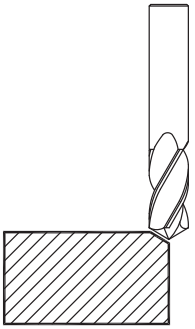
Speeds and Feeds for Drill Mills

Fractional

* Chamfering *

Type	Rc Hardness	SFM (Vc)		CHIPLOAD PER FLUTE (Fz)				
		154M, 154MA 152M, 152MA	1600 152D, 152DA	3/32" - 1/8"	1/8" - 1/4"	1/4" - 3/8"	3/8" - 1/2"	1/2" - 3/4"
COBALT BASE ALLOYS								
Powdered Metal, Stellite, Hs-21, Haynes 25/188, X-40, L-605	< 35 > 35	175 - 225 125 - 175	150 - 200 100 - 150	.0003" - .0008" .0002" - .0004"	.0005" - .0010" .0003" - .0005"	.0008" - .0020" .0005" - .0015"	.0010" - .0030" .0010" - .0020"	.0020" - .0040" .0010" - .0030"
NICKEL BASE ALLOYS								
Invar, Kovar, Inconel-625/718, Waspalloy, Rene, Hastalloy, A286	< 35 > 35	125 - 175 70 - 115	100 - 150 70 - 100	.0003" - .0008" .0002" - .0004"	.0005" - .0010" .0003" - .0005"	.0008" - .0020" .0005" - .0015"	.0010" - .0030" .0010" - .0020"	.0020" - .0040" .0010" - .0030"
TITANIUM ALLOYS								
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-2SN-4Zr-2Mo-Si		200 - 300	125 - 250	.0005" - .0010"	.0007" - .0015"	.0010" - .0025"	.0015" - .0040"	.0030" - .0050"
5553 / Beta Titanium		175 - 225	150 - 200	.0003" - .0008"	.0005" - .0010"	.0008" - .0020"	.0010" - .0030"	.0020" - .0040"
STAINLESS STEELS								
13/8, 15/5, 17-4, pH Types	< 35 > 35	150 - 250 125 - 175	100 - 150 80 - 150	.0003" - .0008" .0002" - .0004"	.0005" - .0010" .0003" - .0005"	.0008" - .0020" .0005" - .0015"	.0010" - .0030" .0010" - .0020"	.0020" - .0040" .0010" - .0030"
Inox, 200 Series, 300 Series	< 35 > 35	200 - 250 150 - 200	125 - 175 100 - 150	.0003" - .0008" .0002" - .0004"	.0005" - .0010" .0003" - .0005"	.0008" - .0020" .0005" - .0015"	.0010" - .0030" .0010" - .0020"	.0020" - .0040" .0010" - .0030"
304L, 316L, Nitronic 50, Inox	< 35 > 35	90 - 125 75 - 110	80 - 120 60 - 90	.0003" - .0006" .0002" - .0004"	.0005" - .0008" .0003" - .0005"	.0008" - .0015" .0005" - .0010"	.0010" - .0020" .0010" - .0015"	.0020" - .0040" .0010" - .0030"
400 Series	< 35 > 35	150 - 250 125 - 175	100 - 150 80 - 150	.0003" - .0008" .0002" - .0004"	.0005" - .0010" .0003" - .0005"	.0008" - .0020" .0005" - .0015"	.0010" - .0030" .0010" - .0020"	.0020" - .0040" .0010" - .0030"
HIGH STRENGTH TOOL STEELS								
4140, 4340, 6150, 5210, A2, D2, P20, H11, H13, S2, O1	< 30	150 - 225	125 - 175	.0003" - .0008"	.0005" - .0010"	.0008" - .0020"	.0010" - .0030"	.0020" - .0040"
	30 - 38	90 - 125	80 - 120	.0002" - .0004"	.0003" - .0005"	.0005" - .0015"	.0010" - .0020"	.0010" - .0030"
	> 38	60 - 90	40 - 70	.0002" - .0003"	.0002" - .0004"	.0003" - .0006"	.0005" - .0010"	.0006" - .0020"
TOOL STEELS								
200, 250, 300, 8620, A36, 12L14, 1018, 1020	< 35 > 35	175 - 250 100 - 175	150 - 200 100 - 150	.0005" - .0010" .0003" - .0008"	.0007" - .0015" .0005" - .0010"	.0010" - .0025" .0008" - .0020"	.0015" - .0040" .0010" - .0030"	.0030" - .0050" .0020" - .0040"
CAST MATERIAL								
Steel, Iron		250 - 350	175 - 250	.0007" - .0015"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0030" - .0060"
Aluminum		250 - 350	250 - 350	.0007" - .0015"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0030" - .0060"
ALUMINUM								
Aircraft Grade (6061, 7075)		350 - 500	300 - 400	.0007" - .0015"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0030" - .0060"
COPPER								
Copper Alloys		250 - 350	150 - 300	.0005" - .0010"	.0007" - .0015"	.0010" - .0025"	.0015" - .0035"	.0020" - .0050"
BRASS, BRONZE								
Brass, Aluminum/Bronze, Low Silicon Bronze		250 - 350	150 - 300	.0005" - .0010"	.0007" - .0015"	.0010" - .0025"	.0015" - .0035"	.0020" - .0050"
COMPOSITE MATERIAL								
Glass Epoxy, Fiberglass, Plastics		250 - 450	200 - 400	.0007" - .0015"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0030" - .0060"
Graphite, G10, Carbon Fiber		300 - 500	250 - 450	.0007" - .0015"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0030" - .0060"



