

# GARR TOOL Drilling Guide

## Fractional

TECHNICAL

Type	Rc Hardness	RECOMMENDED SFM BY SERIES						
		1100, 1120	4000	1200, 1205, 1520, 1600, 1400	1500, 1510, 1300	1700	1700K	1800H
<b>COBALT BASE ALLOYS</b>								
Powdered Metal, Stellite, Hs-21, Haynes 25/188, X-40, L-605	< 35 > 35	80 - 120 -	80 - 120 -	100 - 150 80 - 110	100 - 150 80 - 110	- -	- -	- -
<b>NICKEL BASE ALLOYS</b>								
Invar, Kovar, Inconel-625/718, Waspalloy, Rene, Hastalloy, A286	< 35 > 35	100 - 125 -	100 - 125 -	100 - 150 90 - 125	125 - 175 90 - 125	- -	- -	- -
<b>IRON BASE ALLOYS</b>								
Incoloy 800-802, Multimet N-155, Timkin 16-25-6, Carpenter 22-b3	< 35 > 35	100 - 125 -	100 - 125 -	100 - 150 90 - 125	125 - 175 90 - 150	- -	- -	- -
<b>MONEL</b>								
Monel - 65% Nickel		-	-	100 - 150	100 - 150	-	-	-
<b>TITANIUM ALLOYS</b>								
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25N-4Zr-2Mo-Si		125 - 175	125 - 175	150 - 200	150 - 200	-	-	-
<b>STAINLESS STEELS</b>								
(Precipitation) 13/8, 15/5, 17-4, pH Types	< 35 > 35	- -	125 - 150 -	125 - 175 80 - 125	150 - 200 100 - 150	- -	- -	- -
(Austenitic) Inox, 200 Series, 300 Series	< 35 > 35	- -	125 - 150 -	100 - 175 100 - 125	150 - 200 125 - 150	- -	- -	- -
(Austenitic) 304L, 316L, Nitronic 50, Inox	< 35 > 35	- -	100 - 125 -	80 - 100 60 - 90	90 - 125 80 - 100	- -	- -	- -
(Martensitic) 400 Series	< 35 > 35	- -	125 - 150 -	100 - 150 80 - 125	125 - 175 100 - 140	- -	- -	- -
<b>HIGH STRENGTH TOOL STEELS</b>								
4140, 4340, 6150, 5210, A2, D2, P20, H11, H13, S2, O1	< 35 35 - 50	- -	125 - 150 -	100 - 175 80 - 130	125 - 175 80 - 130	- -	- -	- -
Thompson Shaft, Armor Plate (Class 1)	> 50	-	-	-	70 - 90	-	-	-
<b>MEDIUM ALLOY TOOL STEELS</b>								
200, 250, 300, 8620	< 35 > 35	- -	125 - 150 -	125 - 175 100 - 150	125 - 175 100 - 150	- -	- -	- -
<b>CARBON STEELS</b>								
Platinum, A36, 12L14, 1000's, 1100's, 1300's	< 35 > 35	- -	125 - 150 -	125 - 175 100 - 125	150 - 200 100 - 175	- -	- -	- -
<b>CAST MATERIAL</b>								
Steel		150 - 200	150 - 200	125 - 175	-	100 - 150	125 - 225	-
Ductile Iron		200 - 400	200 - 300	125 - 200	150 - 250	100 - 175	150 - 300	-
Gray Iron		175 - 300	150 - 250	100 - 200	150 - 250	150 - 250	150 - 300	-
Aluminum		200 - 400	175 - 300	150 - 250	-	175 - 300	200 - 350	250 - 400
<b>ALUMINUM</b>								
Aircraft Grade (6061, 7075)		-	200	250 - 350	-	-	-	250 - 400
<b>MAGNESIUM</b>								
		-	200	200 - 300	-	-	-	200 - 400
<b>COPPER</b>								
Copper Alloys		-	200	150 - 250	-	-	-	-
<b>BRASS, BRONZE</b>								
Brass, Aluminum/Bronze, Low Silicon Bronze		-	-	150 - 300 125 - 200	-	-	-	200 - 400 200 - 400
<b>COMPOSITE MATERIAL</b>								
Glass Epoxy, Fiberglass, Plastics, Graphite, G10		200	200	150 - 300	150 - 300	-	-	-

