RECOMMENDED CUTTING CONDITIONS-HSS

Material	Material Hardness		* HSS Grade	Speed (M/min)	Feed (mm/rev)						
	(Bhn)	(HRc)			Ø9.5 ~12.5	Ø13 ~17.5	Ø18 ~24	Ø25 ~35	Ø36 ~47	Ø48 ~65	Ø66 ~114
Free machining Steel	100 - 150	0	HSS	84	0.16	0.23	0.31	0.40	0.48	0.55	0.67
1213, 12L13, 1215	150 - 200	0 - 13	HSS	81	0.16	0.23	0.31	0.40	0.48	0.55	0.67
12L14, 1118 etc	200 - 250	13 - 24	HSS	72	0.14	0.23	0.31	0.38	0.48	0.57	0.69
Low Carbon Steel	85 - 125	0	HSS	75	0.15	0.22	0.28	0.37	0.46	0.56	0.67
1015, 1020, 1140	125 - 175	0 - 7	HSS	72	0.15	0.22	0.28	0.37	0.46	0.56	0.67
1025 etc	175 - 225	7 - 20	HSS	69	0.13	0.19	0.24	0.34	0.43	0.50	0.57
	225 - 275	20 - 28	HSS	66	0.13	0.19	0.24	0.34	0.43	0.50	0.57
Medium Carbon Steel	125 - 175	0 - 7	HSS	75	0.14	0.22	0.28	0.35	0.45	0.55	0.65
1035, 1050, 1045	175 - 225	7 - 20	HSS	69	0.13	0.19	0.23	0.34	0.43	0.50	0.58
1055, 1140 etc	225 - 275	20 - 28	HSS	63	0.13	0.19	0.23	0.34	0.43	0.50	0.58
	275 - 325	28 - 34	SH, PH	58	0.10	0.17	0.21	0.28	0.38	0.45	0.55
Structural Steel	100 - 150	0	HSS	63	0.14	0.23	0.29	0.35	0.44	0.50	0.63
A36, A516, A182 etc	150 - 250	0 - 24	HSS	55	0.13	0.22	0.24	0.28	0.38	0.46	0.59
	250 - 350	24 - 37	SH, PH	41	0.10	0.20	0.22	0.24	0.34	0.40	0.48
Cast Iron / S,G Iron	120 - 150	0	HSS	75	0.16	0.30	0.40	0.49	0.59	0.69	0.75
A48-76 GR30/GR45	150 - 200	0 - 13	HSS	70	0.14	0.26	0.35	0.45	0.56	0.64	0.68
A536-72 60-40-18	200 - 220	13 - 19	HSS	58	0.14	0.23	0.30	0.41	0.46	0.52	0.60
A220-76 GR40010 etc	220 - 260	19 - 26	SH, PH	52	0.13	0.17	0.23	0.30	0.35	0.43	0.50
	260 - 320	26 - 34	SH, PH	41	0.10	0.15	0.16	0.23	0.28	0.35	0.40
Alloy Steel	125 - 175	0 - 7	HSS	63	0.15	0.20	0.24	0.36	0.43	0.47	0.53
8620, 4130, 4137	175 - 225	7 - 20	HSS	58	0.13	0.20	0.24	0.36	0.42	0.46	0.55
4140, 6150 etc	225 - 275	20 - 28	HSS	56	0.13	0.16	0.23	0.35	0.41	0.44	0.55
	275 - 325	28 - 34	SH, PH	53	0.09	0.15	0.22	0.28	0.38	0.41	0.50
	325 - 375	34 - 40	SH, PH	46	0.08	0.15	0.21	0.27	0.38	0.40	0.51
Tool Steel	150 - 200	0 - 13	SH	34	0.09	0.15	0.19	0.25	0.28	0.36	0.41
H13, H21, A2, S1 etc	200 - 250	13 - 24	SH, PH	26	0.09	0.15	0.19	0.25	0.28	0.36	0.41
High Temp. Alloy	140 - 220	0 - 19	SH, PH	12	0.08	0.17	0.20	0.24	0.30	0.37	0.39
Hastelloy B,Inconel etc	220 - 310	19 - 33	PH	11	0.08	0.14	0.18	0.19	0.25	0.29	0.34
High Strength Alloy	225 - 300	0 - 32	SH, PH	35	0.13	0.18	0.23	0.24	0.36	0.43	0.50
9840, 4340, 4330V etc	300 - 350	32 - 37	SH, PH	27	0.10	0.18	0.23	0.24	0.36	0.43	0.50
	350 - 400	37 - 43	PH	21	0.08	0.15	0.20	0.22	0.30	0.48	0.46
Aluminium	30	0	HSS	244	0.19	0.33	0.41	0.50	0.54	0.64	0.62
2014, 6061, 7075 etc	180	0 - 8	HSS	137	0.19	0.33	0.41	0.46	0.54	0.64	0.62
Stainless Steel	135 - 185	0 - 9	HSS	34	0.14	0.20	0.23	0.26	0.36	0.41	0.50
310, 316, 410, 330 etc	185 - 275	9 - 28	HSS	29	0.12	0.18	0.20	0.24	0.30	0.36	0.46

RPM = revolution per minute (rev/min)

M/min = surface meter per minute(M/min)

DIA = diameter of drill (mm)

mm/rev = feed rate(mm/rev)

* Formulas :

$$M/min = \frac{(RPM) \cdot (\pi) \cdot (DIA.)}{1000}$$

$$mm/min = (RPM) \cdot (mm/rev)$$

$$RPM = \frac{(M/min) \cdot (1000)}{(\pi) \cdot (DIA.)}$$

* HSS Grade : HSS = HSS M4,   **SH** = Super HSS T15, **PH** = Premium HSS M48

The recommendations for speeds, feeds and other parameters presented in this chart are nominal recommendations and should be considered only as good starting points.

