



Recommended Drilling Data | Metric (mm)

ISO	Material	Hardness (BHN)	Speed (M/min)			Feed Rate (mm/rev) by Diameter - 2xD, 3xD**			
			P	K	H	M	N	12.00 - 15.00	15.50 - 18.00
			AM480	AM485	TiCN				
P	Free Machining Steel 1118, 1215, 12L14, etc.	100 - 150	-	122 - 365	-	0.07 - 0.10	0.07 - 0.12	0.08 - 0.14	0.08 - 0.14
		150 - 200	-	122 - 305	-	0.07 - 0.10	0.07 - 0.12	0.08 - 0.14	0.08 - 0.14
		200 - 250	122 - 245	122 - 245	-	0.07 - 0.10	0.07 - 0.12	0.08 - 0.14	0.08 - 0.14
	Low Carbon Steel 1010, 1020, 1025, 1522, 1144, etc.	85 - 125	-	122 - 305	-	0.07 - 0.10	0.07 - 0.12	0.08 - 0.14	0.08 - 0.14
		125 - 175	-	122 - 305	-	0.07 - 0.10	0.07 - 0.12	0.08 - 0.14	0.08 - 0.14
		175 - 225	-	122 - 245	-	0.07 - 0.10	0.07 - 0.12	0.08 - 0.14	0.08 - 0.14
		225 - 275	122 - 245	122 - 245	-	0.07 - 0.10	0.07 - 0.12	0.08 - 0.14	0.08 - 0.14
	Medium Carbon Steel 1030, 1040, 1050, 1527, 1140, 1151, etc.	125 - 175	-	100 - 245	-	0.05 - 0.14	0.07 - 0.17	0.08 - 0.21	0.08 - 0.21
		175 - 225	-	100 - 245	-	0.05 - 0.14	0.07 - 0.17	0.08 - 0.21	0.08 - 0.21
		225 - 275	-	100 - 245	-	0.05 - 0.14	0.07 - 0.17	0.08 - 0.21	0.08 - 0.21
		275 - 325	100 - 245	100 - 183	-	0.05 - 0.14	0.07 - 0.17	0.08 - 0.21	0.08 - 0.21
	Alloy Steel 4140, 5140, 8640, etc.	125 - 175	100 - 245	-	-	0.05 - 0.14	0.07 - 0.17	0.08 - 0.21	0.08 - 0.21
		175 - 225	100 - 245	-	-	0.05 - 0.14	0.07 - 0.17	0.08 - 0.21	0.08 - 0.21
		225 - 275	100 - 245	-	-	0.05 - 0.14	0.07 - 0.17	0.08 - 0.21	0.08 - 0.21
		275 - 325	100 - 245	-	-	0.05 - 0.14	0.07 - 0.17	0.08 - 0.21	0.08 - 0.21
		325 - 375	100 - 245	-	-	0.05 - 0.14	0.07 - 0.17	0.08 - 0.21	0.08 - 0.21
	High Strength Alloy 4340, 4330V, 300M, etc.	225 - 300	100 - 163	-	-	0.05 - 0.14	0.07 - 0.17	0.08 - 0.21	0.08 - 0.21
		300 - 350	101 - 183	-	-	0.05 - 0.14	0.07 - 0.17	0.08 - 0.21	0.08 - 0.21
		350 - 400	101 - 183	-	-	0.05 - 0.14	0.07 - 0.17	0.08 - 0.21	0.08 - 0.21
	Structural Steel A36, A285, A516, etc.	100 - 150	101 - 183	-	-	0.05 - 0.13	0.07 - 0.13	0.08 - 0.13	0.08 - 0.13
150 - 250		101 - 183	-	-	0.05 - 0.13	0.07 - 0.13	0.08 - 0.13	0.08 - 0.13	
250 - 350		101 - 183	-	-	0.05 - 0.13	0.07 - 0.13	0.08 - 0.13	0.08 - 0.13	
Tool Steel H-13, H-21, A-4, O-2, S-3, etc.	150 - 200	83 - 183	-	-	0.05 - 0.08	0.07 - 0.12	0.08 - 0.15	0.08 - 0.15	
	200 - 250	83 - 183	-	-	0.05 - 0.08	0.07 - 0.12	0.08 - 0.15	0.08 - 0.15	
S	High Temp Alloy* Hastelloy B, Inconel 600, etc.	140 - 220	-	31 - 77	-	0.06 - 0.08	0.06 - 0.08	0.07 - 0.10	0.07 - 0.10
