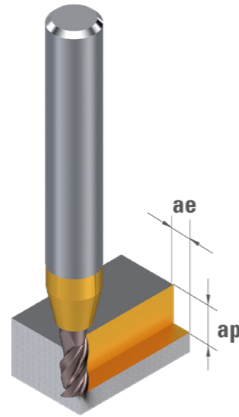


UMFANGSBEARBEITUNG / SCHRUPPEN

	VDI 3323	Ø D ₁ 0.30 - 0.70		Ø D ₁ 0.80 - 1.50		Ø D ₁ 1.60 - 5.00	
		VHM Vc [m/min]	C-TOP Vc [m/min]	VHM Vc [m/min]	C-TOP Vc [m/min]	VHM Vc [m/min]	C-TOP Vc [m/min]
		P	Unlegierter Stahl, Automaten Stahl	1 - 5	30 - 50	50 - 150	120 - 280
	Niedrig legierter Stahl < 800 N/mm ²	6 - 9	25 - 50	50 - 125	90 - 230		
	Hochlegierter Stahl > 800 N/mm ² , ferritischer / martensitischer Edelstahl	10 - 13	25 - 35	50 - 85	90 - 130		
M	Austenitischer rostfreier Stahl < 700 N/mm ²	14.1-14.2	25 - 50	50 - 150	100 - 230		
	Nickelfreier rostfreier Stahl / DUPLEX > 700 N/mm ²	14.3-14.4	20 - 45	50 - 115	75 - 180		
K	Grauguss < 250 HB	15 - 16	20 - 40	45 - 105	70 - 165	150 - 280	
	Duktiles Gusseisen, Temperguss > 250 HB	17 - 20	15 - 35	40 - 90	60 - 140	110 - 250	
N	Kupferlegierung gute Zerspanbarkeit mit Pb	26	20 - 40	50 - 105	80 - 165	150 - 300	
	Kupferlegierung schwere Zerspanbarkeit	27 - 28	15 - 35	40 - 90	60 - 140	130 - 280	
	Gold, Silber	-	20 - 45	50 - 110	75 - 170	160 - 320	
S	Spezielle Nickel-Kobalt-Legierung	31 - 35	15 - 30	40 - 80	60 - 120		
	Titan, Titanlegierung	36 - 37	15 - 30	35 - 80	55 - 120	120 - 170	



$$n \text{ [U/min]} = \frac{Vc \text{ [m/min]} \times 1000}{\pi \times D_1 \text{ [mm]}}$$

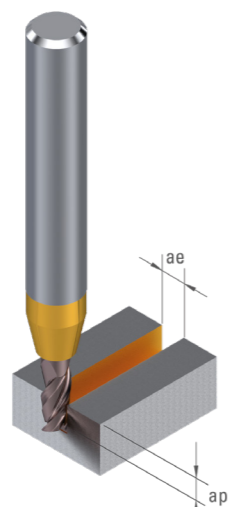
$$Vf \text{ [mm/min]} = n \text{ [U/min]} \times f \text{ [mm]} \times Z$$

Vorschub pro Zahn fz [mm]