Chamfering a corner

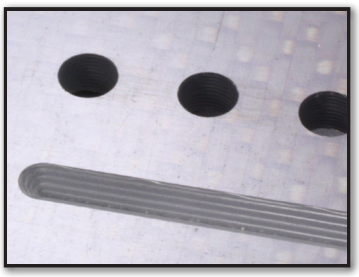
DRILL MILL USES:

Chamfering - for all metals, use general milling speeds and feeds. Depending on depth, use diameter at top of part to determine chipload. For example, if using 1/4" diameter, 90° point and depth is 1/8", calculate the chipload based on 1/8" diameter.

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

* Chamfering *

Type	Rc Hardness	SFM (Vc)		CHIPLOAD PER FLUTE (Fz)				
		154M, 154MA 152M, 152MA	1600 152D, 152DA	2.0 - 3.0	3.0 - 6.0	6.0 - 10.0	10.0 - 14.0	14.0 - 20.0
COBALT BASE ALLOYS								
Powdered Metal, Stellite, Hs-21, Haynes 25/188, X-4. L-605	< 35 > 35	50 - 70 35 - 50	45 - 60 30 - 45	.008 - .020 .003 - .010	.010 - .025 .005 - .015	.020 - .050 .010 - .035	.025 - .075 .025 - .050	.050 - .100 .025 - .075
NICKEL BASE ALLOYS								
Invar, Kovar, Inconel-625/718, Waspalloy, Rene, Hastalloy, A286	< 35 > 35	35 - 50 20 - 35	30 - 45 15 - 25	.006 - .020 .003 - .010	.010 - .025 .005 - .015	.020 - .050 .010 - .035	.025 - .075 .025 - .050	.050 - .100 .025 - .075
TITANIUM ALLOYS								
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-2SN-4Zr-2Mo-Si		60 - 90	35 - 75	.008 - .025	.015 - .035	.025 - .065	.035 - .100	.075 - .125
5553 / Beta Titanium		50 - 65	45 - 60	.006 - .020	.010 - .025	.020 - .050	.025 - .075	.050 - .100
STAINLESS STEELS								
13/8, 15/5, 17-4, pH Types	< 35 > 35	45 - 75 35 - 50	30 - 45 25 - 45	.006 - .020 .003 - .010	.010 - .025 .005 - .015	.020 - .050 .010 - .035	.025 - .075 .025 - .050	.050 - .100 .025 - .075
Inox, 200 Series, 300 Series	< 35 > 35	60 - 80 45 - 60	40 - 55 30 - 45	.008 - .020 .003 - .010	.010 - .025 .005 - .015	.020 - .050 .010 - .035	.025 - .075 .025 - .050	.050 - .100 .025 - .075
304L, 316L, Nitronic 50, Inox	< 35 > 35	25 - 40 20 - 35	25 - 35 15 - 25	.006 - .015 .003 - .010	.010 - .020 .005 - .015	.020 - .035 .010 - .025	.025 - .050 .025 - .035	.035 - .075 .025 - .050
400 Series	< 35 > 35	45 - 70 35 - 50	30 - 45 25 - 40	.006 - .020 .003 - .010	.010 - .025 .005 - .015	.020 - .050 .010 - .035	.025 - .075 .025 - .050	.050 - .100 .025 - .075
HIGH STRENGTH TOOL STEELS								
4140, 4340, 6150, 5210, A2, D2, P20, H11, H13, S2, O1	< 30	45 - 60	35 - 50	.006 - .020	.010 - .025	.020 - .050	.025 - .075	.050 - .100
	30 - 38	30 - 45	25 - 35	.003 - .010	.005 - .015	.010 - .035	.025 - .050	.025 - .075
	> 38	15 - 30	10 - 25	.002 - .006	.003 - .008	.005 - .020	.015 - .040	.020 - .065
TOOL STEELS								
200, 250, 300, 8620, A36, 12L14, 1018, 1020	< 35 > 35	55 - 75 35 - 55	45 - 60 30 - 45	.008 - .025 .006 - .020	.015 - .035 .010 - .025	.025 - .065 .020 - .050	.035 - .100 .025 - .075	.075 - .125 .050 - .100
CAST MATERIAL								
Steel, Iron		75 - 105	50 - 75	.010 - .035	.025 - .050	.035 - .100	.050 - .150	.075 - .250
Aluminum		75 - 105	75 - 105	.010 - .035	.025 - .050	.035 - .100	.050 - .150	.075 - .250
ALUMINUM								
Aircraft Grade (6061, 7075)		90 - 150	90 - 150	.010 - .035	.025 - .050	.035 - .100	.050 - .150	.075 - .250
COPPER								
Copper Alloys		75 - 115	60 - 90	.008 - .025	.020 - .040	.025 - .065	.040 - .090	.050 - .200
BRASS, BRONZE								
Brass, Aluminum/Bronze, Low Silicon Bronze		75 - 115	60 - 90	.008 - .025	.020 - .040	.025 - .065	.040 - .090	.050 - .200
COMPOSITE MATERIAL								
Glass Epoxy, Fiberglass, Plastics		60 - 120	60 - 120	.010 - .035	.025 - .050	.035 - .100	.050 - .150	.075 - .250
Graphite, G10, Carbon Fiber		90 - 150	75 - 135	.010 - .035	.025 - .050	.035 - .100	.050 - .150	.075 - .250