		220 - 310	-	31 - 61	-	0.06 - 0.08	0.06 - 0.08	0.07 - 0.10	0.07 - 0.10
	Titanium Alloy*	140 - 220	-	43 - 153	-	0.06 - 0.08	0.06 - 0.08	0.07 - 0.10	0.07 - 0.10
		220 - 310	-	43 - 92	-	0.06 - 0.08	0.06 - 0.08	0.07 - 0.10	0.07 - 0.10
	Aerospace Alloy* S82	185 - 275	-	31 - 77	-	0.06 - 0.08	0.06 - 0.08	0.07 - 0.10	0.07 - 0.10
275 - 350		-	31 - 61	-	0.06 - 0.08	0.06 - 0.08	0.07 - 0.10	0.07 - 0.10	
M	Stainless Steel 400 Series 416, 420, etc.	185 - 275	74 - 183	74 - 214	-	0.05 - 0.10	0.07 - 0.12	0.07 - 0.14	0.07 - 0.14
		275 - 350	74 - 144	74 - 153	-	0.05 - 0.10	0.07 - 0.12	0.07 - 0.14	0.07 - 0.14
	Stainless Steel 300 Series 304, 316, 17-4PH, etc.	135 - 185	74 - 183	74 - 214	-	0.05 - 0.10	0.07 - 0.12	0.07 - 0.14	0.07 - 0.14
		185 - 275	74 - 144	74 - 153	-	0.05 - 0.10	0.07 - 0.12	0.07 - 0.14	0.07 - 0.14
	Super Duplex Stainless Steel	135 - 185	74 - 183	74 - 214	-	0.05 - 0.10	0.07 - 0.12	0.07 - 0.14	0.07 - 0.14
185 - 275		74 - 144	74 - 153	-	0.05 - 0.10	0.07 - 0.12	0.07 - 0.14	0.07 - 0.14	
H	Wear Plate Hardox, AR400, T-1, etc.	400	31 - 61	-	-	0.05 - 0.08	0.07 - 0.12	0.08 - 0.15	0.08 - 0.15
		500	31 - 61	-	-	0.05 - 0.08	0.07 - 0.12	0.08 - 0.15	0.08 - 0.15
		600	31 - 61	-	-	0.05 - 0.08	0.07 - 0.12	0.08 - 0.15	0.08 - 0.15
	Hardened Steel	300 - 400	31 - 92	-	-	0.05 - 0.08	0.07 - 0.12	0.08 - 0.15	0.08 - 0.15
400 - 500		31 - 61	-	-	0.05 - 0.08	0.07 - 0.12	0.08 - 0.15	0.08 - 0.15	
K	Nodular, Grey, Ductile Cast Iron	120 - 150	92 - 244	-	-	0.08 - 0.14	0.08 - 0.19	0.08 - 0.21	0.08 - 0.21
		150 - 200	92 - 244	-	-	0.08 - 0.14	0.08 - 0.19	0.08 - 0.21	0.08 - 0.21
		200 - 220	92 - 153	-	-	0.08 - 0.14	0.08 - 0.19	0.08 - 0.21	0.08 - 0.21
		220 - 260	83 - 122	-	-	0.08 - 0.14	0.08 - 0.19	0.08 - 0.21	0.08 - 0.21
		260 - 320	83 - 122	-	-	0.08 - 0.14	0.08 - 0.19	0.08 - 0.21	0.08 - 0.21
N	Cast Aluminium	30	-	-	244 - 610	0.07 - 0.12	0.08 - 0.14	0.08 - 0.17	0.08 - 0.21
		180	-	-	244 - 610	0.07 - 0.12	0.08 - 0.14	0.08 - 0.17	0.08 - 0.21
	Wrought Aluminium	30	-	-	244 - 610	0.07 - 0.12	0.08 - 0.14	0.08 - 0.17	0.08 - 0.21
		180	-	-	244 - 610	0.07 - 0.12	0.08 - 0.14	0.08 - 0.17	0.08 - 0.21
	Aluminium Bronze	100 - 200	-	-	153 - 305	0.07 - 0.12	0.08 - 0.14	0.08 - 0.17	0.08 - 0.21
		200 - 250	-	-	153 - 305	0.07 - 0.12	0.08 - 0.14	0.08 - 0.17	0.08 - 0.21
	Brass	100	-	-	153 - 305	0.07 - 0.12	0.08 - 0.14	0.08 - 0.17	0.08 - 0.21
Copper	60	-	-	153 - 305	0.07 - 0.12	0.08 - 0.14	0.08 - 0.17	0.08 - 0.21	

