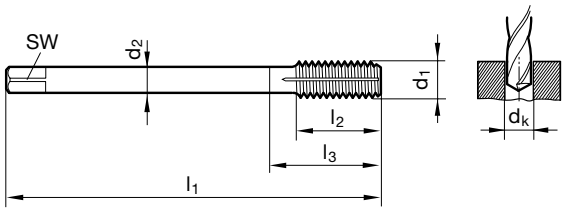
Fluteless machine taps for ISO metric fine threads

P	•
M	•
K	•
N	○
S	•
H	

Tool material	HSS-E-PM		
Tolerance on Ø	6HX	6GX	6HX
Surface	C	C	C
Type	N	N	N
Chamfer Form	C (2-3)	C (2-3)	E (1.5-2)
Internal cooling	N/A	N/A	N/A

DIN 371



DIN 2174 ~DIN 374 — Series no. **4489** **4490** **4495**

d1	d2	SW	dk	l1	l2	l3	Code no.	EDP Number		
	mm	mm	mm	mm	mm	mm				
M8 x 1	6.000	4.900	7.52 - 7.62	90.000	16.000	35.000	8.005	9044890080050	9044900080050	9044950080050
M10 x 1	7.000	5.500	9.52 - 9.62	90.000	16.000	35.000	10.005	9044890100050	9044900100050	9044950100050
M10 x 1.25	7.000	5.500	9.36 - 9.47	100.000	20.000	39.000	10.006	9044890100060	9044900100060	9044950100060
M12 x 1.25	9.000	7.000	11.36 - 11.47	100.000	20.000	40.000	12.006	9044890120060	9044900120060	9044950120060
M12 x 1.5	9.000	7.000	11.26 - 11.38	100.000	20.000	40.000	12.007	9044890120070	9044900120070	9044950120070
M14 x 1.25	11.000	9.000	13.36 - 13.47	100.000	20.000	40.000	14.006	9044890140060	9044900140060	9044950140060
M14 x 1.5	11.000	9.000	13.26 - 13.38	100.000	20.000	40.000	14.007	9044890140070	9044900140070	9044950140070
M16 x 1.5	12.000	9.000	15.26 - 15.38	100.000	22.000	44.000	16.007	9044890160070	9044900160070	9044950160070
M20 x 1.5	16.000	12.000	19.26 - 19.38	125.000	25.000	44.000	20.007	9044890200070	9044900200070	9044950200070

Cutting Rate recommendations for **FORM/FLUTELESS** taps

Thanks to the development of modern tool materials, geometries, coatings and recently the Guhring developed improved tool surface the scope of malleable materials able to be fluteless tapped is expanding. The table "Cutting rate recommendations" below provides an overview of materials that can be machined with Guhring's "Profile" fluteless taps. In many cases, a test in harder or more brittle materials is worth while in order to benefit from the advantages of fluteless tapping in these materials. Please contact our technical specialists for advice.

Cutting rate recommendations

Material group	Approximate Rc	Approximate HB	Recommended SFM		
			HSS-E	HSS-E-PM	Solid carbide
Structural steels, free-cutting steels		<180	45-70	60-90	90-120
Unalloyed case hardened steels	<20	<230	40-65	55-80	75-100
Unalloyed heat-treatable steels	<25	<250	30-55	50-75	65-95
Structural steels, free-cutting steels	<20	<230	40-65	55-80	75-100
Case hardened steels, heat-treatable steels	<25	<250	30-55	50-75	65-95
Nitriding steels, spheroidal graphite iron	<30	<280	25-45	40-70	60-85
	<35	<320	20-35	35-60	50-75
	<38	<380	-	-	-
Stainless- and acid-resistant steels, sulphured		<180	40-50	45-60	50-70
austenitic	<25	<250	35-50	40-55	45-60
martensitic	<30	<280	25-40	35-50	40-55
	<35	<320	-	25-40	30-45
Alloyed case hardened steels	<25	<250	25-45	40-60	55-80
Alloyed heat-treatable steels	<30	<280	20-40	35-55	50-70
Alloyed tool steels	<35	<320	15-30	30-50	40-60
High speed tool steels	<38	<380	-	-	-
	<44	<415	-	-	-
	<60		-	-	-
Cast iron		<180	-	-	-
Spheroidal graphite iron	<25	<250	40-65	60-80	75-130
Malleable cast iron	<35	<320	40-65	60-80	75-130
Aluminum and Al-alloys	SILICON CONTENT	WROUGHT AIUMINUM			
Al cast alloys	<10%	n/a	60-75	70-140	100-165
	>10%	n/a	-	-	-
Al wrought alloys	n/a	30-80	80-100	100-150	150-200
	n/a	75-150	80-100	100-150	150-200
Titanium and Ti-alloys		<320	7-26	7-26	20-35
		>320	-	-	-
Nickel and Ni-alloys		<320	7-26	7-26	20-35
		>320	-	-	-
Plastics			-	-	-
Magnesium-alloys			-	-	-
Brass, short-chipping		<180	35-50	50-65	75-100
long-chipping		<180	40-65	60-80	80-120

