4	3-1/2	0.060	4	100-03612	100-03614
5/8	5/8	7/8	3	0.060	4	100-04022	100-04024
5/8	5/8	1-1/4	3-1/2	0.060	4	100-04012	100-04014
5/8	5/8	2	4	0.060	4	100-04032	100-04034
3/4	3/4	1	3	0.060	4	100-04822	100-04824
3/4	3/4	1-5/8	4	0.060	4	100-04812	100-04814
3/4	3/4	2-1/4	5	0.060	4	100-04832	100-04834
1	1	1-3/4	4	0.060	5	100-06412	100-06414
1	1	2-5/8	5	0.060	5	100-06432	100-06434

Feeds & Speeds Available on Page 65 - 66

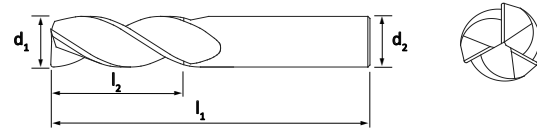
Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●			●			●				

Series 106 3 Flute Universal



$\lambda_s = 35^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/8'' - 3/4'' = -.0001/-0.0004$
 Cutting Dia: $1/8'' - 3/4'' = +.000/-0.002$
 Radius: $1/8'' - 3/4'' = +/-0.001$

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	l ₃ LOR	d ₃ Neck Dia	R Radius	Flutes	TiCN	AlTiN
1/8	1/8	1/4	1-1/2			0.010	3	106-00822	106-00824
1/8	1/8	1/2	1-1/2			0.010	3	106-00812	106-00814
5/32	3/16	5/16	2			0.010	3	106-01022	106-01024
3/16	3/16	5/16	2			0.010	3	106-01222	106-01224
3/16	3/16	5/8	2			0.010	3	106-01212	106-01214
1/4	1/4	3/8	2			0.020	3	106-01622	106-01624
1/4	1/4	3/4	2-1/2			0.020	3	106-01612	106-01614
1/4	1/4	3/8	4	2-1/8	0.240	0.020	3	106-01662	106-01664
5/16	5/16	13/16	2-1/2			0.020	3	106-02012	106-02014
3/8	3/8	1/2	2			0.020	3	106-02422	106-02424
3/8	3/8	1	2-1/2			0.020	3	106-02412	106-02414
3/8	3/8	1/2	6	2-1/8	0.360	0.020	3	106-02462	106-02464
7/16	7/16	1	2-3/4			0.020	3	106-02812	106-02814
1/2	1/2	5/8	2-1/2			0.020	3	106-03222	106-03224
1/2	1/2	1-1/4	3			0.020	3	106-03212	106-03214
1/2	1/2	5/8	6	2-3/8	0.480	0.020	3	106-03262	106-03264
5/8	5/8	1-5/8	3-1/2			0.030	3	106-04012	106-04014
3/4	3/4	1-5/8	4			0.030	3	106-04812	106-04814

Feeds & Speeds Available on Page 66

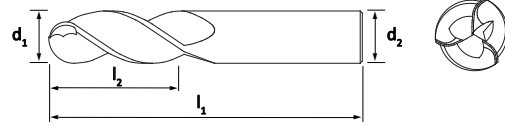
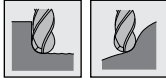
PROMAX PREMIUM

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●						●				



$\lambda_s = 35^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/8'' - 1'' = -.0001/-0.0004$
 Cutting Dia: $1/8'' - 1'' = +.000/-0.002$
 Ball Radius: $1/8'' - 1'' = +/-0.001$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	l_3 LOR	d_3 Neck Dia	R Radius	Flutes	TiCN	AlTiN
1/8	1/8	1/4	1-1/2			0.063	3	113-00822	113-00824
1/8	1/8	1/2	1-1/2			0.063	3	113-00812	113-00814
3/16	3/16	5/8	2			0.094	3	113-01212	113-01214
1/4	1/4	3/4	2-1/2			0.125	3	113-01612	113-01614
1/4	1/4	3/8	4	2-1/8	0.240	0.125	3	113-01662	113-01664
5/16	5/16	13/16	2-1/2			0.156	3	113-02012	113-02014
5/16	5/16	7/16	4	2-1/8	0.300	0.156	3	113-02062	113-02064
3/8	3/8	1	2-1/2			0.188	3	113-02412	113-02414
3/8	3/8	1/2	6	2-1/8	0.360	0.188	3	113-02462	113-02464
3/8	3/8	1/2	6	3-3/8	0.360	0.188	3	113-02472	113-02474
1/2	1/2	1-1/4	3			0.250	3	113-03212	113-03214
1/2	1/2	5/8	6	2-3/8	0.480	0.250	3	113-03262	113-03264
5/8	5/8	1-1/4	3-1/2			0.313	3	113-04012	113-04014
3/4	3/4	1-5/8	4			0.375	3	113-04812	113-04814
1	1	1-3/4	4			0.500	3	113-06412	113-06414

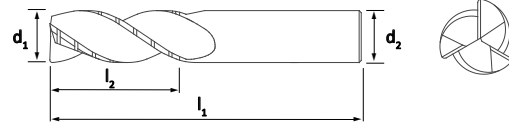
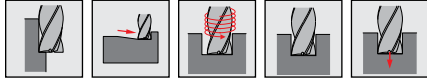
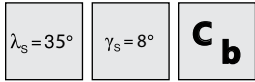
Feeds & Speeds Available on Page 67

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●						●				

Series 117

3 Flute Universal Rougher-Finisher



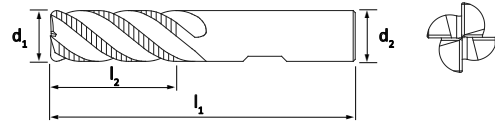
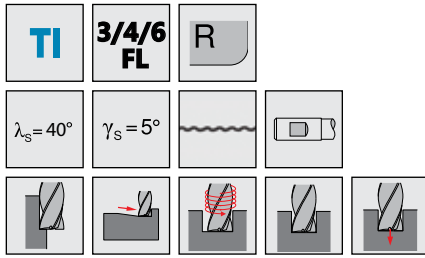
Tolerances
 Shank: 1/8" - 3/4" = -.0001/-0.0004
 Cutting Dia: 1/8" - 3/4" = +.000/-0.002
 Radius: 1/8" - 3/4" = +.002/-0.001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	TiCN	AlTiN
1/8	1/8	1/2	1-1/2	0.010	3	117-00812	117-00814
3/16	3/16	5/16	2	0.010	3	117-01222	117-01224
3/16	3/16	5/8	2	0.010	3	117-01212	117-01214
1/4	1/4	3/8	2	0.020	3	117-01622	117-01624
1/4	1/4	3/4	2-1/2	0.020	3	117-01612	117-01614
5/16	5/16	13/16	2-1/2	0.020	3	117-02012	117-02014
3/8	3/8	1	2-1/2	0.020	3	117-02412	117-02414
7/16	7/16	5/8	2-3/4	0.020	3	117-02822	117-02824
7/16	7/16	1	2-3/4	0.020	3	117-02812	117-02814
1/2	1/2	5/8	2-1/2	0.020	3	117-03222	117-03224
1/2	1/2	1-1/4	3	0.020	3	117-03212	117-03214
5/8	5/8	1-1/4	3-1/2	0.030	3	117-04012	117-04014
3/4	3/4	1-5/8	4	0.030	3	117-04812	117-04814

Feeds & Speeds Available on Page 67

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●						●				



Tolerances
 Shank: 3/16" - 1" = -.0001/-0.0004
 Cutting Dia: 3/16" - 1" = +.000/-0.005
 Radius: 3/16" - 1" = +/-0.005

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	TiCN	AlTiN	nACRo®
3/16	3/16	3/8	2	0.030	3	101-01222	101-01224	101-01225
3/16	3/16	5/8	2	0.030	3	101-01212	101-01214	101-01215
1/4	1/4	3/8	2	0.045	4	101-01622	101-01624	101-01625
1/4	1/4	3/4	2-1/2	0.045	4	101-01612	101-01614	101-01615
5/16	5/16	1/2	2-1/2	0.045	4	101-02022	101-02024	101-02025
5/16	5/16	3/4	2-1/2	0.045	4	101-02012	101-02014	101-02015
3/8	3/8	5/8	2	0.060	4	101-02422	101-02424	101-02425
3/8	3/8	7/8	2-1/2	0.060	4	101-02412	101-02414	101-02415
7/16	7/16	1	2-3/4	0.060	4	101-02812	101-02814	101-02815
1/2	1/2	5/8	2-1/2	0.060	4	101-03222	101-03224	101-03225
1/2	1/2	1-1/4	3	0.060	4	101-03212	101-03214	101-03215
1/2	1/2	1-1/2	3-1/2	0.060	4	101-03232	101-03234	101-03235
9/16	9/16	1-1/4	3-1/2	0.060	4	101-03612	101-03614	101-03615
5/8	5/8	7/8	3	0.060	4	101-04022	101-04024	101-04025
5/8	5/8	1-1/4	3-1/2	0.060	4	101-04012	101-04014	101-04015
5/8	5/8	2	4	0.060	4	101-04032	101-04034	101-04035
3/4	3/4	1	3	0.060	4	101-04822	101-04824	101-04825
3/4	3/4	1-5/8	4	0.060	4	101-04812	101-04814	101-04815
3/4	3/4	2-1/4	5	0.060	4	101-04832	101-04834	101-04835
1	1	1-3/4	4	0.060	6	101-06412	101-06414	101-06415
1	1	2-5/8	5	0.060	6	101-06432	101-06434	101-06435

Feeds & Speeds Available on Page 68

Application Range:

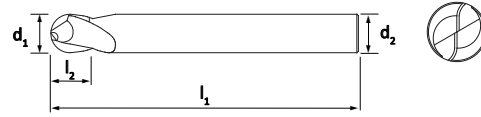
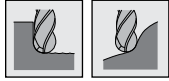
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
	•		•	•	•					

Series 250

2 Flute 0° Die and Mold Tool



$\lambda_s = 30^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/8'' - 1/2'' = -.0001/-0.0004$
 Cutting Dia: $1/8'' - 1/2'' = +.000/-0.0008$
 Radius: $1/8'' - 1/2'' = +.000/-0.0004$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	R Radius	Flutes	AITiN
1/8	1/8	1/8	3	0.063	2	250-00814
3/16	3/16	3/16	3	0.094	2	250-01214
1/4	1/4	1/4	4	0.125	2	250-01614
3/8	3/8	3/8	4	0.188	2	250-02414
3/8	3/8	3/8	6	0.188	2	250-02444
1/2	1/2	1/2	4	0.250	2	250-03214
1/2	1/2	1/2	6	0.250	2	250-03244

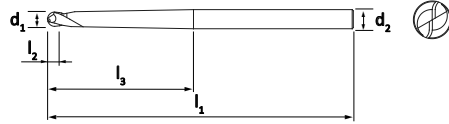
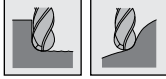
Feeds & Speeds Available on Page 68

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•							



$\lambda_s = 30^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: 1/32" - 3/16" = -.0001/-0.0004
 Cutting Dia: 1/32" - 3/16" = +.000/-0.0008
 Radius: 1/32" - 3/16" = +.000/-0.0004

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	l ₃ LOR	R Radius	Flutes	AlTiN
1/32	1/4	1/32	4	0.625	0.016	2	251-00214
0.06	1/4	.060	4	1.250	0.030	2	251-00414
0.06	1/4	.080	4	1.625	0.040	2	251-00514
3/32	1/4	3/32	4	1.875	0.047	2	251-00614
1/8	1/4	1/8	4	2.500	0.063	2	251-00814
3/16	1/4	3/16	4	2.265	0.094	2	251-01214

Feeds & Speeds Available on Page 69

Application Range:

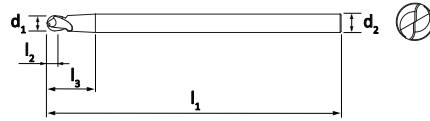
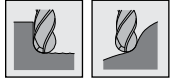
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•							

Series 252

2 Flute 3° Die and Mold Tool



$\lambda_s = 30^\circ$ $\gamma_s = 8^\circ$



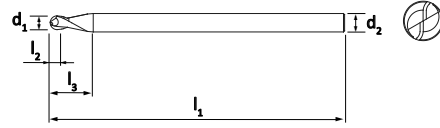
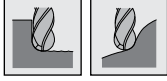
Tolerances
 Shank: $1/32'' - 3/16'' = -.0001/-0.0004$
 Cutting Dia: $1/32'' - 3/16'' = +.000/-0.0008$
 Radius: $1/32'' - 3/16'' = +.000/-0.0004$

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	l ₃ LOR	R Radius	Flutes	AlTiN
1/32	1/4	1/32	4	2.112	0.016	2	252-00214
0.06	1/4	.060	4	1.875	0.030	2	252-00414
0.06	1/4	.080	4	1.704	0.040	2	252-00514
3/32	1/4	3/32	4	1.584	0.047	2	252-00614
1/8	1/4	1/8	4	1.324	0.063	2	252-00814
3/16	1/4	3/16	4	0.786	0.094	2	252-01214

Feeds & Speeds Available on Page 69

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•							

 $\lambda_s = 30^\circ$ $\gamma_s = 8^\circ$ **Tolerances**

Shank: $1/32'' - 3/16'' = -.0001/-0.0004$
 Cutting Dia: $1/32'' - 3/16'' = +.000/-0.0008$
 Radius: $1/32'' - 3/16'' = +.000/-0.0004$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	l_3 LOR	R Radius	Flutes	AlTiN
1/32	1/4	1/32	4	1.282	0.016	2	253-00214
0.06	1/4	.060	4	1.175	0.030	2	253-00414
0.06	1/4	.080	4	1.084	0.040	2	253-00514
3/32	1/4	3/32	4	1.018	0.047	2	253-00614
1/8	1/4	1/8	4	0.897	0.063	2	253-00814
3/16	1/4	3/16	4	0.680	0.094	2	253-01214

Feeds & Speeds Available on Page 69
Application Range:

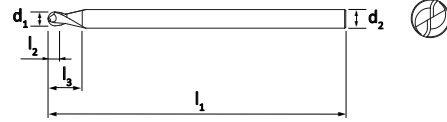
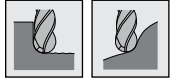
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•							

Series 254

2 Flute 8° Die and Mold Tool



$\lambda_s = 30^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/32'' - 3/16'' = -.0001/-0.0004$
 Cutting Dia: $1/32'' - 3/16'' = +.000/-0.0008$
 Radius: $1/32'' - 3/16'' = +.000/-0.0004$

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	l ₃ LOR	R Radius	Flutes	AlTiN
1/32	1/4	1/32	4	0.851	0.016	2	254-00214
0.06	1/4	.060	4	0.773	0.030	2	254-00414
0.06	1/4	.080	4	0.726	0.040	2	254-00514
3/32	1/4	3/32	4	0.690	0.047	2	254-00614
1/8	1/4	1/8	4	0.636	0.063	2	254-00814
3/16	1/4	3/16	4	0.454	0.094	2	254-01214

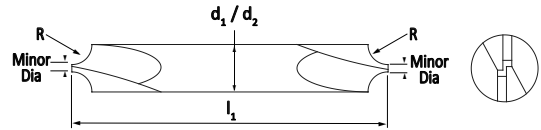
Feeds & Speeds Available on Page 69

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•							


Tolerances

Shank: 1/8" - 3/8" = -.0001/- .0004
 Radius: 1/8" - 3/8" = +/- .001



d ₁ Dia	d ₂ Shank	L ₁ OAL	Minor Dia	R Radius	Flutes	Uncoated	TiCN	AlTiN
1/8	1/8	1-1/2	0.105	0.010	2	137-00810	137-00812	137-00814
1/8	1/8	1-1/2	0.095	0.010	2	137-00820	137-00822	137-00824
1/8	1/8	1-1/2	0.085	0.020	2	137-00830	137-00832	137-00834
1/8	1/8	1-1/2	0.075	0.020	2	137-00840	137-00842	137-00844
1/8	1/8	1-1/2	0.063	0.031	2	137-00850	137-00852	137-00854
1/8	1/8	1-1/2	0.055	0.031	2	137-00860	137-00862	137-00864
1/8	1/8	1-1/2	0.045	0.040	2	137-00870	137-00872	137-00874
1/8	1/8	1-1/2	0.095	0.040	2	137-01210	137-01212	137-01214
3/16	3/16	2	0.087	0.050	2	137-01220	137-01222	137-01224
3/16	3/16	2	0.077	0.050	2	137-01230	137-01232	137-01234
3/16	3/16	2	0.058	0.062	2	137-01240	137-01242	137-01244
1/4	1/4	2-1/2	0.106	0.072	2	137-01610	137-01612	137-01614
1/4	1/4	2-1/2	0.094	0.072	2	137-01620	137-01622	137-01624
1/4	1/4	2-1/2	0.080	0.085	2	137-01630	137-01632	137-01634
1/4	1/4	2-1/2	0.062	0.094	2	137-01640	137-01642	137-01644
1/4	1/4	2-1/2	0.050	0.100	2	137-01650	137-01652	137-01654
1/4	1/4	2-1/2	0.094	0.100	2	137-02010	137-02012	137-02014
5/16	5/16	2-1/2	0.076	0.118	2	137-02020	137-02022	137-02024
5/16	5/16	2-1/2	0.063	0.125	2	137-02030	137-02032	137-02034
3/8	3/8	2-1/2	0.095	0.140	2	137-02410	137-02412	137-02414
3/8	3/8	2-1/2	0.063	0.156	2	137-02420	137-02422	137-02424

Application Range:

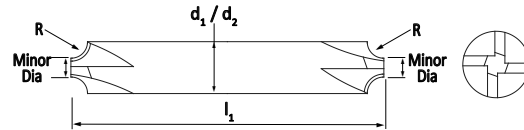
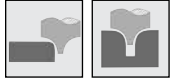
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•							

Series 139

4 Flute Corner Rounder



$\gamma_s = 3.5^\circ$



Tolerances
 Shank: $3/16'' - 1/2'' = -.0001/-0.0004$
 Radius: $3/16'' - 1/2'' = +/-0.001$

d_1 Dia	d_2 Shank	l_1 OAL	Minor Dia	R Radius	Flutes	Uncoated	TiCN	AlTiN
3/16	3/16	2	0.162	0.010	4	139-01200	139-01202	139-01204
3/16	3/16	2	0.152	0.015	4	139-01210	139-01212	139-01214
3/16	3/16	2	0.142	0.020	4	139-01220	139-01222	139-01224
3/16	3/16	2	0.132	0.025	4	139-01230	139-01232	139-01234
3/16	3/16	2	0.120	0.031	4	139-01240	139-01242	139-01244
3/16	3/16	2	0.112	0.035	4	139-01250	139-01252	139-01254
1/4	1/4	2-1/2	0.165	0.040	4	139-01600	139-01602	139-01604
1/4	1/4	2-1/2	0.153	0.046	4	139-01610	139-01612	139-01614
1/4	1/4	2-1/2	0.145	0.050	4	139-01620	139-01622	139-01624
1/4	1/4	2-1/2	0.135	0.055	4	139-01640	139-01642	139-01644
1/4	1/4	2-1/2	0.121	0.062	4	139-01630	139-01632	139-01634
3/8	3/8	2-1/2	0.214	0.078	4	139-02400	139-02402	139-02404
3/8	3/8	2-1/2	0.182	0.094	4	139-02410	139-02412	139-02414
3/8	3/8	2-1/2	0.170	0.100	4	139-02420	139-02422	139-02424
3/8	3/8	2-1/2	0.134	0.118	4	139-02430	139-02432	139-02434
3/8	3/8	2-1/2	0.120	0.125	4	139-02440	139-02442	139-02444
1/2	1/2	3	0.183	0.156	4	139-03200	139-03202	139-03204

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•		•							

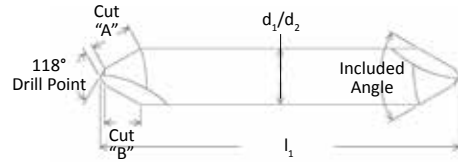
UN

2 FL

4 FL



Standard with 118° Drill Point

**Tolerances**Shank: $1/8'' - 1/2'' = -.0001/- .0004$ 

d_1 Dia	d_2 Shank	l_1 OAL	Included Angle	Cut "A"	Cut "B"	Flutes	Uncoated	TiCN	AlTiN
* 1/8	1/8	1-1/2	60°	0.098	0.085	2	132-00820	132-00822	132-00824
* 3/16	3/16	2	60°	0.147	0.127	2	132-01220	132-01222	132-01224
1/4	1/4	2-1/2	60°	0.200	0.173	2	132-01520	132-01522	132-01524
3/8	3/8	2-1/2	60°	0.313	0.271	2	132-02420	132-02422	132-02424
1/2	1/2	3	60°	0.430	0.372	2	132-03220	132-03222	132-03224

* No Drill Point



Standard with 118° Drill Point

d_1 Dia	d_2 Shank	l_1 OAL	Included Angle	Cut "A"	Cut "B"	Flutes	Uncoated	TiCN	AlTiN
1/4	1/4	2-1/2	60°	0.200	0.173	4	133-01520	133-01522	133-01524
3/8	3/8	2-1/2	60°	0.313	0.271	4	133-02420	133-02422	133-02424
1/2	1/2	3	60°	0.430	0.372	4	133-03220	133-03222	133-03224

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•	•	•	•	•	•	•	•	•	•

Series 134 & 135

2 & 4 Flute 90° Chamfer-Spot

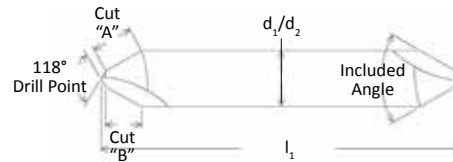
UN **2 FL** **4 FL**



Standard with 118° Drill Point



Tolerances
Shank: $1/8'' - 1/2'' = -.0001/- .0004$



d ₁ Dia	d ₂ Shank	l ₁ OAL	Included Angle	Cut "A"	Cut "B"	Flutes	Uncoated	TiCN	AlTiN
* 1/8	1/8	1-1/2	90°	0.071	0.050	2	134-00830	134-00832	134-00834
* 3/16	3/16	2	90°	0.107	0.076	2	134-01230	134-01232	134-01234
1/4	1/4	2-1/2	90°	0.141	0.100	2	134-01530	134-01532	134-01534
3/8	3/8	2-1/2	90°	0.221	0.157	2	134-02430	134-02432	134-02434
1/2	1/2	3	90°	0.304	0.215	2	134-03230	134-03232	134-03234

* No Drill Point



Standard with 118° Drill Point

d ₁ Dia	d ₂ Shank	l ₁ OAL	Included Angle	Cut "A"	Cut "B"	Flutes	Uncoated	TiCN	AlTiN
1/4	1/4	2-1/2	90°	0.141	0.100	4	135-01530	135-01532	135-01534
3/8	3/8	2-1/2	90°	0.221	0.157	4	135-02430	135-02432	135-02434
1/2	1/2	3	90°	0.304	0.215	4	135-03230	135-03232	135-03234

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•	•	•	•	•	•	•	•	•	•

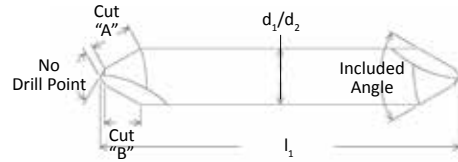
UN

2 FL

4 FL



No Drill Point

**Tolerances**Shank: $1/4" - 1/2" = -.0001/-0.0004$ 

d_1 Dia	d_2 Shank	l_1 OAL	Included Angle	Cut "A"	Cut "B"	Cut "B"	Uncoated	TiCN	AlTiN
* 1/4	1/4	2-1/2	120°	0.124	0.062	2	130-01510	130-01512	130-01514
* 3/8	3/8	2-1/2	120°	0.199	0.100	2	130-02410	130-02412	130-02414
* 1/2	1/2	3	120°	0.266	0.133	2	130-03210	130-03212	130-03214

* No Drill Point



No Drill Point

d_1 Dia	d_2 Shank	l_1 OAL	Included Angle	Cut "A"	Cut "B"	Cut "B"	Uncoated	TiCN	AlTiN
* 1/4	1/4	2-1/2	120°	0.144	0.072	4	131-01510	131-01512	131-01514
* 3/8	3/8	2-1/2	120°	0.217	0.108	4	131-02410	131-02412	131-02414
* 1/2	1/2	3	120°	0.289	0.144	4	131-03210	131-03212	131-03214

* No Drill Point

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•	•	•	•	•	•	•	•	•	•

Aluminum - 109 / 102										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Aluminium	Non-Alloy	410	1xø	0.7xø	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	Wrought Alloy Non-Hardened	410	1xø	0.7xø	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	Wrought Alloy Hardened	410	1xø	0.7xø	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	Casting Alloy < 6% Si	328	1xø	0.7xø	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	Casting Alloy 6-12% Si	295	1xø	0.7xø	0.0008	0.0014	0.0019	0.0033	0.0047	0.0058
	Casting Alloy > 6% Si	246	1xø	0.7xø	0.0008	0.0014	0.0019	0.0033	0.0047	0.0058
Magnesium	Wrought Alloy	295	1xø	0.7xø	0.0008	0.0014	0.0019	0.0033	0.0047	0.0058
	Casting Alloy	262	1xø	0.7xø	0.0008	0.0014	0.0019	0.0033	0.0047	0.0058
Copper	Non-Alloy	230	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	Wrought Alloy Non-Hardened	197	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	Wrought Alloy Hardened	164	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	CuNi-Alloy	197	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	CuNiZn-Alloy Long-Chipping	164	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	CuNiZn-Alloy Short-Chipping	197	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
CuZn (Brass)	Long-Chipping	246	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	Short-Chipping	328	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
CuSn (Bronze)	Long-Chipping	197	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	Short-Chipping	230	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
CuAlFe (Ampco)	Long-Chipping	197	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	Short-Chipping	230	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
Titanium	Non-Alloy	82	1xø	0.7xø	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Alloyed-Annealed	57	1xø	0.7xø	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Alloyed-Hardened	33	1xø	0.7xø	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017

Aluminum - 119										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Aluminium	Non-Alloy	984	1xø	0.7xø	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Wrought Alloy Non-Hardened	984	1xø	0.7xø	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Wrought Alloy Hardened	984	1xø	0.7xø	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Casting Alloy < 6% Si	787	1xø	0.7xø	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Casting Alloy 6-12% Si	591	1xø	0.7xø	0.0008	0.0014	0.0019	0.0033	0.0047	0.0058
	Casting Alloy > 6% Si	394	1xø	0.7xø	0.0008	0.0014	0.0019	0.0033	0.0047	0.0058
Magnesium	Wrought Alloy	361	1xø	0.7xø	0.0008	0.0014	0.0019	0.0033	0.0047	0.0058
	Casting Alloy	328	1xø	0.7xø	0.0008	0.0014	0.0019	0.0033	0.0047	0.0058
Copper	Non-Alloy	279	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	Wrought Alloy Non-Hardened	254	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	Wrought Alloy Hardened	197	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	CuNi-Alloy	246	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	CuNiZn-Alloy Long-Chipping	197	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	CuNiZn-Alloy Short-Chipping	246	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
CuZn (Brass)	Long-Chipping	295	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	Short-Chipping	394	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
CuSn (Bronze)	Long-Chipping	246	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	Short-Chipping	279	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
CuAlFe (Ampco)	Long-Chipping	90	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039
	Short-Chipping	115	1xø	0.7xø	0.0006	0.0011	0.0017	0.0022	0.0033	0.0039

*** Feeds and Speeds are starting points for Overall Lengths of 4" and shorter.
For End Mills with Overall Lengths over 4" decrease the Feeds and Speeds.**

Universal - 160 / 161										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	533	0.05xø	1.4xø	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	> 500 N/mm ²	492	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Construction Steel	Non-Alloy < 500 N/mm ²	509	0.05xø	1.4xø	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Non-Alloy > 500 N/mm ²	476	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Spring Steel	Alloy	459	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Annealed < 250 HB	262	0.05xø	1.4xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Natural Hard 250-350 HB	246	0.05xø	1.4xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Cementation Steel	Feeder Hard 1200-1600 N/mm ²	230	0.05xø	1.4xø	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	< 150 HB	427	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	150-200 HB	410	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Nitriding Steel	> 200 HB	377	0.05xø	1.4xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	< 1000 N/mm ²	377	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Quenched & Tempered Steel	> 1000 N/mm ²	344	0.05xø	1.4xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Non-Alloy < 800 N/mm ²	410	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Non-Alloy Tool Steel	Non-Alloy 800-1000 N/mm ²	377	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy < 800 N/mm ²	377	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy 800-1000 N/mm ²	361	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy 1000-1300 N/mm ²	344	0.05xø	1.4xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Alloy 1300-1600 N/mm ²	312	0.05xø	1.4xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	General	377	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	361	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low Alloy < 1200 N/mm ²	344	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low Alloy < 1500 N/mm ²	303	0.05xø	1.4xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	High Alloy Annealed < 1000 N/mm ²	328	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy Hardened < 1300 N/mm ²	287	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Tool Steel for Warm Processing	Low Alloy < 1200 N/mm ²	336	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low Alloy < 1500 N/mm ²	303	0.05xø	1.4xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	High Alloy Annealed < 1000 N/mm ²	303	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy Hardened < 1300 N/mm ²	287	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy Hardened < 1600 N/mm ²	262	0.05xø	1.4xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Stainless Steel	Ferric	197	0.05xø	1.4xø	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Martensitic	164	0.05xø	1.4xø	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austenitic A5 < 40%	197	0.05xø	1.4xø	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austenitic A5 > 40%	197	0.05xø	1.4xø	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Sulphured	213	0.05xø	1.4xø	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
High Temperature Alloy	Fe-Alloy	66	0.05xø	1.4xø	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Ni-Alloy not hardened	66	0.05xø	1.4xø	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Ni-Alloy hardened	66	0.05xø	1.4xø	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Co-Alloy	66	0.05xø	1.4xø	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
Cast Iron	Non-Alloy	410	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low-Alloy	328	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High-Alloy	246	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Stainless Cast Steel	Ferric/Martensitic	197	0.05xø	1.4xø	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austentic	197	0.05xø	1.4xø	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	410	0.05xø	1.4xø	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Non-Alloy > 180 HB	361	0.05xø	1.4xø	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Alloy	328	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy	246	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Spheroidal Cast Iron	Non-Alloy < 180 HB	377	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Non-Alloy > 180 HB	344	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy	303	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
White Malleable Cast Iron	< 180 HB	361	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 180 HB	328	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Black Malleable Cast Iron	< 180 HB	361	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 180 HB	328	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Titanium	Non-Alloy	328	0.05xø	1.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloyed-Annealed	287	0.05xø	1.4xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Alloyed-Hardened	205	0.05xø	1.4xø	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025

* Feeds and Speeds are starting points for Overall Lengths of 4" and shorter.
For End Mills with Overall Lengths over 4" decrease the Feeds and Speeds.