Speed and feed reductions (20% reduction in speed and 10% reduction in feed) are recommended.

RECOMMENDED CUTTING CONDITIONS-CARBIDE

Material	Material Hardness		CARBIDE Grade	Speed (M/min)	Feed (mm/rev)				
	(Bhn)	(HRc)			Ø 9.5 ~12.5	Ø 13 ~17.5	Ø 18 ~24	Ø 25 ~35	Ø 36 ~47
Free machining Steel	100 - 150	0	P40	125	0.18	0.28	0.36	0.44	0.50
1213, 12L13, 1215	150 - 200	0 - 13	P40	110	0.16	0.26	0.33	0.39	0.45
12L14, 1118 etc	200 - 250	13 - 24	P40	101	0.14	0.23	0.31	0.41	0.42
Low Carbon Steel	85 - 125	0	P40	119	0.20	0.24	0.31	0.42	0.46
1015, 1020, 1140	125 - 175	0 - 7	P40	107	0.18	0.24	0.31	0.39	0.43
1025 etc	175 - 225	7 - 20	P40	96	0.15	0.22	0.29	0.36	0.40
	225 - 275	20 - 28	P40	84	0.13	0.22	0.29	0.36	0.40
Medium Carbon Steel	125 - 175	0 - 7	P40	102	0.17	0.24	0.31	0.37	0.42
1035, 1050, 1045	175 - 225	7 - 20	P40	93	0.15	0.22	0.28	0.36	0.40
1055, 1140 etc	225 - 275	20 - 28	P40	84	0.15	0.22	0.28	0.36	0.40
	275 - 325	28 - 34	P40	67	0.13	0.19	0.26	0.33	0.37
Structural Steel	100 - 150	0	P40	91	0.19	0.26	0.34	0.39	0.43
A36, A516, A182 etc	150 - 250	0 - 24	P40	75	0.15	0.24	0.29	0.33	0.37
	250 - 350	24 - 37	P40	73	0.13	0.23	0.27	0.29	0.33
Cast Iron / S,G Iron	120 - 150	0	K20,K10	137	0.18	0.30	0.37	0.46	0.56
A48-76 GR30/GR45	150 - 200	0 - 13	K20,K10	125	0.17	0.26	0.32	0.42	0.53
A536-72 60-40-18	200 - 220	13 - 19	K20,K10	111	0.14	0.23	0.30	0.38	0.45
A220-76 GR40010 etc	220 - 260	19 - 26	K20,K10	93	0.13	0.15	0.28	0.33	0.37
	260 - 320	26 - 34	K20,K10	79	0.13	0.18	0.23	0.28	0.33
Alloy Steel	125 - 175	0 - 7	P40	98	0.18	0.25	0.32	0.40	0.45
8620, 4130, 4137	175 - 225	7 - 20	P40	88	0.15	0.23	0.29	0.38	0.42
4140, 6150 etc	225 - 275	20 - 28	P40	81	0.15	0.21	0.28	0.37	0.41
	275 - 325	28 - 34	P40	78	0.12	0.20	0.27	0.33	0.40
	325 - 375	34 - 40	P40	64	0.10	0.18	0.23	0.30	0.38
Tool Steel	150 - 200	0 - 13	P40	67	0.09	0.18	0.22	0.28	0.31
H13, H21, A2, S1 etc	200 - 250	13 - 24	P40	50	0.09	0.18	0.22	0.28	0.31
High Temp. Alloy	140 - 220	0 - 19	K20	30	0.10	0.17	0.23	0.27	0.33
Hastelloy B,Inconel etc	220 - 310	19 - 33	K20	24	0.10	0.14	0.20	0.24	0.30
High Strength Alloy	225 - 300	0 - 32	P40	62	0.15	0.23	0.25	0.29	0.38
9840, 4340, 4330V etc	300 - 350	32 - 37	P40	55	0.12	0.20	0.23	0.27	0.35
	350 - 400	37 - 43	P40	47	0.10	0.18	0.20	0.24	0.30
Aluminium	30	0	K20	427	0.24	0.38	0.45	0.50	0.53
2014, 6061, 7075 etc	180	0 - 8	K20	291	0.22	0.33	0.40	0.45	0.48
Stainless Steel	135 - 185	0 - 9	K20	62	0.19	0.19	0.21	0.24	0.30
310, 316, 410, 330 etc	185 - 275	9 - 28	K20	46	0.15	0.17	0.20	0.21	0.25

RPM = revolution per minute (rev/min)

M/min = surface meter per minute(M/min)

DIA = diameter of drill (mm)

mm/rev = feed rate(mm/rev)

* Formulas :

$$\text{M/min} = \frac{(RPM) \cdot (\pi) \cdot (DIA.)}{1000}$$

$$\text{mm/min} = (RPM) \cdot (mm/rev)$$

$$\text{RPM} = \frac{(M/min) \cdot (1000)}{(\pi) \cdot (DIA.)}$$

The recommendations for speeds, feeds and other parameters presented in this chart are nominal recommendations and should be considered only as good starting points.

Speed and feed reductions (20% reduction in speed and 10% reduction in feed) are recommended.