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

Speeds and Feeds for Drill Mills

Fractional

* Through Hole *

Type	Rc Hardness	SFM (Vc)		CHIPLOAD PER FLUTE (Fz)			
		152M, 152MA 154M, 154MA	152D, 152DA	1/8" - 1/4"	1/4" - 3/8"	3/8" - 1/2"	1/2" - 3/4"
TITANIUM ALLOYS							
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25N-4Zr-2Mo-Si		-	125 - 250	.0007" - .0015"	.0010" - .0025"	.0015" - .0040"	.0030" - .0050"
STAINLESS STEELS							
13/8, 15/5, 17-4, pH Types	< 35 > 35	- -	100 - 150 80 - 150	.0005" - .0010" .0003" - .0005"	.0008" - .0020" .0005" - .0015"	.0010" - .0030" .0010" - .0020"	.0020" - .0040" .0010" - .0030"
HIGH STRENGTH TOOL STEELS							
4140, 4340, 6150, 5210, A2, D2, P20, H11, H13, S2, O1	< 30 30 - 38	-	125 - 175 80 - 120	.0005" - .0010" .0003" - .0005"	.0008" - .0020" .0005" - .0015"	.0010" - .0030" .0010" - .0020"	.0020" - .0040" .0010" - .0030"
MEDIUM ALLOY TOOL STEELS							
200, 250, 300, 8620	< 35 > 35	- -	150 - 200 100 - 150	.0007" - .0015" .0005" - .0010"	.0010" - .0025" .0008" - .0020"	.0015" - .0040" .0010" - .0030"	.0030" - .0050" .0020" - .0040"
CARBON STEELS							
A36, 12L14, 1000's, 1100's, 1300's	< 35 > 35	175 - 250 -	150 - 200 100 - 150	.0007" - .0015" .0005" - .0010"	.0010" - .0025" .0008" - .0020"	.0015" - .0040" .0010" - .0030"	.0030" - .0050" .0020" - .0040"
CAST MATERIAL							
Steel		-	175 - 250	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0030" - .0060"
Ductile Iron		-	175 - 250	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0030" - .0060"
Gray Iron		-	175 - 250	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0030" - .0060"
Aluminum		250 - 350	250 - 350	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0030" - .0060"
ALUMINUM							
Aircraft Grade (6061, 7075)		350 - 500	300 - 400	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0030" - .0060"
MAGNESIUM							
		250 - 400	250 - 350	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0030" - .0060"
COPPER							
Copper Alloys		250 - 350	150 - 300	.0007" - .0015"	.0010" - .0025"	.0015" - .0035"	.0020" - .0050"
BRASS, BRONZE							
Brass, Aluminum/Bronze, Low Silicon Bronze		250 - 350	150 - 300	.0007" - .0015"	.0010" - .0025"	.0015" - .0035"	.0020" - .0050"
COMPOSITE MATERIAL							
Glass Epoxy, Fiberglass, Plastics		250 - 450	200 - 400	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0030" - .0060"
Graphite, G10, Carbon Fiber		300 - 500	250 - 450	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0030" - .0060"