Universal - 112										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	427	1x ϕ	0.7x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	> 500 N/mm ²	394	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Construction Steel	Non-Alloy < 500 N/mm ²	410	1x ϕ	0.7x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Non-Alloy > 500 N/mm ²	377	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy	361	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Cementation Steel	< 150 HB	344	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	150-200 HB	328	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 200 HB	312	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Nitriding Steel	< 1000 N/mm ²	312	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 1000 N/mm ²	279	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	328	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Non-Alloy 800-1000 N/mm ²	312	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy < 800 N/mm ²	312	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy 800-1000 N/mm ²	295	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy 1000-1300 N/mm ²	279	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Alloy 1300-1600 N/mm ²	246	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Non-Alloy Tool Steel	General	303	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	295	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low Alloy < 1200 N/mm ²	279	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low Alloy < 1500 N/mm ²	246	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	High Alloy Annealed < 1000 N/mm ²	262	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy Hardened < 1300 N/mm ²	230	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Tool Steel for Warm Processing	Low Alloy < 1200 N/mm ²	328	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low Alloy < 1500 N/mm ²	295	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	High Alloy Annealed < 1000 N/mm ²	246	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy Hardened < 1300 N/mm ²	230	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy Hardened < 1600 N/mm ²	213	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Stainless Steel	Ferric	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Martensitic	131	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austenitic A5 < 40%	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austenitic A5 > 40%	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Sulphured	180	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
High Temperature Alloy	Fe-Alloy	90	0.5x ϕ	0.7x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy not hardened	90	0.5x ϕ	0.7x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy hardened	90	0.5x ϕ	0.7x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Co-Alloy	90	0.5x ϕ	0.7x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Cast Iron	Non-Alloy	328	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low-Alloy	262	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High-Alloy	197	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Stainless Cast Steel	Ferric/Martensitic	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austentic	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	328	1x ϕ	0.7x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Non-Alloy > 180 HB	295	1x ϕ	0.7x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Alloy	262	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy	197	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Spheroidal Cast Iron	Non-Alloy < 180 HB	312	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Non-Alloy > 180 HB	279	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy	246	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
White Malleable Cast Iron	< 180 HB	295	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 180 HB	262	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Black Malleable Cast Iron	< 180 HB	295	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 180 HB	262	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Titanium	Non-Alloy	197	0.5x ϕ	0.7x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Alloyed-Annealed	164	0.5x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloyed-Hardened	131	0.5x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028

* Feeds and Speeds are starting points for Overall Lengths of 4" and shorter.
For End Mills with Overall Lengths over 4" decrease the Feeds and Speeds.

Universal - 158 / 159										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip load per tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	427	1x ϕ	0.7x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	> 500 N/mm ²	394	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Construction Steel	Non-Alloy < 500 N/mm ²	410	1x ϕ	0.7x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Non-Alloy > 500 N/mm ²	377	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Cementation Steel	Alloy	361	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	< 150 HB	344	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	150-200 HB	328	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 200 HB	312	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Nitriding Steel	< 1000 N/mm ²	312	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 1000 N/mm ²	279	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	328	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Non-Alloy 800-1000 N/mm ²	312	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy < 800 N/mm ²	312	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy 800-1000 N/mm ²	295	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy 1000-1300 N/mm ²	279	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Alloy 1300-1600 N/mm ²	246	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Non-Alloy Tool Steel	General	303	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	295	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low Alloy < 1200 N/mm ²	279	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low Alloy < 1500 N/mm ²	246	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	High Alloy Annealed < 1000 N/mm ²	262	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy Hardened < 1300 N/mm ²	230	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Tool Steel for Warm Processing	Low Alloy < 1200 N/mm ²	328	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low Alloy < 1500 N/mm ²	295	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	High Alloy Annealed < 1000 N/mm ²	246	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy Hardened < 1300 N/mm ²	230	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy Hardened < 1600 N/mm ²	213	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Stainless Steel	Ferric	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Martensitic	131	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austenitic A5 < 40%	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austenitic A5 > 40%	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Sulphured	180	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
High Temperature Alloy	Fe-Alloy	90	1x ϕ	0.4x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy not hardened	90	1x ϕ	0.4x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy hardened	90	1x ϕ	0.4x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Co-Alloy	90	1x ϕ	0.4x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Cast Iron	Non-Alloy	328	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low-Alloy	262	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High-Alloy	197	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Stainless Cast Steel	Ferric/Martensitic	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austentic	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	328	1x ϕ	0.7x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Non-Alloy > 180 HB	295	1x ϕ	0.7x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Alloy	262	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy	197	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Spheroidal Cast Iron	Non-Alloy < 180 HB	312	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Non-Alloy > 180 HB	279	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy	246	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
White Malleable Cast Iron	< 180 HB	295	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 180 HB	262	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Black Malleable Cast Iron	< 180 HB	295	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 180 HB	262	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy	246	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Titanium	Non-Alloy	197	1x ϕ	0.4x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Alloyed-Annealed	164	1x ϕ	0.4x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloyed-Hardened	131	1x ϕ	0.4x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028

* Feeds and Speeds are starting points for Overall Lengths of 4" and shorter.
For End Mills with Overall Lengths over 4" decrease the Feeds and Speeds.

Universal - 121										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	287	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	> 500 N/mm ²	246	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Construction Steel	Non-Alloy < 500 N/mm ²	287	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Non-Alloy > 500 N/mm ²	246	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Alloy	246	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Spring Steel	Annealed < 250 HB	246	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Cementation Steel	< 150 HB	287	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	150-200 HB	246	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	> 200 HB	246	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Nitriding Steel	< 1000 N/mm ²	246	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	> 1000 N/mm ²	230	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	246	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Non-Alloy 800-1000 N/mm ²	246	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy < 800 N/mm ²	246	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 800-1000 N/mm ²	246	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 1000-1300 N/mm ²	230	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Non-Alloy Tool Steel	General	246	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	230	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Low Alloy < 1200 N/mm ²	230	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	High Alloy Annealed < 1000 N/mm ²	230	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Tool Steel for Warm Processing	High Alloy Annealed < 1000 N/mm ²	230	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019

Universal - 111										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	427	1xØ	1.1xØ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	> 500 N/mm ²	394	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Construction Steel	Non-Alloy < 500 N/mm ²	410	1xØ	1.1xØ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Non-Alloy > 500 N/mm ²	377	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy	361	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Spring Steel	Annealed < 250 HB	213	1xØ	1.1xØ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Natural Hard 250-350 HB	197	1xØ	1.1xØ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Feeder Hard 1200-1600 N/mm ²	180	1xØ	1.1xØ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
Cementation Steel	< 150 HB	344	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	150-200 HB	328	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 200 HB	312	1xØ	1.1xØ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Nitriding Steel	< 1000 N/mm ²	312	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 1000 N/mm ²	279	1xØ	1.1xØ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	328	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Non-Alloy 800-1000 N/mm ²	312	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy < 800 N/mm ²	312	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy 800-1000 N/mm ²	295	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy 1000-1300 N/mm ²	279	1xØ	1.1xØ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Alloy 1300-1600 N/mm ²	246	1xØ	1.1xØ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Non-Alloy Tool Steel	General	303	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Stainless Steel	Ferric	164	0.8xØ	0.7xØ	0.0004	0.0006	0.0008	0.0014	0.0017	0.0019
	Martensitic	131	0.8xØ	0.7xØ	0.0004	0.0006	0.0008	0.0014	0.0017	0.0019
	Austenitic A5 < 40%	164	0.8xØ	0.7xØ	0.0004	0.0006	0.0008	0.0014	0.0017	0.0019
	Austenitic A5 > 40%	164	0.8xØ	0.7xØ	0.0004	0.0006	0.0008	0.0014	0.0017	0.0019
	Sulphured	180	0.8xØ	0.7xØ	0.0004	0.0006	0.0008	0.0014	0.0017	0.0019
High Temperature Alloy	Fe-Alloy	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy not hardened	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy hardened	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Co-Alloy	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Cast Iron	Non-Alloy	328	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low-Alloy	262	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High-Alloy	197	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Stainless Cast Steel	Ferric/Martensitic	197	1xØ	1.1xØ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austentic	197	1xØ	1.1xØ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025

* Feeds and Speeds are starting points for Overall Lengths of 4" and shorter.
For End Mills with Overall Lengths over 4" decrease the Feeds and Speeds.

Universal - 111 (Continued)										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	328	1x ϕ	1.1x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Non-Alloy > 180 HB	295	1x ϕ	1.1x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Alloy	262	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy	197	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Spheroidal Cast Iron	Non-Alloy < 180 HB	312	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Non-Alloy > 180 HB	279	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy	246	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
White Malleable Cast Iron	< 180 HB	295	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 180 HB	262	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Black Malleable Cast Iron	< 180 HB	295	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 180 HB	262	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Titanium	Non-Alloy	197	1x ϕ	0.4x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Alloyed-Annealed	164	1x ϕ	0.4x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloyed-Hardened	131	1x ϕ	0.4x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028

Universal - 155 / 156										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	427	1x ϕ	1.1x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	> 500 N/mm ²	394	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Construction Steel	Non-Alloy < 500 N/mm ²	410	1x ϕ	1.1x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Non-Alloy > 500 N/mm ²	377	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy	361	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Spring Steel	Annealed < 250 HB	213	1x ϕ	1.1x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Natural Hard 250-350 HB	197	1x ϕ	1.1x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Feader Hard 1200-1600 N/mm ²	180	1x ϕ	1.1x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
Cementation Steel	< 150 HB	344	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	150-200 HB	328	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 200 HB	312	1x ϕ	1.1x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Nitriding Steel	< 1000 N/mm ²	312	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 1000 N/mm ²	279	1x ϕ	1.1x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	328	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Non-Alloy 800-1000 N/mm ²	312	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy < 800 N/mm ²	312	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy 800-1000 N/mm ²	295	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy 1000-1300 N/mm ²	279	1x ϕ	1.1x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Alloy 1300-1600 N/mm ²	246	1x ϕ	1.1x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Non-Alloy Tool Steel	General	303	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	295	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low Alloy < 1200 N/mm ²	279	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low Alloy < 1500 N/mm ²	246	1x ϕ	1.1x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	High Alloy Annealed < 1000 N/mm ²	262	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy Hardened < 1300 N/mm ²	230	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Tool Steel for Warm Processing	Low Alloy < 1200 N/mm ²	328	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low Alloy < 1500 N/mm ²	295	1x ϕ	1.1x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	High Alloy Annealed < 1000 N/mm ²	246	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy Hardened < 1300 N/mm ²	230	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy Hardened < 1600 N/mm ²	213	1x ϕ	1.1x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Stainless Steel	Ferric	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Martensitic	131	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austenitic A5 < 40%	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austenitic A5 > 40%	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
High Temperature Alloy	Sulphured	180	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Fe-Alloy	90	1x ϕ	0.4x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy not hardened	90	1x ϕ	0.4x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy hardened	90	1x ϕ	0.4x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Cast Iron	Co-Alloy	90	1x ϕ	0.4x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Non-Alloy	328	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low-Alloy	262	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
High-Alloy	197	1x ϕ	1.1x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033	

* Feeds and Speeds are starting points for Overall Lengths of 4" and shorter.
For End Mills with Overall Lengths over 4" decrease the Feeds and Speeds.

Universal - 155 / 156 (Continued)										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Stainless Cast Steel	Ferric/Martensitic	197	1xØ	1.1xØ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austenitic	197	1xØ	1.1xØ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	328	1xØ	1.1xØ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Non-Alloy > 180 HB	295	1xØ	1.1xØ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Alloy	262	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy	197	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Spheroidal Cast Iron	Non-Alloy < 180 HB	312	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Non-Alloy > 180 HB	279	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy	246	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
White Malleable Cast Iron	< 180 HB	295	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 180 HB	262	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Black Malleable Cast Iron	< 180 HB	295	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 180 HB	262	1xØ	1.1xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Titanium	Non-Alloy	197	1xØ	0.4xØ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Alloyed-Annealed	164	1xØ	0.4xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloyed-Hardened	131	1xØ	0.4xØ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028

Universal - 157										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load Per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	968	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	> 500 N/mm ²	755	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
Construction Steel	Non-Alloy < 500 N/mm ²	968	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Non-Alloy > 500 N/mm ²	755	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Alloy	640	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
Spring Steel	Annealed < 250 HB	853	0.04xØ	0.05xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Natural Hard 250-350 HB	755	0.04xØ	0.05xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	Feeder Hard 1200-1600 N/mm ²	509	0.04xØ	0.05xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Cementation Steel	< 150 HB	919	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	150-200 HB	853	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	> 200 HB	656	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
Nitriding Steel	< 1000 N/mm ²	771	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	> 1000 N/mm ²	574	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	853	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Non-Alloy 800-1000 N/mm ²	689	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Alloy < 800 N/mm ²	574	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Alloy 800-1000 N/mm ²	640	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Alloy 1000-1300 N/mm ²	574	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	Alloy 1300-1600 N/mm ²	476	0.04xØ	0.05xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Non-Alloy Tool Steel	General	755	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	640	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Low Alloy < 1200 N/mm ²	541	0.04xØ	0.05xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	Low Alloy < 1500 N/mm ²	427	0.04xØ	0.05xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	High Alloy Annealed < 1000 N/mm ²	541	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	High Alloy Hardened < 1300 N/mm ²	377	0.04xØ	0.05xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Tool Steel for Warm Processing	Low Alloy < 1200 N/mm ²	543	0.04xØ	0.05xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Low Alloy < 1500 N/mm ²	427	0.04xØ	0.05xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	High Alloy Annealed < 1000 N/mm ²	541	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	High Alloy Hardened < 1300 N/mm ²	377	0.04xØ	0.05xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	High Alloy Hardened < 1600 N/mm ²	344	0.04xØ	0.05xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Stainless Steel	Ferric	82	0.05xØ	0.08xØ	0.0003	0.0006	0.0008	0.0011	0.0014
Martensitic	66	0.05xØ	0.08xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017	
Austenitic A5 < 40%	82	0.05xØ	0.08xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017	
Austenitic A5 > 40%	66	0.05xØ	0.08xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017	
Sulphured	98	0.05xØ	0.08xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017	
High Temperature Alloy	Fe-Alloy	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy not hardened	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy hardened	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Co-Alloy	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Co-Alloy	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022

*** Feeds and Speeds are starting points for Overall Lengths of 4" and shorter.
For End Mills with Overall Lengths over 4" decrease the Feeds and Speeds.**

Universal - 157 (Continued)										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Cast Iron	Non-Alloy	755	0.05x ϕ	0.08x ϕ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Low-Alloy	541	0.04x ϕ	0.05x ϕ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	High-Alloy	377	0.04x ϕ	0.05x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	1001	0.05x ϕ	0.08x ϕ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Non-Alloy > 180 HB	853	0.05x ϕ	0.08x ϕ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Alloy	755	0.05x ϕ	0.08x ϕ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	High Alloy	541	0.05x ϕ	0.08x ϕ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
Spheroidal Cast Iron	Non-Alloy < 180 HB	1001	0.05x ϕ	0.08x ϕ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Non-Alloy > 180 HB	853	0.05x ϕ	0.08x ϕ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	Alloy	705	0.05x ϕ	0.08x ϕ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
White Malleable Cast Iron	< 180 HB	1001	0.05x ϕ	0.08x ϕ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	> 180 HB	853	0.05x ϕ	0.08x ϕ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
Black Malleable Cast Iron	< 180 HB	1001	0.05x ϕ	0.08x ϕ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	> 180 HB	853	0.05x ϕ	0.08x ϕ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
Copper	Non-Alloy	1394	0.1x ϕ	0.15x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Wrought Alloy Non-Hardened	1181	0.1x ϕ	0.15x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Wrought Alloy Hardened	968	0.1x ϕ	0.15x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039

Universal - 190 / 191										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Nitriding Steel	< 1000 N/mm ²	98	0.5x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	> 1000 N/mm ²	74	0.5x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	115	0.5x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Non-Alloy 800-1000 N/mm ²	98	0.5x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy < 800 N/mm ²	98	0.5x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 800-1000 N/mm ²	82	0.5x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 1000-1300 N/mm ²	74	0.5x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 1300-1600 N/mm ²	66	0.5x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Stainless Steel	Ferric	82	0.5x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Martensitic	66	0.5x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austenitic A5 < 40%	57	0.5x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austenitic A5 > 40%	82	0.5x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Sulphured	98	0.5x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
High Temperature Alloy	Fe-Alloy	49	1x ϕ	0.4x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Ni-Alloy not hardened	49	1x ϕ	0.4x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Ni-Alloy hardened	49	1x ϕ	0.4x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Co-Alloy	49	1x ϕ	0.4x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
Cast Iron	Non-Alloy	328	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low-Alloy	262	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High-Alloy	197	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Stainless Cast Steel	Ferric/Martensitic	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	Austenitic	164	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	328	1x ϕ	0.7x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Non-Alloy > 180 HB	295	1x ϕ	0.7x ϕ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Alloy	262	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High Alloy	197	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Spheroidal Cast Iron	Non-Alloy < 180 HB	312	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Non-Alloy > 180 HB	279	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloy	246	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
White Malleable Cast Iron	< 180 HB	295	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 180 HB	262	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Black Malleable Cast Iron	< 180 HB	295	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	> 180 HB	262	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Titanium	Non-Alloy	148	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloyed-Annealed	131	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Alloyed-Hardened	82	1x ϕ	0.7x ϕ	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025

* Feeds and Speeds are starting points for Overall Lengths of 4" and shorter.
For End Mills with Overall Lengths over 4" decrease the Feeds and Speeds.

Universal - 120										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	295	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	> 500 N/mm ²	213	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Construction Steel	Non-Alloy < 500 N/mm ²	295	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Non-Alloy > 500 N/mm ²	213	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Alloy	180	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Spring Steel	Annealed < 250 HB	180	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Cementation Steel	< 150 HB	279	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	150-200 HB	230	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	> 200 HB	180	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Nitriding Steel	< 1000 N/mm ²	213	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	> 1000 N/mm ²	164	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	230	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Non-Alloy 800-1000 N/mm ²	213	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy < 800 N/mm ²	213	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 800-1000 N/mm ²	180	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 1000-1300 N/mm ²	148	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Non-Alloy Tool Steel	General	180	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	164	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Low Alloy < 1200 N/mm ²	131	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	High Alloy Annealed < 1000 N/mm ²	131	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Tool Steel for Warm Processing	High Alloy Annealed < 1000 N/mm ²	131	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Stainless Steel	Ferric	164	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Martensitic	131	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austenitic A5 < 40%	164	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austenitic A5 > 40%	164	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Sulphured	180	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
High Temperature Alloy	Fe-Alloy	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy not hardened	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy hardened	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Co-Alloy	90	1xØ	0.4xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Cast Iron	Non-Alloy	295	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Low-Alloy	213	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Stainless Cast Steel	Ferric/Martensitic	131	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austentic	164	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	361	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Non-Alloy > 180 HB	312	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Alloy	262	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	High Alloy	213	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Spheroidal Cast Iron	Non-Alloy < 180 HB	361	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Non-Alloy > 180 HB	312	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Alloy	262	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
White Malleable Cast Iron	< 180 HB	361	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	> 180 HB	312	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Black Malleable Cast Iron	< 180 HB	361	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	> 180 HB	312	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Titanium	Non-Alloy	197	1xØ	0.4xØ	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Alloyed-Annealed	164	1xØ	0.4xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloyed-Hardened	131	1xØ	0.4xØ	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028

Universal - 100										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	295	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	> 500 N/mm ²	213	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Construction Steel	Non-Alloy < 500 N/mm ²	295	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Non-Alloy > 500 N/mm ²	213	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Alloy	180	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Spring Steel	Annealed < 250 HB	180	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Cementation Steel	< 150 HB	279	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	150-200 HB	230	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	> 200 HB	180	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Nitriding Steel	< 1000 N/mm ²	213	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	> 1000 N/mm ²	164	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019

* Feeds and Speeds are starting points for Overall Lengths of 4" and shorter.
For End Mills with Overall Lengths over 4" decrease the Feeds and Speeds.

Universal - 100 (Continued)		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
Material Designation					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	230	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Non-Alloy 800-1000 N/mm ²	213	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy < 800 N/mm ²	213	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 800-1000 N/mm ²	180	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 1000-1300 N/mm ²	148	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Non-Alloy Tool Steel	General	180	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	164	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Low Alloy < 1200 N/mm ²	131	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	High Alloy Annealed < 1000 N/mm ²	131	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Tool Steel for Warm Processing	High Alloy Annealed < 1000 N/mm ²	131	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Stainless Steel	Ferric	164	1x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Martensitic	131	1x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austenitic A5 < 40%	164	1x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austenitic A5 > 40%	164	1x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Sulphured	180	1x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
Cast Iron	Non-Alloy	295	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Low-Alloy	213	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Stainless Cast Steel	Ferric/Martensitic	131	1x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austentic	164	1x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	361	1x ϕ	0.7x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Non-Alloy > 180 HB	312	1x ϕ	0.7x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Alloy	262	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	High Alloy	213	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Spheroidal Cast Iron	Non-Alloy < 180 HB	361	1x ϕ	0.7x ϕ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Non-Alloy > 180 HB	312	1x ϕ	0.7x ϕ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Alloy	262	1x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
White Malleable Cast Iron	< 180 HB	361	1x ϕ	0.7x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	> 180 HB	312	1x ϕ	0.7x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Black Malleable Cast Iron	< 180 HB	361	1x ϕ	0.7x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	> 180 HB	312	1x ϕ	0.7x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039

Universal - 106		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
Material Designation					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	230	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	> 500 N/mm ²	164	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Construction Steel	Non-Alloy < 500 N/mm ²	230	1x ϕ	0.7x ϕ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Non-Alloy > 500 N/mm ²	164	1x ϕ	0.7x ϕ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Alloy	131	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Cementation Steel	< 150 HB	180	1x ϕ	0.7x ϕ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	150-200 HB	148	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	> 200 HB	115	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Nitriding Steel	< 1000 N/mm ²	131	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	> 1000 N/mm ²	90	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	148	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Non-Alloy 800-1000 N/mm ²	131	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy < 800 N/mm ²	131	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 800-1000 N/mm ²	115	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 1000-1300 N/mm ²	90	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Cast Iron	Non-Alloy	197	1x ϕ	0.7x ϕ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Low-Alloy	148	1x ϕ	0.7x ϕ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	High-Alloy	115	1x ϕ	0.7x ϕ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
Stainless Cast Steel	Ferric/Martensitic	98	1x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
	Austentic	98	1x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	213	1x ϕ	0.7x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Non-Alloy > 180 HB	197	1x ϕ	0.7x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Alloy	148	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	High Alloy	131	1x ϕ	0.7x ϕ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Spheroidal Cast Iron	Non-Alloy < 180 HB	213	1x ϕ	0.7x ϕ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Non-Alloy > 180 HB	197	1x ϕ	0.7x ϕ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Alloy	148	1x ϕ	0.7x ϕ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
White Malleable Cast Iron	< 180 HB	213	1x ϕ	0.7x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	> 180 HB	197	1x ϕ	0.7x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Black Malleable Cast Iron	< 180 HB	213	1x ϕ	0.7x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	> 180 HB	197	1x ϕ	0.7x ϕ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039

Universal - 113										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	968	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	> 500 N/mm ²	755	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
Construction Steel	Non-Alloy < 500 N/mm ²	968	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Non-Alloy > 500 N/mm ²	755	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Alloy	640	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
Spring Steel	Annealed < 250 HB	853	0.04xØ	0.05xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Natural Hard 250-350 HB	755	0.04xØ	0.05xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	Feeder Hard 1200-1600 N/mm ²	509	0.04xØ	0.05xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Cementation Steel	< 150 HB	919	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	150-200 HB	853	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	> 200 HB	656	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
Nitriding Steel	< 1000 N/mm ²	771	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	> 1000 N/mm ²	574	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	853	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Non-Alloy 800-1000 N/mm ²	689	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Alloy < 800 N/mm ²	574	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Alloy 800-1000 N/mm ²	640	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Alloy 1000-1300 N/mm ²	574	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
Cast Iron	Non-Alloy	755	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Low-Alloy	541	0.04xØ	0.05xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	High-Alloy	377	0.04xØ	0.05xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	1001	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Non-Alloy > 180 HB	853	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Alloy	755	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	High Alloy	541	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
Spheroidal Cast Iron	Non-Alloy < 180 HB	1001	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	Non-Alloy > 180 HB	853	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
White Malleable Cast Iron	< 180 HB	705	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062
	> 180 HB	1001	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
Black Malleable Cast Iron	< 180 HB	1001	0.05xØ	0.08xØ	0.0011	0.0022	0.0033	0.0055	0.0069	0.0083
	> 180 HB	853	0.05xØ	0.08xØ	0.0011	0.0017	0.0022	0.0041	0.0055	0.0062

Universal - 117										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Machining Steel	< 500 N/mm ²	164	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	> 500 N/mm ²	115	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Construction Steel	Non-Alloy < 500 N/mm ²	164	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Non-Alloy > 500 N/mm ²	115	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Alloy	98	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Spring Steel	Annealed < 250 HB	98	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Cementation Steel	< 150 HB	156	1xØ	0.7xØ	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	150-200 HB	123	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	> 200 HB	98	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Nitriding Steel	< 1000 N/mm ²	115	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	> 1000 N/mm ²	90	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	131	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Non-Alloy 800-1000 N/mm ²	115	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy < 800 N/mm ²	115	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 800-1000 N/mm ²	98	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	Alloy 1000-1300 N/mm ²	90	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Cast Iron	Non-Alloy	328	0.8xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Low-Alloy	262	0.8xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	High-Alloy	197	0.8xØ	0.7xØ	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
Cast Iron with Lamellar Graphite	Non-Alloy < 180 HB	197	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Non-Alloy > 180 HB	164	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	Alloy	131	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
	High Alloy	115	1xØ	0.7xØ	0.0004	0.0008	0.0011	0.0014	0.0017	0.0019
Spheroidal Cast Iron	Non-Alloy < 180 HB	197	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Non-Alloy > 180 HB	164	1xØ	0.7xØ	0.0008	0.0012	0.0014	0.0019	0.0022	0.0025
	Alloy	131	1xØ	0.7xØ	0.0003	0.0006	0.0008	0.0011	0.0014	0.0017
White Malleable Cast Iron	< 180 HB	197	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	> 180 HB	164	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
Black Malleable Cast Iron	< 180 HB	197	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039
	> 180 HB	164	1xØ	0.7xØ	0.0010	0.0017	0.0019	0.0025	0.0033	0.0039