Technical Information

DRILL SIZE FOR THREAD FORMING @ 55% THREAD

Metric Threads			Metric Threads			UNC / UNF Threads		
Tap Dia.	Pitch mm	Drill size mm	Tap Dia.	Pitch mm	Drill size mm	Tap Size	TPI	Drill size mm
M 1	0.25	0.91	M 10	0.75	9.72	2	56	2.01
M 1.1	0.25	1.01	M 10	1.00	9.63	2	64	2.04
M 1.2	0.25	1.11	M 10	1.25	9.53	3	48	2.32
M 1.4	0.30	1.29	M 10	1.50	9.44	3	56	2.34
M 1.6	0.35	1.47	M 11	0.75	10.72	4	40	2.61
M 1.7	0.35	1.57	M 11	1.00	10.63	4	48	2.65
M 1.8	0.35	1.67	M 11	1.50	10.44	5	40	2.94
M 2	0.40	1.85	M 12	1.00	11.63	5	44	2.96
M 2.2	0.45	2.03	M 12	1.25	11.53	6	32	3.21
M 2.3	0.40	2.15	M 12	1.50	11.44	6	40	3.27
M 2.5	0.45	2.33	M 12	1.75	11.35	8	32	3.87
M 2.6	0.45	2.43	M 14	1.00	13.63	8	36	3.90
M 3	0.50	2.81	M 14	1.25	13.53	10	24	4.43
M 3.5	0.60	3.28	M 14	1.50	13.44	10	32	4.53
M 4	0.70	3.74	M 14	2.00	13.25	12	24	5.09
M 4.5	0.75	4.22	M 15	1.00	14.63	12	28	5.15
M 5	0.50	4.81	M 15	1.50	14.44	1/4	20	5.88
M 5	0.80	4.70	M 16	1.00	15.63	1/4	28	6.01
M 5.5	0.50	5.31	M 16	1.50	15.44	5/16	18	7.41
M 6	0.75	5.72	M 16	2.00	15.25	5/16	24	7.54
M 6	1.00	5.63	M 17	1.00	16.63	3/8	16	8.93
M 7	0.75	6.72	M 17	1.50	16.44	3/8	24	9.13
M 7	1.00	6.63	M 18	1.00	17.63	7/16	14	10.43
M 8	0.75	7.72	M 18	1.50	17.44	7/16	20	10.64
M 8	1.00	7.63	M 18	2.00	17.25	1/2	13	11.97
M 8	1.25	7.53	M 18	2.50	17.07	1/2	20	12.23
M 9	0.75	8.72	M 20	1.00	19.63	9/16	12	13.50
M 9	1.00	8.63	M 20	2.50	19.07	9/16	18	13.76
M 9	1.25	8.53				5/8	11	15.01
						5/8	18	15.35
						3/4	10	18.10
						3/4	16	18.46
						7/8	9	21.17
						7/8	14	21.55
						1	8	24.21
						1	12	24.61

DRILL SIZE FOR THREAD FORMING @ 57.5% THREAD

Metric Threads			Metric Threads			UNC / UNF Threads		
Tap Dia.	Pitch mm	Drill size mm	Tap Dia.	Pitch mm	Drill size mm	Tap Size	TPI	Drill size mm
M 1	0.25	0.90	M 10	0.75	9.71	2	56	2.01
M 1.1	0.25	1.00	M 10	1.00	9.61	2	64	2.03
M 1.2	0.25	1.10	M 10	1.25	9.51	3	48	2.31
M 1.4	0.30	1.28	M 10	1.50	9.41	3	56	2.34
M 1.6	0.35	1.46	M 11	0.75	10.71	4	40	2.60
M 1.7	0.35	1.56	M 11	1.00	10.61	4	48	2.64
M 1.8	0.35	1.66	M 11	1.50	10.41	5	40	2.93
M 2	0.40	1.84	M 12	1.00	11.61	5	44	2.95
M 2.2	0.45	2.02	M 12	1.25	11.51	6	32	3.19
M 2.3	0.40	2.14	M 12	1.50	11.41	6	40	3.26
M 2.5	0.45	2.32	M 12	1.75	11.32	8	32	3.86
M 2.6	0.45	2.42	M 14	1.00	13.61	8	36	3.89
M 3	0.50	2.80	M 14	1.25	13.51	10	24	4.41
M 3.5	0.60	3.27	M 14	1.50	13.41	10	32	4.52
M 4	0.70	3.73	M 14	2.00	13.22	12	24	5.07
M 4.5	0.75	4.21	M 15	1.00	14.61	12	28	5.13
M 5	0.50	4.80	M 15	1.50	14.41	1/4	20	5.85
M 5	0.80	4.69	M 16	1.00	15.61	1/4	28	6.00
M 5.5	0.50	5.30	M 16	1.50	15.41	5/16	18	7.39
M 6	0.75	5.71	M 16	2.00	15.22	5/16	24	7.52
M 6	1.00	5.61	M 17	1.00	16.61	3/8	16	8.90
M 7	0.75	6.71	M 17	1.50	16.41	3/8	24	9.11
M 7	1.00	6.61	M 18	1.00	17.61	7/16	14	10.40
M 8	0.75	7.71	M 18	1.50	17.41	7/16	20	10.62
M 8	1.00	7.61	M 18	2.00	17.22	1/2	13	11.94
M 8	1.25	7.51	M 18	2.50	17.02	1/2	20	12.20
M 9	0.75	8.71	M 20	1.00	19.61	9/16	12	13.46
M 9	1.00	8.61	M 20	2.50	19.02	9/16	18	13.74
M 9	1.25	8.51				5/8	11	14.97
						5/8	18	15.32
						3/4	10	18.06
						3/4	16	18.43
						7/8	9	21.12
						7/8	14	21.52
						1	8	24.16
						1	12	24.57