\*For high temp materials, 68.95 bar is recommended as well as a quality synthetic coolant at approximately 10% emulsion.

\*\*For 4xD tools, begin at low end of feed recommendation.

**IMPORTANT:** The speeds and feeds listed above are a general starting point for all applications. Refer to the Coolant Recommendation charts for coolant requirements to run at the recommended speeds and feeds. Factory technical assistance is also available through our Application Engineering Team.

Recommended Drilling Data | Imperial (inch)

ISO	Material	Hardness (BHN)	Speed (SFM)			Feed Rate (IPR) by Diameter - 2xD, 3xD**			
			P	K	H	M	N	.432 - .591	.630 - .709
			AM480	AM485	TiCN				
P	Free Machining Steel 1118, 1215, 12L14, etc.	100 - 150	-	400 - 1200	-	.0024 - .0039	.0024 - .0047	.0031 - .0055	.0031 - .0055
		150 - 200	-	400 - 1000	-	.0024 - .0039	.0024 - .0047	.0031 - .0055	.0031 - .0055
		200 - 250	400 - 800	400 - 800	-	.0024 - .0039	.0024 - .0047	.0031 - .0055	.0031 - .0055
	Low Carbon Steel 1010, 1020, 1025, 1522, 1144, etc.	85 - 125	-	400 - 1000	-	.0024 - .0039	.0024 - .0047	.0031 - .0055	.0031 - .0055
		125 - 175	-	400 - 1000	-	.0024 - .0039	.0024 - .0047	.0031 - .0055	.0031 - .0055
		175 - 225	-	400 - 800	-	.0024 - .0039	.0024 - .0047	.0031 - .0055	.0031 - .0055
		225 - 275	400 - 800	400 - 800	-	.0024 - .0039	.0024 - .0047	.0031 - .0055	.0031 - .0055
	Medium Carbon Steel 1030, 1040, 1050, 1527, 1140, 1151, etc.	125 - 175	-	330 - 800	-	.0016 - .0055	.0024 - .0063	.0031 - .008	.0031 - .008
		175 - 225	-	330 - 800	-	.0016 - .0055	.0024 - .0063	.0031 - .008	.0031 - .008
		225 - 275	-	330 - 800	-	.0016 - .0055	.0024 - .0063	.0031 - .008	.0031 - .008
		275 - 325	330 - 600	330 - 600	-	.0016 - .0055	.0024 - .0063	.0031 - .008	.0031 - .008
	Alloy Steel 4140, 5140, 8640, etc.	125 - 175	330 - 800	-	-	.0016 - .0055	.0024 - .0063	.0031 - .008	.0031 - .008
		175 - 225	330 - 800	-	-	.0016 - .0055	.0024 - .0063	.0031 - .008	.0031 - .008
		225 - 275	330 - 800	-	-	.0016 - .0055	.0024 - .0063	.0031 - .008	.0031 - .008
		275 - 325	330 - 800	-	-	.0016 - .0055	.0024 - .0063	.0031 - .008	.0031 - .008
High Strength Alloy 4340, 4330V, 300M, etc.	225 - 300	330 - 600	-	-	.0016 - .0055	.0024 - .0063	.0031 - .008	.0031 - .008	
	300 - 350	330 - 600	-	-	.0016 - .0055	.0024 - .0063	.0031 - .008	.0031 - .008	
	350 - 400	330 - 600	-	-	.0016 - .0055	.0024 - .0063	.0031 - .008	.0031 - .008	
Structural Steel A36, A285, A516, etc.	100 - 150	330 - 600	-	-	.0016 - .005	.0024 - .005	.0031 - .005	.0031 - .005	
	150 - 250	330 - 600	-	-	.0016 - .005	.0024 - .005	.0031 - .005	.0031 - .005	
	250 - 350	330 - 600	-	-	.0016 - .005	.0024 - .005	.0031 - .005	.0031 - .005	
Tool Steel H-13, H-21, A-4, O-2, S-3, etc.	150 - 200	270 - 600	-	-	.0016 - .0031	.0024 - .0047	.0031 - .0059	.0031 - .0059	