Titanium - 101										
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]					
					1/8"	3/16" 1/4" 5/16"	3/8" 7/16"	1/2" 5/8"	3/4"	1"
Non-Alloy Tool Steel	General	303	0.8xø	0.7xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	295	0.8xø	0.7xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Low Alloy < 1200 N/mm ²	279	0.8xø	0.7xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Low Alloy < 1500 N/mm ²	246	0.8xø	0.7xø	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	High Alloy Annealed < 1000 N/mm ²	262	0.8xø	0.7xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	High Alloy Hardened < 1300 N/mm ²	230	0.8xø	0.7xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
Tool Steel for Warm Processing	Low Alloy < 1200 N/mm ²	328	0.8xø	0.7xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	Low Alloy < 1500 N/mm ²	295	0.8xø	0.7xø	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
	High Alloy Annealed < 1000 N/mm ²	246	0.8xø	0.7xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	High Alloy Hardened < 1300 N/mm ²	230	0.8xø	0.7xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028
	High Alloy Hardened < 1600 N/mm ²	213	0.8xø	0.7xø	0.0003	0.0007	0.0011	0.0014	0.0019	0.0025
Stainless Steel	Ferric	164	0.8xø	0.7xø	0.0004	0.0006	0.0008	0.0014	0.0017	0.0019
	Martensitic	131	0.8xø	0.7xø	0.0004	0.0006	0.0008	0.0014	0.0017	0.0019
	Austenitic A5 < 40%	164	0.8xø	0.7xø	0.0004	0.0006	0.0008	0.0014	0.0017	0.0019
	Austenitic A5 > 40%	164	0.8xø	0.7xø	0.0004	0.0006	0.0008	0.0014	0.0017	0.0019
	Sulphured	180	0.8xø	0.7xø	0.0004	0.0006	0.0008	0.0014	0.0017	0.0019
High Temperature Alloy	Fe-Alloy	90	1xø	0.4xø	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy not hardened	90	1xø	0.4xø	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Ni-Alloy hardened	90	1xø	0.4xø	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
	Co-Alloy	90	1xø	0.4xø	0.0006	0.0011	0.0014	0.0017	0.0019	0.0022
Titanium	Non-Alloy	197	1xø	0.4xø	0.0007	0.0012	0.0019	0.0028	0.0033	0.0039
	Alloyed-Annealed	164	1xø	0.4xø	0.0006	0.0011	0.0017	0.0022	0.0028	0.0033
	Alloyed-Hardened	131	1xø	0.4xø	0.0004	0.0008	0.0014	0.0017	0.0022	0.0028

Steel - 250								
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]			
					1/8"	3/16" 1/4"	3/8" 1/2"	
Machining Steel	< 500 N/mm ²	968	0.05xø	0.08xø	0.0011	0.0022	0.0033	0.0055
	> 500 N/mm ²	755	0.05xø	0.08xø	0.0011	0.0022	0.0033	0.0055
Construction Steel	Non-Alloy < 500 N/mm ²	968	0.05xø	0.08xø	0.0011	0.0022	0.0033	0.0055
	Non-Alloy > 500 N/mm ²	755	0.05xø	0.08xø	0.0011	0.0022	0.0033	0.0055
	Alloy	640	0.05xø	0.08xø	0.0011	0.0017	0.0022	0.0041
Spring Steel	Annealed < 250 HB	853	0.04xø	0.05xø	0.0011	0.0022	0.0033	0.0055
	Natural Hard 250-350 HB	755	0.04xø	0.05xø	0.0011	0.0017	0.0022	0.0041
	Feader Hard 1200-1600 N/mm ²	509	0.04xø	0.05xø	0.0010	0.0017	0.0019	0.0025
Cementation Steel	< 150 HB	919	0.05xø	0.08xø	0.0011	0.0022	0.0033	0.0055
	150-200 HB	853	0.05xø	0.08xø	0.0011	0.0022	0.0033	0.0055
	> 200 HB	656	0.05xø	0.08xø	0.0011	0.0022	0.0033	0.0055
Nitriding Steel	< 1000 N/mm ²	771	0.05xø	0.08xø	0.0011	0.0022	0.0033	0.0055
	> 1000 N/mm ²	574	0.05xø	0.08xø	0.0011	0.0017	0.0022	0.0041
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	853	0.05xø	0.08xø	0.0011	0.0022	0.0033	0.0055
	Non-Alloy 800-1000 N/mm ²	689	0.05xø	0.08xø	0.0011	0.0022	0.0033	0.0055
	Alloy < 800 N/mm ²	574	0.05xø	0.08xø	0.0011	0.0022	0.0033	0.0055
	Alloy 800-1000 N/mm ²	640	0.05xø	0.08xø	0.0011	0.0022	0.0033	0.0055
	Alloy 1000-1300 N/mm ²	574	0.05xø	0.08xø	0.0011	0.0017	0.0022	0.0041
	Alloy 1300-1600 N/mm ²	476	0.04xø	0.05xø	0.0010	0.0017	0.0019	0.0025
Non-Alloy Tool Steel	General	755	0.05xø	0.08xø	0.0011	0.0022	0.0033	0.0055
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	640	0.05xø	0.08xø	0.0011	0.0022	0.0033	0.0055
	Low Alloy < 1200 N/mm ²	541	0.04xø	0.05xø	0.0011	0.0017	0.0022	0.0041
	Low Alloy < 1500 N/mm ²	427	0.04xø	0.05xø	0.0010	0.0017	0.0019	0.0025
	High Alloy Annealed < 1000 N/mm ²	541	0.05xø	0.08xø	0.0011	0.0017	0.0022	0.0041
	High Alloy Hardened < 1300 N/mm ²	377	0.04xø	0.05xø	0.0010	0.0017	0.0019	0.0025
Tool Steel for Warm Processing	Low Alloy < 1200 N/mm ²	541	0.04xø	0.05xø	0.0011	0.0022	0.0033	0.0055
	Low Alloy < 1500 N/mm ²	427	0.04xø	0.05xø	0.0011	0.0017	0.0022	0.0041
	High Alloy Annealed < 1000 N/mm ²	541	0.05xø	0.08xø	0.0011	0.0017	0.0022	0.0041
	High Alloy Hardened < 1300 N/mm ²	377	0.04xø	0.05xø	0.0010	0.0017	0.0019	0.0025
	High Alloy Hardened < 1600 N/mm ²	344	0.04xø	0.05xø	0.0010	0.0017	0.0019	0.0025
Stainless Steel	Ferric	82	0.05xø	0.08xø	0.0003	0.0006	0.0008	0.0011
	Martensitic	66	0.05xø	0.08xø	0.0003	0.0006	0.0008	0.0011
	Austenitic A5 < 40%	82	0.05xø	0.08xø	0.0003	0.0006	0.0008	0.0011
	Austenitic A5 > 40%	66	0.05xø	0.08xø	0.0003	0.0006	0.0008	0.0011
	Sulphured	98	0.05xø	0.08xø	0.0003	0.0006	0.0008	0.0011

* Feeds and Speeds are starting points for Overall Lengths of 4" and shorter.
For End Mills with Overall Lengths over 4" decrease the Feeds and Speeds.

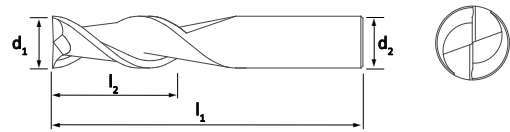
Steel - 251 / 252 / 253 / 254						
Material Designation		SFM [ft/min]	ae max. [inch]	ap max [inch]	Chip Load per Tooth [inch]	
					1/32" 3/32" 1/8"	3/16"
Machining Steel	< 500 N/mm ²	213	1x∅	0.04x∅	0.0011	0.0017
	> 500 N/mm ²	189	1x∅	0.04x∅	0.0011	0.0017
Construction Steel	Non-Alloy < 500 N/mm ²	213	1x∅	0.04x∅	0.0011	0.0017
	Non-Alloy > 500 N/mm ²	189	1x∅	0.04x∅	0.0011	0.0017
	Alloy	148	1x∅	0.04x∅	0.0011	0.0017
Spring Steel	Annealed < 250 HB	189	1x∅	0.04x∅	0.0011	0.0017
	Natural Hard 250-350 HB	148	1x∅	0.04x∅	0.0011	0.0017
	Feeder Hard 1200-1600 N/mm ²	115	1x∅	0.03x∅	0.0010	0.0017
Cementation Steel	< 150 HB	213	1x∅	0.04x∅	0.0011	0.0017
	150-200 HB	189	1x∅	0.04x∅	0.0011	0.0017
	> 200 HB	148	1x∅	0.04x∅	0.0011	0.0017
Nitriding Steel	< 1000 N/mm ²	148	1x∅	0.04x∅	0.0011	0.0017
	> 1000 N/mm ²	148	1x∅	0.04x∅	0.0011	0.0017
Quenched & Tempered Steel	Non-Alloy < 800 N/mm ²	189	1x∅	0.04x∅	0.0011	0.0017
	Non-Alloy 800-1000 N/mm ²	148	1x∅	0.04x∅	0.0011	0.0017
	Alloy < 800 N/mm ²	189	1x∅	0.04x∅	0.0011	0.0017
	Alloy 800-1000 N/mm ²	148	1x∅	0.04x∅	0.0011	0.0017
	Alloy 1000-1300 N/mm ²	115	1x∅	0.03x∅	0.0010	0.0017
Alloy 1300-1600 N/mm ²	98	1x∅	0.03x∅	0.0010	0.0017	
Non-Alloy Tool Steel	General	148	1x∅	0.04x∅	0.0011	0.0017
Tool Steel for Cold Processing	Low Alloy < 1000 N/mm ²	148	1x∅	0.04x∅	0.0011	0.0017
	Low Alloy < 1200 N/mm ²	115	1x∅	0.03x∅	0.0010	0.0017
	Low Alloy < 1500 N/mm ²	98	1x∅	0.03x∅	0.0010	0.0017
	High Alloy Annealed < 1000 N/mm ²	148	1x∅	0.04x∅	0.0011	0.0017
	High Alloy Hardened < 1300 N/mm ²	115	1x∅	0.03x∅	0.0010	0.0017
Tool Steel for Warm Processing	Low Alloy < 1200 N/mm ²	115	1x∅	0.03x∅	0.0010	0.0017
	Low Alloy < 1500 N/mm ²	98	1x∅	0.03x∅	0.0010	0.0017
	High Alloy Annealed < 1000 N/mm ²	148	1x∅	0.04x∅	0.0011	0.0017
	High Alloy Hardened < 1300 N/mm ²	115	1x∅	0.03x∅	0.0010	0.0017
	High Alloy Hardened < 1600 N/mm ²	98	1x∅	0.03x∅	0.0010	0.0017
Stainless Steel	Ferric	82	0.05x∅	0.08x∅	0.0003	0.0006
	Martensitic	66	0.05x∅	0.08x∅	0.0003	0.0006
	Austenitic A5 < 40%	82	0.05x∅	0.08x∅	0.0003	0.0006
	Austenitic A5 > 40%	66	0.05x∅	0.08x∅	0.0003	0.0006
	Sulphured	98	0.05x∅	0.08x∅	0.0003	0.0006

* Feeds and Speeds are starting points for Overall Lengths of 4" and shorter.
For End Mills with Overall Lengths over 4" decrease the Feeds and Speeds.

DESIGN-RITE XL Series D142 2 Flute Aluminum



$\lambda_s = 40^\circ$ $\gamma_s = 12^\circ$



Tolerances
 Shank: 1/8" - 1" = +.0001/-0.0004
 Cutting Dia: 1/8" - 1" = +.000/-0.002

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	ZrN
1/8	1/8	1/4	1-1/2	2	D1422120	D1422126
1/8	1/8	3/8	1-1/2	2	D1421120	D1421126
5/32	3/16	5/16	2	2	D1422150	D1422156
5/32	3/16	9/16	2	2	D1421150	D1421156
3/16	3/16	5/16	2	2	D1422180	D1422186
3/16	3/16	9/16	2	2	D1421180	D1421186
7/32	1/4	3/8	2	2	D1422210	D1422216
1/4	1/4	3/8	2	2	D1422250	D1422256
1/4	1/4	3/4	2-1/2	2	D1421250	D1421256
1/4	1/4	1-1/4	3-1/2	2	D1423250	D1423256
9/32	5/16	13/16	2-1/2	2	D1421280	D1421286
5/16	5/16	13/16	2-1/2	2	D1421310	D1421316
5/16	5/16	1-1/4	4	2	D1423310	D1423316
5/16	5/16	2-1/8	4	2	D1424310	D1424316
11/32	3/8	1	2-1/2	2	D1421340	D1421346
3/8	3/8	1/2	2-1/2	2	D1422370	D1422376
3/8	3/8	1	2-1/2	2	D1421370	D1421376
3/8	3/8	1-1/2	4	2	D1423370	D1423376
3/8	3/8	2-1/2	6	2	D1424370	D1424376
13/32	7/16	1	2-3/4	2	D1421400	D1421406
1/2	1/2	5/8	2-1/2	2	D1422500	D1422506
1/2	1/2	1-1/4	3	2	D1421500	D1421506
1/2	1/2	2	4	2	D1423500	D1423506
1/2	1/2	3	6	2	D1424500	D1424506
5/8	5/8	1-5/8	3-1/2	2	D1421620	D1421626
3/4	3/4	1	4	2	D1422750	D1422756
3/4	3/4	1-5/8	4	2	D1421750	D1421756
3/4	3/4	3	6	2	D1423750	D1423756
3/4	3/4	4	7	2	D1424750	D1424756
1	1	2	5	2	D1421100	D1421106
1	1	3	6	2	D1423100	D1423106

Feeds & Speeds Available on Page 115

Application Range:

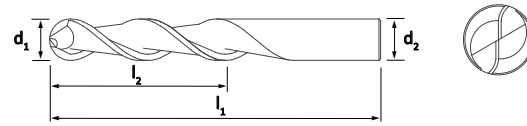
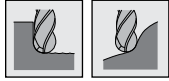
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
							●	●	●	

Series D162

2 Flute Aluminum Ball



$\lambda_s = 40^\circ$ $\gamma_s = 12^\circ$



Tolerances
 Shank: $1/4'' - 1'' = -.0001/-0.0004$
 Cutting Dia: $1/4'' - 1'' = +.000/-0.002$
 Ball: $1/4'' - 1'' = +/-0.001$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	Flutes	Uncoated	ZrN
1/4	1/4	3/8	2	2	D1622250	D1622256
1/4	1/4	3/4	2-1/2	2	D1621250	D1621256
1/4	1/4	1-1/4	3-1/2	2	D1623250	D1623256
5/16	5/16	7/16	2-1/2	2	D1622310	D1622316
5/16	5/16	13/16	2-1/2	2	D1621310	D1621316
5/16	5/16	1-1/4	4	2	D1623310	D1623316
3/8	3/8	1/2	2-1/2	2	D1622370	D1622376
3/8	3/8	1	2-1/2	2	D1621370	D1621376
3/8	3/8	1-1/2	4	2	D1623370	D1623376
7/16	7/16	9/16	2-3/4	2	D1622430	D1622436
7/16	7/16	1	2-3/4	2	D1621430	D1621436
1/2	1/2	5/8	2-1/2	2	D1622500	D1622506
1/2	1/2	1-1/4	3	2	D1621500	D1621506
1/2	1/2	2	4	2	D1623500	D1623506
5/8	5/8	3/4	3	2	D1622620	D1622626
5/8	5/8	1-5/8	3-1/2	2	D1621620	D1621626
3/4	3/4	1	4	2	D1622750	D1622756
3/4	3/4	1-5/8	4	2	D1621750	D1621756
1	1	1-1/4	4	2	D1622100	D1622106
1	1	3	6	2	D1623100	D1623106

Feeds & Speeds Available on Page 115

Application Range:

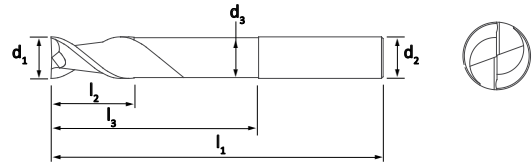
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
							•	•	•	



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$

**Tolerances**

Shank: $1/8'' - 1'' = -.0001/-0.0004$
Cutting Dia: $1/8'' - 1'' = +.000/-0.002$



d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	l_3 LOR	d_3 Neck Dia	Flutes	Uncoated	TiCN	AlTiN
1/8	1/8	1/2	3	2 1/2	0.120	2	D4424120	D4424122	D4424124
3/16	3/16	1/2	3	4 1/4	0.180	2	D4424180	D4424182	D4424184
1/4	1/4	3/4	4	2	0.240	2	D4424250	D4424252	D4424254
5/16	5/16	3/4	4	2	0.300	2	D4424310	D4424312	D4424314
3/8	3/8	3/4	4	2 1/2	0.360	2	D4424370	D4424372	D4424374
1/2	1/2	1	4	2 1/2	0.480	2	D4423500	D4423502	D4423504
1/2	1/2	1-1/8	6	2 1/2	0.480	2	D4424500	D4424502	D4424504
5/8	5/8	1-1/4	6	4 1/8	0.600	2	D4424620	D4424622	D4424624
3/4	3/4	1-1/2	6	4 1/8	0.720	2	D4424750	D4424752	D4424754
1	1	1-1/2	6	4 1/8	0.960	2	D4424100	D4424102	D4424104

Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•						•	•	•	•	

Series D642

2 Flute Universal

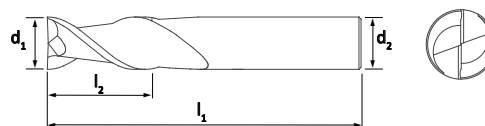


$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances

Shank: $1/32'' - 1'' = -.0001/-0.0004$
 Cutting Dia: $1/32'' - 7/64'' = +/-0.0005$
 Cutting Dia: $1/8'' - 1'' = +.000/-0.002$



d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	Flutes	Uncoated	TiCN	AlTiN
1/32	1/8	3/32	1-1/2	2	D6421030	D6421032	D6421034
3/64	1/8	9/64	1-1/2	2	D6421040	D6421042	D6421044
1/16	1/8	1/8	1-1/2	2	D6422060	D6422062	D6422064
1/16	1/8	3/16	1-1/2	2	D6421060	D6421062	D6421064
5/64	1/8	1/4	1-1/2	2	D6421070	D6421072	D6421074
3/32	1/8	3/16	1-1/2	2	D6422090	D6422092	D6422094
3/32	1/8	9/32	1-1/2	2	D6421090	D6421092	D6421094
7/64	1/8	3/16	1-1/2	2	D6422190	D6422192	D6422194
7/64	1/8	3/8	1-1/2	2	D6421190	D6421192	D6421194
1/8	1/8	1/4	1-1/2	2	D6422120	D6422122	D6422124
1/8	1/8	1/2	1-1/2	2	D6421120	D6421122	D6421124
1/8	1/8	3/4	2-1/4	2	D6423120	D6423122	D6423124
1/8	1/8	3/4	3	2	D6426120	D6426122	D6426124
1/8	1/8	1	3	2	D6424120	D6424122	D6424124
9/64	3/16	3/8	2	2	D6422140	D6422142	D6422144
9/64	3/16	1/2	2	2	D6421140	D6421142	D6421144
5/32	3/16	3/8	2	2	D6422150	D6422152	D6422154
5/32	3/16	1/2	2	2	D6421150	D6421152	D6421154
5/32	3/16	3/4	2-1/2	2	D6425150	D6425152	D6425154
11/64	3/16	3/8	2	2	D6422170	D6422172	D6422174
11/64	3/16	5/8	2	2	D6421170	D6421172	D6421174
3/16	3/16	3/8	2	2	D6422180	D6422182	D6422184
3/16	3/16	5/8	2	2	D6421180	D6421182	D6421184
3/16	3/16	3/4	2-1/2	2	D6423180	D6423182	D6423184
3/16	3/16	1	2-1/2	2	D6425180	D6425182	D6425184
3/16	3/16	1	4	2	D6426180	D6426182	D6426184
3/16	3/16	1-1/8	3	2	D6424180	D6424182	D6424184
13/64	1/4	3/8	2	2	D6422200	D6422202	D6422204
13/64	1/4	5/8	2-1/2	2	D6421200	D6421202	D6421204
7/32	1/4	3/8	2	2	D6422210	D6422212	D6422214
7/32	1/4	5/8	2-1/2	2	D6421210	D6421212	D6421214
7/32	1/4	1	3	2	D6425210	D6425212	D6425214
15/64	1/4	3/8	2	2	D6422230	D6422232	D6422234
15/64	1/4	3/4	2-1/2	2	D6421230	D6421232	D6421234
1/4	1/4	3/8	2	2	D6422250	D6422252	D6422254
1/4	1/4	3/4	2-1/2	2	D6421250	D6421252	D6421254
1/4	1/4	1	4	2	D6426250	D6426252	D6426254
1/4	1/4	1-1/8	3	2	D6423250	D6423252	D6423254
1/4	1/4	1-1/4	3	2	D6425250	D6425252	D6425254
1/4	1/4	1-1/2	4	2	D6424250	D6424252	D6424254
1/4	1/4	1-1/2	6	2	D6427250	D6427252	D6427254
17/64	5/16	1/2	2	2	D6422260	D6422262	D6422264

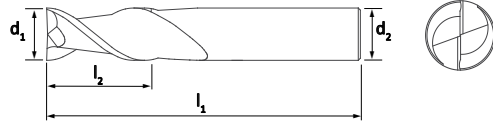
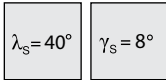
Additional Sizes On Pages 74 - 75

Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•						•		•	•	

DESIGN-RITE XL Series D642 2 Flute Universal



Tolerances
 Shank: 1/32" - 1" = -.0001/- .0004
 Cutting Dia: 1/32" - 7/64" = +/- .0005
 Cutting Dia: 1/8" - 1" = +.000/- .002

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
17/64	5/16	3/4	2-1/2	2	D6421260	D6421262	D6421264
9/32	5/16	1/2	2	2	D6422280	D6422282	D6422284
9/32	5/16	3/4	2-1/2	2	D6421280	D6421282	D6421284
9/32	5/16	1-1/4	3	2	D6425280	D6425282	D6425284
19/64	5/16	1/2	2	2	D6422290	D6422292	D6422294
19/64	5/16	3/4	2-1/2	2	D6421290	D6421292	D6421294
5/16	5/16	1/2	2	2	D6422310	D6422312	D6422314
5/16	5/16	3/4	2-1/2	2	D6421310	D6421312	D6421314
5/16	5/16	1	4	2	D6426310	D6426312	D6426314
5/16	5/16	1-1/8	3	2	D6423310	D6423312	D6423314
5/16	5/16	1-3/8	3	2	D6425310	D6425312	D6425314
5/16	5/16	1-1/2	6	2	D6427310	D6427312	D6427314
5/16	5/16	1-5/8	4	2	D6424310	D6424312	D6424314
21/64	3/8	5/8	2	2	D6422320	D6422322	D6422324
21/64	3/8	7/8	2-1/2	2	D6421320	D6421322	D6421324
11/32	3/8	5/8	2	2	D6422340	D6422342	D6422344
11/32	3/8	7/8	2-1/2	2	D6421340	D6421342	D6421344
23/64	3/8	5/8	2	2	D6422350	D6422352	D6422354
23/64	3/8	7/8	2-1/2	2	D6421350	D6421352	D6421354
3/8	3/8	5/8	2	2	D6422370	D6422372	D6422374
3/8	3/8	7/8	2-1/2	2	D6421370	D6421372	D6421374
3/8	3/8	1	4	2	D6426370	D6426372	D6426374
3/8	3/8	1-1/8	3	2	D6423370	D6423372	D6423374
3/8	3/8	1-3/8	3	2	D6425370	D6425372	D6425374
3/8	3/8	1-1/2	6	2	D6427370	D6427372	D6427374
3/8	3/8	1-3/4	4	2	D6424370	D6424372	D6424374
3/8	3/8	3	6	2	D6428370	D6428372	D6428374
25/64	7/16	5/8	2	2	D6422390	D6422392	D6422394
25/64	7/16	1	2-3/4	2	D6421390	D6421392	D6421394
13/32	7/16	5/8	2	2	D6422400	D6422402	D6422404
13/32	7/16	1	2-3/4	2	D6421400	D6421402	D6421404
27/64	7/16	5/8	2	2	D6422420	D6422422	D6422424
27/64	7/16	1	2-3/4	2	D6421420	D6421422	D6421424
7/16	7/16	5/8	2	2	D6422430	D6422432	D6422434
7/16	7/16	1	2-3/4	2	D6421430	D6421432	D6421434
7/16	7/16	1	4	2	D6426430	D6426432	D6426434
7/16	7/16	1-3/8	4	2	D6425430	D6425432	D6425434
7/16	7/16	1-1/2	6	2	D6427430	D6427432	D6427434
7/16	7/16	2	4	2	D6423430	D6423432	D6423434
7/16	7/16	3	6	2	D6424430	D6424432	D6424434
29/64	1/2	5/8	2-1/2	2	D6422450	D6422452	D6422454
29/64	1/2	1	3	2	D6421450	D6421452	D6421454

Additional Sizes On Pages 73 & 75

Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●						●		●	●	

Series D642

2 Flute Universal

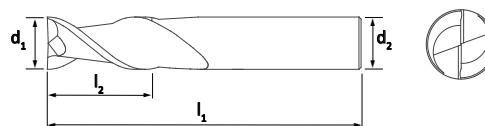


$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances

Shank: $1/32'' - 1'' = -.0001/- .0004$
 Cutting Dia: $1/32'' - 7/64'' = +/- .0005$
 Cutting Dia: $1/8'' - 1'' = +.000/- .002$



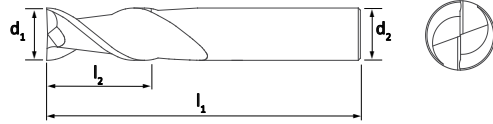
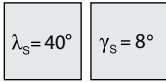
d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	Flutes	Uncoated	TiCN	AlTiN
15/32	1/2	5/8	2-1/2	2	D6422460	D6422462	D6422464
15/32	1/2	1	3	2	D6421460	D6421462	D6421464
31/64	1/2	5/8	2-1/2	2	D6422480	D6422482	D6422484
31/64	1/2	1	3	2	D6421480	D6421482	D6421484
1/2	1/2	5/8	2-1/2	2	D6422500	D6422502	D6422504
1/2	1/2	1	3	2	D6421500	D6421502	D6421504
1/2	1/2	1	4	2	D6426500	D6426502	D6426504
1/2	1/2	1-1/2	3-1/2	2	D6425500	D6425502	D6425504
1/2	1/2	1-1/2	6	2	D6427500	D6427502	D6427504
1/2	1/2	2	4	2	D6423500	D6423502	D6423504
1/2	1/2	3	6	2	D6424500	D6424502	D6424504
9/16	9/16	7/8	3	2	D6422560	D6422562	D6422564
9/16	9/16	1-1/4	3-1/2	2	D6421560	D6421562	D6421564
9/16	9/16	2	6	2	D6426560	D6426562	D6426564
9/16	9/16	3	6	2	D6424560	D6424562	D6424564
5/8	5/8	7/8	3	2	D6422620	D6422622	D6422624
5/8	5/8	1-1/4	3-1/2	2	D6421620	D6421622	D6421624
5/8	5/8	2	6	2	D6426620	D6426622	D6426624
5/8	5/8	2-1/8	4-5/8	2	D6423620	D6423622	D6423624
5/8	5/8	3	6	2	D6424620	D6424622	D6424624
11/16	3/4	1	3	2	D6422680	D6422682	D6422684
11/16	3/4	1-1/2	4	2	D6421680	D6421682	D6421684
3/4	3/4	1	3	2	D6422750	D6422752	D6422754
3/4	3/4	1-1/2	4	2	D6421750	D6421752	D6421754
3/4	3/4	2	6	2	D6426750	D6426752	D6426754
3/4	3/4	2-1/4	5	2	D6423750	D6423752	D6423754
3/4	3/4	3	6	2	D6424750	D6424752	D6424754
7/8	7/8	1-3/4	4	2	D6421870	D6421872	D6421874
1	1	1-3/4	4	2	D6421100	D6421102	D6421104
1	1	2	6	2	D6426100	D6426102	D6426104
1	1	2-1/4	5	2	D6423100	D6423102	D6423104
1	1	3	6	2	D6424100	D6424102	D6424104

Additional Sizes On Pages 73 - 74

Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•						•		•	•	



Tolerances
 Shank: 1mm - 25mm = -.0025/-.0102
 Cutting Dia: 1mm - 2.5mm = +/- .0127
 Cutting Dia: 3mm - 25mm = +.000/- .0508