**INCREASE SFM 20%-40% FOR HARDLUBE COATING**

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

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## Fractional

Type	Rc Hardness	CHIPLOAD PER FLUTE (Fz)				
		1/16" - 1/8"	1/8" - 1/4"	1/4" - 3/8"	3/8" - 1/2"	1/2" - 5/8"
<b>COBALT BASE ALLOYS</b>						
Powdered Metal, Stellite, Hs-21, Haynes 25/188, X-40, L-605	< 35	.0004" - .0010"	.0008" - .0020"	.0015" - .0025"	.0020" - .0040"	.0025" - .0050"
	> 35	.0004" - .0010"	.0005" - .0010"	.0010" - .0015"	.0010" - .0020"	.0015" - .0030"
<b>NICKEL BASE ALLOYS</b>						
Invar, Kovar, Inconel-625/718, Waspalloy, Rene, Hastalloy, A286	< 35	.0005" - .0015"	.0010" - .0015"	.0015" - .0025"	.0020" - .0040"	.0025" - .0050"
	> 35	.0004" - .0010"	.0008" - .0015"	.0010" - .0015"	.0015" - .0030"	.0020" - .0040"
<b>IRON BASE ALLOYS</b>						
Incoloy 800-802, Multimet N-155, Timkin 16-25-6, Carpenter 22-b3	< 35	.0010" - .0015"	.0010" - .0020"	.0015" - .0035"	.0020" - .0050"	.0030" - .0060"
	> 35	.0008" - .0015"	.0010" - .0020"	.0015" - .0025"	.0020" - .0040"	.0025" - .0050"
<b>MONEL</b>						
Monel - 65% Nickel		.0004" - .0010"	.0008" - .0015"	.0010" - .0015"	.0015" - .0030"	.0020" - .0040"
<b>TITANIUM ALLOYS</b>						
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25N-4Zr-2Mo-Si		.0008" - .0015"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0025" - .0050"
<b>STAINLESS STEELS</b>						
(Precipitation) 13/8, 15/5, 17-4, pH Types	< 35	.0005" - .0015"	.0010" - .0020"	.0015" - .0035"	.0020" - .0040"	.0025" - .0050"
	> 35	.0004" - .0010"	.0008" - .0015"	.0010" - .0015"	.0015" - .0030"	.0020" - .0040"
(Austenitic) Inox, 200 Series, 300 Series	< 35	.0005" - .0015"	.0010" - .0020"	.0015" - .0035"	.0020" - .0040"	.0025" - .0050"
	> 35	.0004" - .0010"	.0008" - .0015"	.0010" - .0015"	.0015" - .0030"	.0020" - .0040"
(Austenitic) 304L, 316L, Nitronic 50, Inox	< 35	.0004" - .0010"	.0008" - .0015"	.0010" - .0015"	.0015" - .0030"	.0020" - .0040"
	> 35	.0003" - .0008"	.0005" - .0010"	.0010" - .0015"	.0010" - .0020"	.0015" - .0030"
(Martensitic) 400 Series	< 35	.0005" - .0015"	.0010" - .0020"	.0015" - .0035"	.0020" - .0040"	.0025" - .0050"