Ø D ₁ 0.30 - 0.50		Ø D ₁ 0.50 - 0.80		Ø D ₁ 0.80 - 1.60		Ø D ₁ 1.60 - 3.00		Ø D ₁ 3.00 - 5.00	
fz	ae ap (mm)	fz	ae ap (mm)	fz	ae ap (mm)	fz	ae ap (mm)	fz	ae ap (mm)
0.002 - 0.004	< 0.90 × Ø < 1.50 × Ø	0.003 - 0.006	< 0.90 × Ø < 1.50 × Ø	0.005 - 0.012	< 0.90 × Ø < 1.50 × Ø	0.010 - 0.022	< 0.90 × Ø < 1.50 × Ø	0.018 - 0.036	< 0.90 × Ø < 1.50 × Ø
0.002 - 0.003	< 0.90 × Ø < 1.50 × Ø	0.003 - 0.005	< 0.90 × Ø < 1.50 × Ø	0.004 - 0.010	< 0.90 × Ø < 1.50 × Ø	0.009 - 0.019	< 0.90 × Ø < 1.50 × Ø	0.016 - 0.032	< 0.90 × Ø < 1.50 × Ø
0.002 - 0.003	< 0.90 × Ø < 1.50 × Ø	0.003 - 0.005	< 0.90 × Ø < 1.50 × Ø	0.004 - 0.010	< 0.90 × Ø < 1.50 × Ø	0.008 - 0.018	< 0.90 × Ø < 1.50 × Ø	0.015 - 0.030	< 0.90 × Ø < 1.50 × Ø
0.002 - 0.003	< 0.90 × Ø < 1.50 × Ø	0.003 - 0.005	< 0.90 × Ø < 1.50 × Ø	0.004 - 0.010	< 0.90 × Ø < 1.50 × Ø	0.008 - 0.018	< 0.90 × Ø < 1.50 × Ø	0.015 - 0.030	< 0.90 × Ø < 1.50 × Ø
0.001 - 0.003	< 0.90 × Ø < 1.50 × Ø	0.002 - 0.005	< 0.90 × Ø < 1.50 × Ø	0.004 - 0.009	< 0.90 × Ø < 1.50 × Ø	0.008 - 0.017	< 0.90 × Ø < 1.50 × Ø	0.014 - 0.028	< 0.90 × Ø < 1.50 × Ø
0.002 - 0.005	< 0.90 × Ø < 1.50 × Ø	0.004 - 0.007	< 0.90 × Ø < 1.50 × Ø	0.006 - 0.015	< 0.90 × Ø < 1.50 × Ø	0.012 - 0.028	< 0.90 × Ø < 1.50 × Ø	0.023 - 0.046	< 0.90 × Ø < 1.50 × Ø
0.002 - 0.004	< 0.90 × Ø < 1.50 × Ø	0.003 - 0.006	< 0.90 × Ø < 1.50 × Ø	0.005 - 0.013	< 0.90 × Ø < 1.50 × Ø	0.011 - 0.024	< 0.90 × Ø < 1.50 × Ø	0.020 - 0.040	< 0.90 × Ø < 1.50 × Ø
0.003 - 0.005	< 0.90 × Ø < 1.50 × Ø	0.005 - 0.009	< 0.90 × Ø < 1.50 × Ø	0.007 - 0.017	< 0.90 × Ø < 1.50 × Ø	0.014 - 0.032	< 0.90 × Ø < 1.50 × Ø	0.027 - 0.054	< 0.90 × Ø < 1.50 × Ø
0.002 - 0.004	< 0.90 × Ø < 1.50 × Ø	0.004 - 0.007	< 0.90 × Ø < 1.50 × Ø	0.006 - 0.014	< 0.90 × Ø < 1.50 × Ø	0.012 - 0.026	< 0.90 × Ø < 1.50 × Ø	0.022 - 0.044	< 0.90 × Ø < 1.50 × Ø
0.002 - 0.004	< 0.90 × Ø < 1.50 × Ø	0.003 - 0.006	< 0.90 × Ø < 1.50 × Ø	0.005 - 0.013	< 0.90 × Ø < 1.50 × Ø	0.011 - 0.024	< 0.90 × Ø < 1.50 × Ø	0.020 - 0.040	< 0.90 × Ø < 1.50 × Ø
0.001 - 0.002	< 0.90 × Ø < 1.50 × Ø	0.002 - 0.003	< 0.90 × Ø < 1.50 × Ø	0.002 - 0.006	< 0.90 × Ø < 1.50 × Ø	0.005 - 0.011	< 0.90 × Ø < 1.50 × Ø	0.009 - 0.018	< 0.90 × Ø < 1.50 × Ø
0.002 - 0.004	< 0.90 × Ø < 1.50 × Ø	0.004 - 0.007	< 0.90 × Ø < 1.50 × Ø	0.006 - 0.014	< 0.90 × Ø < 1.50 × Ø	0.012 - 0.026	< 0.90 × Ø < 1.50 × Ø	0.022 - 0.044	< 0.90 × Ø < 1.50 × Ø