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
1.0mm	3.0mm	2.0mm	38.0mm	2	D64220390	D64220392	D64220394
1.0mm	3.0mm	4.0mm	38.0mm	2	D64210390	D64210392	D64210394
1.5mm	3.0mm	3.0mm	38.0mm	2	D64220590	D64220592	D64220594
1.5mm	3.0mm	5.0mm	38.0mm	2	D64210590	D64210592	D64210594
2.0mm	3.0mm	4.0mm	38.0mm	2	D64220780	D64220782	D64220784
2.0mm	3.0mm	8.0mm	38.0mm	2	D64210780	D64210782	D64210784
2.5mm	3.0mm	5.0mm	38.0mm	2	D64220980	D64220982	D64220984
2.5mm	3.0mm	9.5mm	38.0mm	2	D64210980	D64210982	D64210984
3.0mm	3.0mm	6.0mm	38.0mm	2	D64221180	D64221182	D64221184
3.0mm	3.0mm	12.0mm	38.0mm	2	D64211180	D64211182	D64211184
3.5mm	4.0mm	7.0mm	50.0mm	2	D64221370	D64221372	D64221374
3.5mm	4.0mm	12.0mm	50.0mm	2	D64211370	D64211372	D64211374
4.0mm	4.0mm	8.0mm	50.0mm	2	D64221570	D64221572	D64221574
4.0mm	4.0mm	14.0mm	50.0mm	2	D64211570	D64211572	D64211574
4.5mm	6.0mm	9.5mm	63.0mm	2	D64221770	D64221772	D64221774
4.5mm	6.0mm	16.0mm	63.0mm	2	D64211770	D64211772	D64211774
5.0mm	6.0mm	10.0mm	63.0mm	2	D64221960	D64221962	D64221964
5.0mm	6.0mm	16.0mm	63.0mm	2	D64211960	D64211962	D64211964
6.0mm	6.0mm	12.0mm	63.0mm	2	D64222360	D64222362	D64222364
6.0mm	6.0mm	19.0mm	63.0mm	2	D64212360	D64212362	D64212364
7.0mm	8.0mm	12.0mm	63.0mm	2	D64222750	D64222752	D64222754
7.0mm	8.0mm	19.0mm	63.0mm	2	D64212750	D64212752	D64212754
8.0mm	8.0mm	12.0mm	63.0mm	2	D64223150	D64223152	D64223154
8.0mm	8.0mm	20.0mm	63.0mm	2	D64213150	D64213152	D64213154
9.0mm	10.0mm	14.0mm	70.0mm	2	D64223540	D64223542	D64223544
9.0mm	10.0mm	25.0mm	70.0mm	2	D64213540	D64213542	D64213544
10.0mm	10.0mm	14.0mm	70.0mm	2	D64223930	D64223932	D64223934
10.0mm	10.0mm	25.0mm	70.0mm	2	D64213930	D64213932	D64213934
11.0mm	12.0mm	14.0mm	76.0mm	2	D64224330	D64224332	D64224334
11.0mm	12.0mm	25.0mm	76.0mm	2	D64214330	D64214332	D64214334
12.0mm	12.0mm	16.0mm	76.0mm	2	D64224720	D64224722	D64224724
12.0mm	12.0mm	25.0mm	76.0mm	2	D64214720	D64214722	D64214724
14.0mm	14.0mm	32.0mm	89.0mm	2	D64215510	D64215512	D64215514
16.0mm	16.0mm	32.0mm	89.0mm	2	D64216290	D64216292	D64216294
18.0mm	18.0mm	38.0mm	100.0mm	2	D64217080	D64217082	D64217084
20.0mm	20.0mm	38.0mm	100.0mm	2	D64217870	D64217872	D64217874
25.0mm	25.0mm	38.0mm	100.0mm	2	D64219840	D64219842	D64219844

Feeds & Speeds Available on Page 115

Application Range:

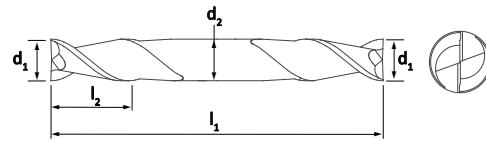
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●						●		●	●	

Series D842

2 Flute Universal



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: 1/32" - 1/2" = -.0001/-0.0004
 Cutting Dia: 1/32" - 7/64" = +/- .0005
 Cutting Dia: 1/8" - 1/2" = +.000/-0.002

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
1/32	1/8	1/16	1-1/2	2	D8422030	D8422032	D8422034
3/64	1/8	3/32	1-1/2	2	D8422040	D8422042	D8422044
1/16	1/8	1/8	1-1/2	2	D8422060	D8422062	D8422064
5/64	1/8	5/32	1-1/2	2	D8422070	D8422072	D8422074
3/32	1/8	3/16	1-1/2	2	D8422090	D8422092	D8422094
7/64	1/8	3/16	1-1/2	2	D8422190	D8422192	D8422194
1/8	1/8	1/4	1-1/2	2	D8422120	D8422122	D8422124
1/8	3/8	3/8	3	2	D8421120	D8421122	D8421124
9/64	3/16	5/16	2	2	D8422140	D8422142	D8422144
5/32	3/16	5/16	2	2	D8422150	D8422152	D8422154
5/32	3/8	7/16	3	2	D8421150	D8421152	D8421154
11/64	3/16	5/16	2	2	D8422170	D8422172	D8422174
3/16	3/16	3/8	2	2	D8422180	D8422182	D8422184
3/16	3/8	1/2	3	2	D8421180	D8421182	D8421184
13/64	1/4	1/2	2-1/2	2	D8422200	D8422202	D8422204
7/32	1/4	7/16	2-1/2	2	D8422210	D8422212	D8422214
7/32	3/8	9/16	3	2	D8421210	D8421212	D8421214
15/64	1/4	1/2	2-1/2	2	D8422230	D8422232	D8422234
1/4	1/4	1/2	2-1/2	2	D8422250	D8422252	D8422254
1/4	3/8	5/8	3	2	D8421250	D8421252	D8421254
9/32	5/16	1/2	2-1/2	2	D8422280	D8422282	D8422284
9/32	3/8	11/16	3-1/2	2	D8421280	D8421282	D8421284
5/16	5/16	1/2	2-1/2	2	D8422310	D8422312	D8422314
5/16	3/8	3/4	3-1/2	2	D8421310	D8421312	D8421314
11/32	3/8	3/4	3-1/2	2	D8421340	D8421342	D8421344
3/8	3/8	1/2	2-1/2	2	D8422370	D8422372	D8422374
3/8	3/8	3/4	3-1/2	2	D8421370	D8421372	D8421374
7/16	7/16	9/16	2-3/4	2	D8422430	D8422432	D8422434
7/16	1/2	7/8	4	2	D8421430	D8421432	D8421434
1/2	1/2	5/8	3	2	D8422500	D8422502	D8422504
1/2	1/2	1	4	2	D8421500	D8421502	D8421504

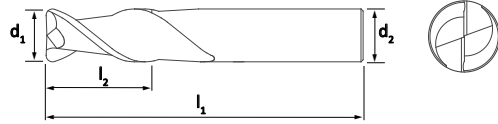
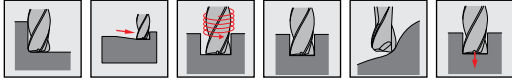
Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•						•		•	•	



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/8'' - 3/4'' = -.0001/-0.0004$
 Cutting Dia: $1/8'' - 3/4'' = +.000/-0.002$
 Radius: $1/8'' - 3/4'' = +/- .001$

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	Uncoated	TiCN	AlTiN
1/8	1/8	1/2	1-1/2	0.010	2	D6421120/10	D6421122/10	D6421124/10
1/8	1/8	1/2	1-1/2	0.015	2	D6421120/15	D6421122/15	D6421124/15
1/8	1/8	1/2	1-1/2	0.020	2	D6421120/20	D6421122/20	D6421124/20
1/8	1/8	1/2	1-1/2	0.030	2	D6421120/30	D6421122/30	D6421124/30
1/8	1/8	1/2	1-1/2	0.045	2	D6421120/45	D6421122/45	D6421124/45
3/16	3/16	5/8	2	0.010	2	D6421180/10	D6421182/10	D6421184/10
3/16	3/16	5/8	2	0.015	2	D6421180/15	D6421182/15	D6421184/15
3/16	3/16	5/8	2	0.020	2	D6421180/20	D6421182/20	D6421184/20
3/16	3/16	5/8	2	0.030	2	D6421180/30	D6421182/30	D6421184/30
3/16	3/16	5/8	2	0.045	2	D6421180/45	D6421182/45	D6421184/45
3/16	3/16	5/8	2	0.060	2	D6421180/60	D6421182/60	D6421184/60
1/4	1/4	3/4	2-1/2	0.010	2	D6421250/10	D6421252/10	D6421254/10
1/4	1/4	3/4	2-1/2	0.015	2	D6421250/15	D6421252/15	D6421254/15
1/4	1/4	3/4	2-1/2	0.020	2	D6421250/20	D6421252/20	D6421254/20
1/4	1/4	3/4	2-1/2	0.030	2	D6421250/30	D6421252/30	D6421254/30
1/4	1/4	3/4	2-1/2	0.045	2	D6421250/45	D6421252/45	D6421254/45
1/4	1/4	3/4	2-1/2	0.060	2	D6421250/60	D6421252/60	D6421254/60
1/4	1/4	3/4	2-1/2	0.090	2	D6421250/90	D6421252/90	D6421254/90
5/16	5/16	3/4	2-1/2	0.010	2	D6421310/10	D6421312/10	D6421314/10
5/16	5/16	3/4	2-1/2	0.015	2	D6421310/15	D6421312/15	D6421314/15
5/16	5/16	3/4	2-1/2	0.020	2	D6421310/20	D6421312/20	D6421314/20
5/16	5/16	3/4	2-1/2	0.030	2	D6421310/30	D6421312/30	D6421314/30
5/16	5/16	3/4	2-1/2	0.045	2	D6421310/45	D6421312/45	D6421314/45
5/16	5/16	3/4	2-1/2	0.060	2	D6421310/60	D6421312/60	D6421314/60
5/16	5/16	3/4	2-1/2	0.090	2	D6421310/90	D6421312/90	D6421314/90
3/8	3/8	7/8	2-1/2	0.010	2	D6421370/10	D6421372/10	D6421374/10
3/8	3/8	7/8	2-1/2	0.015	2	D6421370/15	D6421372/15	D6421374/15
3/8	3/8	7/8	2-1/2	0.020	2	D6421370/20	D6421372/20	D6421374/20
3/8	3/8	7/8	2-1/2	0.030	2	D6421370/30	D6421372/30	D6421374/30
3/8	3/8	7/8	2-1/2	0.045	2	D6421370/45	D6421372/45	D6421374/45
3/8	3/8	7/8	2-1/2	0.060	2	D6421370/60	D6421372/60	D6421374/60
3/8	3/8	7/8	2-1/2	0.090	2	D6421370/90	D6421372/90	D6421374/90
3/8	3/8	7/8	2-1/2	0.125	2	D6421370/12	D6421372/12	D6421374/12
1/2	1/2	1	3	0.010	2	D6421500/10	D6421502/10	D6421504/10
1/2	1/2	1	3	0.015	2	D6421500/15	D6421502/15	D6421504/15
1/2	1/2	1	3	0.020	2	D6421500/20	D6421502/20	D6421504/20
1/2	1/2	1	3	0.030	2	D6421500/30	D6421502/30	D6421504/30
1/2	1/2	1	3	0.045	2	D6421500/45	D6421502/45	D6421504/45
1/2	1/2	1	3	0.060	2	D6421500/60	D6421502/60	D6421504/60
1/2	1/2	1	3	0.090	2	D6421500/90	D6421502/90	D6421504/90
1/2	1/2	1	3	0.125	2	D6421500/12	D6421502/12	D6421504/12
5/8	5/8	1-1/4	3-1/2	0.010	2	D6421620/10	D6421622/10	D6421624/10

Additional Sizes On Pages 79
 Feeds & Speeds Available on Page 115

Application Range:

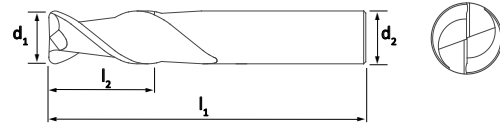
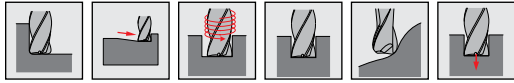
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●						●		●	●	

Series D642CR

2 Flute Universal Corner Radius



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/8'' - 3/4'' = -.0001/- .0004$
 Cutting Dia: $1/8'' - 3/4'' = +.000/- .002$
 Radius: $1/8'' - 3/4'' = +/- .001$

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	Uncoated	TiCN	AlTiN
5/8	5/8	1-1/4	3-1/2	0.015	2	D6421620/15	D6421622/15	D6421624/15
5/8	5/8	1-1/4	3-1/2	0.020	2	D6421620/20	D6421622/20	D6421624/20
5/8	5/8	1-1/4	3-1/2	0.030	2	D6421620/30	D6421622/30	D6421624/30
5/8	5/8	1-1/4	3-1/2	0.045	2	D6421620/45	D6421622/45	D6421624/45
5/8	5/8	1-1/4	3-1/2	0.060	2	D6421620/60	D6421622/60	D6421624/60
5/8	5/8	1-1/4	3-1/2	0.090	2	D6421620/90	D6421622/90	D6421624/90
5/8	5/8	1-1/4	3-1/2	0.125	2	D6421620/12	D6421622/12	D6421624/12
3/4	3/4	1-1/2	4	0.010	2	D6421750/10	D6421752/10	D6421754/10
3/4	3/4	1-1/2	4	0.015	2	D6421750/15	D6421752/15	D6421754/15
3/4	3/4	1-1/2	4	0.020	2	D6421750/20	D6421752/20	D6421754/20
3/4	3/4	1-1/2	4	0.030	2	D6421750/30	D6421752/30	D6421754/30
3/4	3/4	1-1/2	4	0.045	2	D6421750/45	D6421752/45	D6421754/45
3/4	3/4	1-1/2	4	0.060	2	D6421750/60	D6421752/60	D6421754/60
3/4	3/4	1-1/2	4	0.090	2	D6421750/90	D6421752/90	D6421754/90
3/4	3/4	1-1/2	4	0.125	2	D6421750/12	D6421752/12	D6421754/12

Additional Sizes On Pages 78

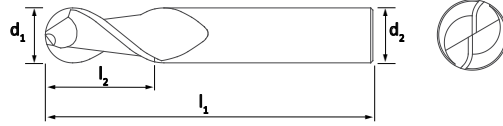
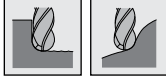
Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•						•		•	•	



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances

Shank: 1/32" - 1" = -.0001/-0.0004
 Cutting Dia: 1/32" - 7/64" = +/- .0005
 Cutting Dia: 1/8" - 1" = +.000/-0.002
 Ball: 1/32" - 1" = +/- .001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
1/32	1/8	3/32	1-1/2	2	D6621030	D6621032	D6621034
3/64	1/8	9/64	1-1/2	2	D6621040	D6621042	D6621044
1/16	1/8	1/8	1-1/2	2	D6622060	D6622062	D6622064
1/16	1/8	3/16	1-1/2	2	D6621060	D6621062	D6621064
5/64	1/8	1/4	1-1/2	2	D6621070	D6621072	D6621074
3/32	1/8	3/16	1-1/2	2	D6622090	D6622092	D6622094
3/32	1/8	9/32	1-1/2	2	D6621090	D6621092	D6621094
7/64	1/8	3/16	1-1/2	2	D6622190	D6622192	D6622194
7/64	1/8	3/8	1-1/2	2	D6621190	D6621192	D6621194
1/8	1/8	1/4	1-1/2	2	D6622120	D6622122	D6622124
1/8	1/8	1/2	1-1/2	2	D6621120	D6621122	D6621124
1/8	1/8	3/4	2-1/4	2	D6623120	D6623122	D6623124
1/8	1/8	3/4	3	2	D6626120	D6626122	D6626124
1/8	1/8	1	3	2	D6624120	D6624122	D6624124
9/64	3/16	3/8	2	2	D6622140	D6622142	D6622144
9/64	3/16	1/2	2	2	D6621140	D6621142	D6621144
5/32	3/16	3/8	2	2	D6622150	D6622152	D6622154
5/32	3/16	1/2	2	2	D6621150	D6621152	D6621154
11/64	3/16	3/8	2	2	D6622170	D6622172	D6622174
11/64	3/16	5/8	2	2	D6621170	D6621172	D6621174
3/16	3/16	3/8	2	2	D6622180	D6622182	D6622184
3/16	3/16	5/8	2	2	D6621180	D6621182	D6621184
3/16	3/16	3/4	2-1/2	2	D6623180	D6623182	D6623184
3/16	3/16	1	4	2	D6626180	D6626182	D6626184
3/16	3/16	1-1/8	3	2	D6624180	D6624182	D6624184
13/64	1/4	3/8	2	2	D6622200	D6622202	D6622204
13/64	1/4	5/8	2-1/2	2	D6621200	D6621202	D6621204
7/32	1/4	3/8	2	2	D6622210	D6622212	D6622214
7/32	1/4	5/8	2-1/2	2	D6621210	D6621212	D6621214
15/64	1/4	3/8	2	2	D6622230	D6622232	D6622234
15/64	1/4	3/4	2-1/2	2	D6621230	D6621232	D6621234
1/4	1/4	3/8	2	2	D6622250	D6622252	D6622254
1/4	1/4	3/4	2-1/2	2	D6621250	D6621252	D6621254
1/4	1/4	1	4	2	D6626250	D6626252	D6626254
1/4	1/4	1-1/8	3	2	D6623250	D6623252	D6623254
1/4	1/4	1-1/2	4	2	D6624250	D6624252	D6624254
1/4	1/4	1-1/2	6	2	D6627250	D6627252	D6627254
17/64	5/16	1/2	2	2	D6622260	D6622262	D6622264
17/64	5/16	3/4	2-1/2	2	D6621260	D6621262	D6621264
9/32	5/16	1/2	2	2	D6622280	D6622282	D6622284
9/32	5/16	3/4	2-1/2	2	D6621280	D6621282	D6621284
19/64	5/16	1/2	2	2	D6622290	D6622292	D6622294

Additional Sizes On Pages 81 - 82

Feeds & Speeds Available on Page 115

Application Range:

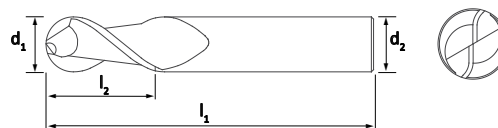
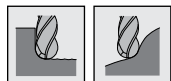
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●						●		●	●	

Series D662

2 Flute Universal Ball



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/32'' - 1'' = -.0001/-0.0004$
 Cutting Dia: $1/32'' - 7/64'' = +/-0.0005$
 Cutting Dia: $1/8'' - 1'' = +.000/-0.002$
 Ball: $1/32'' - 1'' = +/-0.001$

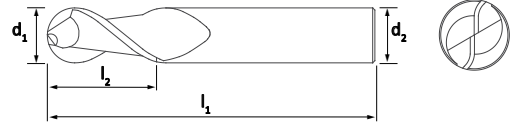
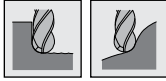
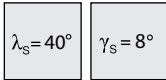
d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
19/64	5/16	3/4	2-1/2	2	D6621290	D6621292	D6621294
5/16	5/16	1/2	2	2	D6622310	D6622312	D6622314
5/16	5/16	3/4	2-1/2	2	D6621310	D6621312	D6621314
5/16	5/16	1	4	2	D6626310	D6626312	D6626314
5/16	5/16	1-1/8	3	2	D6623310	D6623312	D6623314
5/16	5/16	1-1/2	6	2	D6627310	D6627312	D6627314
5/16	5/16	1-5/8	4	2	D6624310	D6624312	D6624314
21/64	3/8	5/8	2	2	D6622320	D6622322	D6622324
21/64	3/8	7/8	2-1/2	2	D6621320	D6621322	D6621324
11/32	3/8	5/8	2	2	D6622340	D6622342	D6622344
11/32	3/8	7/8	2-1/2	2	D6621340	D6621342	D6621344
23/64	3/8	5/8	2	2	D6622350	D6622352	D6622354
23/64	3/8	7/8	2-1/2	2	D6621350	D6621352	D6621354
3/8	3/8	5/8	2	2	D6622370	D6622372	D6622374
3/8	3/8	7/8	2-1/2	2	D6621370	D6621372	D6621374
3/8	3/8	1	4	2	D6626370	D6626372	D6626374
3/8	3/8	1-1/8	3	2	D6623370	D6623372	D6623374
3/8	3/8	1-1/2	6	2	D6627370	D6627372	D6627374
3/8	3/8	1-3/4	4	2	D6624370	D6624372	D6624374
3/8	3/8	3	6	2	D6628370	D6628372	D6628374
25/64	7/16	5/8	2	2	D6622390	D6622392	D6622394
25/64	7/16	1	2-3/4	2	D6621390	D6621392	D6621394
13/32	7/16	5/8	2	2	D6622400	D6622402	D6622404
13/32	7/16	1	2-3/4	2	D6621400	D6621402	D6621404
27/64	7/16	5/8	2	2	D6622420	D6622422	D6622424
27/64	7/16	1	2-3/4	2	D6621420	D6621422	D6621424
7/16	7/16	5/8	2	2	D6622430	D6622432	D6622434
7/16	7/16	1	2-3/4	2	D6621430	D6621432	D6621434
7/16	7/16	1	4	2	D6626430	D6626432	D6626434
7/16	7/16	1-1/2	6	2	D6627430	D6627432	D6627434
7/16	7/16	2	4	2	D6623430	D6623432	D6623434
7/16	7/16	3	6	2	D6624430	D6624432	D6624434
29/64	1/2	5/8	2-1/2	2	D6622450	D6622452	D6622454
29/64	1/2	1	3	2	D6621450	D6621452	D6621454
15/32	1/2	5/8	2-1/2	2	D6622460	D6622462	D6622464
15/32	1/2	1	3	2	D6621460	D6621462	D6621464
31/64	1/2	5/8	2-1/2	2	D6622480	D6622482	D6622484
31/64	1/2	1	3	2	D6621480	D6621482	D6621484
1/2	1/2	5/8	2-1/2	2	D6622500	D6622502	D6622504
1/2	1/2	1	3	2	D6621500	D6621502	D6621504
1/2	1/2	1	4	2	D6626500	D6626502	D6626504
1/2	1/2	1-1/2	6	2	D6627500	D6627502	D6627504

Additional Sizes On Pages 80 & 82

Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●						●		●	●	

**Tolerances**

Shank:	1/32" - 1" = -.0001/-.0004
Cutting Dia:	1/32" - 7/64" = +/- .0005
Cutting Dia:	1/8" - 1" = +.000/- .002
Ball:	1/32" - 1" = +/- .001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
1/2	1/2	2	4	2	D6623500	D6623502	D6623504
1/2	1/2	3	6	2	D6624500	D6624502	D6624504
9/16	9/16	7/8	3	2	D6622560	D6622562	D6622564
9/16	9/16	1-1/4	3-1/2	2	D6621560	D6621562	D6621564
9/16	9/16	2	6	2	D6626560	D6626562	D6626564
9/16	9/16	3	6	2	D6624560	D6624562	D6624564
5/8	5/8	7/8	3	2	D6622620	D6622622	D6622624
5/8	5/8	1-1/4	3-1/2	2	D6621620	D6621622	D6621624
5/8	5/8	2	6	2	D6626620	D6626622	D6626624
5/8	5/8	2-1/8	4-5/8	2	D6623620	D6623622	D6623624
5/8	5/8	3	6	2	D6624620	D6624622	D6624624
11/16	3/4	1	3	2	D6622680	D6622682	D6622684
11/16	3/4	1-1/2	4	2	D6621680	D6621682	D6621684
3/4	3/4	1	3	2	D6622750	D6622752	D6622754
3/4	3/4	1-1/2	4	2	D6621750	D6621752	D6621754
3/4	3/4	2	6	2	D6626750	D6626752	D6626754
3/4	3/4	2-1/4	5	2	D6623750	D6623752	D6623754
3/4	3/4	3	6	2	D6624750	D6624752	D6624754
7/8	7/8	1-3/4	4	2	D6621870	D6621872	D6621874
1	1	1-3/4	4	2	D6621100	D6621102	D6621104
1	1	2	6	2	D6626100	D6626102	D6626104
1	1	2-1/4	5	2	D6623100	D6623102	D6623104
1	1	3	6	2	D6624100	D6624102	D6624104

Additional Sizes On Pages 80 - 81

Feeds & Speeds Available on Page 115

Application Range:

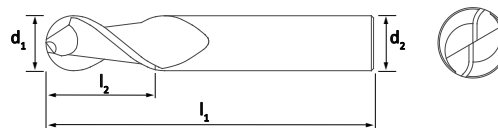
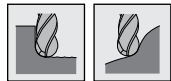
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●						●		●	●	

Series D662M

2 Flute Universal Ball



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances

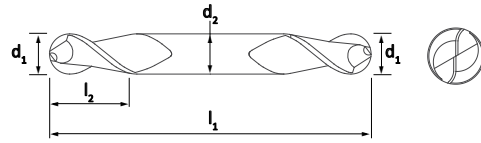
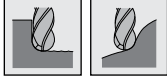
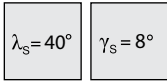
Shank: 1mm - 25mm = $-.0025/-0.0102$
 Cutting Dia: 1mm - 2.5mm = $+/-0.0127$
 Cutting Dia: 3mm - 25mm = $+0.000/-0.0508$
 Ball: 1mm - 25mm = $+/-0.0254$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	Flutes	Uncoated	TiCN	AlTiN
1.0mm	3.0mm	2.0mm	38.0mm	2	D66220390	D66220392	D66220394
1.0mm	3.0mm	4.0mm	38.0mm	2	D66210390	D66210392	D66210394
1.5mm	3.0mm	3.0mm	38.0mm	2	D66220590	D66220592	D66220594
1.5mm	3.0mm	6.0mm	38.0mm	2	D66210590	D66210592	D66210594
2.0mm	3.0mm	4.0mm	38.0mm	2	D66220780	D66220782	D66220784
2.0mm	3.0mm	8.0mm	38.0mm	2	D66210780	D66210782	D66210784
2.5mm	3.0mm	10.0mm	38.0mm	2	D66210980	D66210982	D66210984
2.5mm	3.0mm	5.0mm	38.0mm	2	D66220980	D66220982	D66220984
3.0mm	3.0mm	6.0mm	38.0mm	2	D66221180	D66221182	D66221184
3.0mm	3.0mm	12.0mm	38.0mm	2	D66211180	D66211182	D66211184
3.5mm	4.0mm	7.0mm	50.0mm	2	D66221370	D66221372	D66221374
3.5mm	4.0mm	12.0mm	50.0mm	2	D66211370	D66211372	D66211374
4.0mm	4.0mm	8.0mm	50.0mm	2	D66221570	D66221572	D66221574
4.0mm	4.0mm	14.0mm	50.0mm	2	D66211570	D66211572	D66211574
4.5mm	6.0mm	9.5mm	63.0mm	2	D66221770	D66221772	D66221774
4.5mm	6.0mm	16.0mm	63.0mm	2	D66211770	D66211772	D66211774
5.0mm	6.0mm	10.0mm	63.0mm	2	D66221960	D66221962	D66221964
5.0mm	6.0mm	16.0mm	63.0mm	2	D66211960	D66211962	D66211964
6.0mm	6.0mm	12.0mm	63.0mm	2	D66222360	D66222362	D66222364
6.0mm	6.0mm	19.0mm	63.0mm	2	D66212360	D66212362	D66212364
7.0mm	8.0mm	12.0mm	63.0mm	2	D66222750	D66222752	D66222754
7.0mm	8.0mm	19.0mm	63.0mm	2	D66212750	D66212752	D66212754
8.0mm	8.0mm	12.0mm	63.0mm	2	D66223150	D66223152	D66223154
8.0mm	8.0mm	20.0mm	63.0mm	2	D66213150	D66213152	D66213154
9.0mm	10.0mm	14.0mm	70.0mm	2	D66223540	D66223542	D66223544
9.0mm	10.0mm	25.0mm	70.0mm	2	D66213540	D66213542	D66213544
10.0mm	10.0mm	14.0mm	70.0mm	2	D66223930	D66223932	D66223934
10.0mm	10.0mm	25.0mm	70.0mm	2	D66213930	D66213932	D66213934
11.0mm	12.0mm	14.0mm	76.0mm	2	D66224330	D66224332	D66224334
11.0mm	12.0mm	25.0mm	76.0mm	2	D66214330	D66214332	D66214334
12.0mm	12.0mm	16.0mm	76.0mm	2	D66224720	D66224722	D66224724
12.0mm	12.0mm	25.0mm	76.0mm	2	D66214720	D66214722	D66214724
14.0mm	14.0mm	32.0mm	89.0mm	2	D66215510	D66215512	D66215514
16.0mm	16.0mm	32.0mm	89.0mm	2	D66216290	D66216292	D66216294
18.0mm	18.0mm	38.0mm	100.0mm	2	D66217080	D66217082	D66217084
20.0mm	20.0mm	38.0mm	100.0mm	2	D66217870	D66217872	D66217874
25.0mm	25.0mm	38.0mm	100.0mm	2	D66219840	D66219842	D66219844

Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•						•		•	•	

**Tolerances**

Shank: $1/32'' - 3/8'' = -.0001/-0.0004$
 Cutting Dia: $1/32'' - 3/32'' = +/- .0005$
 Ball: $1/8'' - 3/8'' = +/- .001$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	Flutes	Uncoated	TiCN	AlTiN
1/32	1/8	1/16	1-1/2	2	D8622030	D8622032	D8622034
3/64	1/8	3/32	1-1/2	2	D8622040	D8622042	D8622044
1/16	1/8	1/8	1-1/2	2	D8622060	D8622062	D8622064
5/64	1/8	5/32	1-1/2	2	D8622070	D8622072	D8622074
3/32	1/8	3/16	1-1/2	2	D8622090	D8622092	D8622094
1/8	1/8	1/4	1-1/2	2	D8622120	D8622122	D8622124
5/32	3/16	5/16	2	2	D8622150	D8622152	D8622154
3/16	3/16	3/8	2	2	D8622180	D8622182	D8622184
7/32	1/4	7/16	2-1/2	2	D8622210	D8622212	D8622214
1/4	1/4	1/2	2-1/2	2	D8622250	D8622252	D8622254
5/16	5/16	1/2	2-1/2	2	D8622310	D8622312	D8622314
3/8	3/8	1/2	2-1/2	2	D8622370	D8622372	D8622374