	200 - 250	270 - 600	-	-	.0016 - .0031	.0024 - .0047	.0031 - .0059	.0031 - .0059	
S	High Temp Alloy* Hastelloy B, Inconel 600, etc.	140 - 220	-	100 - 250	-	.0020 - .0031	.0020 - .0031	.0024 - .0039	.0024 - .0039
		220 - 310	-	100 - 200	-	.0020 - .0031	.0020 - .0031	.0024 - .0039	.0024 - .0039
	Titanium Alloy*	140 - 220	-	140 - 500	-	.0020 - .0031	.0020 - .0031	.0024 - .0039	.0024 - .0039
		220 - 310	-	140 - 300	-	.0020 - .0031	.0020 - .0031	.0024 - .0039	.0024 - .0039
	Aerospace Alloy* S82	185 - 275	-	100 - 250	-	.0020 - .0031	.0020 - .0031	.0024 - .0039	.0024 - .0039
275 - 350		-	100 - 200	-	.0020 - .0031	.0020 - .0031	.0024 - .0039	.0024 - .0039	
M	Stainless Steel 400 Series 416, 420, etc.	185 - 275	240 - 600	240 - 700	-	.0016 - .0039	.0024 - .0047	.0024 - .0055	.0024 - .0055
		275 - 350	240 - 470	240 - 500	-	.0016 - .0039	.0024 - .0047	.0024 - .0055	.0024 - .0055
	Stainless Steel 300 Series 304, 316, 17-4PH, etc.	135 - 185	240 - 600	240 - 700	-	.0016 - .0039	.0024 - .0047	.0024 - .0055	.0024 - .0055
		185 - 275	240 - 470	240 - 500	-	.0016 - .0039	.0024 - .0047	.0024 - .0055	.0024 - .0055
	Super Duplex Stainless Steel		240 - 600	240 - 700	-	.0016 - .0039	.0024 - .0047	.0024 - .0055	.0024 - .0055
		135 - 275	240 - 470	240 - 500	-	.0016 - .0039	.0024 - .0047	.0024 - .0055	.0024 - .0055
H	Wear Plate Hardox, AR400, T-1, etc.	400	100 - 200	-	-	.0016 - .0031	.0024 - .0047	.0031 - .0059	.0031 - .0059
		500	100 - 200	-	-	.0016 - .0031	.0024 - .0047	.0031 - .0059	.0031 - .0059
		600	100 - 200	-	-	.0016 - .0031	.0024 - .0047	.0031 - .0059	.0031 - .0059
	Hardened Steel	300 - 400	100 - 300	-	-	.0016 - .0031	.0024 - .0047	.0031 - .0059	.0031 - .0059
400 - 500		100 - 200	-	-	.0016 - .0031	.0024 - .0047	.0031 - .0059	.0031 - .0059	
K	Nodular, Grey, Ductile Cast Iron	120 - 150	300 - 800	-	-	.0031 - .0055	.0031 - .0071	.0031 - .0079	.0031 - .008
		150 - 200	300 - 800	-	-	.0031 - .0055	.0031 - .0071	.0031 - .0079	.0031 - .008
		200 - 220	300 - 500	-	-	.0031 - .0055	.0031 - .0071	.0031 - .0079	.0031 - .008
		220 - 260	270 - 400	-	-	.0031 - .0055	.0031 - .0071	.0031 - .0079	.0031 - .008
		260 - 320	270 - 400	-	-	.0031 - .0055	.0031 - .0071	.0031 - .0079	.0031 - .008
N	Cast Aluminium	30	-	-	800 - 2000	.0024 - .0047	.0031 - .0055	.0031 - .0063	.0031 - .008
		180	-	-	800 - 2000	.0024 - .0047	.0031 - .0055	.0031 - .0063	.0031 - .008
	Wrought Aluminium	30	-	-	800 - 2000	.0024 - .0047	.0031 - .0055	.0031 - .0063	.0031 - .008
		180	-	-	800 - 2000	.0024 - .0047	.0031 - .0055	.0031 - .0063	.0031 - .008
	Aluminium Bronze	100 - 200	-	-	500 - 1000	.0024 - .0047	.0031 - .0055	.0031 - .0063	.0031 - .008
		200 - 250	-	-	500 - 1000	.0024 - .0047	.0031 - .0055	.0031 - .0063	.0031 - .008
	Brass	100	-	-	500 - 1000	.0024 - .0047	.0031 - .0055	.0031 - .0063	.0031 - .008
Copper	60	-	-	500 - 1000	.0024 - .0047	.0031 - .0055	.0031 - .0063	.0031 - .008	