	> 35	.0004" - .0010"	.0008" - .0015"	.0010" - .0015"	.0015" - .0030"	.0020" - .0040"
<b>HIGH STRENGTH TOOL STEELS</b>						
4140, 4340, 6150, 5210, A2, D2, P20, H11, H13, S2, O1	< 35	.0005" - .0015"	.0010" - .0020"	.0015" - .0025"	.0015" - .0030"	.0020" - .0040"
	35 - 50	.0004" - .0010"	.0008" - .0020"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"
Thompson Shaft, Armor Plate (Class 1)	> 50	.0003" - .0006"	.0005" - .0010"	.0008" - .0015"	.0010" - .0020"	.0015" - .0030"
<b>MEDIUM ALLOY TOOL STEELS</b>						
200, 250, 300, 8620	< 35	.0010" - .0015"	.0015" - .0025"	.0020" - .0030"	.0020" - .0040"	.0025" - .0050"
	> 35	.0005" - .0010"	.0010" - .0020"	.0010" - .0025"	.0015" - .0030"	.0020" - .0040"
<b>CARBON STEELS</b>						
Platinum, A36, 12L14, 1000's, 1100's, 1300's	< 35	.0010" - .0015"	.0015" - .0025"	.0020" - .0030"	.0020" - .0040"	.0025" - .0050"
	> 35	.0005" - .0010"	.0010" - .0020"	.0010" - .0025"	.0015" - .0035"	.0020" - .0040"
<b>CAST MATERIAL</b>						
Steel		.0008" - .0015"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0025" - .0050"
Ductile Iron		.0010" - .0020"	.0010" - .0030"	.0015" - .0035"	.0025" - .0040"	.0030" - .0050"
Gray Iron		.0010" - .0020"	.0010" - .0030"	.0015" - .0035"	.0025" - .0040"	.0030" - .0050"
Aluminum		.0010" - .0020"	.0015" - .0040"	.0020" - .0050"	.0030" - .0060"	.0035" - .0070"
<b>ALUMINUM</b>						
Aircraft Grade (6061, 7075)		.0010" - .0020"	.0015" - .0040"	.0020" - .0050"	.0030" - .0060"	.0035" - .0070"
<b>MAGNESIUM</b>						
		.0010" - .0020"	.0010" - .0030"	.0015" - .0035"	.0025" - .0040"	.0030" - .0050"
<b>COPPER</b>						
Copper Alloys		.0010" - .0020"	.0010" - .0030"	.0015" - .0035"	.0025" - .0040"	.0030" - .0050"
<b>BRASS, BRONZE</b>						
Brass, Aluminum/Bronze, Low Silicon Bronze		.0010" - .0020"	.0010" - .0030"	.0015" - .0035"	.0025" - .0040"	.0030" - .0050"
		.0008" - .0015"	.0010" - .0020"	.0015" - .0030"	.0020" - .0040"	.0025" - .0050"
<b>COMPOSITE MATERIAL</b>						
Glass Epoxy, Fiberglass, Plastics, Graphite, G10		.0006" - .0015"	.0008" - .0020"	.0010" - .0025"	.0015" - .0030"	.0020" - .0040"