NUTBEARBEITUNG

	VDI 3323	Ø D ₁ 0.30 - 0.70		Ø D ₁ 0.80 - 1.50		Ø D ₁ 1.60 - 5.00	
		VHM Vc [m/min]	C-TOP Vc [m/min]	VHM Vc [m/min]	C-TOP Vc [m/min]	VHM Vc [m/min]	C-TOP Vc [m/min]
		P	Unlegierter Stahl, Automaten Stahl	1 - 5	25 - 50	50 - 150	100 - 240
	Niedrig legierter Stahl < 800 N/mm ²	6 - 9	20 - 50	50 - 125	75 - 195		
	Hochlegierter Stahl > 800 N/mm ² , ferritischer / martensitischer Edelstahl	10 - 13	20 - 30	50 - 70	75 - 110		
M	Austenitischer rostfreier Stahl < 700 N/mm ²	14.1-14.2	20 - 50	50 - 125	85 - 195		
	Nickelfreier rostfreier Stahl / DUPLEX > 700 N/mm ²	14.3-14.4	15 - 40	40 - 100	65 - 155		
K	Grauguss < 250 HB	15 - 16	15 - 35	40 - 90	60 - 140	130 - 240	
	Duktiles Gusseisen, Temperguss > 250 HB	17 - 20	15 - 30	35 - 80	50 - 120	95 - 215	
N	Kupferlegierung gute Zerspanbarkeit mit Pb	26	20 - 35	45 - 90	70 - 140	130 - 255	
	Kupferlegierung schwere Zerspanbarkeit	27 - 28	15 - 35	35 - 80	50 - 120	110 - 240	
	Gold, Silber	-	15 - 30	40 - 95	65 - 145	135 - 270	
S	Spezielle Nickel-Kobalt-Legierung	31 - 35	15 - 25	30 - 65	50 - 100		
	Titan, Titanlegierung	36 - 37	10 - 25	30 - 65	45 - 100	100 - 145	

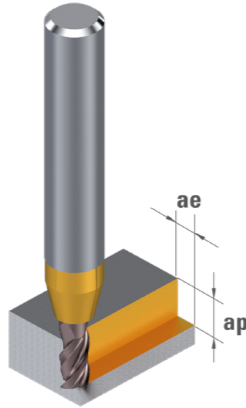


Vorschub pro Zahn fz [mm]

Ø D ₁ 0.30 - 0.50		Ø D ₁ 0.50 - 0.80		Ø D ₁ 0.80 - 1.60		Ø D ₁ 1.60 - 3.00		Ø D ₁ 3.00 - 5.00	
fz	ap (mm)	fz	ap (mm)	fz	ap (mm)	fz	ap (mm)	fz	ap (mm)
0.0015 - 0.0030	< 0.50 × Ø	0.003 - 0.005	< 1.00 × Ø	0.004 - 0.010	< 1.50 × Ø	0.008 - 0.018	< 1.50 × Ø	0.015 - 0.030	< 1.50 × Ø
0.0014 - 0.0028	< 0.50 × Ø	0.002 - 0.004	< 1.00 × Ø	0.004 - 0.009	< 1.50 × Ø	0.007 - 0.017	< 1.50 × Ø	0.014 - 0.028	< 1.50 × Ø
0.0013 - 0.0026	< 0.50 × Ø	0.002 - 0.004	< 1.00 × Ø	0.003 - 0.008	< 1.50 × Ø	0.007 - 0.016	< 1.50 × Ø	0.013 - 0.026	< 1.50 × Ø
0.0013 - 0.0026	< 0.50 × Ø	0.002 - 0.004	< 1.00 × Ø	0.003 - 0.008	< 1.50 × Ø	0.007 - 0.016	< 1.50 × Ø	0.013 - 0.026	< 1.50 × Ø
0.0012 - 0.0024	< 0.25 × Ø	0.002 - 0.004	< 0.50 × Ø	0.003 - 0.008	< 1.00 × Ø	0.007 - 0.015	< 1.00 × Ø	0.012 - 0.024	< 1.00 × Ø
0.0020 - 0.0040	< 0.50 × Ø	0.003 - 0.006	< 1.00 × Ø	0.005 - 0.013	< 1.50 × Ø	0.011 - 0.024	< 1.50 × Ø	0.020 - 0.040	< 1.50 × Ø
0.0017 - 0.0034	< 0.50 × Ø	0.003 - 0.005	< 1.00 × Ø	0.004 - 0.011	< 1.50 × Ø	0.009 - 0.020	< 1.50 × Ø	0.017 - 0.034	< 1.50 × Ø
0.0023 - 0.0046	< 0.50 × Ø	0.004 - 0.007	< 1.00 × Ø	0.006 - 0.015	< 1.50 × Ø	0.012 - 0.028	< 1.50 × Ø	0.023 - 0.046	< 1.50 × Ø
0.0018 - 0.0036	< 0.50 × Ø	0.003 - 0.006	< 1.00 × Ø	0.005 - 0.012	< 1.50 × Ø	0.010 - 0.022	< 1.50 × Ø	0.018 - 0.036	< 1.50 × Ø
0.0017 - 0.0034	< 0.50 × Ø	0.003 - 0.005	< 1.00 × Ø	0.004 - 0.011	< 1.50 × Ø	0.009 - 0.020	< 1.50 × Ø	0.017 - 0.034	< 1.50 × Ø
0.0008 - 0.0016	< 0.50 × Ø	0.001 - 0.002	< 0.25 × Ø	0.002 - 0.005	< 0.50 × Ø	0.004 - 0.009	< 1.00 × Ø	0.008 - 0.016	< 1.00 × Ø
0.0018 - 0.0036	< 0.25 × Ø	0.003 - 0.006	< 1.00 × Ø	0.005 - 0.012	< 1.50 × Ø	0.010 - 0.022	< 1.50 × Ø	0.018 - 0.036	< 1.50 × Ø