\*For high temp materials, 1000 PSI is recommended as well as a quality synthetic coolant at approximately 10% emulsion.

\*\*For 4xD tools, begin at low end of feed recommendation.

**IMPORTANT:** The speeds and feeds listed above are a general starting point for all applications. Refer to the Coolant Recommendation charts for coolant requirements to run at the recommended speeds and feeds. Factory technical assistance is also available through our Application Engineering Team.

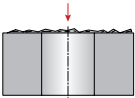

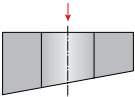
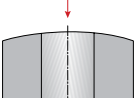
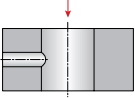
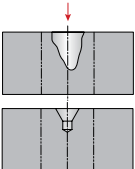
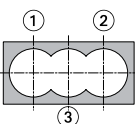
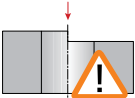
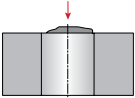
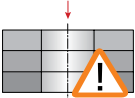
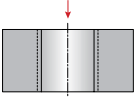
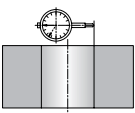
A  
DRILLING  
B  
BORING  
C  
REAMING  
D  
BURNISHING  
E  
THREADING  
X  
SPECIALS



## Insert Geometry Recommendations

A DRILLING	ISO	Material	Hardness (BHN)	Geometry				
				P	M	K	N	H
B BORING	P	Free Machining Steel 1118, 1215, 12L14, etc.	100 - 150	○	●			
			150 - 200	●	○			
			200 - 250	●	○			
		Low Carbon Steel 1010, 1020, 1025, 1522, 1144, etc.	85 - 125	○	●			
			125 - 175	○	●			
			175 - 225	○	●			
			225 - 275	●	○			
		Medium Carbon Steel 1030, 1040, 1050, 1527, 1140, 1151, etc.	125 - 175	○	●			
			175 - 225	○	●			
			225 - 275	●	○			
			275 - 325	●	○			○
		Alloy Steel 4140, 5140, 8640, etc.	125 - 175	○	●			
			175 - 225	●	○			
			225 - 275	●				○
			275 - 325	●				○
			325 - 375	○				●
		High Strength Alloy 4340, 4330V, 300M, etc.	225 - 300	●				
			300 - 350	○				●
350 - 400			○				●	
	Structural Steel A36, A285, A516, etc.	100 - 150	○	●				
		150 - 250	○	●				
		250 - 350	●				○	
	Tool Steel H-13, H-21, A-4, O-2, S-3, etc.	150 - 200	●	○				
		200 - 250	●				○	
C REAMING	S	High Temp Alloy* Hastelloy B, Inconel 600, etc.	140 - 220	○	●			
			220 - 310	○	●			
		Titanium Alloy*	140 - 220	○	●			
			220 - 310	○	●			
		Aerospace Alloy* S82	185 - 275	○	●			
275 - 350	○	●						
D URNISHING	M	Stainless Steel 400 Series 416, 420, etc.	185 - 275	○	●			
			275 - 350	○	●			
		Stainless Steel 300 Series 304, 316, 17-4PH, etc.	135 - 185	○	●			
			185 - 275	○	●			
		Super Duplex Stainless Steel		○	●			
135 - 275	○	●						
E HREADING	H	Wear Plate Hardox, AR400, T-1, etc.	400	○				●
			500	○				●
			600	○				●
		Hardened Steel	300 - 400	○				●
			400 - 500	○				●
F HREADING	K	Nodular, Ductile Cast Iron	120 - 150	●	○			
			150 - 200	●	○			
			200 - 220	●	○			
			220 - 260			●		○
			260 - 320			●		○
		Grey / White Iron	120 - 150			●		○
			150 - 200			●		○
			200 - 220			●		
			220 - 260			●		
			260 - 320			●		
X PECIALS	N	Cast Aluminium	30				●	
			180				●	
		Wrought Aluminium	30				●	
			180				●	
		Aluminium Bronze	100 - 200	○			●	
			200 - 250	○			●	
		Brass	100	○			●	
Copper	60				●			