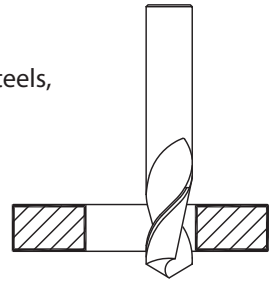
NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

* Through Hole *

Type	Rc Hardness	SFM (Vc)		CHIPLOAD PER FLUTE (Fz)			
		152M, 152MA 154M, 154MA	152D, 152DA	3.0 - 6.0	6.0 - 10.0	10.0 - 14.0	14.0 - 20.0
TITANIUM ALLOYS							
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-2SN-4Zr-2Mo-Si		-	35 - 75	.015 - .035	.025 - .065	.035 - .100	.075 - .125
STAINLESS STEELS							
13/8, 15/5, 17-4, pH Types	< 35 > 35	- -	30 - 45 25 - 45	.010 - .025 .005 - .015	.020 - .050 .010 - .035	.025 - .075 .025 - .050	.050 - .100 .025 - .075
HIGH STRENGTH TOOL STEELS							
4140, 4340, 6150, 5210, A2, D2, P20, H11, H13, S2, O1	< 30 30 - 38	- -	35 - 50 25 - 35	.010 - .025 .005 - .015	.020 - .050 .010 - .035	.025 - .075 .025 - .050	.050 - .100 .025 - .075
MEDIUM ALLOY TOOL STEELS							
200, 250, 300, 8620	< 35 > 35	- -	45 - 60 30 - 45	.015 - .035 .010 - .025	.025 - .065 .020 - .050	.035 - .100 .025 - .075	.075 - .125 .050 - .100
CARBON STEELS							
A36, 12L14, 1000's, 1100's, 1300's	< 35 > 35	55 - 75 -	45 - 60 30 - 45	.015 - .035 .010 - .025	.025 - .065 .020 - .050	.035 - .100 .025 - .075	.075 - .125 .050 - .100
CAST MATERIAL							
Steel		-	50 - 75	.025 - .050	.035 - .075	.050 - .100	.075 - .150
Ductile Iron		-	60 - 90	.025 - .050	.035 - .075	.050 - .100	.075 - .150
Gray Iron		-	50 - 75	.025 - .050	.035 - .075	.050 - .100	.075 - .150
Aluminum		75 - 105	75 - 105	.025 - .050	.035 - .075	.050 - .100	.075 - .150
ALUMINUM							
Aircraft Grade (6061, 7075)		90 - 150	90 - 150	.025 - .050	.035 - .075	.050 - .100	.075 - .150
MAGNESIUM							
		90 - 135	75 - 105	.020 - .040	.025 - .065	.040 - .090	.050 - .125
COPPER							
Copper Alloys		75 - 115	60 - 90	.020 - .040	.025 - .065	.040 - .090	.050 - .125
BRASS, BRONZE							
Brass, Aluminum/Bronze, Low Silicon Bronze		75 - 115	60 - 90	.020 - .040	.025 - .065	.040 - .090	.050 - .125
COMPOSITE MATERIAL							
Glass Epoxy, Fiberglass, Plastics		60 - 120	60 - 120	.025 - .050	.035 - .075	.050 - .100	.075 - .150
Graphite, G10, Carbon Fiber		90 - 150	75 - 135	.025 - .050	.035 - .075	.050 - .100	.075 - .150

DRILL MILL USES:

Through Hole - mostly for composites, plastics, softer steels, copper, aluminum and similar metals.



Drilling through, then side milling

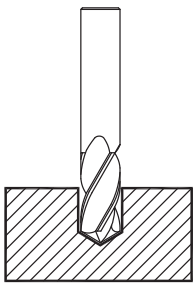
NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