UMFANGSBEARBEITUNG / SCHLICHTEN

	VDI 3323	Ø D ₁ 0.30 - 0.70		Ø D ₁ 0.80 - 1.50		Ø D ₁ 1.60 - 5.00		
		VHM Vc [m/min]	C-TOP Vc [m/min]	VHM Vc [m/min]	C-TOP Vc [m/min]	VHM Vc [m/min]	C-TOP Vc [m/min]	
P Unlegierter Stahl, Automaten Stahl	1 - 5		30 - 50		50 - 150		150 - 350	
	Niedrig legierter Stahl < 800 N/mm ²	6 - 9	30 - 50		50 - 150		110 - 290	
	Hochlegierter Stahl > 800 N/mm ² , ferritischer / martensitischer Edelstahl	10 - 13	30 - 40		50 - 105		110 - 160	
M Austenitischer rostfreier Stahl < 700 N/mm ²	14.1-14.2		30 - 50		50 - 150		130 - 290	
	Nickelfreier rostfreier Stahl / DUPLEX > 700 N/mm ²	14.3-14.4	25 - 50		50 - 150		90 - 230	
K Grauguss < 250 HB	15 - 16	25 - 50	30 - 50	50 - 150	50 - 150	90 - 210	190 - 350	
	Duktiles Gusseisen, Temperguss > 250 HB	17 - 20	20 - 45	30 - 50	50 - 150	50 - 150	80 - 180	140 - 310
N Kupferlegierung gute Zerspanbarkeit mit Pb	26	25 - 50	30 - 50	50 - 150	50 - 150	100 - 210	190 - 380	
	Kupferlegierung schwere Zerspanbarkeit	27 - 28	20 - 45	30 - 50	50 - 150	50 - 150	80 - 180	160 - 350
	Gold, Silber	-	25 - 50	30 - 50	50 - 150	50 - 150	90 - 210	200 - 400
S Spezielle Nickel-Kobalt-Legierung	31 - 35		20 - 40		50 - 135		80 - 150	
	Titan, Titanlegierung	36 - 37	20 - 40	30 - 50	45 - 150	50 - 110	70 - 150	150 - 210



$$n \text{ [U/min]} = \frac{Vc \text{ [m/min]} \times 1000}{\pi \times D_1 \text{ [mm]}}$$

$$Vf \text{ [mm/min]} = n \text{ [U/min]} \times f \text{ [mm]} \times Z$$

Vorschub pro Zahn fz [mm]