Feeds & Speeds Available on Page 115

Application Range:

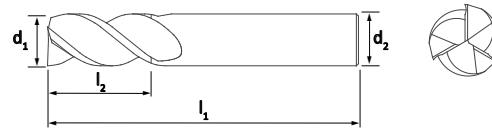
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•						•		•	•	

Series D643

3 Flute Universal



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/16'' - 1'' = -.0001/- .0004$
 Cutting Dia: $1/16'' - 7/64'' = +/- .0005$
 Cutting Dia: $1/8'' - 1'' = +.000/- .002$

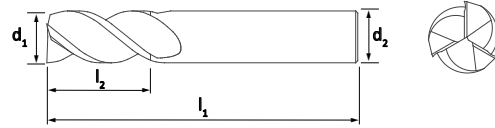
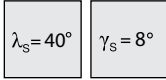
d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
1/16	1/8	1/8	1-1/2	3	D6432060	D6432062	D6432064
1/16	1/8	3/16	1-1/2	3	D6431060	D6431062	D6431064
5/64	1/8	1/4	1-1/2	3	D6431070	D6431072	D6431074
3/32	1/8	3/16	1-1/2	3	D6432090	D6432092	D6432094
3/32	1/8	9/32	1-1/2	3	D6431090	D6431092	D6431094
7/64	1/8	3/8	1-1/2	3	D6431190	D6431192	D6431194
1/8	1/8	1/4	1-1/2	3	D6432120	D6432122	D6432124
1/8	1/8	1/2	1-1/2	3	D6431120	D6431122	D6431124
1/8	1/8	3/4	2-1/4	3	D6433120	D6433122	D6433124
1/8	1/8	3/4	3	3	D6436120	D6436122	D6436124
1/8	1/8	1	3	3	D6434120	D6434122	D6434124
9/64	3/16	1/2	2	3	D6431140	D6431142	D6431144
5/32	3/16	3/8	2	3	D6432150	D6432152	D6432154
5/32	3/16	1/2	2	3	D6431150	D6431152	D6431154
11/64	3/16	5/8	2	3	D6431170	D6431172	D6431174
3/16	3/16	3/8	2	3	D6432180	D6432182	D6432184
3/16	3/16	5/8	2	3	D6431180	D6431182	D6431184
3/16	3/16	3/4	2-1/2	3	D6433180	D6433182	D6433184
3/16	3/16	1	2-1/2	3	D6435180	D6435182	D6435184
3/16	3/16	1	4	3	D6436180	D6436182	D6436184
3/16	3/16	1-1/8	3	3	D6434180	D6434182	D6434184
13/64	1/4	5/8	2-1/2	3	D6431200	D6431202	D6431204
7/32	1/4	3/8	2	3	D6432210	D6432212	D6432214
7/32	1/4	5/8	2-1/2	3	D6431210	D6431212	D6431214
15/64	1/4	3/4	2-1/2	3	D6431230	D6431232	D6431234
1/4	1/4	3/8	2	3	D6432250	D6432252	D6432254
1/4	1/4	3/4	2-1/2	3	D6431250	D6431252	D6431254
1/4	1/4	1	4	3	D6436250	D6436252	D6436254
1/4	1/4	1-1/8	3	3	D6433250	D6433252	D6433254
1/4	1/4	1-1/2	4	3	D6434250	D6434252	D6434254
1/4	1/4	1-1/2	6	3	D6437250	D6437252	D6437254
17/64	5/16	3/4	2-1/2	3	D6431260	D6431262	D6431264
9/32	5/16	1/2	2	3	D6432280	D6432282	D6432284
9/32	5/16	3/4	2-1/2	3	D6431280	D6431282	D6431284
19/64	5/16	3/4	2-1/2	3	D6431290	D6431292	D6431294
5/16	5/16	1/2	2	3	D6432310	D6432312	D6432314
5/16	5/16	3/4	2-1/2	3	D6431310	D6431312	D6431314
5/16	5/16	1	4	3	D6436310	D6436312	D6436314
5/16	5/16	1-1/8	3	3	D6433310	D6433312	D6433314
5/16	5/16	1-1/2	6	3	D6437310	D6437312	D6437314
5/16	5/16	1-5/8	4	3	D6434310	D6434312	D6434314
21/64	3/8	7/8	2-1/2	3	D6431320	D6431322	D6431324

Additional Sizes On Pages 86 - 87

Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•						•	•	•	•	



Tolerances

Shank: 1/16" - 1" = -.0001/-.0004
 Cutting Dia: 1/16" - 7/64" = +/- .0005
 Cutting Dia: 1/8" - 1" = +.000/- .002

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
11/32	3/8	5/8	2	3	D6432340	D6432342	D6432344
11/32	3/8	7/8	2-1/2	3	D6431340	D6431342	D6431344
23/64	3/8	7/8	2-1/2	3	D6431350	D6431352	D6431354
3/8	3/8	5/8	2	3	D6432370	D6432372	D6432374
3/8	3/8	7/8	2-1/2	3	D6431370	D6431372	D6431374
3/8	3/8	1	4	3	D6436370	D6436372	D6436374
3/8	3/8	1-1/8	3	3	D6433370	D6433372	D6433374
3/8	3/8	1-1/2	6	3	D6437370	D6437372	D6437374
3/8	3/8	1-3/4	4	3	D6434370	D6434372	D6434374
3/8	3/8	3	6	3	D6438370	D6438372	D6438374
25/64	7/16	1	2-3/4	3	D6431390	D6431392	D6431394
13/32	7/16	1	2-3/4	3	D6431400	D6431402	D6431404
27/64	7/16	1	2-3/4	3	D6431420	D6431422	D6431424
7/16	7/16	5/8	2	3	D6432430	D6432432	D6432434
7/16	7/16	1	2-3/4	3	D6431430	D6431432	D6431434
7/16	7/16	1	4	3	D6436430	D6436432	D6436434
7/16	7/16	1-1/2	6	3	D6437430	D6437432	D6437434
7/16	7/16	2	4	3	D6433430	D6433432	D6433434
7/16	7/16	3	6	3	D6434430	D6434432	D6434434
29/64	1/2	1	3	3	D6431450	D6431452	D6431454
15/32	1/2	1	3	3	D6431460	D6431462	D6431464
31/64	1/2	1	3	3	D6431480	D6431482	D6431484
1/2	1/2	5/8	2-1/2	3	D6432500	D6432502	D6432504
1/2	1/2	1	3	3	D6431500	D6431502	D6431504
1/2	1/2	1	4	3	D6436500	D6436502	D6436504
1/2	1/2	1-1/2	6	3	D6437500	D6437502	D6437504
1/2	1/2	2	4	3	D6433500	D6433502	D6433504
1/2	1/2	3	6	3	D6434500	D6434502	D6434504
9/16	9/16	7/8	3	3	D6432560	D6432562	D6432564
9/16	9/16	1-1/4	3-1/2	3	D6431560	D6431562	D6431564
9/16	9/16	2	6	3	D6436560	D6436562	D6436564
9/16	9/16	3	6	3	D6434560	D6434562	D6434564
5/8	5/8	7/8	3	3	D6432620	D6432622	D6432624
5/8	5/8	1-1/4	3-1/2	3	D6431620	D6431622	D6431624
5/8	5/8	2	6	3	D6436620	D6436622	D6436624
5/8	5/8	2-1/8	4-5/8	3	D6433620	D6433622	D6433624
5/8	5/8	3	6	3	D6434620	D6434622	D6434624
11/16	3/4	1	3	3	D6432680	D6432682	D6432684
11/16	3/4	1-1/2	4	3	D6431680	D6431682	D6431684
3/4	3/4	1	3	3	D6432750	D6432752	D6432754
3/4	3/4	1-1/2	4	3	D6431750	D6431752	D6431754
3/4	3/4	2	6	3	D6436750	D6436752	D6436754

Additional Sizes On Pages 85 & 87

Feeds & Speeds Available on Page 115

Application Range:

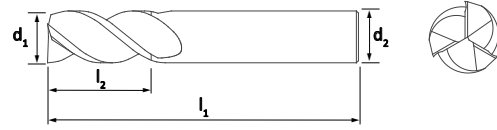
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●						●	●	●	●	

Series D643

3 Flute Universal



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances

Shank: $1/16'' - 1'' = -.0001/- .0004$
 Cutting Dia: $1/16'' - 7/64'' = +/- .0005$
 Cutting Dia: $1/8'' - 1'' = +.000/- .002$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	Flutes	Uncoated	TiCN	AlTiN
3/4	3/4	2-1/4	5	3	D6433750	D6433752	D6433754
3/4	3/4	3	6	3	D6434750	D6434752	D6434754
7/8	7/8	1-3/4	4	3	D6431870	D6431872	D6431874
1	1	1-3/4	4	3	D6431100	D6431102	D6431104
1	1	2	6	3	D6436100	D6436102	D6436104
1	1	2-1/4	5	3	D6433100	D6433102	D6433104
1	1	3	6	3	D6434100	D6434102	D6434104

Additional Sizes On Pages 85 - 86

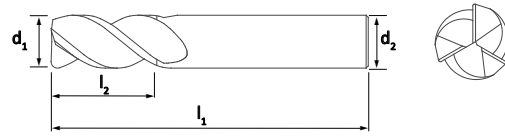
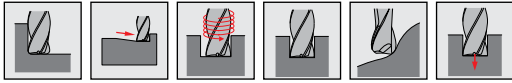
Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•						•	•	•	•	



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: 1/8" - 1" = -.0001/-0.0004
 Cutting Dia: 1/8" - 1" = +.000/-0.002
 Radius: 1/8" - 1" = +/-0.001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	Uncoated	TiCN	AlTiN
1/8	1/8	1/2	1-1/2	0.010	3	D6431120/10	D6431122/10	D6431124/10
1/8	1/8	1/2	1-1/2	0.015	3	D6431120/15	D6431122/15	D6431124/15
1/8	1/8	1/2	1-1/2	0.020	3	D6431120/20	D6431122/20	D6431124/20
1/8	1/8	1/2	1-1/2	0.030	3	D6431120/30	D6431122/30	D6431124/30
1/8	1/8	1/2	1-1/2	0.045	3	D6431120/45	D6431122/45	D6431124/45
3/16	3/16	5/8	2	0.010	3	D6431180/10	D6431182/10	D6431184/10
3/16	3/16	5/8	2	0.015	3	D6431180/15	D6431182/15	D6431184/15
3/16	3/16	5/8	2	0.020	3	D6431180/20	D6431182/20	D6431184/20
3/16	3/16	5/8	2	0.030	3	D6431180/30	D6431182/30	D6431184/30
3/16	3/16	5/8	2	0.045	3	D6431180/45	D6431182/45	D6431184/45
3/16	3/16	5/8	2	0.060	3	D6431180/60	D6431182/60	D6431184/60
1/4	1/4	3/4	2-1/2	0.010	3	D6431250/10	D6431252/10	D6431254/10
1/4	1/4	3/4	2-1/2	0.015	3	D6431250/15	D6431252/15	D6431254/15
1/4	1/4	3/4	2-1/2	0.020	3	D6431250/20	D6431252/20	D6431254/20
1/4	1/4	3/4	2-1/2	0.030	3	D6431250/30	D6431252/30	D6431254/30
1/4	1/4	3/4	2-1/2	0.045	3	D6431250/45	D6431252/45	D6431254/45
1/4	1/4	3/4	2-1/2	0.060	3	D6431250/60	D6431252/60	D6431254/60
1/4	1/4	3/4	2-1/2	0.090	3	D6431250/90	D6431252/90	D6431254/90
5/16	5/16	3/4	2-1/2	0.010	3	D6431310/10	D6431312/10	D6431314/10
5/16	5/16	3/4	2-1/2	0.015	3	D6431310/15	D6431312/15	D6431314/15
5/16	5/16	3/4	2-1/2	0.020	3	D6431310/20	D6431312/20	D6431314/20
5/16	5/16	3/4	2-1/2	0.030	3	D6431310/30	D6431312/30	D6431314/30
5/16	5/16	3/4	2-1/2	0.045	3	D6431310/45	D6431312/45	D6431314/45
5/16	5/16	3/4	2-1/2	0.060	3	D6431310/60	D6431312/60	D6431314/60
5/16	5/16	3/4	2-1/2	0.090	3	D6431310/90	D6431312/90	D6431314/90
3/8	3/8	7/8	2-1/2	0.010	3	D6431370/10	D6431372/10	D6431374/10
3/8	3/8	7/8	2-1/2	0.015	3	D6431370/15	D6431372/15	D6431374/15
3/8	3/8	7/8	2-1/2	0.020	3	D6431370/20	D6431372/20	D6431374/20
3/8	3/8	7/8	2-1/2	0.030	3	D6431370/30	D6431372/30	D6431374/30
3/8	3/8	7/8	2-1/2	0.045	3	D6431370/45	D6431372/45	D6431374/45
3/8	3/8	7/8	2-1/2	0.060	3	D6431370/60	D6431372/60	D6431374/60
3/8	3/8	7/8	2-1/2	0.090	3	D6431370/90	D6431372/90	D6431374/90
3/8	3/8	7/8	2-1/2	0.125	3	D6431370/12	D6431372/12	D6431374/12
1/2	1/2	1	3	0.010	3	D6431500/10	D6431502/10	D6431504/10
1/2	1/2	1	3	0.015	3	D6431500/15	D6431502/15	D6431504/15
1/2	1/2	1	3	0.020	3	D6431500/20	D6431502/20	D6431504/20
1/2	1/2	1	3	0.030	3	D6431500/30	D6431502/30	D6431504/30
1/2	1/2	1	3	0.045	3	D6431500/45	D6431502/45	D6431504/45
1/2	1/2	1	3	0.060	3	D6431500/60	D6431502/60	D6431504/60
1/2	1/2	1	3	0.090	3	D6431500/90	D6431502/90	D6431504/90
1/2	1/2	1	3	0.125	3	D6431500/12	D6431502/12	D6431504/12
5/8	5/8	1-1/4	3-1/2	0.010	3	D6431620/10	D6431622/10	D6431624/10

Additional Sizes On Pages 89

Feeds & Speeds Available on Page 115

Application Range:

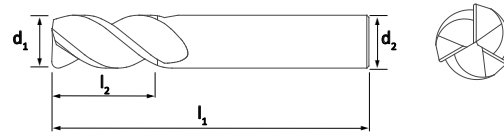
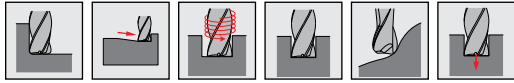
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●						●	●	●	●	

Series D643CR

3 Flute Universal Corner Radius



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/8'' - 1'' = -.0001/-0.0004$
 Cutting Dia: $1/8'' - 1'' = +.000/-0.002$
 Radius: $1/8'' - 1'' = +/-0.001$

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	Uncoated	TiCN	AlTiN
5/8	5/8	1-1/4	3-1/2	0.015	3	D6431620/15	D6431622/15	D6431624/15
5/8	5/8	1-1/4	3-1/2	0.020	3	D6431620/20	D6431622/20	D6431624/20
5/8	5/8	1-1/4	3-1/2	0.030	3	D6431620/30	D6431622/30	D6431624/30
5/8	5/8	1-1/4	3-1/2	0.045	3	D6431620/45	D6431622/45	D6431624/45
5/8	5/8	1-1/4	3-1/2	0.060	3	D6431620/60	D6431622/60	D6431624/60
5/8	5/8	1-1/4	3-1/2	0.090	3	D6431620/90	D6431622/90	D6431624/90
5/8	5/8	1-1/4	3-1/2	0.125	3	D6431620/12	D6431622/12	D6431624/12
3/4	3/4	1-1/2	4	0.010	3	D6431750/10	D6431752/10	D6431754/10
3/4	3/4	1-1/2	4	0.015	3	D6431750/15	D6431752/15	D6431754/15
3/4	3/4	1-1/2	4	0.020	3	D6431750/20	D6431752/20	D6431754/20
3/4	3/4	1-1/2	4	0.030	3	D6431750/30	D6431752/30	D6431754/30
3/4	3/4	1-1/2	4	0.045	3	D6431750/45	D6431752/45	D6431754/45
3/4	3/4	1-1/2	4	0.060	3	D6431750/60	D6431752/60	D6431754/60
3/4	3/4	1-1/2	4	0.090	3	D6431750/90	D6431752/90	D6431754/90
3/4	3/4	1-1/2	4	0.125	3	D6431750/12	D6431752/12	D6431754/12
1	1	1-3/4	4	0.010	3	D6431100/10	D6431102/10	D6431104/10
1	1	1-3/4	4	0.015	3	D6431100/15	D6431102/15	D6431104/15
1	1	1-3/4	4	0.020	3	D6431100/20	D6431102/20	D6431104/20
1	1	1-3/4	4	0.030	3	D6431100/30	D6431102/30	D6431104/30
1	1	1-3/4	4	0.045	3	D6431100/45	D6431102/45	D6431104/45
1	1	1-3/4	4	0.060	3	D6431100/60	D6431102/60	D6431104/60
1	1	1-3/4	4	0.090	3	D6431100/90	D6431102/90	D6431104/90
1	1	1-3/4	4	0.125	3	D6431100/12	D6431102/12	D6431104/12

Additional Sizes On Pages 88

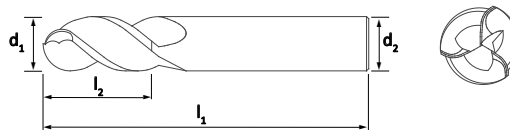
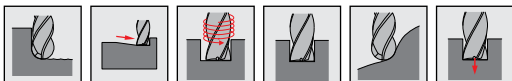
Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•						•	•	•	•	



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances

Shank: 1/8" - 1" = -.0001/- .0004
 Cutting Dia: 1/8" - 1" = +.000/- .002
 Radius: 1/8" - 1" = +/- .001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
1/8	1/8	1/4	1-1/2	3	D6632120	D6632122	D6632124
1/8	1/8	1/2	1-1/2	3	D6631120	D6631122	D6631124
1/8	1/8	3/4	2-1/4	3	D6633120	D6633122	D6633124
1/8	1/8	3/4	3	3	D6636120	D6636122	D6636124
1/8	1/8	1	3	3	D6634120	D6634122	D6634124
9/64	3/16	1/2	2	3	D6631140	D6631142	D6631144
5/32	3/16	1/2	2	3	D6631150	D6631152	D6631154
11/64	3/16	5/8	2	3	D6631170	D6631172	D6631174
3/16	3/16	3/8	2	3	D6632180	D6632182	D6632184
3/16	3/16	5/8	2	3	D6631180	D6631182	D6631184
3/16	3/16	3/4	2-1/2	3	D6633180	D6633182	D6633184
3/16	3/16	1	2-1/2	3	D6635180	D6635182	D6635184
3/16	3/16	1	4	3	D6636180	D6636182	D6636184
3/16	3/16	1-1/8	3	3	D6634180	D6634182	D6634184
13/64	1/4	5/8	2-1/2	3	D6631200	D6631202	D6631204
7/32	1/4	5/8	2-1/2	3	D6631210	D6631212	D6631214
15/64	1/4	3/4	2-1/2	3	D6631230	D6631232	D6631234
1/4	1/4	3/8	2	3	D6632250	D6632252	D6632254
1/4	1/4	3/4	2-1/2	3	D6631250	D6631252	D6631254
1/4	1/4	1	4	3	D6636250	D6636252	D6636254
1/4	1/4	1-1/8	3	3	D6633250	D6633252	D6633254
1/4	1/4	1-1/2	4	3	D6634250	D6634252	D6634254
1/4	1/4	1-1/2	6	3	D6637250	D6637252	D6637254
17/64	5/16	3/4	2-1/2	3	D6631260	D6631262	D6631264
9/32	5/16	3/4	2-1/2	3	D6631280	D6631282	D6631284
19/64	5/16	3/4	2-1/2	3	D6631290	D6631292	D6631294
5/16	5/16	3/4	2-1/2	3	D6631310	D6631312	D6631314
5/16	5/16	1	4	3	D6636310	D6636312	D6636314
5/16	5/16	1-1/2	6	3	D6637310	D6637312	D6637314
21/64	3/8	7/8	2-1/2	3	D6631320	D6631322	D6631324
11/32	3/8	7/8	2-1/2	3	D6631340	D6631342	D6631344
23/64	3/8	7/8	2-1/2	3	D6631350	D6631352	D6631354
3/8	3/8	5/8	2	3	D6632370	D6632372	D6632374
3/8	3/8	7/8	2-1/2	3	D6631370	D6631372	D6631374
3/8	3/8	1	4	3	D6636370	D6636372	D6636374
3/8	3/8	1-1/8	3	3	D6633370	D6633372	D6633374
3/8	3/8	1-1/2	6	3	D6637370	D6637372	D6637374
3/8	3/8	1-3/4	4	3	D6634370	D6634372	D6634374
3/8	3/8	3	6	3	D6638370	D6638372	D6638374
25/64	7/16	1	2-3/4	3	D6631390	D6631392	D6631394
13/32	7/16	1	2-3/4	3	D6631400	D6631402	D6631404
27/64	7/16	1	2-3/4	3	D6631420	D6631422	D6631424

Additional Sizes On Pages 91

Feeds & Speeds Available on Page 115

Application Range:

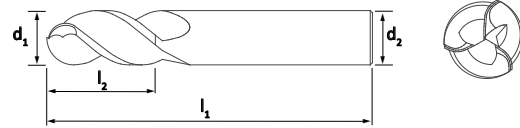
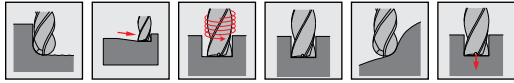
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●						●	●	●	●	

Series D663

3 Flute Universal Ball



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/8'' - 1'' = -.0001/-0.0004$
 Cutting Dia: $1/8'' - 1'' = +.000/-0.002$
 Radius: $1/8'' - 1'' = +/-0.001$

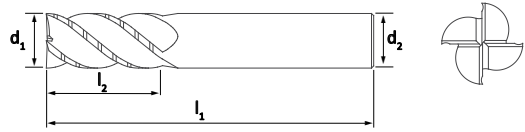
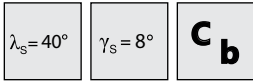
d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	Flutes	Uncoated	TiCN	AlTiN
7/16	7/16	1	2-3/4	3	D6631430	D6631432	D6631434
7/16	7/16	1	4	3	D6636430	D6636432	D6636434
7/16	7/16	1-1/2	6	3	D6637430	D6637432	D6637434
7/16	7/16	2	4	3	D6633430	D6633432	D6633434
7/16	7/16	3	6	3	D6634430	D6634432	D6634434
29/64	1/2	1	3	3	D6631450	D6631452	D6631454
15/32	1/2	1	3	3	D6631460	D6631462	D6631464
31/64	1/2	1	3	3	D6631480	D6631482	D6631484
1/2	1/2	5/8	2-1/2	3	D6632500	D6632502	D6632504
1/2	1/2	1	3	3	D6631500	D6631502	D6631504
1/2	1/2	1	4	3	D6636500	D6636502	D6636504
1/2	1/2	1-1/2	6	3	D6637500	D6637502	D6637504
1/2	1/2	2	4	3	D6633500	D6633502	D6633504
1/2	1/2	3	6	3	D6634500	D6634502	D6634504
9/16	9/16	1-1/4	3-1/2	3	D6631560	D6631562	D6631564
9/16	9/16	2	6	3	D6636560	D6636562	D6636564
9/16	9/16	3	6	3	D6634560	D6634562	D6634564
5/8	5/8	1-1/4	3-1/2	3	D6631620	D6631622	D6631624
5/8	5/8	2	6	3	D6636620	D6636622	D6636624
5/8	5/8	2-1/8	4-5/8	3	D6633620	D6633622	D6633624
5/8	5/8	3	6	3	D6634620	D6634622	D6634624
11/16	3/4	1-1/2	4	3	D6631680	D6631682	D6631684
3/4	3/4	1-1/2	4	3	D6631750	D6631752	D6631754
3/4	3/4	2	6	3	D6636750	D6636752	D6636754
3/4	3/4	2-1/4	5	3	D6633750	D6633752	D6633754
3/4	3/4	3	6	3	D6634750	D6634752	D6634754
7/8	7/8	1-3/4	4	3	D6631870	D6631872	D6631874
1	1	1-3/4	4	3	D6631100	D6631102	D6631104
1	1	2	6	3	D6636100	D6636102	D6636104
1	1	2-1/4	5	3	D6633100	D6633102	D6633104
1	1	3	6	3	D6634100	D6634102	D6634104

Additional Sizes On Pages 90

Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•						•	•	•	•	



Tolerances
Shank: 1/8" - 1" = -.0001/- .0004
Cutting Dia: 1/8" - 1" = +.000/- .002

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	AlTiN
1/8	1/8	1/4	1-1/2	4	D70100824
1/8	1/8	1/2	1-1/2	4	D70100814
1/8	1/8	3/4	2-1/4	4	D70100834
3/16	3/16	3/8	2	4	D70101224
3/16	3/16	5/8	2	4	D70101214
3/16	3/16	3/4	2-1/2	4	D70101234
3/16	3/16	1-1/8	3	4	D70101244
1/4	1/4	3/8	2	4	D70101624
1/4	1/4	3/4	2-1/2	4	D70101614
1/4	1/4	1-1/8	3	4	D70101634
5/16	5/16	1/2	2	4	D70102024
5/16	5/16	3/4	2-1/2	4	D70102014
5/16	5/16	1-1/8	3	4	D70102034
3/8	3/8	5/8	2	4	D70102424
3/8	3/8	7/8	2-1/2	4	D70102414
3/8	3/8	1-1/8	3	4	D70102434
3/8	3/8	1-3/4	4	4	D70102444
7/16	7/16	1	2-3/4	4	D70102814
7/16	7/16	2	4	4	D70102834
1/2	1/2	5/8	2-1/2	4	D70103224
1/2	1/2	1	3	4	D70103214
1/2	1/2	2	4	4	D70103234
5/8	5/8	7/8	3	4	D70104024
5/8	5/8	1-1/4	3-1/2	4	D70104014
3/4	3/4	1-1/2	4	4	D70104814
3/4	3/4	2-1/4	5	4	D70104834
3/4	3/4	3	6	4	D70104844
1	1	1-3/4	4	4	D70106414
1	1	2-1/4	5	4	D70106434

Feeds & Speeds Available on Page 115

Application Range:

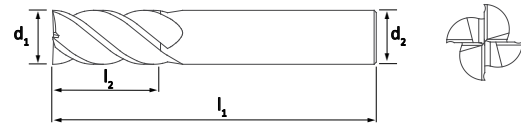
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•	•	•	•	•	•		•		

Series D644

4 Flute Universal



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances

Shank: 1/32" - 1" = -.0001/- .0004
 Cutting Dia: 1/32" - 7/64" = +/- .0005
 Cutting Dia: 1/8" - 1" = +.000/- .002