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

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## Metric

Type	Rc Hardness	RECOMMENDED M/Min. BY SERIES						
		1100, 1120	4000	1200, 1205, 1520, 1600, 1400	1500, 1510, 1300	1700	1700K	1800H
<b>COBALT BASE ALLOYS</b>								
Powdered Metal, Stellite, Hs-21, Haynes 25/188, X-40, L-605	< 35	25 - 40	25 - 40	30 - 45	30 - 45	-	-	-
	> 35	-	-	25 - 35	25 - 35	-	-	-
<b>NICKEL BASE ALLOYS</b>								
Invar, Kovar, Inconel-625/718, Waspalloy, Rene, Hastalloy, A286	< 35	30 - 40	30 - 40	30 - 45	40 - 50	-	-	-
	> 35	-	-	25 - 40	25 - 40	-	-	-
<b>IRON BASE ALLOYS</b>								
Incoloy 800-802, Multimet N-155, Timkin 16-25-6, Carpenter 22-b3	< 35	30 - 40	30 - 40	40 - 50	40 - 50	-	-	-
	> 35	-	-	30 - 40	30 - 45	-	-	-
<b>MONEL</b>								
Monel - 65% Nickel		-	-	30 - 45	30 - 45	-	-	-
<b>TITANIUM ALLOYS</b>								
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25N-4Zr-2Mo-Si		-	40 - 50	45 - 60	45 - 60	-	-	-
<b>STAINLESS STEELS</b>								
(Precipitation) 13/8, 15/5, 17-4, pH Types	< 35	-	40 - 45	40 - 50	45 - 60	-	-	-
	> 35	-	-	25 - 40	30 - 45	-	-	-
(Austenitic) Inox, 200 Series, 300 Series	< 35	-	40 - 45	30 - 50	45 - 60	-	-	-
	> 35	-	-	30 - 40	40 - 45	-	-	-
(Austenitic) 304L, 316L, Nitronic 50, Inox	< 35	-	30 - 40	25 - 30	30 - 40	-	-	-
	> 35	-	-	20 - 30	25 - 30	-	-	-
(Martensitic) 400 Series	< 35	-	40 - 45	30 - 45	40 - 55	-	-	-
	> 35	-	-	25 - 40	30 - 45	-	-	-
<b>HIGH STRENGTH TOOL STEELS</b>								
4140, 4340, 6150, 5210, A2, D2, P20, H11, H13, S2, O1	< 35	-	40 - 45	30 - 55	40 - 55	-	-	-
	35 - 50	-	-	25 - 40	25 - 40	-	-	-
Thompson Shaft, Armor Plate (Class 1)	> 50	-	-	-	20 - 30	-	-	-
<b>MEDIUM ALLOY TOOL STEELS</b>								
200, 250, 300, 8620	< 35	-	40 - 45	40 - 55	40 - 55	-	-	-
	> 35	-	-	30 - 45	30 - 45	-	-	-
<b>CARBON STEELS</b>								
Platinum, A36, 12L14, 1000's, 1100's, 1300's	< 35	-	40 - 45	40 - 55	45 - 60	-	-	-
	> 35	-	-	30 - 40	30 - 55	-	-	-
<b>CAST MATERIAL</b>								
Ductile Iron		60 - 120	60 - 90	40 - 60	45 - 75	40 - 60	50 - 80	-
Gray Iron		50 - 90	45 - 75	30 - 60	45 - 75	40 - 60	50 - 80	-
Aluminum		60 - 120	55 - 90	45 - 70	-	40 - 70	60 - 90	70 - 120
Steel		45 - 60	45 - 60	40 - 55	-	40 - 60	50 - 80	-
<b>ALUMINUM</b>								
Aircraft Grade (6061, 7075)		-	60	75 - 100	-	-	-	70 - 120
<b>MAGNESIUM</b>								
		-	60	60 - 90	-	-	-	60 - 120
<b>COPPER</b>								
Copper Alloys		-	60	45 - 70	-	-	-	-
<b>BRASS, BRONZE</b>								
Brass, Aluminum/Bronze, Low Silicon Bronze		-	-	45 - 90	-	-	-	60 - 120
		-	-	40 - 60	-	-	-	60 - 120
<b>COMPOSITE MATERIAL</b>								
Glass Epoxy, Fiberglass, Plastics, Graphite, G10		60	60	45 - 90	45 - 90	-	-	-