## Troubleshooting

1.		<p><b>Starting on Uneven Surfaces</b></p> <ul style="list-style-type: none"> <li>• Reduce entry feed by 50% if necessary</li> </ul>
2.		<p><b>Starting on Angled Surfaces</b></p> <ul style="list-style-type: none"> <li>• Reduce entry feed by 20 - 50%</li> <li>• Use lower rake geometry if insert chipping occurs</li> </ul>
3.		<p><b>Angled Bore Exit</b></p> <ul style="list-style-type: none"> <li>• Reduce entry feed by 50% on breakout</li> <li>• Use tough insert and stable corner radius</li> </ul>
4.		<p><b>Starting on Convex Surfaces</b></p> <ul style="list-style-type: none"> <li>• Reduce entry feed by 50%</li> <li>• Use lower rake geometry if insert chipping occurs</li> </ul>
5.		<p><b>Drilling through a Cross Hole</b></p> <ul style="list-style-type: none"> <li>• Reduce feed rate 50% if necessary</li> <li>• Use good coolant flow and monitor chip packing</li> <li>• Use lower rake geometry if insert chipping occurs</li> </ul>
6.		<p><b>Drilling on a Groove or Large Centreing Box</b></p> <ul style="list-style-type: none"> <li>• Reduce entry feed</li> <li>• Use lower rake geometry for Centre insert</li> </ul>
7.		<p><b>Chain Drilling</b></p> <ul style="list-style-type: none"> <li>• Use good coolant flow</li> <li>• Reduce feed rate by 50% for interrupted cut</li> <li>• Use lower rake geometry if insert chipping occurs</li> </ul>
8.		<p><b>Starting on an Edge</b></p> <ul style="list-style-type: none"> <li>• Reduce entry feed rate by 50%</li> <li>• Use lower rake geometry if insert chipping occurs</li> </ul>
9.		<p><b>Starting on a Welded Seam</b></p> <ul style="list-style-type: none"> <li>• Reduce entry feed rate by 50%</li> <li>• Use lower rake geometry if insert chipping occurs</li> </ul>
10.		<p><b>Drilling through Stacked Plates</b></p> <ul style="list-style-type: none"> <li>• Not recommended</li> </ul>
11.		<p><b>Opening an Existing Hole</b></p> <ul style="list-style-type: none"> <li>• Use flood coolant</li> </ul>
12.		<p><b>Adjustable</b></p> <ul style="list-style-type: none"> <li>• For mills, use eccentric sleeve with end mill holder</li> <li>• For lathes, use x-axis to adjust offset <math>\emptyset</math></li> </ul> <p>NOTE: Refer to maximum offset <math>\emptyset</math> in data tables</p>

A

DRILLING

B

BORING

C

REAMING

D

BURNISHING

E

THREADING

X

SPECIALS