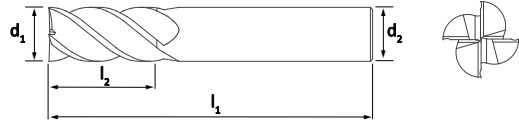
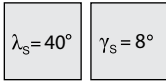
d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
1/32	1/8	1/16	1-1/2	4	D6442030	D6442032	D6442034
1/32	1/8	3/32	1-1/2	4	D6441030	D6441032	D6441034
3/64	1/8	3/32	1-1/2	4	D6442040	D6442042	D6442044
3/64	1/8	9/64	1-1/2	4	D6441040	D6441042	D6441044
1/16	1/8	1/8	1-1/2	4	D6442060	D6442062	D6442064
1/16	1/8	3/16	1-1/2	4	D6441060	D6441062	D6441064
5/64	1/8	1/4	1-1/2	4	D6441070	D6441072	D6441074
3/32	1/8	3/16	1-1/2	4	D6442090	D6442092	D6442094
3/32	1/8	9/32	1-1/2	4	D6441090	D6441092	D6441094
7/64	1/8	3/16	1-1/2	4	D6442190	D6442192	D6442194
7/64	1/8	3/8	1-1/2	4	D6441190	D6441192	D6441194
1/8	1/8	1/4	1-1/2	4	D6442120	D6442122	D6442124
1/8	1/8	1/2	1-1/2	4	D6441120	D6441122	D6441124
1/8	1/8	3/4	2-1/4	4	D6445120	D6445122	D6445124
1/8	1/8	3/4	3	4	D6446120	D6446122	D6446124
1/8	1/8	1	3	4	D6444120	D6444122	D6444124
9/64	3/16	3/8	2	4	D6442140	D6442142	D6442144
9/64	3/16	1/2	2	4	D6441140	D6441142	D6441144
5/32	3/16	3/8	2	4	D6442150	D6442152	D6442154
5/32	3/16	1/2	2	4	D6441150	D6441152	D6441154
5/32	3/16	3/4	2-1/2	4	D6445150	D6445152	D6445154
11/64	3/16	3/8	2	4	D6442170	D6442172	D6442174
11/64	3/16	5/8	2	4	D6441170	D6441172	D6441174
3/16	3/16	3/8	2	4	D6442180	D6442182	D6442184
3/16	3/16	5/8	2	4	D6441180	D6441182	D6441184
3/16	3/16	3/4	2-1/2	4	D6443180	D6443182	D6443184
3/16	3/16	1	2-1/2	4	D6445180	D6445182	D6445184
3/16	3/16	1	4	4	D6446180	D6446182	D6446184
3/16	3/16	1-1/8	3	4	D6444180	D6444182	D6444184
13/64	1/4	3/8	2	4	D6442200	D6442202	D6442204
13/64	1/4	5/8	2-1/2	4	D6441200	D6441202	D6441204
7/32	1/4	3/8	2	4	D6442210	D6442212	D6442214
7/32	1/4	5/8	2-1/2	4	D6441210	D6441212	D6441214
7/32	1/4	1	3	4	D6445210	D6445212	D6445214
15/64	1/4	3/8	2	4	D6442230	D6442232	D6442234
15/64	1/4	3/4	2-1/2	4	D6441230	D6441232	D6441234
1/4	1/4	3/8	2	4	D6442250	D6442252	D6442254
1/4	1/4	3/4	2-1/2	4	D6441250	D6441252	D6441254
1/4	1/4	1	4	4	D6446250	D6446252	D6446254
1/4	1/4	1-1/8	3	4	D6443250	D6443252	D6443254
1/4	1/4	1-1/4	3	4	D6445250	D6445252	D6445254
1/4	1/4	1-1/2	4	4	D6444250	D6444252	D6444254

Additional Sizes On Pages 94 - 95

Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●	●	●	●	●	●		●	●	



Tolerances
 Shank: 1/32" - 1" = -.0001/-.0004
 Cutting Dia: 1/32" - 7/64" = +/- .0005
 Cutting Dia: 1/8" - 1" = +.000/- .002

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
1/4	1/4	1-1/2	6	4	D6447250	D6447252	D6447254
17/64	5/16	1/2	2	4	D6442260	D6442262	D6442264
17/64	5/16	3/4	2-1/2	4	D6441260	D6441262	D6441264
9/32	5/16	1/2	2	4	D6442280	D6442282	D6442284
9/32	5/16	3/4	2-1/2	4	D6441280	D6441282	D6441284
9/32	5/16	1-1/4	3	4	D6445280	D6445282	D6445284
19/64	5/16	1/2	2	4	D6442290	D6442292	D6442294
19/64	5/16	3/4	2-1/2	4	D6441290	D6441292	D6441294
5/16	5/16	1/2	2	4	D6442310	D6442312	D6442314
5/16	5/16	3/4	2-1/2	4	D6441310	D6441312	D6441314
5/16	5/16	1	4	4	D6446310	D6446312	D6446314
5/16	5/16	1-1/8	3	4	D6443310	D6443312	D6443314
5/16	5/16	1-3/8	3	4	D6445310	D6445312	D6445314
5/16	5/16	1-1/2	6	4	D6447310	D6447312	D6447314
5/16	5/16	1-5/8	4	4	D6444310	D6444312	D6444314
21/64	3/8	5/8	2	4	D6442320	D6442322	D6442324
21/64	3/8	7/8	2-1/2	4	D6441320	D6441322	D6441324
11/32	3/8	5/8	2	4	D6442340	D6442342	D6442344
11/32	3/8	7/8	2-1/2	4	D6441340	D6441342	D6441344
23/64	3/8	5/8	2	4	D6442350	D6442352	D6442354
23/64	3/8	7/8	2-1/2	4	D6441350	D6441352	D6441354
3/8	3/8	5/8	2	4	D6442370	D6442372	D6442374
3/8	3/8	7/8	2-1/2	4	D6441370	D6441372	D6441374
3/8	3/8	1	4	4	D6446370	D6446372	D6446374
3/8	3/8	1-1/8	3	4	D6443370	D6443372	D6443374
3/8	3/8	1-3/8	3	4	D6445370	D6445372	D6445374
3/8	3/8	1-1/2	6	4	D6447370	D6447372	D6447374
3/8	3/8	1-3/4	4	4	D6444370	D6444372	D6444374
3/8	3/8	3	6	4	D6448370	D6448372	D6448374
25/64	7/16	5/8	2	4	D6442390	D6442392	D6442394
25/64	7/16	1	2-3/4	4	D6441390	D6441392	D6441394
13/32	7/16	5/8	2	4	D6442400	D6442402	D6442404
13/32	7/16	1	2-3/4	4	D6441400	D6441402	D6441404
27/64	7/16	5/8	2	4	D6442420	D6442422	D6442424
27/64	7/16	1	2-3/4	4	D6441420	D6441422	D6441424
7/16	7/16	5/8	2	4	D6442430	D6442432	D6442434
7/16	7/16	1	2-3/4	4	D6441430	D6441432	D6441434
7/16	7/16	1	4	4	D6446430	D6446432	D6446434
7/16	7/16	1-3/8	4	4	D6445430	D6445432	D6445434
7/16	7/16	1-1/2	6	4	D6447430	D6447432	D6447434
7/16	7/16	2	4	4	D6443430	D6443432	D6443434
7/16	7/16	3	6	4	D6444430	D6444432	D6444434

Additional Sizes On Pages 93 & 95

Feeds & Speeds Available on Page 115

Application Range:

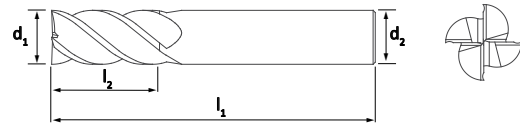
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●	●	●	●	●	●		●	●	

Series D644

4 Flute Universal



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances

Shank: $1/32'' - 1'' = -.0001/-0.0004$
 Cutting Dia: $1/32'' - 7/64'' = +/-0.0005$
 Cutting Dia: $1/8'' - 1'' = +.000/-0.002$

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
29/64	1/2	5/8	2-1/2	4	D6442450	D6442452	D6442454
29/64	1/2	1	3	4	D6441450	D6441452	D6441454
15/32	1/2	5/8	2-1/2	4	D6442460	D6442462	D6442464
15/32	1/2	1	3	4	D6441460	D6441462	D6441464
31/64	1/2	5/8	2-1/2	4	D6442480	D6442482	D6442484
31/64	1/2	1	3	4	D6441480	D6441482	D6441484
1/2	1/2	5/8	2-1/2	4	D6442500	D6442502	D6442504
1/2	1/2	1	3	4	D6441500	D6441502	D6441504
1/2	1/2	1	4	4	D6446500	D6446502	D6446504
1/2	1/2	1-1/2	3-1/2	4	D6445500	D6445502	D6445504
1/2	1/2	1-1/2	6	4	D6447500	D6447502	D6447504
1/2	1/2	2	4	4	D6443500	D6443502	D6443504
1/2	1/2	3	6	4	D6444500	D6444502	D6444504
9/16	9/16	7/8	3	4	D6442560	D6442562	D6442564
9/16	9/16	1-1/4	3-1/2	4	D6441560	D6441562	D6441564
9/16	9/16	2	6	4	D6446560	D6446562	D6446564
9/16	9/16	3	6	4	D6444560	D6444562	D6444564
5/8	5/8	7/8	3	4	D6442620	D6442622	D6442624
5/8	5/8	1-1/4	3-1/2	4	D6441620	D6441622	D6441624
5/8	5/8	2	6	4	D6446620	D6446622	D6446624
5/8	5/8	2-1/8	4-5/8	4	D6443620	D6443622	D6443624
5/8	5/8	3	6	4	D6444620	D6444622	D6444624
11/16	3/4	1	3	4	D6442680	D6442682	D6442684
11/16	3/4	1-1/2	4	4	D6441680	D6441682	D6441684
3/4	3/4	1	3	4	D6442750	D6442752	D6442754
3/4	3/4	1-1/2	4	4	D6441750	D6441752	D6441754
3/4	3/4	2	6	4	D6446750	D6446752	D6446754
3/4	3/4	2-1/4	5	4	D6443750	D6443752	D6443754
3/4	3/4	3	6	4	D6444750	D6444752	D6444754
7/8	7/8	1-3/4	4	4	D6441870	D6441872	D6441874
1	1	1-3/4	4	4	D6441100	D6441102	D6441104
1	1	2	6	4	D6446100	D6446102	D6446104
1	1	2-1/4	5	4	D6443100	D6443102	D6443104
1	1	3	6	4	D6444100	D6444102	D6444104

Additional Sizes On Pages 93 - 94

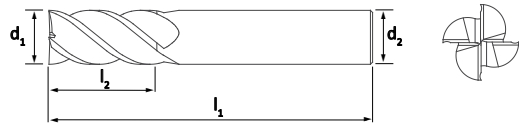
Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●	●	●	●	●	●		●	●	



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: 1mm - 25mm = -.0025/-.0102
 Cutting Dia: 1mm - 2.5mm = +/- .0127
 Cutting Dia: 3mm - 25mm = +.000/-.0508

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
1.0mm	3.0mm	2.0mm	38.0mm	4	D64420390	D64420392	D64420394
1.0mm	3.0mm	4.0mm	38.0mm	4	D64410390	D64410392	D64410394
1.5mm	3.0mm	3.0mm	38.0mm	4	D64420590	D64420592	D64420594
1.5mm	3.0mm	5.0mm	38.0mm	4	D64410590	D64410592	D64410594
2.0mm	3.0mm	4.0mm	38.0mm	4	D64420780	D64420782	D64420784
2.0mm	3.0mm	8.0mm	38.0mm	4	D64410780	D64410782	D64410784
2.5mm	3.0mm	10.0mm	38.0mm	4	D64410980	D64410982	D64410984
3.0mm	3.0mm	6.0mm	38.0mm	4	D64421180	D64421182	D64421184
3.0mm	3.0mm	12.0mm	38.0mm	4	D64411180	D64411182	D64411184
3.5mm	4.0mm	7.0mm	50.0mm	4	D64421370	D64421372	D64421374
3.5mm	4.0mm	12.0mm	50.0mm	4	D64411370	D64411372	D64411374
4.0mm	4.0mm	8.0mm	50.0mm	4	D64421570	D64421572	D64421574
4.0mm	4.0mm	14.0mm	50.0mm	4	D64411570	D64411572	D64411574
4.5mm	6.0mm	9.5mm	63.0mm	4	D64421770	D64421772	D64421774
4.5mm	6.0mm	16.0mm	63.0mm	4	D64411770	D64411772	D64411774
5.0mm	6.0mm	10.0mm	63.0mm	4	D64421960	D64421962	D64421964
5.0mm	6.0mm	16.0mm	63.0mm	4	D64411960	D64411962	D64411964
5.0mm	6.0mm	16.0mm	63.0mm	4	D64412360	D64412362	D64412364
6.0mm	6.0mm	12.0mm	63.0mm	4	D64422360	D64422362	D64422364
7.0mm	8.0mm	12.0mm	63.0mm	4	D64422750	D64422752	D64422754
7.0mm	8.0mm	19.0mm	63.0mm	4	D64412750	D64412752	D64412754
8.0mm	8.0mm	12.0mm	63.0mm	4	D64423150	D64423152	D64423154
8.0mm	8.0mm	20.0mm	63.0mm	4	D64413150	D64413152	D64413154
9.0mm	10.0mm	14.0mm	70.0mm	4	D64423540	D64423542	D64423544
9.0mm	10.0mm	25.0mm	70.0mm	4	D64413540	D64413542	D64413544
10.0mm	10.0mm	14.0mm	70.0mm	4	D64423930	D64423932	D64423934
10.0mm	10.0mm	25.0mm	70.0mm	4	D64413930	D64413932	D64413934
11.0mm	12.0mm	14.0mm	76.0mm	4	D64424330	D64424332	D64424334
11.0mm	12.0mm	25.0mm	76.0mm	4	D64414330	D64414332	D64414334
12.0mm	12.0mm	16.0mm	76.0mm	4	D64424720	D64424722	D64424724
12.0mm	12.0mm	25.0mm	76.0mm	4	D64414720	D64414722	D64414724
14mm	14.0mm	32.0mm	89.0mm	4	D64415510	D64415512	D64415514
16.0mm	16.0mm	32.0mm	89.0mm	4	D64416290	D64416292	D64416294
18.0mm	18.0mm	38.0mm	100.0mm	4	D64417080	D64417082	D64417084
20.0mm	20.0mm	38.0mm	100.0mm	4	D64417870	D64417872	D64417874
20.0mm	20.0mm	38.0mm	100.0mm	4	D64420980	D64420982	D64420984
25.0mm	25.0mm	38.0mm	100.0mm	4	D64419840	D64419842	D64419844

Feeds & Speeds Available on Page 115

Application Range:

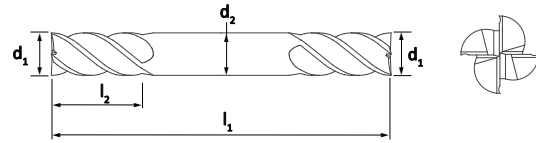
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●	●	●	●	●	●		●	●	

Series D844

4 Flute Universal



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/32'' - 1/2'' = -.0001/-0.0004$
 Cutting Dia: $1/32'' - 7/64'' = +/- .0005$
 Cutting Dia: $1/8'' - 1/2'' = +.000/-0.002$

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
1/32	1/8	1/16	1-1/2	4	D8442030	D8442032	D8442034
3/64	1/8	3/32	1-1/2	4	D8442040	D8442042	D8442044
1/16	1/8	1/8	1-1/2	4	D8442060	D8442062	D8442064
5/64	1/8	5/32	1-1/2	4	D8442070	D8442072	D8442074
3/32	1/8	3/16	1-1/2	4	D8442090	D8442092	D8442094
7/64	1/8	3/16	1-1/2	4	D8442190	D8442192	D8442194
1/8	1/8	1/4	1-1/2	4	D8442120	D8442122	D8442124
1/8	3/8	3/8	3	4	D8441120	D8441122	D8441124
9/64	3/16	5/16	2	4	D8442140	D8442142	D8442144
5/32	3/16	5/16	2	4	D8442150	D8442152	D8442154
5/32	3/8	7/16	3	4	D8441150	D8441152	D8441154
11/64	3/16	5/16	2	4	D8442170	D8442172	D8442174
3/16	3/16	3/8	2	4	D8442180	D8442182	D8442184
3/16	3/8	1/2	3	4	D8441180	D8441182	D8441184
13/64	1/4	1/2	2-1/2	4	D8442200	D8442202	D8442204
7/32	1/4	7/16	2-1/2	4	D8442210	D8442212	D8442214
7/32	3/8	9/16	3	4	D8441210	D8441212	D8441214
15/64	1/4	1/2	2-1/2	4	D8442230	D8442232	D8442234
1/4	1/4	1/2	2-1/2	4	D8442250	D8442252	D8442254
1/4	3/8	5/8	3	4	D8441250	D8441252	D8441254
9/32	5/16	1/2	2-1/2	4	D8442280	D8442282	D8442284
9/32	3/8	11/16	3-1/2	4	D8441280	D8441282	D8441284
5/16	5/16	1/2	2-1/2	4	D8442310	D8442312	D8442314
5/16	3/8	3/4	3-1/2	4	D8441310	D8441312	D8441314
11/32	3/8	3/4	3-1/2	4	D8441340	D8441342	D8441344
3/8	3/8	1/2	2-1/2	4	D8442370	D8442372	D8442374
3/8	3/8	3/4	3-1/2	4	D8441370	D8441372	D8441374
7/16	7/16	9/16	2-3/4	4	D8442430	D8442432	D8442434
7/16	1/2	7/8	4	4	D8441430	D8441432	D8441434
1/2	1/2	5/8	3	4	D8442500	D8442502	D8442504
1/2	1/2	1	4	4	D8441500	D8441502	D8441504

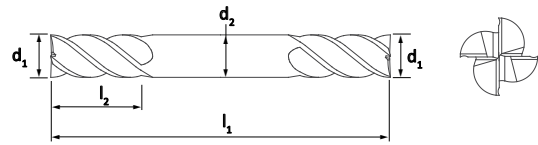
Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•	•	•	•	•	•		•	•	



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances

Shank: 1mm - 12mm = -.0025/-.0102
 Cutting Dia: 1mm - 2.5mm = +/--.0127
 Cutting Dia: 3mm - 12mm = +.000/-.0508

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
1.0mm	3.0mm	2.0mm	38.0mm	4	D84420390	D84420392	D84420394
1.5mm	3.0mm	3.0mm	38.0mm	4	D84420590	D84420592	D84420594
2.0mm	3.0mm	4.0mm	38.0mm	4	D84420780	D84420782	D84420784
2.5mm	3.0mm	5.0mm	38.0mm	4	D84420980	D84420982	D84420984
3.0mm	3.0mm	6.0mm	38.0mm	4	D84421180	D84421182	D84421184
3.5mm	4.0mm	7.0mm	38.0mm	4	D84421370	D84421372	D84421374
4.0mm	4.0mm	8.0mm	50.0mm	4	D84421570	D84421572	D84421574
4.5mm	6.0mm	9.5mm	63.0mm	4	D84421770	D84421772	D84421774
5.0mm	6.0mm	10.0mm	63.0mm	4	D84421960	D84421962	D84421964
6.0mm	6.0mm	12.0mm	63.0mm	4	D84422360	D84422362	D84422364
7.0mm	8.0mm	12.0mm	63.0mm	4	D84422750	D84422752	D84422754
8.0mm	8.0mm	12.0mm	63.0mm	4	D84423150	D84423152	D84423154
9.0mm	10.0mm	14.0mm	70.0mm	4	D84423540	D84423542	D84423544
10.0mm	10.0mm	14.0mm	70.0mm	4	D84423930	D84423932	D84423934
11.0mm	12.0mm	14.0mm	76.0mm	4	D84424330	D84424332	D84424334
12.0mm	12.0mm	16.0mm	76.0mm	4	D84424720	D84424722	D84424724

Feeds & Speeds Available on Page 115

Application Range:

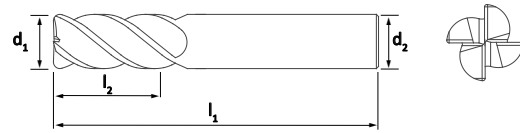
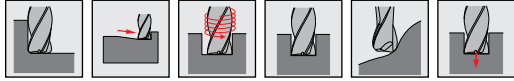
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•	•	•	•	•	•		•	•	

Series D644CR

4 Flute Universal Corner Radius



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: 1/8" - 1" = -.0001/-0.0004
 Cutting Dia: 1/8" - 1" = +.000/-0.002
 Radius: 1/8" - 1" = +/-0.001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	Uncoated	TiCN	AlTiN
1/8	1/8	1/4	1-1/2	0.010	4	D6442120/10	D6442122/10	D6442124/10
1/8	1/8	1/4	1-1/2	0.015	4	D6442120/15	D6442122/15	D6442124/15
1/8	1/8	1/4	1-1/2	0.020	4	D6442120/20	D6442122/20	D6442124/20
1/8	1/8	1/4	1-1/2	0.030	4	D6442120/30	D6442122/30	D6442124/30
1/8	1/8	1/4	1-1/2	0.045	4	D6442120/45	D6442122/45	D6442124/45
1/8	1/8	1/2	1-1/2	0.010	4	D6441120/10	D6441122/10	D6441124/10
1/8	1/8	1/2	1-1/2	0.015	4	D6441120/15	D6441122/15	D6441124/15
1/8	1/8	1/2	1-1/2	0.020	4	D6441120/20	D6441122/20	D6441124/20
1/8	1/8	1/2	1-1/2	0.030	4	D6441120/30	D6441122/30	D6441124/30
1/8	1/8	1/2	1-1/2	0.045	4	D6441120/45	D6441122/45	D6441124/45
1/8	1/8	1	3	0.010	4	D6444120/10	D6444122/10	D6444124/10
1/8	1/8	1	3	0.015	4	D6444120/15	D6444122/15	D6444124/15
1/8	1/8	1	3	0.020	4	D6444120/20	D6444122/20	D6444124/20
1/8	1/8	1	3	0.030	4	D6444120/30	D6444122/30	D6444124/30
1/8	1/8	1	3	0.045	4	D6444120/45	D6444122/45	D6444124/45
3/16	3/16	3/8	2	0.010	4	D6442180/10	D6442182/10	D6442184/10
3/16	3/16	3/8	2	0.015	4	D6442180/15	D6442182/15	D6442184/15
3/16	3/16	3/8	2	0.020	4	D6442180/20	D6442182/20	D6442184/20
3/16	3/16	3/8	2	0.030	4	D6442180/30	D6442182/30	D6442184/30
3/16	3/16	3/8	2	0.045	4	D6442180/45	D6442182/45	D6442184/45
3/16	3/16	3/8	2	0.060	4	D6442180/60	D6442182/60	D6442184/60
3/16	3/16	5/8	2	0.010	4	D6441180/10	D6441182/10	D6441184/10
3/16	3/16	5/8	2	0.015	4	D6441180/15	D6441182/15	D6441184/15
3/16	3/16	5/8	2	0.020	4	D6441180/20	D6441182/20	D6441184/20
3/16	3/16	5/8	2	0.030	4	D6441180/30	D6441182/30	D6441184/30
3/16	3/16	5/8	2	0.045	4	D6441180/45	D6441182/45	D6441184/45
3/16	3/16	5/8	2	0.060	4	D6441180/60	D6441182/60	D6441184/60
3/16	3/16	1	4	0.010	4	D6446180/10	D6446182/10	D6446184/10
3/16	3/16	1	4	0.015	4	D6446180/15	D6446182/15	D6446184/15
3/16	3/16	1	4	0.020	4	D6446180/20	D6446182/20	D6446184/20
3/16	3/16	1	4	0.030	4	D6446180/30	D6446182/30	D6446184/30
3/16	3/16	1	4	0.045	4	D6446180/45	D6446182/45	D6446184/45
3/16	3/16	1	4	0.060	4	D6446180/60	D6446182/60	D6446184/60
3/16	3/16	1-1/8	3	0.010	4	D6444180/10	D6444182/10	D6444184/10
3/16	3/16	1-1/8	3	0.015	4	D6444180/15	D6444182/15	D6444184/15
3/16	3/16	1-1/8	3	0.020	4	D6444180/20	D6444182/20	D6444184/20
3/16	3/16	1-1/8	3	0.030	4	D6444180/30	D6444182/30	D6444184/30
3/16	3/16	1-1/8	3	0.045	4	D6444180/45	D6444182/45	D6444184/45
3/16	3/16	1-1/8	3	0.060	4	D6444180/60	D6444182/60	D6444184/60
1/4	1/4	3/8	2	0.010	4	D6442250/10	D6442252/10	D6442254/10
1/4	1/4	3/8	2	0.015	4	D6442250/15	D6442252/15	D6442254/15
1/4	1/4	3/8	2	0.020	4	D6442250/20	D6442252/20	D6442254/20

Additional Sizes On Pages 100 - 106

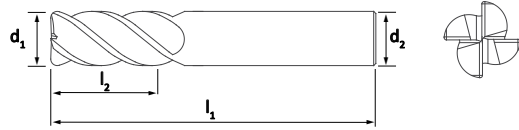
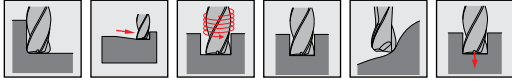
Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●	●	●	●	●	●		●	●	



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: 1/8" - 1" = -.0001/-0.0004
 Cutting Dia: 1/8" - 1" = +.000/-0.002
 Radius: 1/8" - 1" = +/-0.001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	Uncoated	TiCN	AlTiN
1/4	1/4	3/8	2	0.030	4	D6442250/30	D6442252/30	D6442254/30
1/4	1/4	3/8	2	0.045	4	D6442250/45	D6442252/45	D6442254/45
1/4	1/4	3/8	2	0.060	4	D6442250/60	D6442252/60	D6442254/60
1/4	1/4	3/8	2	0.090	4	D6442250/90	D6442252/90	D6442254/90
1/4	1/4	3/4	2-1/2	0.010	4	D6441250/10	D6441252/10	D6441254/10
1/4	1/4	3/4	2-1/2	0.015	4	D6441250/15	D6441252/15	D6441254/15
1/4	1/4	3/4	2-1/2	0.020	4	D6441250/20	D6441252/20	D6441254/20
1/4	1/4	3/4	2-1/2	0.030	4	D6441250/30	D6441252/30	D6441254/30
1/4	1/4	3/4	2-1/2	0.045	4	D6441250/45	D6441252/45	D6441254/45
1/4	1/4	3/4	2-1/2	0.060	4	D6441250/60	D6441252/60	D6441254/60
1/4	1/4	3/4	2-1/2	0.090	4	D6441250/90	D6441252/90	D6441254/90
1/4	1/4	1	4	0.010	4	D6446250/10	D6446252/10	D6446254/10
1/4	1/4	1	4	0.015	4	D6446250/15	D6446252/15	D6446254/15
1/4	1/4	1	4	0.020	4	D6446250/20	D6446252/20	D6446254/20
1/4	1/4	1	4	0.030	4	D6446250/30	D6446252/30	D6446254/30
1/4	1/4	1	4	0.045	4	D6446250/45	D6446252/45	D6446254/45
1/4	1/4	1	4	0.060	4	D6446250/60	D6446252/60	D6446254/60
1/4	1/4	1	4	0.090	4	D6446250/90	D6446252/90	D6446254/90
1/4	1/4	1-1/8	3	0.010	4	D6443250/10	D6443252/10	D6443254/10
1/4	1/4	1-1/8	3	0.015	4	D6443250/15	D6443252/15	D6443254/15
1/4	1/4	1-1/8	3	0.020	4	D6443250/20	D6443252/20	D6443254/20
1/4	1/4	1-1/8	3	0.030	4	D6443250/30	D6443252/30	D6443254/30
1/4	1/4	1-1/8	3	0.045	4	D6443250/45	D6443252/45	D6443254/45
1/4	1/4	1-1/8	3	0.060	4	D6443250/60	D6443252/60	D6443254/60
1/4	1/4	1-1/8	3	0.090	4	D6443250/90	D6443252/90	D6443254/90
1/4	1/4	1-1/2	4	0.010	4	D6444250/10	D6444252/10	D6444254/10
1/4	1/4	1-1/2	6	0.010	4	D6447250/10	D6447252/10	D6447254/10
1/4	1/4	1-1/2	4	0.015	4	D6444250/15	D6444252/15	D6444254/15
1/4	1/4	1-1/2	6	0.015	4	D6447250/15	D6447252/15	D6447254/15
1/4	1/4	1-1/2	4	0.020	4	D6444250/20	D6444252/20	D6444254/20
1/4	1/4	1-1/2	6	0.020	4	D6447250/20	D6447252/20	D6447254/20
1/4	1/4	1-1/2	4	0.030	4	D6444250/30	D6444252/30	D6444254/30
1/4	1/4	1-1/2	6	0.030	4	D6447250/30	D6447252/30	D6447254/30
1/4	1/4	1-1/2	4	0.045	4	D6444250/45	D6444252/45	D6444254/45
1/4	1/4	1-1/2	6	0.045	4	D6447250/45	D6447252/45	D6447254/45
1/4	1/4	1-1/2	4	0.060	4	D6444250/60	D6444252/60	D6444254/60
1/4	1/4	1-1/2	6	0.060	4	D6447250/60	D6447252/60	D6447254/60
1/4	1/4	1-1/2	4	0.090	4	D6444250/90	D6444252/90	D6444254/90
1/4	1/4	1-1/2	6	0.090	4	D6447250/90	D6447252/90	D6447254/90
5/16	5/16	1/2	2	0.010	4	D6442310/10	D6442312/10	D6442314/10
5/16	5/16	1/2	2	0.015	4	D6442310/15	D6442312/15	D6442314/15
5/16	5/16	1/2	2	0.020	4	D6442310/20	D6442312/20	D6442314/20

Additional Sizes On Pages 99, 101 - 106

Feeds & Speeds Available on Page 115

Application Range:

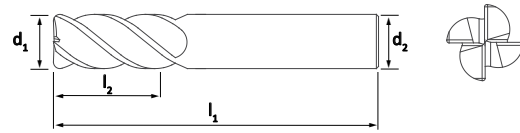
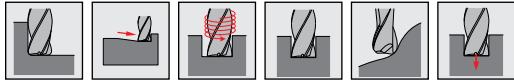
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●	●	●	●	●	●		●	●	

Series D644CR

4 Flute Universal Corner Radius



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/8'' - 1'' = -.0001/-0.0004$
 Cutting Dia: $1/8'' - 1'' = +.000/-0.002$
 Radius: $1/8'' - 1'' = +/-0.001$