**INCREASE M/Min. 20%-40% FOR HARDLUBE COATING**

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

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## Metric

Type	Rc Hardness	CHIPLOAD PER FLUTE (Fz)				
		2.0 - 3.0	3.0 - 6.0	6.0 - 10.0	10.0 - 13.0	13.0 - 16.0
<b>COBALT BASE ALLOYS</b>						
Powdered Metal, Stellite, Hs-21, Haynes 25/188, X-4, L-605	< 35	.010 - .025	.020 - .050	.040 - .065	.050 - .100	.065 - .125
	> 35	.010 - .025	.013 - .025	.025 - .040	.025 - .050	.040 - .075
<b>NICKEL BASE ALLOYS</b>						
Invar, Kovar, Inconel-625/718, Waspalloy, Rene, Hastalloy, A286	< 35	.013 - .040	.025 - .040	.040 - .065	.050 - .100	.065 - .125
	> 35	.010 - .025	.020 - .040	.025 - .040	.040 - .075	.050 - .100
<b>IRON BASE ALLOYS</b>						
Incoloy 800-802, Multimet N-155, Timkin 16-25-6, Carpenter 22-b3	< 35	.025 - .040	.025 - .050	.040 - .090	.050 - .100	.075 - .150
	> 35	.020 - .040	.025 - .050	.040 - .065	.040 - .075	.065 - .125
<b>MONEL</b>						
Monel - 65% Nickel		.010 - .025	.020 - .040	.025 - .040	.040 - .075	.050 - .100
<b>TITANIUM ALLOYS</b>						
Commercially Pure, 6Al-4V, Astm 1/2/3, 6Al-25N-4Zr-2Mo-Si		.020 - .040	.025 - .050	.040 - .075	.050 - .100	.065 - .125
<b>STAINLESS STEELS</b>						
(Precipitation) 13/8, 15/5, 17-4, pH Types	< 35	.013 - .040	.025 - .050	.040 - .090	.050 - .100	.065 - .125
	> 35	.010 - .025	.020 - .040	.025 - .040	.040 - .075	.050 - .100
(Austenitic) Inox, 200 Series, 300 Series	< 35	.013 - .040	.025 - .050	.040 - .090	.050 - .100	.065 - .125
	> 35	.010 - .025	.020 - .040	.025 - .040	.040 - .075	.050 - .100
(Austenitic) 304L, 316L, Nitronic 50, Inox	< 35	.010 - .025	.020 - .040	.025 - .040	.040 - .075	.050 - .100
	> 35	.008 - .020	.013 - .025	.025 - .040	.025 - .050	.040 - .075
(Martensitic) 400 Series	< 35	.013 - .040	.025 - .050	.040 - .090	.050 - .100	.065 - .125
	> 35	.010 - .025	.020 - .040	.025 - .040	.040 - .075	.050 - .100
<b>HIGH STRENGTH TOOL STEELS</b>						
4140, 4340, 6150, 5210, A2, D2, P20, H11, H13, S2, O1	< 35	.013 - .040	.025 - .050	.040 - .065	.050 - .100	.075 - .125
	35 - 50	.010 - .025	.020 - .050	.025 - .050	.030 - .075	.040 - .100
Thompson Shaft, Armor Plate (Class 1)	> 50	.008 - .020	.010 - .030	.015 - .040	.020 - .060	.030 - .080
<b>MEDIUM ALLOY TOOL STEELS</b>						
200, 250, 300, 8620	< 35	.025 - .040	.040 - .065	.050 - .075	.050 - .100	.065 - .125
	> 35	.013 - .040	.025 - .050	.025 - .065	.040 - .075	.050 - .100
<b>CARBON STEELS</b>						
Platinum, A36, 12L14, 1000's, 1100's, 1300's	< 35	.025 - .040	.040 - .065	.050 - .075	.050 - .100	.065 - .125
	> 35	.013 - .040	.025 - .050	.025 - .065	.040 - .090	.050 - .100
<b>CAST MATERIAL</b>						
Steel		.020 - .040	.025 - .050	.040 - .075	.050 - .100	.065 - .125
Ductile Iron		.025 - .050	.025 - .075	.040 - .090	.065 - .100	.075 - .125
Gray Iron		.025 - .050	.025 - .075	.040 - .090	.065 - .100	.075 - .125
Aluminum		.025 - .050	.025 - .100	.050 - .125	.075 - .150	.090 - .180
<b>ALUMINUM</b>						
Aircraft Grade (6061, 7075)		.025 - .050	.025 - .100	.050 - .125	.075 - .150	.090 - .180
<b>MAGNESIUM</b>						
		.025 - .050	.025 - .075	.040 - .090	.065 - .100	.075 - .125
<b>COPPER</b>						
Copper Alloys		.025 - .050	.025 - .075	.040 - .090	.065 - .100	.075 - .125
<b>BRASS, BRONZE</b>						
Brass, Aluminum/Bronze, Low Silicon Bronze		.025 - .050	.025 - .075	.040 - .090	.065 - .100	.075 - .125
		.020 - .040	.025 - .050	.040 - .075	.050 - .100	.065 - .125
<b>COMPOSITE MATERIAL</b>						
Glass Epoxy, Fiberglass, Plastics, Graphite, G10		.015 - .040	.020 - .050	.025 - .065	.040 - .075	.050 - .100

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