Ø D ₁ 0.30 - 0.50		Ø D ₁ 0.50 - 0.80		Ø D ₁ 0.80 - 1.60		Ø D ₁ 1.60 - 3.00		Ø D ₁ 3.00 - 5.00	
fz	ae ap (mm)	fz	ae ap (mm)	fz	ae ap (mm)	fz	ae ap (mm)	fz	ae ap (mm)
0.002 - 0.004	< 0.30 × Ø < 1.50 × Ø	0.003 - 0.006	< 0.30 × Ø < 1.50 × Ø	0.005 - 0.012	< 0.30 × Ø < 1.50 × Ø	0.010 - 0.022	< 0.30 × Ø < 1.50 × Ø	0.018 - 0.036	< 0.30 × Ø < 1.50 × Ø
0.002 - 0.003	< 0.30 × Ø < 1.50 × Ø	0.003 - 0.005	< 0.30 × Ø < 1.50 × Ø	0.004 - 0.010	< 0.30 × Ø < 1.50 × Ø	0.009 - 0.019	< 0.30 × Ø < 1.50 × Ø	0.016 - 0.032	< 0.30 × Ø < 1.50 × Ø
0.002 - 0.003	< 0.30 × Ø < 1.50 × Ø	0.003 - 0.005	< 0.30 × Ø < 1.50 × Ø	0.004 - 0.010	< 0.30 × Ø < 1.50 × Ø	0.008 - 0.018	< 0.30 × Ø < 1.50 × Ø	0.015 - 0.030	< 0.30 × Ø < 1.50 × Ø
0.002 - 0.003	< 0.30 × Ø < 1.50 × Ø	0.003 - 0.005	< 0.30 × Ø < 1.50 × Ø	0.004 - 0.010	< 0.30 × Ø < 1.50 × Ø	0.008 - 0.018	< 0.30 × Ø < 1.50 × Ø	0.015 - 0.030	< 0.30 × Ø < 1.50 × Ø
0.001 - 0.003	< 0.30 × Ø < 1.50 × Ø	0.002 - 0.005	< 0.30 × Ø < 1.50 × Ø	0.004 - 0.009	< 0.30 × Ø < 1.50 × Ø	0.008 - 0.017	< 0.30 × Ø < 1.50 × Ø	0.014 - 0.028	< 0.30 × Ø < 1.50 × Ø
0.002 - 0.005	< 0.30 × Ø < 1.50 × Ø	0.004 - 0.007	< 0.30 × Ø < 1.50 × Ø	0.006 - 0.015	< 0.30 × Ø < 1.50 × Ø	0.012 - 0.028	< 0.30 × Ø < 1.50 × Ø	0.023 - 0.046	< 0.30 × Ø < 1.50 × Ø
0.002 - 0.004	< 0.30 × Ø < 1.50 × Ø	0.003 - 0.006	< 0.30 × Ø < 1.50 × Ø	0.005 - 0.013	< 0.30 × Ø < 1.50 × Ø	0.011 - 0.024	< 0.30 × Ø < 1.50 × Ø	0.020 - 0.040	< 0.30 × Ø < 1.50 × Ø
0.003 - 0.005	< 0.30 × Ø < 1.50 × Ø	0.005 - 0.009	< 0.30 × Ø < 1.50 × Ø	0.007 - 0.017	< 0.30 × Ø < 1.50 × Ø	0.014 - 0.032	< 0.30 × Ø < 1.50 × Ø	0.027 - 0.054	< 0.30 × Ø < 1.50 × Ø
0.002 - 0.004	< 0.30 × Ø < 1.50 × Ø	0.004 - 0.007	< 0.30 × Ø < 1.50 × Ø	0.006 - 0.014	< 0.30 × Ø < 1.50 × Ø	0.012 - 0.026	< 0.30 × Ø < 1.50 × Ø	0.022 - 0.044	< 0.30 × Ø < 1.50 × Ø
0.002 - 0.004	< 0.30 × Ø < 1.50 × Ø	0.003 - 0.006	< 0.30 × Ø < 1.50 × Ø	0.005 - 0.013	< 0.30 × Ø < 1.50 × Ø	0.011 - 0.024	< 0.30 × Ø < 1.50 × Ø	0.020 - 0.040	< 0.30 × Ø < 1.50 × Ø
0.001 - 0.002	< 0.30 × Ø < 1.50 × Ø	0.002 - 0.003	< 0.30 × Ø < 1.50 × Ø	0.002 - 0.006	< 0.30 × Ø < 1.50 × Ø	0.005 - 0.011	< 0.30 × Ø < 1.50 × Ø	0.009 - 0.018	< 0.30 × Ø < 1.50 × Ø
0.002 - 0.004	< 0.30 × Ø < 1.50 × Ø	0.004 - 0.007	< 0.30 × Ø < 1.50 × Ø	0.006 - 0.014	< 0.30 × Ø < 1.50 × Ø	0.012 - 0.026	< 0.30 × Ø < 1.50 × Ø	0.022 - 0.044	< 0.30 × Ø < 1.50 × Ø