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	Uncoated	TiCN	AlTiN
5/16	5/16	1/2	2	0.030	4	D6442310/30	D6442312/30	D6442314/30
5/16	5/16	1/2	2	0.045	4	D6442310/45	D6442312/45	D6442314/45
5/16	5/16	1/2	2	0.060	4	D6442310/60	D6442312/60	D6442314/60
5/16	5/16	1/2	2	0.090	4	D6442310/90	D6442312/90	D6442314/90
5/16	5/16	1/2	2	0.125	4	D6442310/12	D6442312/12	D6442314/12
5/16	5/16	3/4	2-1/2	0.010	4	D6441310/10	D6441312/10	D6441314/10
5/16	5/16	3/4	2-1/2	0.015	4	D6441310/15	D6441312/15	D6441314/15
5/16	5/16	3/4	2-1/2	0.020	4	D6441310/20	D6441312/20	D6441314/20
5/16	5/16	3/4	2-1/2	0.030	4	D6441310/30	D6441312/30	D6441314/30
5/16	5/16	3/4	2-1/2	0.045	4	D6441310/45	D6441312/45	D6441314/45
5/16	5/16	3/4	2-1/2	0.060	4	D6441310/60	D6441312/60	D6441314/60
5/16	5/16	3/4	2-1/2	0.090	4	D6441310/90	D6441312/90	D6441314/90
5/16	5/16	3/4	2-1/2	0.125	4	D6441310/12	D6441312/12	D6441314/12
5/16	5/16	1	4	0.010	4	D6446310/10	D6446312/10	D6446314/10
5/16	5/16	1	4	0.015	4	D6446310/15	D6446312/15	D6446314/15
5/16	5/16	1	4	0.020	4	D6446310/20	D6446312/20	D6446314/20
5/16	5/16	1	4	0.030	4	D6446310/30	D6446312/30	D6446314/30
5/16	5/16	1	4	0.045	4	D6446310/45	D6446312/45	D6446314/45
5/16	5/16	1	4	0.060	4	D6446310/60	D6446312/60	D6446314/60
5/16	5/16	1	4	0.090	4	D6446310/90	D6446312/90	D6446314/90
5/16	5/16	1	4	0.125	4	D6446310/12	D6446312/12	D6446314/12
5/16	5/16	1-1/8	3	0.010	4	D6443310/10	D6443312/10	D6443314/10
5/16	5/16	1-1/8	3	0.015	4	D6443310/15	D6443312/15	D6443314/15
5/16	5/16	1-1/8	3	0.020	4	D6443310/20	D6443312/20	D6443314/20
5/16	5/16	1-1/8	3	0.030	4	D6443310/30	D6443312/30	D6443314/30
5/16	5/16	1-1/8	3	0.045	4	D6443310/45	D6443312/45	D6443314/45
5/16	5/16	1-1/8	3	0.060	4	D6443310/60	D6443312/60	D6443314/60
5/16	5/16	1-1/8	3	0.090	4	D6443310/90	D6443312/90	D6443314/90
5/16	5/16	1-1/8	3	0.125	4	D6443310/12	D6443312/12	D6443314/12
5/16	5/16	1-1/2	6	0.010	4	D6447310/10	D6447312/10	D6447314/10
5/16	5/16	1-1/2	6	0.015	4	D6447310/15	D6447312/15	D6447314/15
5/16	5/16	1-1/2	6	0.020	4	D6447310/20	D6447312/20	D6447314/20
5/16	5/16	1-1/2	6	0.030	4	D6447310/30	D6447312/30	D6447314/30
5/16	5/16	1-1/2	6	0.045	4	D6447310/45	D6447312/45	D6447314/45
5/16	5/16	1-1/2	6	0.060	4	D6447310/60	D6447312/60	D6447314/60
5/16	5/16	1-1/2	6	0.090	4	D6447310/90	D6447312/90	D6447314/90
5/16	5/16	1-1/2	6	0.125	4	D6447310/12	D6447312/12	D6447314/12
5/16	5/16	1-5/8	4	0.010	4	D6444310/10	D6444312/10	D6444314/10
5/16	5/16	1-5/8	4	0.015	4	D6444310/15	D6444312/15	D6444314/15
5/16	5/16	1-5/8	4	0.020	4	D6444310/20	D6444312/20	D6444314/20
5/16	5/16	1-5/8	4	0.030	4	D6444310/30	D6444312/30	D6444314/30
5/16	5/16	1-5/8	4	0.045	4	D6444310/45	D6444312/45	D6444314/45

Additional Sizes On Pages 99 - 100 & 102 - 106

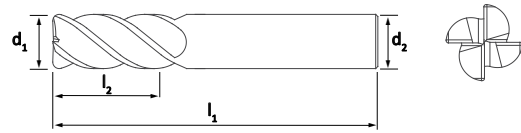
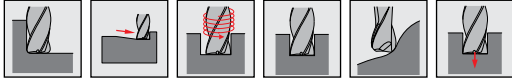
Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●	●	●	●	●	●		●	●	



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: 1/8" - 1" = -.0001/-0.0004
 Cutting Dia: 1/8" - 1" = +.000/-0.002
 Radius: 1/8" - 1" = +/-0.001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	Uncoated	TiCN	AlTiN
5/16	5/16	1-5/8	4	0.060	4	D6444310/60	D6444312/60	D6444314/60
5/16	5/16	1-5/8	4	0.090	4	D6444310/90	D6444312/90	D6444314/90
5/16	5/16	1-5/8	4	0.125	4	D6444310/12	D6444312/12	D6444314/12
3/8	3/8	5/8	2	0.010	4	D6442370/10	D6442372/10	D6442374/10
3/8	3/8	5/8	2	0.015	4	D6442370/15	D6442372/15	D6442374/15
3/8	3/8	5/8	2	0.020	4	D6442370/20	D6442372/20	D6442374/20
3/8	3/8	5/8	2	0.030	4	D6442370/30	D6442372/30	D6442374/30
3/8	3/8	5/8	2	0.045	4	D6442370/45	D6442372/45	D6442374/45
3/8	3/8	5/8	2	0.060	4	D6442370/60	D6442372/60	D6442374/60
3/8	3/8	5/8	2	0.090	4	D6442370/90	D6442372/90	D6442374/90
3/8	3/8	5/8	2	0.125	4	D6442370/12	D6442372/12	D6442374/12
3/8	3/8	7/8	2-1/2	0.010	4	D6441370/10	D6441372/10	D6441374/10
3/8	3/8	7/8	2-1/2	0.015	4	D6441370/15	D6441372/15	D6441374/15
3/8	3/8	7/8	2-1/2	0.020	4	D6441370/20	D6441372/20	D6441374/20
3/8	3/8	7/8	2-1/2	0.030	4	D6441370/30	D6441372/30	D6441374/30
3/8	3/8	7/8	2-1/2	0.045	4	D6441370/45	D6441372/45	D6441374/45
3/8	3/8	7/8	2-1/2	0.060	4	D6441370/60	D6441372/60	D6441374/60
3/8	3/8	7/8	2-1/2	0.090	4	D6441370/90	D6441372/90	D6441374/90
3/8	3/8	7/8	2-1/2	0.125	4	D6441370/12	D6441372/12	D6441374/12
3/8	3/8	1	4	0.010	4	D6446370/10	D6446372/10	D6446374/10
3/8	3/8	1	4	0.015	4	D6446370/15	D6446372/15	D6446374/15
3/8	3/8	1	4	0.020	4	D6446370/20	D6446372/20	D6446374/20
3/8	3/8	1	4	0.030	4	D6446370/30	D6446372/30	D6446374/30
3/8	3/8	1	4	0.045	4	D6446370/45	D6446372/45	D6446374/45
3/8	3/8	1	4	0.060	4	D6446370/60	D6446372/60	D6446374/60
3/8	3/8	1	4	0.090	4	D6446370/90	D6446372/90	D6446374/90
3/8	3/8	1	4	0.125	4	D6446370/12	D6446372/12	D6446374/12
3/8	3/8	1-1/8	3	0.010	4	D6443370/10	D6443372/10	D6443374/10
3/8	3/8	1-1/8	3	0.015	4	D6443370/15	D6443372/15	D6443374/15
3/8	3/8	1-1/8	3	0.020	4	D6443370/20	D6443372/20	D6443374/20
3/8	3/8	1-1/8	3	0.030	4	D6443370/30	D6443372/30	D6443374/30
3/8	3/8	1-1/8	3	0.045	4	D6443370/45	D6443372/45	D6443374/45
3/8	3/8	1-1/8	3	0.060	4	D6443370/60	D6443372/60	D6443374/60
3/8	3/8	1-1/8	3	0.090	4	D6443370/90	D6443372/90	D6443374/90
3/8	3/8	1-1/8	3	0.125	4	D6443370/12	D6443372/12	D6443374/12
3/8	3/8	1-1/2	6	0.010	4	D6447370/10	D6447372/10	D6447374/10
3/8	3/8	1-1/2	6	0.015	4	D6447370/15	D6447372/15	D6447374/15
3/8	3/8	1-1/2	6	0.020	4	D6447370/20	D6447372/20	D6447374/20
3/8	3/8	1-1/2	6	0.030	4	D6447370/30	D6447372/30	D6447374/30
3/8	3/8	1-1/2	6	0.045	4	D6447370/45	D6447372/45	D6447374/45
3/8	3/8	1-1/2	6	0.060	4	D6447370/60	D6447372/60	D6447374/60
3/8	3/8	1-1/2	6	0.090	4	D6447370/90	D6447372/90	D6447374/90

Additional Sizes On Pages 99 - 101 & 103 - 106

Feeds & Speeds Available on Page 115

Application Range:

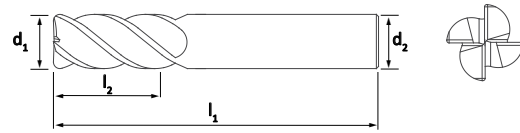
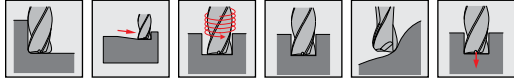
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●	●	●	●	●	●		●	●	

Series D644CR

4 Flute Universal Corner Radius



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/8'' - 1'' = -.0001/-0.0004$
 Cutting Dia: $1/8'' - 1'' = +.000/-0.002$
 Radius: $1/8'' - 1'' = +/-0.001$

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	Uncoated	TiCN	AlTiN
3/8	3/8	1-1/2	6	0.125	4	D6447370/12	D6447372/12	D6447374/12
3/8	3/8	1-3/4	4	0.010	4	D6444370/10	D6444372/10	D6444374/10
3/8	3/8	1-3/4	4	0.015	4	D6444370/15	D6444372/15	D6444374/15
3/8	3/8	1-3/4	4	0.020	4	D6444370/20	D6444372/20	D6444374/20
3/8	3/8	1-3/4	4	0.030	4	D6444370/30	D6444372/30	D6444374/30
3/8	3/8	1-3/4	4	0.045	4	D6444370/45	D6444372/45	D6444374/45
3/8	3/8	1-3/4	4	0.060	4	D6444370/60	D6444372/60	D6444374/60
3/8	3/8	1-3/4	4	0.090	4	D6444370/90	D6444372/90	D6444374/90
3/8	3/8	1-3/4	4	0.125	4	D6444370/12	D6444372/12	D6444374/12
3/8	3/8	3	6	0.010	4	D6448370/10	D6448372/10	D6448374/10
3/8	3/8	3	6	0.015	4	D6448370/15	D6448372/15	D6448374/15
3/8	3/8	3	6	0.020	4	D6448370/20	D6448372/20	D6448374/20
3/8	3/8	3	6	0.030	4	D6448370/30	D6448372/30	D6448374/30
3/8	3/8	3	6	0.045	4	D6448370/45	D6448372/45	D6448374/45
3/8	3/8	3	6	0.060	4	D6448370/60	D6448372/60	D6448374/60
3/8	3/8	3	6	0.090	4	D6448370/90	D6448372/90	D6448374/90
3/8	3/8	3	6	0.125	4	D6448370/12	D6448372/12	D6448374/12
1/2	1/2	5/8	2-1/2	0.010	4	D6442500/10	D6442502/10	D6442504/10
1/2	1/2	5/8	2-1/2	0.015	4	D6442500/15	D6442502/15	D6442504/15
1/2	1/2	5/8	2-1/2	0.020	4	D6442500/20	D6442502/20	D6442504/20
1/2	1/2	5/8	2-1/2	0.030	4	D6442500/30	D6442502/30	D6442504/30
1/2	1/2	5/8	2-1/2	0.045	4	D6442500/45	D6442502/45	D6442504/45
1/2	1/2	5/8	2-1/2	0.060	4	D6442500/60	D6442502/60	D6442504/60
1/2	1/2	5/8	2-1/2	0.090	4	D6442500/90	D6442502/90	D6442504/90
1/2	1/2	5/8	2-1/2	0.125	4	D6442500/12	D6442502/12	D6442504/12
1/2	1/2	1	3	0.010	4	D6441500/10	D6441502/10	D6441504/10
1/2	1/2	1	4	0.010	4	D6446500/10	D6446502/10	D6446504/10
1/2	1/2	1	3	0.015	4	D6441500/15	D6441502/15	D6441504/15
1/2	1/2	1	4	0.015	4	D6446500/15	D6446502/15	D6446504/15
1/2	1/2	1	3	0.020	4	D6441500/20	D6441502/20	D6441504/20
1/2	1/2	1	4	0.020	4	D6446500/20	D6446502/20	D6446504/20
1/2	1/2	1	3	0.030	4	D6441500/30	D6441502/30	D6441504/30
1/2	1/2	1	4	0.030	4	D6446500/30	D6446502/30	D6446504/30
1/2	1/2	1	3	0.045	4	D6441500/45	D6441502/45	D6441504/45
1/2	1/2	1	4	0.045	4	D6446500/45	D6446502/45	D6446504/45
1/2	1/2	1	3	0.060	4	D6441500/60	D6441502/60	D6441504/60
1/2	1/2	1	4	0.060	4	D6446500/60	D6446502/60	D6446504/60
1/2	1/2	1	3	0.090	4	D6441500/90	D6441502/90	D6441504/90
1/2	1/2	1	4	0.090	4	D6446500/90	D6446502/90	D6446504/90
1/2	1/2	1	3	0.125	4	D6441500/12	D6441502/12	D6441504/12
1/2	1/2	1	4	0.125	4	D6446500/12	D6446502/12	D6446504/12
1/2	1/2	1-1/2	6	0.010	4	D6447500/10	D6447502/10	D6447504/10

Additional Sizes On Pages 99 - 102 & 104 - 106

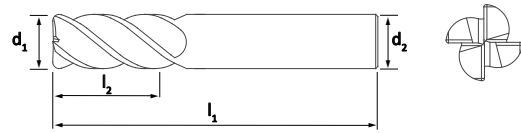
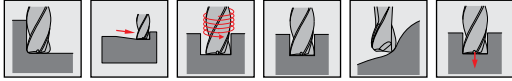
Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●	●	●	●	●	●		●	●	



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/8'' - 1'' = -.0001/-0.0004$
 Cutting Dia: $1/8'' - 1'' = +.000/-0.002$
 Radius: $1/8'' - 1'' = +/-0.001$

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	Uncoated	TiCN	AlTiN
1/2	1/2	1-1/2	6	0.015	4	D6447500/15	D6447502/15	D6447504/15
1/2	1/2	1-1/2	6	0.020	4	D6447500/20	D6447502/20	D6447504/20
1/2	1/2	1-1/2	6	0.030	4	D6447500/30	D6447502/30	D6447504/30
1/2	1/2	1-1/2	6	0.045	4	D6447500/45	D6447502/45	D6447504/45
1/2	1/2	1-1/2	6	0.060	4	D6447500/60	D6447502/60	D6447504/60
1/2	1/2	1-1/2	6	0.090	4	D6447500/90	D6447502/90	D6447504/90
1/2	1/2	1-1/2	6	0.125	4	D6447500/12	D6447502/12	D6447504/12
1/2	1/2	2	4	0.010	4	D6443500/10	D6443502/10	D6443504/10
1/2	1/2	2	4	0.015	4	D6443500/15	D6443502/15	D6443504/15
1/2	1/2	2	4	0.020	4	D6443500/20	D6443502/20	D6443504/20
1/2	1/2	2	4	0.030	4	D6443500/30	D6443502/30	D6443504/30
1/2	1/2	2	4	0.045	4	D6443500/45	D6443502/45	D6443504/45
1/2	1/2	2	4	0.060	4	D6443500/60	D6443502/60	D6443504/60
1/2	1/2	2	4	0.090	4	D6443500/90	D6443502/90	D6443504/90
1/2	1/2	2	4	0.125	4	D6443500/12	D6443502/12	D6443504/12
1/2	1/2	3	6	0.010	4	D6444500/10	D6444502/10	D6444504/10
1/2	1/2	3	6	0.015	4	D6444500/15	D6444502/15	D6444504/15
1/2	1/2	3	6	0.020	4	D6444500/20	D6444502/20	D6444504/20
1/2	1/2	3	6	0.030	4	D6444500/30	D6444502/30	D6444504/30
1/2	1/2	3	6	0.045	4	D6444500/45	D6444502/45	D6444504/45
1/2	1/2	3	6	0.060	4	D6444500/60	D6444502/60	D6444504/60
1/2	1/2	3	6	0.090	4	D6444500/90	D6444502/90	D6444504/90
1/2	1/2	3	6	0.125	4	D6444500/12	D6444502/12	D6444504/12
5/8	5/8	1-1/4	3-1/2	0.010	4	D6441620/10	D6441622/10	D6441624/10
5/8	5/8	1-1/4	3-1/2	0.015	4	D6441620/15	D6441622/15	D6441624/15
5/8	5/8	1-1/4	3-1/2	0.020	4	D6441620/20	D6441622/20	D6441624/20
5/8	5/8	1-1/4	3-1/2	0.030	4	D6441620/30	D6441622/30	D6441624/30
5/8	5/8	1-1/4	3-1/2	0.045	4	D6441620/45	D6441622/45	D6441624/45
5/8	5/8	1-1/4	3-1/2	0.060	4	D6441620/60	D6441622/60	D6441624/60
5/8	5/8	1-1/4	3-1/2	0.090	4	D6441620/90	D6441622/90	D6441624/90
5/8	5/8	1-1/4	3-1/2	0.125	4	D6441620/12	D6441622/12	D6441624/12
5/8	5/8	2	6	0.010	4	D6446620/10	D6446622/10	D6446624/10
5/8	5/8	2	6	0.015	4	D6446620/15	D6446622/15	D6446624/15
5/8	5/8	2	6	0.020	4	D6446620/20	D6446622/20	D6446624/20
5/8	5/8	2	6	0.030	4	D6446620/30	D6446622/30	D6446624/30
5/8	5/8	2	6	0.045	4	D6446620/45	D6446622/45	D6446624/45
5/8	5/8	2	6	0.060	4	D6446620/60	D6446622/60	D6446624/60
5/8	5/8	2	6	0.090	4	D6446620/90	D6446622/90	D6446624/90
5/8	5/8	2	6	0.125	4	D6446620/12	D6446622/12	D6446624/12
5/8	5/8	2-1/8	4-5/8	0.010	4	D6443620/10	D6443622/10	D6443624/10
5/8	5/8	2-1/8	4-5/8	0.015	4	D6443620/15	D6443622/15	D6443624/15
5/8	5/8	2-1/8	4-5/8	0.020	4	D6443620/20	D6443622/20	D6443624/20

Additional Sizes On Pages 99 - 103 & 105 - 106

Feeds & Speeds Available on Page 115

Application Range:

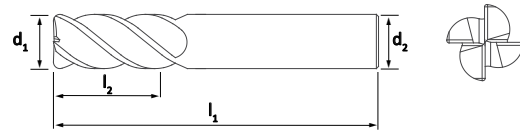
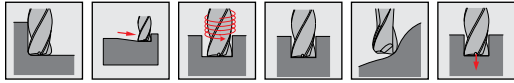
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•	•	•	•	•	•		•	•	

Series D644CR

4 Flute Universal Corner Radius



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/8'' - 1'' = -.0001/-0.0004$
 Cutting Dia: $1/8'' - 1'' = +.000/-0.002$
 Radius: $1/8'' - 1'' = +/-0.001$

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	Uncoated	TiCN	AlTiN
5/8	5/8	2-1/8	4-5/8	0.030	4	D6443620/30	D6443622/30	D6443624/30
5/8	5/8	2-1/8	4-5/8	0.045	4	D6443620/45	D6443622/45	D6443624/45
5/8	5/8	2-1/8	4-5/8	0.060	4	D6443620/60	D6443622/60	D6443624/60
5/8	5/8	2-1/8	4-5/8	0.090	4	D6443620/90	D6443622/90	D6443624/90
5/8	5/8	2-1/8	4-5/8	0.125	4	D6443620/12	D6443622/12	D6443624/12
5/8	5/8	3	6	0.010	4	D6444620/10	D6444622/10	D6444624/10
5/8	5/8	3	6	0.015	4	D6444620/15	D6444622/15	D6444624/15
5/8	5/8	3	6	0.020	4	D6444620/20	D6444622/20	D6444624/20
5/8	5/8	3	6	0.030	4	D6444620/30	D6444622/30	D6444624/30
5/8	5/8	3	6	0.045	4	D6444620/45	D6444622/45	D6444624/45
5/8	5/8	3	6	0.060	4	D6444620/60	D6444622/60	D6444624/60
5/8	5/8	3	6	0.090	4	D6444620/90	D6444622/90	D6444624/90
5/8	5/8	3	6	0.125	4	D6444620/12	D6444622/12	D6444624/12
3/4	3/4	1-1/2	4	0.010	4	D6441750/10	D6441752/10	D6441754/10
3/4	3/4	1-1/2	4	0.015	4	D6441750/15	D6441752/15	D6441754/15
3/4	3/4	1-1/2	4	0.020	4	D6441750/20	D6441752/20	D6441754/20
3/4	3/4	1-1/2	4	0.030	4	D6441750/30	D6441752/30	D6441754/30
3/4	3/4	1-1/2	4	0.045	4	D6441750/45	D6441752/45	D6441754/45
3/4	3/4	1-1/2	4	0.060	4	D6441750/60	D6441752/60	D6441754/60
3/4	3/4	1-1/2	4	0.090	4	D6441750/90	D6441752/90	D6441754/90
3/4	3/4	1-1/2	4	0.125	4	D6441750/12	D6441752/12	D6441754/12
3/4	3/4	2	6	0.010	4	D6446750/10	D6446752/10	D6446754/10
3/4	3/4	2	6	0.015	4	D6446750/15	D6446752/15	D6446754/15
3/4	3/4	2	6	0.020	4	D6446750/20	D6446752/20	D6446754/20
3/4	3/4	2	6	0.030	4	D6446750/30	D6446752/30	D6446754/30
3/4	3/4	2	6	0.045	4	D6446750/45	D6446752/45	D6446754/45
3/4	3/4	2	6	0.060	4	D6446750/60	D6446752/60	D6446754/60
3/4	3/4	2	6	0.090	4	D6446750/90	D6446752/90	D6446754/90
3/4	3/4	2	6	0.125	4	D6446750/12	D6446752/12	D6446754/12
3/4	3/4	2-1/4	5	0.010	4	D6443750/10	D6443752/10	D6443754/10
3/4	3/4	2-1/4	5	0.015	4	D6443750/15	D6443752/15	D6443754/15
3/4	3/4	2-1/4	5	0.020	4	D6443750/20	D6443752/20	D6443754/20
3/4	3/4	2-1/4	5	0.030	4	D6443750/30	D6443752/30	D6443754/30
3/4	3/4	2-1/4	5	0.045	4	D6443750/45	D6443752/45	D6443754/45
3/4	3/4	2-1/4	5	0.060	4	D6443750/60	D6443752/60	D6443754/60
3/4	3/4	2-1/4	5	0.090	4	D6443750/90	D6443752/90	D6443754/90
3/4	3/4	2-1/4	5	0.125	4	D6443750/12	D6443752/12	D6443754/12
3/4	3/4	3	6	0.010	4	D6444750/10	D6444752/10	D6444754/10
3/4	3/4	3	6	0.015	4	D6444750/15	D6444752/15	D6444754/15
3/4	3/4	3	6	0.020	4	D6444750/20	D6444752/20	D6444754/20
3/4	3/4	3	6	0.030	4	D6444750/30	D6444752/30	D6444754/30
3/4	3/4	3	6	0.045	4	D6444750/45	D6444752/45	D6444754/45

Additional Sizes On Pages 99 - 104 & 106

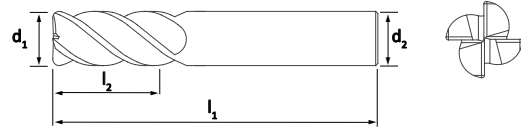
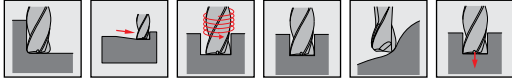
Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●	●	●	●	●	●		●	●	



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: 1/8" - 1" = -.0001/-0.0004
 Cutting Dia: 1/8" - 1" = +.000/-0.002
 Radius: 1/8" - 1" = +/-0.001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	R Radius	Flutes	Uncoated	TiCN	AlTiN
3/4	3/4	3	6	0.060	4	D6444750/60	D6444752/60	D6444754/60
3/4	3/4	3	6	0.090	4	D6444750/90	D6444752/90	D6444754/90
3/4	3/4	3	6	0.125	4	D6444750/12	D6444752/12	D6444754/12
1	1	1-3/4	4	0.010	4	D6441100/10	D6441102/10	D6441104/10
1	1	1-3/4	4	0.015	4	D6441100/15	D6441102/15	D6441104/15
1	1	1-3/4	4	0.020	4	D6441100/20	D6441102/20	D6441104/20
1	1	1-3/4	4	0.030	4	D6441100/30	D6441102/30	D6441104/30
1	1	1-3/4	4	0.045	4	D6441100/45	D6441102/45	D6441104/45
1	1	1-3/4	4	0.060	4	D6441100/60	D6441102/60	D6441104/60
1	1	1-3/4	4	0.090	4	D6441100/90	D6441102/90	D6441104/90
1	1	1-3/4	4	0.125	4	D6441100/12	D6441102/12	D6441104/12
1	1	2	6	0.010	4	D6446100/10	D6446102/10	D6446104/10
1	1	2	6	0.015	4	D6446100/15	D6446102/15	D6446104/15
1	1	2	6	0.020	4	D6446100/20	D6446102/20	D6446104/20
1	1	2	6	0.030	4	D6446100/30	D6446102/30	D6446104/30
1	1	2	6	0.045	4	D6446100/45	D6446102/45	D6446104/45
1	1	2	6	0.060	4	D6446100/60	D6446102/60	D6446104/60
1	1	2	6	0.090	4	D6446100/90	D6446102/90	D6446104/90
1	1	2	6	0.125	4	D6446100/12	D6446102/12	D6446104/12
1	1	2-1/4	5	0.010	4	D6443100/10	D6443102/10	D6443104/10
1	1	2-1/4	5	0.015	4	D6443100/15	D6443102/15	D6443104/15
1	1	2-1/4	5	0.020	4	D6443100/20	D6443102/20	D6443104/20
1	1	2-1/4	5	0.030	4	D6443100/30	D6443102/30	D6443104/30
1	1	2-1/4	5	0.045	4	D6443100/45	D6443102/45	D6443104/45
1	1	2-1/4	5	0.060	4	D6443100/60	D6443102/60	D6443104/60
1	1	2-1/4	5	0.090	4	D6443100/90	D6443102/90	D6443104/90
1	1	2-1/4	5	0.125	4	D6443100/12	D6443102/12	D6443104/12
1	1	3	6	0.010	4	D6444100/10	D6444102/10	D6444104/10
1	1	3	6	0.015	4	D6444100/15	D6444102/15	D6444104/15
1	1	3	6	0.020	4	D6444100/20	D6444102/20	D6444104/20
1	1	3	6	0.030	4	D6444100/30	D6444102/30	D6444104/30
1	1	3	6	0.045	4	D6444100/45	D6444102/45	D6444104/45
1	1	3	6	0.060	4	D6444100/60	D6444102/60	D6444104/60
1	1	3	6	0.090	4	D6444100/90	D6444102/90	D6444104/90
1	1	3	6	0.125	4	D6444100/12	D6444102/12	D6444104/12

Additional Sizes On Pages 99 - 105

Feeds & Speeds Available on Page 115

Application Range:

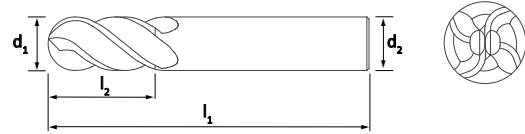
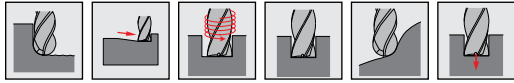
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●	●	●	●	●	●		●	●	