Speeds and Feeds for Drill Mills

Fractional

* Solids *

Type	Rc Hardness	SFM (Vc)	CHIPLOAD PER FLUTE (Fz)			
		152M, 152MA 154M, 154MA	1/8" - 1/4"	1/4" - 3/8"	3/8" - 1/2"	1/2" - 3/4"
STAINLESS STEELS						
13/8, 15/5, 17-4, pH Types	< 35	125 - 175	.0003" - .0008"	.0005" - .0010"	.0008" - .0020"	.0010" - .0030"
400 Series	< 35	125 - 175	.0003" - .0008"	.0005" - .0010"	.0008" - .0020"	.0010" - .0030"
HIGH STRENGTH TOOL STEELS						
4140, 4340, 6150, 5210, A2, D2, P20, H11, H13, S2, O1	< 30 30 - 38	125 - 200 90 - 125	.0003" - .0008" .0002" - .0004"	.0005" - .0010" .0003" - .0005"	.0008" - .0020" .0005" - .0015"	.0010" - .0030" .0010" - .0020"
MEDIUM ALLOY TOOL STEELS						
200, 250, 300	< 35	150 - 225	.0005" - .0010"	.0007" - .0015"	.0010" - .0025"	.0015" - .0040"
CARBON STEELS						
A36, 1000's, 1100's, 1300's	< 35	150 - 250	.0005" - .0010"	.0007" - .0015"	.0010" - .0025"	.0015" - .0040"
CAST MATERIAL						
Steel		150 - 250	.0007" - .0015"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"
Aluminum		200 - 350	.0007" - .0015"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"
ALUMINUM						
Aircraft Grade (6061, 7075)		250 - 400	.0007" - .0015"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"
MAGNESIUM						
		250 - 400	.0007" - .0015"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"
COPPER						
Copper Alloys		250 - 350	.0005" - .0010"	.0007" - .0015"	.0010" - .0025"	.0015" - .0035"
BRASS, BRONZE						
Brass, Aluminum/Bronze, Low Silicon Bronze		250 - 350	.0005" - .0010"	.0007" - .0015"	.0010" - .0025"	.0015" - .0035"
COMPOSITE MATERIAL						
Glass Epoxy, Fiberglass, Plastics		250 - 450	.0007" - .0015"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"
Graphite, G10, Carbon Fiber		300 - 500	.0007" - .0015"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"



Slotting

DRILL MILL USES:

Solids - primarily for use in composites and plastics.

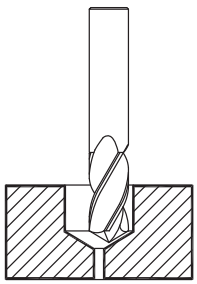
NOTE - ABOVE ARE STARTING PARAMETERS ONLY. HIGHER RESULTS MAY BE ACHIEVED WITH OPTIMUM CONDITIONS.

Speeds and Feeds for Drill Mills

Metric

* Solids *

Type	Rc Hardness	SFM (Vc)	CHIPLOAD PER FLUTE (Fz)			
		152M, 152MA 154M, 154MA	3.0 - 6.0	6.0 - 10.0	10.0 - 14.0	14.0 - 20.0
STAINLESS STEELS						
13/8, 15/5, 17-4, pH Types	< 35	45 - 75	.006 - .020	.010 - .025	.020 - .050	.025 - .075
400 Series	< 35	45 - 75	.006 - .020	.010 - .025	.020 - .050	.025 - .075
HIGH STRENGTH TOOL STEELS						
4140, 4340, 6150, 5210, A2, D2, P20, H11, H13, S2, O1	< 30 30 - 38	45 - 60 30 - 45	.006 - .020 .003 - .010	.010 - .025 .005 - .015	.020 - .050 .010 - .035	.025 - .075 .025 - .050
MEDIUM ALLOY TOOL STEELS						
200, 250, 300	< 35	55 - 75	.008 - .025	.015 - .035	.025 - .065	.035 - .100
CARBON STEELS						
A36, 1000's, 1100's, 1300's	< 35	55 - 75	.008 - .025	.015 - .035	.025 - .065	.035 - .100
CAST MATERIAL						
Steel		75 - 105	.010 - .035	.025 - .050	.035 - .075	.050 - .100
Aluminum		75 - 105	.010 - .035	.020 - .050	.035 - .075	.050 - .100
ALUMINUM						
Aircraft Grade (6061, 7075)		90 - 150	.010 - .035	.025 - .050	.035 - .075	.050 - .100
MAGNESIUM						
		90 - 135	.008 - .025	.020 - .040	.025 - .065	.040 - .090
COPPER						
Copper Alloys		75 - 115	.008 - .025	.020 - .040	.025 - .065	.040 - .090
BRASS, BRONZE						
Brass, Aluminum/Bronze, Low Silicon Bronze		75 - 115	.008 - .025	.020 - .040	.025 - .065	.040 - .090
COMPOSITE MATERIAL						
Glass Epoxy, Fiberglass, Plastics		60 - 120	.010 - .035	.025 - .050	.035 - .075	.050 - .100
Graphite, G10, Carbon Fiber		90 - 150	.010 - .035	.025 - .050	.035 - .075	.050 - .100



Milling pre-drilled through hole to size

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