RAMPEN

	VDI 3323	Ø D ₁ 0.30 - 0.70		Ø D ₁ 0.80 - 1.50		Ø D ₁ 1.60 - 5.00		
		VHM Vc [m/min]	C-TOP Vc [m/min]	VHM Vc [m/min]	C-TOP Vc [m/min]	VHM Vc [m/min]	C-TOP Vc [m/min]	
P Unlegierter Stahl, Automaten Stahl	1 - 5		25 - 50		50 - 125		100 - 190	
	Niedrig legierter Stahl < 800 N/mm ²	6 - 9	20 - 40		50 - 100		75 - 155	
	Hochlegierter Stahl > 800 N/mm ² , ferritischer / martensitischer Edelstahl	10 - 13	20 - 25		50 - 60		75 - 90	
M Austenitischer rostfreier Stahl < 700 N/mm ²	14.1-14.2		20 - 40		50 - 100		85 - 155	
	Nickelfreier rostfreier Stahl / DUPLEX > 700 N/mm ²	14.3-14.4	15 - 30		40 - 80		65 - 120	
K Grauguss < 250 HB	15 - 16	15 - 35	30 - 50	40 - 90	50 - 125	60 - 140	130 - 190	
	Duktiles Gusseisen, Temperguss > 250 HB	17 - 20	15 - 30	25 - 45	35 - 80	50 - 110	50 - 120	95 - 170
N Kupferlegierung gute Zerspanbarkeit mit Pb	26	20 - 35	30 - 50	45 - 90	50 - 135	70 - 140	130 - 205	
	Kupferlegierung schwere Zerspanbarkeit	27 - 28	15 - 35	30 - 50	35 - 80	50 - 125	50 - 120	110 - 190
	Gold, Silber	-	15 - 30	30 - 50	40 - 95	50 - 145	65 - 145	135 - 220
S Spezielle Nickel-Kobalt-Legierung	31 - 35		15 - 20		30 - 50		50 - 80	
	Titan, Titanlegierung	36 - 37	10 - 25	25 - 35	30 - 65	50 - 75	45 - 100	100 - 115



Vorschub pro Zahn fz [mm]

Ø D ₁ 0.30 - 0.50		Ø D ₁ 0.50 - 0.80		Ø D ₁ 0.80 - 1.60		Ø D ₁ 1.60 - 3.00		Ø D ₁ 3.00 - 5.00	
fz	α (°)	fz	α (°)	fz	α (°)	fz	α (°)	fz	α (°)
0.0010 - 0.0020	< 30°	0.002 - 0.003	< 30°	0.003 - 0.006	< 30°	0.005 - 0.012	< 30°	0.010 - 0.020	< 30°
0.0009 - 0.0018	< 30°	0.001 - 0.003	< 30°	0.002 - 0.006	< 30°	0.005 - 0.011	< 30°	0.009 - 0.018	< 30°
0.0008 - 0.0016	< 30°	0.001 - 0.003	< 30°	0.002 - 0.005	< 30°	0.004 - 0.010	< 30°	0.008 - 0.016	< 30°
0.0008 - 0.0016	< 30°	0.001 - 0.003	< 30°	0.002 - 0.005	< 30°	0.004 - 0.010	< 30°	0.008 - 0.016	< 30°
0.0008 - 0.0016	< 15°	0.001 - 0.003	< 15°	0.002 - 0.005	< 15°	0.004 - 0.010	< 15°	0.008 - 0.016	< 15°
0.0013 - 0.0026	< 30°	0.002 - 0.004	< 30°	0.003 - 0.008	< 30°	0.007 - 0.015	< 30°	0.013 - 0.026	< 30°
0.0011 - 0.0022	< 30°	0.002 - 0.003	< 30°	0.003 - 0.007	< 30°	0.006 - 0.013	< 30°	0.011 - 0.022	< 30°
0.0015 - 0.0030	< 35°	0.002 - 0.005	< 35°	0.004 - 0.010	< 35°	0.008 - 0.018	< 35°	0.015 - 0.030	< 35°
0.0012 - 0.0024	< 35°	0.002 - 0.004	< 35°	0.003 - 0.008	< 35°	0.006 - 0.014	< 35°	0.012 - 0.024	< 35°
0.0011 - 0.0022	< 35°	0.002 - 0.003	< 35°	0.003 - 0.007	< 35°	0.006 - 0.013	< 35°	0.011 - 0.022	< 35°
0.0005 - 0.0010	< 8°	0.001 - 0.002	< 8°	0.001 - 0.003	< 8°	0.003 - 0.006	< 8°	0.005 - 0.010	< 8°
0.0012 - 0.0024	< 15°	0.002 - 0.004	< 15°	0.003 - 0.008	< 15°	0.006 - 0.014	< 15°	0.012 - 0.024	< 15°