Series D664

4 Flute Universal Ball



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances

Shank: $1/32'' - 1'' = -.0001/- .0004$
 Cutting Dia: $1/32'' - 7/64'' = +/- .0005$
 Cutting Dia: $1/8'' - 1'' = +.000/- .002$
 Ball: $1/32'' - 1'' = +/- .001$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	Flutes	Uncoated	TiCN	AlTiN
1/32	1/8	3/32	1-1/2	4	D6641030	D6641032	D6641034
3/64	1/8	9/64	1-1/2	4	D6641040	D6641042	D6641044
1/16	1/8	1/8	1-1/2	4	D6642060	D6642062	D6642064
1/16	1/8	3/16	1-1/2	4	D6641060	D6641062	D6641064
5/64	1/8	1/4	1-1/2	4	D6641070	D6641072	D6641074
3/32	1/8	3/16	1-1/2	4	D6642090	D6642092	D6642094
3/32	1/8	9/32	1-1/2	4	D6641090	D6641092	D6641094
7/64	1/8	3/16	1-1/2	4	D6642190	D6642192	D6642194
7/64	1/8	3/8	1-1/2	4	D6641190	D6641192	D6641194
1/8	1/8	1/4	1-1/2	4	D6642120	D6642122	D6642124
1/8	1/8	1/2	1-1/2	4	D6641120	D6641122	D6641124
1/8	1/8	3/4	2-1/4	4	D6643120	D6643122	D6643124
1/8	1/8	3/4	3	4	D6646120	D6646122	D6646124
1/8	1/8	1	3	4	D6644120	D6644122	D6644124
9/64	3/16	3/8	2	4	D6642140	D6642142	D6642144
9/64	3/16	1/2	2	4	D6641140	D6641142	D6641144
5/32	3/16	3/8	2	4	D6642150	D6642152	D6642154
5/32	3/16	1/2	2	4	D6641150	D6641152	D6641154
11/64	3/16	3/8	2	4	D6642170	D6642172	D6642174
11/64	3/16	5/8	2	4	D6641170	D6641172	D6641174
3/16	3/16	3/8	2	4	D6642180	D6642182	D6642184
3/16	3/16	5/8	2	4	D6641180	D6641182	D6641184
3/16	3/16	3/4	2-1/2	4	D6643180	D6643182	D6643184
3/16	3/16	1	4	4	D6646180	D6646182	D6646184
3/16	3/16	1-1/8	3	4	D6644180	D6644182	D6644184
13/64	1/4	3/8	2	4	D6642200	D6642202	D6642204
13/64	1/4	5/8	2-1/2	4	D6641200	D6641202	D6641204
7/32	1/4	3/8	2	4	D6642210	D6642212	D6642214
7/32	1/4	5/8	2-1/2	4	D6641210	D6641212	D6641214
15/64	1/4	3/8	2	4	D6642230	D6642232	D6642234
15/64	1/4	3/4	2-1/2	4	D6641230	D6641232	D6641234
1/4	1/4	3/8	2	4	D6642250	D6642252	D6642254
1/4	1/4	3/4	2-1/2	4	D6641250	D6641252	D6641254
1/4	1/4	1	4	4	D6646250	D6646252	D6646254
1/4	1/4	1-1/8	3	4	D6643250	D6643252	D6643254
1/4	1/4	1-1/2	4	4	D6644250	D6644252	D6644254
1/4	1/4	1-1/2	6	4	D6647250	D6647252	D6647254
17/64	5/16	1/2	2	4	D6642260	D6642262	D6642264
17/64	5/16	3/4	2-1/2	4	D6641260	D6641262	D6641264
9/32	5/16	1/2	2	4	D6642280	D6642282	D6642284
9/32	5/16	3/4	2-1/2	4	D6641280	D6641282	D6641284
19/64	5/16	1/2	2	4	D6642290	D6642292	D6642294

Additional Sizes On Pages 108 - 109

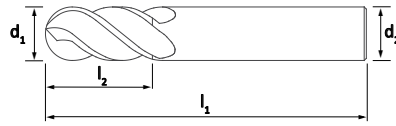
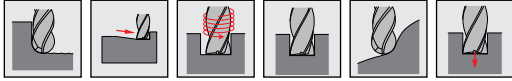
Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•	•	•	•	•	•		•	•	



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances

Shank: 1/32" - 1" = -.0001/-0.0004
 Cutting Dia: 1/32" - 7/64" = +/- .0005
 Cutting Dia: 1/8" - 1" = +.000/-0.002
 Ball: 1/32" - 1" = +/- .001

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
19/64	5/16	3/4	2-1/2	4	D6641290	D6641292	D6641294
5/16	5/16	1/2	2	4	D6642310	D6642312	D6642314
5/16	5/16	3/4	2-1/2	4	D6641310	D6641312	D6641314
5/16	5/16	1	4	4	D6646310	D6646312	D6646314
5/16	5/16	1-1/8	3	4	D6643310	D6643312	D6643314
5/16	5/16	1-1/2	6	4	D6647310	D6647312	D6647314
5/16	5/16	1-5/8	4	4	D6644310	D6644312	D6644314
21/64	3/8	5/8	2	4	D6642320	D6642322	D6642324
21/64	3/8	7/8	2-1/2	4	D6641320	D6641322	D6641324
11/32	3/8	5/8	2	4	D6642340	D6642342	D6642344
11/32	3/8	7/8	2-1/2	4	D6641340	D6641342	D6641344
23/64	3/8	5/8	2	4	D6642350	D6642352	D6642354
23/64	3/8	7/8	2-1/2	4	D6641350	D6641352	D6641354
3/8	3/8	5/8	2	4	D6642370	D6642372	D6642374
3/8	3/8	7/8	2-1/2	4	D6641370	D6641372	D6641374
3/8	3/8	1	4	4	D6646370	D6646372	D6646374
3/8	3/8	1-1/8	3	4	D6643370	D6643372	D6643374
3/8	3/8	1-1/2	6	4	D6647370	D6647372	D6647374
3/8	3/8	1-3/4	4	4	D6644370	D6644372	D6644374
3/8	3/8	3	6	4	D6648370	D6648372	D6648374
25/64	7/16	5/8	2	4	D6642390	D6642392	D6642394
25/64	7/16	1	2-3/4	4	D6641390	D6641392	D6641394
13/32	7/16	5/8	2	4	D6642400	D6642402	D6642404
13/32	7/16	1	2-3/4	4	D6641400	D6641402	D6641404
27/64	7/16	5/8	2	4	D6642420	D6642422	D6642424
27/64	7/16	1	2-3/4	4	D6641420	D6641422	D6641424
7/16	7/16	5/8	2	4	D6642430	D6642432	D6642434
7/16	7/16	1	2-3/4	4	D6641430	D6641432	D6641434
7/16	7/16	1	4	4	D6646430	D6646432	D6646434
7/16	7/16	1-1/2	6	4	D6647430	D6647432	D6647434
7/16	7/16	2	4	4	D6643430	D6643432	D6643434
7/16	7/16	3	6	4	D6644430	D6644432	D6644434
29/64	1/2	5/8	2-1/2	4	D6642450	D6642452	D6642454
29/64	1/2	1	3	4	D6641450	D6641452	D6641454
15/32	1/2	5/8	2-1/2	4	D6642460	D6642462	D6642464
15/32	1/2	1	3	4	D6641460	D6641462	D6641464
31/64	1/2	5/8	2-1/2	4	D6642480	D6642482	D6642484
31/64	1/2	1	3	4	D6641480	D6641482	D6641484
1/2	1/2	5/8	2-1/2	4	D6642500	D6642502	D6642504
1/2	1/2	1	3	4	D6641500	D6641502	D6641504
1/2	1/2	1	4	4	D6646500	D6646502	D6646504
1/2	1/2	1-1/2	6	4	D6647500	D6647502	D6647504

Additional Sizes On Pages 107 & 109

Feeds & Speeds Available on Page 115

Application Range:

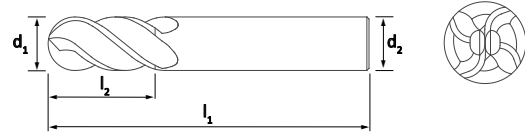
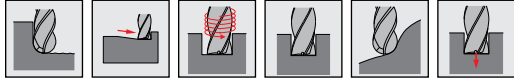
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•	•	•	•	•	•		•	•	

Series D664

4 Flute Universal Ball



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/32'' - 1'' = -.0001/- .0004$
 Cutting Dia: $1/32'' - 7/64'' = +/- .0005$
 Cutting Dia: $1/8'' - 1'' = +.000/- .002$
 Ball: $1/32'' - 1'' = +/- .001$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	Flutes	Uncoated	TiCN	AlTiN
1/2	1/2	2	4	4	D6643500	D6643502	D6643504
1/2	1/2	3	6	4	D6644500	D6644502	D6644504
9/16	9/16	7/8	3	4	D6642560	D6642562	D6642564
9/16	9/16	1-1/4	3-1/2	4	D6641560	D6641562	D6641564
9/16	9/16	2	6	4	D6646560	D6646562	D6646564
9/16	9/16	3	6	4	D6644560	D6644562	D6644564
5/8	5/8	7/8	3	4	D6642620	D6642622	D6642624
5/8	5/8	1-1/4	3-1/2	4	D6641620	D6641622	D6641624
5/8	5/8	2	6	4	D6646620	D6646622	D6646624
5/8	5/8	2-1/8	4-5/8	4	D6643620	D6643622	D6643624
5/8	5/8	3	6	4	D6644620	D6644622	D6644624
11/16	3/4	1	3	4	D6642680	D6642682	D6642684
11/16	3/4	1-1/2	4	4	D6641680	D6641682	D6641684
3/4	3/4	1	3	4	D6642750	D6642752	D6642754
3/4	3/4	1-1/2	4	4	D6641750	D6641752	D6641754
3/4	3/4	2	6	4	D6646750	D6646752	D6646754
3/4	3/4	2-1/4	5	4	D6643750	D6643752	D6643754
3/4	3/4	3	6	4	D6644750	D6644752	D6644754
7/8	7/8	1-3/4	4	4	D6641870	D6641872	D6641874
1	1	1-3/4	4	4	D6641100	D6641102	D6641104
1	1	2	6	4	D6646100	D6646102	D6646104
1	1	2-1/4	5	4	D6643100	D6643102	D6643104
1	1	3	6	4	D6644100	D6644102	D6644104

Additional Sizes On Pages 107 & 108

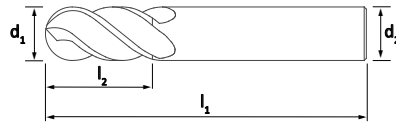
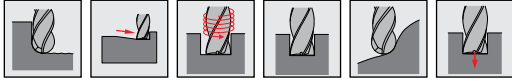
Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•	•	•	•	•	•		•	•	



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



Tolerances

Shank: 1mm - 25mm = $-.0025/-0.102$
 Cutting Dia: 1mm - 2.5mm = $+/-0.0127$
 Cutting Dia: 3mm - 25mm = $+0.000/-0.0508$
 Ball: 1mm - 25mm = $+/-0.0254$

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
1.0mm	3.0mm	2.0mm	38.0mm	4	D66420390	D66420392	D66420394
1.0mm	3.0mm	4.0mm	38.0mm	4	D66410390	D66410392	D66410394
1.5mm	3.0mm	3.0mm	38.0mm	4	D66420590	D66420592	D66420594
1.5mm	3.0mm	6.0mm	38.0mm	4	D66410590	D66410592	D66410594
2.0mm	3.0mm	4.0mm	38.0mm	4	D66420780	D66420782	D66420784
2.0mm	3.0mm	8.0mm	38.0mm	4	D66410780	D66410782	D66410784
2.5mm	3.0mm	5.0mm	38.0mm	4	D66420980	D66420982	D66420984
2.5mm	3.0mm	9.5mm	38.0mm	4	D66410980	D66410982	D66410984
3.0mm	3.0mm	6.0mm	38.0mm	4	D66421180	D66421182	D66421184
3.0mm	3.0mm	12.0mm	38.0mm	4	D66411180	D66411182	D66411184
3.5mm	4.0mm	7.0mm	50.0mm	4	D66421370	D66421372	D66421374
3.5mm	4.0mm	12.0mm	50.0mm	4	D66411370	D66411372	D66411374
4.0mm	4.0mm	8.0mm	50.0mm	4	D66421570	D66421572	D66421574
4.0mm	4.0mm	14.0mm	50.0mm	4	D66411570	D66411572	D66411574
4.5mm	6.0mm	9.5mm	63.0mm	4	D66421770	D66421772	D66421774
4.5mm	6.0mm	16.0mm	63.0mm	4	D66411770	D66411772	D66411774
5.0mm	6.0mm	10.0mm	63.0mm	4	D66421960	D66421962	D66421964
5.0mm	6.0mm	16.0mm	63.0mm	4	D66411960	D66411962	D66411964
6.0mm	6.0mm	12.0mm	63.0mm	4	D66422360	D66422362	D66422364
6.0mm	6.0mm	19.0mm	63.0mm	4	D66412360	D66412362	D66412364
7.0mm	8.0mm	12.0mm	63.0mm	4	D66422750	D66422752	D66422754
7.0mm	8.0mm	19.0mm	63.0mm	4	D66412750	D66412752	D66412754
8.0mm	8.0mm	12.0mm	63.0mm	4	D66423150	D66423152	D66423154
8.0mm	8.0mm	20.0mm	63.0mm	4	D66413150	D66413152	D66413154
9.0mm	10.0mm	14.0mm	70.0mm	4	D66423540	D66423542	D66423544
9.0mm	10.0mm	25.0mm	70.0mm	4	D66413540	D66413542	D66413544
10.0mm	10.0mm	14.0mm	70.0mm	4	D66423930	D66423932	D66423934
10.0mm	10.0mm	25.0mm	70.0mm	4	D66413930	D66413932	D66413934
11.0mm	12.0mm	14.0mm	76.0mm	4	D66424330	D66424332	D66424334
11.0mm	12.0mm	25.0mm	76.0mm	4	D66414330	D66414332	D66414334
12.0mm	12.0mm	16.0mm	76.0mm	4	D66424720	D66424722	D66424724
12.0mm	12.0mm	25.0mm	76.0mm	4	D66414720	D66414722	D66414724
14.0mm	14.0mm	32.0mm	89.0mm	4	D66415510	D66415512	D66415514
16.0mm	16.0mm	32.0mm	89.0mm	4	D66416290	D66416292	D66416294
18.0mm	18.0mm	38.0mm	100.0mm	4	D66417080	D66417082	D66417084
20.0mm	20.0mm	38.0mm	100.0mm	4	D66417870	D66417872	D66417874
25.0mm	25.0mm	38.0mm	100.0mm	4	D66419840	D66419842	D66419844

Feeds & Speeds Available on Page 115

Application Range:

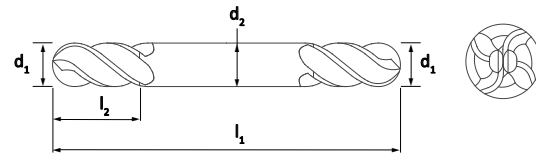
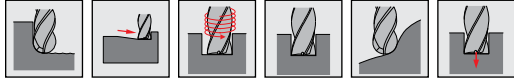
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●	●	●	●	●	●		●	●	

Series D864

4 Flute Universal Ball



$\lambda_s = 40^\circ$ $\gamma_s = 8^\circ$



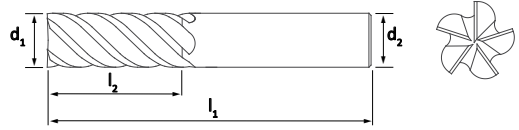
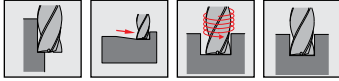
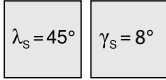
Tolerances
 Shank: $1/32'' - 1/2'' = -.0001/- .0004$
 Cutting Dia: $1/32'' - 7/64'' = +/- .0005$
 Cutting Dia: $1/8'' - 1/2'' = +.000/- .002$
 Ball: $1/32'' - 1/2'' = +/- .001$

d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	Flutes	Uncoated	TiCN	AlTiN
1/32	1/8	1/16	1-1/2	4	D8642030	D8642032	D8642034
3/64	1/8	3/32	1-1/2	4	D8642040	D8642042	D8642044
1/16	1/8	1/8	1-1/2	4	D8642060	D8642062	D8642064
5/64	1/8	5/32	1-1/2	4	D8642070	D8642072	D8642074
3/32	1/8	3/16	1-1/2	4	D8642090	D8642092	D8642094
7/64	1/8	3/16	1-1/2	4	D8642190	D8642192	D8642194
1/8	1/8	1/4	1-1/2	4	D8642120	D8642122	D8642124
1/8	3/8	3/8	3	4	D8641120	D8641122	D8641124
9/64	3/16	5/16	2	4	D8642140	D8642142	D8642144
5/32	3/16	5/16	2	4	D8642150	D8642152	D8642154
5/32	3/8	7/16	3	4	D8641150	D8641152	D8641154
11/64	3/16	5/16	2	4	D8642170	D8642172	D8642174
3/16	3/16	3/8	2	4	D8642180	D8642182	D8642184
3/16	3/8	1/2	3	4	D8641180	D8641182	D8641184
13/64	1/4	1/2	2-1/2	4	D8642200	D8642202	D8642204
7/32	1/4	7/16	2-1/2	4	D8642210	D8642212	D8642214
15/64	1/4	1/2	2-1/2	4	D8642230	D8642232	D8642234
1/4	1/4	1/2	2-1/2	4	D8642250	D8642252	D8642254
1/4	3/8	5/8	3	4	D8641250	D8641252	D8641254
9/32	5/16	1/2	2-1/2	4	D8642280	D8642282	D8642284
5/16	5/16	1/2	2-1/2	4	D8642310	D8642312	D8642314
5/16	3/8	3/4	3-1/2	4	D8641310	D8641312	D8641314
3/8	3/8	1/2	2-1/2	4	D8642370	D8642372	D8642374
3/8	3/8	3/4	3-1/2	4	D8641370	D8641372	D8641374
7/16	7/16	9/16	2-3/4	4	D8642430	D8642432	D8642434
1/2	1/2	5/8	3	4	D8642500	D8642502	D8642504
1/2	1/2	1	4	4	D8641500	D8641502	D8641504

Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•	•	•	•	•	•		•	•	



Tolerances
 Shank: 1/8" - 1" = -.0001/- .0004
 Cutting Dia: 1/8" - 1" = +.000/- .002

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	AlTiN
1/8	1/8	1/4	1-1/2	5	D6452120	D6452124
1/8	1/8	1/2	1-1/2	5	D6451120	D6451124
5/32	3/16	5/16	2	5	D6452150	D6452154
5/32	3/16	9/16	2	5	D6451150	D6451154
3/16	3/16	5/16	2	5	D6452180	D6452184
3/16	3/16	9/16	2	5	D6451180	D6451184
7/32	1/4	3/8	2	5	D6452210	D6452214
7/32	1/4	3/4	2-1/2	5	D6451210	D6451214
1/4	1/4	3/8	2	5	D6452250	D6452254
1/4	1/4	3/4	2-1/2	5	D6451250	D6451254
1/4	1/4	1-1/4	4	5	D6454250	D6454254
9/32	5/16	7/16	2	5	D6452280	D6452284
9/32	5/16	13/16	2-1/2	5	D6451280	D6451284
5/16	5/16	7/16	2	5	D6452310	D6452314
5/16	5/16	13/16	2-1/2	5	D6451310	D6451314
11/32	3/8	1/2	2	5	D6452340	D6452344
11/32	3/8	1	2-1/2	5	D6451340	D6451344
3/8	3/8	1/2	2	5	D6452370	D6452374
3/8	3/8	1	2-1/2	5	D6451370	D6451374
3/8	3/8	1-1/2	4	5	D6454370	D6454374
13/32	7/16	1	2-3/4	5	D6451400	D6451404
7/16	7/16	1	2-3/4	5	D6451430	D6451434
15/32	1/2	1-1/4	3	5	D6451460	D6451464
1/2	1/2	5/8	2-1/2	5	D6452500	D6452504
1/2	1/2	1-1/4	3	5	D6451500	D6451504
1/2	1/2	2	4	5	D6453500	D6453504
9/16	9/16	1-1/2	3-1/2	5	D6451560	D6451564
5/8	5/8	3/4	3	5	D6452620	D6452624
5/8	5/8	1-5/8	3-1/2	5	D6451620	D6451624
5/8	5/8	2-1/2	5	5	D6453620	D6453624
3/4	3/4	1	3	5	D6452750	D6452754
3/4	3/4	1-5/8	4	5	D6451750	D6451754
3/4	3/4	3-1/4	6	5	D6454750	D6454754
7/8	7/8	2	4	5	D6451870	D6451874
1	1	1-1/4	3	5	D6452100	D6452104
1	1	2	4	5	D6451100	D6451104
1	1	3-1/4	6	5	D6454100	D6454104

Feeds & Speeds Available on Page 115

Application Range:

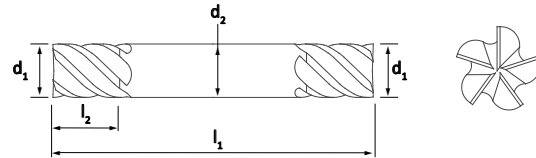
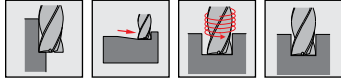
Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
●	●	●	●	●	●	●				

Series D845 5 Flute Universal

DESIGN-RITE XL



$\lambda_s = 45^\circ$ $\gamma_s = 8^\circ$



Tolerances
 Shank: $1/8'' - 1/2'' = -.0001/- .0004$
 Cutting Dia: $1/8'' - 1/2'' = +.000/- .002$

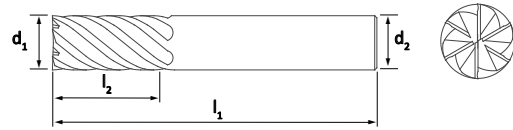
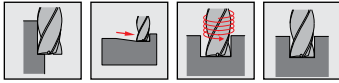
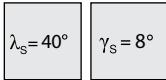
d_1 Dia	d_2 Shank	l_2 LOC	l_1 OAL	Flutes	Uncoated	TiCN	AlTiN
1/8	1/8	1/4	1-1/2	5	D8452120	D8452122	D8452124
3/16	3/16	5/16	2	5	D8452180	D8452182	D8452184
1/4	1/4	3/8	2-1/2	5	D8452250	D8452252	D8452254
5/16	5/16	7/16	2-1/2	5	D8452310	D8452312	D8452314
3/8	3/8	1/2	2-1/2	5	D8452370	D8452372	D8452374
7/16	7/16	9/16	2-3/4	5	D8452430	D8452432	D8452434
1/2	1/2	5/8	3	5	D8452500	D8452502	D8452504

Feeds & Speeds Available on Page 115

DESIGN-RITE XL

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•	•	•	•	•	•				



Tolerances
 Shank: 3/16" - 1" = -.0001/-0.0004
 Cutting Dia: 3/16" - 1" = +.000/-0.002

d ₁ Dia	d ₂ Shank	l ₂ LOC	l ₁ OAL	Flutes	Uncoated	TiCN	AlTiN
3/16	3/16	5/8	2	6	D6461180	D6461182	D6461184
1/4	1/4	3/4	2-1/2	6	D6461250	D6461252	D6461254
1/4	1/4	1-1/8	3	6	D6463250	D6463252	D6463254
5/16	5/16	7/8	2-1/2	6	D6461310	D6461312	D6461314
3/8	3/8	7/8	2-1/2	6	D6461370	D6461372	D6461374
3/8	3/8	1-1/8	3	6	D6463370	D6463372	D6463374
7/16	7/16	1	2-3/4	6	D6461430	D6461432	D6461434
1/2	1/2	1	3	6	D6461500	D6461502	D6461504
1/2	1/2	2	4	6	D6463500	D6463502	D6463504
5/8	5/8	1-1/4	3-1/2	6	D6461620	D6461622	D6461624
5/8	5/8	2-1/8	4-5/8	6	D6463620	D6463622	D6463624
3/4	3/4	1-1/2	4	6	D6461750	D6461752	D6461754
3/4	3/4	2-1/4	5	6	D6463750	D6463752	D6463754
1	1	1-3/4	4	6	D6461100	D6461102	D6461104
1	1	2-1/4	5	6	D6463100	D6463102	D6463104

Feeds & Speeds Available on Page 115

Application Range:

Steel	Tool Steel	Hardened Steel	Stainless Steel	Titanium	High Temp Alloys	Cast Iron	Aluminum	Aluminum High Silicone	Copper, Brass	Plastic, Composites
•	•	•	•	•	•	•				

MATERIAL	SPEED (S.M.F.)	END MILL DIAMETER		
		UP TO 1/4"	UP TO 1/2"	UP TO 1"
FEED PER TOOTH (INCHES)				
Aluminum/Aluminum Alloys	600-1200	.0002-.0020	.0020-.0040	.0060-.0100
Brass/Bronze	200-350	.0005-.0020	.0020-.0030	.0040-.0080
Copper/Copper Alloys	350-900	.0005-.0020	.0020	.0020-.0060
Iron-Cast (soft)	200-500	.0005-.0020	.0020-.0030	.0030-.0080
Iron-Cast (hard)	80-350	.0003-.0008	.0008-.0020	.0020-.0040
Iron-Ductile	80-400	.0002-.0010	.0010-.0020	.0020-.0060
Iron-Malleable	200-600	.0002-.0010	.0010-.0030	.0030-.0070
Magnesium/Magnesium Alloys	800-1400	.0005-.0020	.0020-.0060	.0040-.0100
Monel/High Nickel Steel	150-300	.0002-.0010	.0010-.0020	.0020-.0040
Plastics	600-1200	.0006-.0030	.0030-.0060	.0060-.0150
Plastic-Glass Filled	300-800	.0006-.0030	.0030-.0040	.0040-.0120
Refractory Alloys	80-400	.0002-.0010	.0010	.0010-.0020
Steel-Low Carbon	200-500	.0002-.0010	.0010-.0030	.0030-.0070
Steel-Medium Carbon	100-250	.0004-.0015	.0015-.0020	.0020-.0050
Steel-Hardened	25-120	.0002-.0005	.0005-.0010	.0010-.0030
Steel-Mold	200-350	.0002-.0010	.0010-.0020	.0020-.0060
Steel-Tool	100-300	.0002-.0010	.0010-.0020	.0020-.0060

ALL DESIGN-RITE END MILLS ARE CENTER CUTTING

- Lower Radial Width of Cut – Higher range of recommended surface speeds should be used
- Greater Radial Width of Cut – Lower range of recommended surface speeds should be used
- For Slotting Applications – Speeds should be reduced by approximately 20% of lowest range value
- For Peripheral Applications – Axial depth of cut not to exceed 1-1/2 times the cutter diameter
 - Long & X-Long End Mills – Reduce feed per tooth by 50%
 - TiCN & AlTiN Coating – Increase S.F.M. by 25% to 40%

S.F.M./R.P.M. CONVERSION CHART															
DIAMETER															
S.F.M.	1/16	3/32	1/8	5/32	3/16	7/32	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1
50	3,050	2,040	1,530	1,220	1,020	875	765	610	510	440	380	310	250	220	190
75	4,580	3,060	2,290	1,830	1,530	1,310	1,150	920	760	660	570	460	380	330	285
100	6,100	4,080	3,050	2,450	2,040	1,750	1,530	1,220	1,020	870	760	610	510	440	385
125	7,630	5,100	3,820	3,050	2,550	2,180	1,920	1,530	1,270	1,100	950	770	630	550	475
150	9,150	6,120	4,570	3,670	3,060	2,620	2,290	1,830	1,530	1,310	1,140	920	760	660	575
175	10,680	7,140	5,350	4,270	3,570	3,060	2,680	2,140	1,780	1,540	1,330	1,080	880	770	665
200	12,200	8,150	6,100	4,900	4,070	3,500	3,100	2,450	2,000	1,750	1,500	1,200	1,000	875	750
300	18,500	12,200	9,200	7,300	6,100	5,250	4,600	3,700	3,100	2,600	2,300	1,800	1,500	1,300	1,100
400	24,500	16,300	12,200	9,800	8,150	7,000	6,100	4,900	4,100	3,500	3,050	2,450	2,050	1,750	1,525
500	30,500	20,400	15,300	12,200	10,200	8,700	7,600	6,100	5,100	4,400	3,800	3,100	2,500	2,200	1,900
750	45,800	36,700	22,900	18,300	15,300	13,100	11,500	9,200	7,600	6,550	5,700	4,600	3,800	3,770	2,850
1,000	-	40,800	30,600	24,500	20,400	17,500	15,300	12,200	10,200	8,750	7,650	6,100	5,100	4,400	3,800
1,500	-	-	45,900	36,700	30,600	26,200	22,900	18,300	15,300	13,150	11,300	9,200	7,600	6,500	5,700
2,000	-	-	-	49,000	40,800	35,000	30,600	24,400	20,400	17,500	15,300	12,200	10,200	8,700	7,600
3,000	-	-	-	-	-	52,500	45,900	36,600	30,600	26,250	22,900	18,300	15,300	13,100	11,400
4,000	-	-	-	-	-	-	-	48,800	40,800	35,000	30,600	24,400	20,400	17,500	15,200
5,000	-	-	-	-	-	-	-	-	-	43,700	38,200	30,600	25,500	21,800	19,000



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