DRILL SIZE FOR THREAD FORMING @ 60% THREAD

Metric Threads			Metric Threads			UNC / UNF Threads		
Tap Dia.	Pitch mm	Drill size mm	Tap Dia.	Pitch mm	Drill size mm	Tap Size	TPI	Drill size mm
M 1	0.25	0.90	M 10	0.75	9.69	2	56	2.00
M 1.1	0.25	1.00	M 10	1.00	9.59	2	64	2.02
M 1.2	0.25	1.10	M 10	1.25	9.49	3	48	2.30
M 1.4	0.30	1.28	M 10	1.50	9.39	3	56	2.33
M 1.6	0.35	1.46	M 11	0.75	10.69	4	40	2.59
M 1.7	0.35	1.56	M 11	1.00	10.59	4	48	2.63
M 1.8	0.35	1.66	M 11	1.50	10.39	5	40	2.92
M 2	0.40	1.84	M 12	1.00	11.59	5	44	2.94
M 2.2	0.45	2.02	M 12	1.25	11.49	6	32	3.18
M 2.3	0.40	2.14	M 12	1.50	11.39	6	40	3.25
M 2.5	0.45	2.32	M 12	1.75	11.29	8	32	3.84
M 2.6	0.45	2.42	M 14	1.00	13.59	8	36	3.88
M 3	0.50	2.80	M 14	1.25	13.49	10	24	4.39
M 3.5	0.60	3.26	M 14	1.50	13.39	10	32	4.50
M 4	0.70	3.71	M 14	2.00	13.18	12	24	5.05
M 4.5	0.75	4.19	M 15	1.00	14.59	12	28	5.12
M 5	0.50	4.80	M 15	1.50	14.39	1/4	20	5.83
M 5	0.80	4.67	M 16	1.00	15.59	1/4	28	5.98
M 5.5	0.50	5.30	M 16	1.50	15.39	5/16	18	7.36
M 6	0.75	5.69	M 16	2.00	15.18	5/16	24	7.51
M 6	1.00	5.59	M 17	1.00	16.59	3/8	16	8.88
M 7	0.75	6.69	M 17	1.50	16.39	3/8	24	9.09
M 7	1.00	6.59	M 18	1.00	17.59	7/16	14	10.37
M 8	0.75	7.69	M 18	1.50	17.39	7/16	20	10.59
M 8	1.00	7.59	M 18	2.00	17.18	1/2	13	11.90
M 8	1.25	7.49	M 18	2.50	16.98	1/2	20	12.18
M 9	0.75	8.69	M 20	1.00	19.59	9/16	12	13.42
M 9	1.00	8.59	M 20	2.50	18.98	9/16	18	13.71
M 9	1.25	8.49				5/8	11	14.93
						5/8	18	15.30
						3/4	10	18.01
						3/4	16	18.40
						7/8	9	21.07
						7/8	14	21.48
						1	8	24.10
						1	12	24.54

DRILL SIZE FOR THREAD FORMING @ 62.5% THREAD

Metric Threads			Metric Threads			UNC / UNF Threads		
Tap Dia.	Pitch mm	Drill size mm	Tap Dia.	Pitch mm	Drill size mm	Tap Size	TPI	Drill size mm
M 1	0.25	0.89	M 10	0.75	9.68	2	56	1.99
M 1.1	0.25	0.99	M 10	1.00	9.58	2	64	2.02
M 1.2	0.25	1.09	M 10	1.25	9.47	3	48	2.29
M 1.4	0.30	1.27	M 10	1.50	9.36	3	56	2.32
M 1.6	0.35	1.45	M 11	0.75	10.68	4	40	2.57
M 1.7	0.35	1.55	M 11	1.00	10.58	4	48	2.62
M 1.8	0.35	1.65	M 11	1.50	10.36	5	40	2.91
M 2	0.40	1.83	M 12	1.00	11.58	5	44	2.93
M 2.2	0.45	2.01	M 12	1.25	11.47	6	32	3.17
M 2.3	0.40	2.13	M 12	1.50	11.36	6	40	3.24
M 2.5	0.45	2.31	M 12	1.75	11.26	8	32	3.83
M 2.6	0.45	2.41	M 14	1.00	13.58	8	36	3.87
M 3	0.50	2.79	M 14	1.25	13.47	10	24	4.38
M 3.5	0.60	3.25	M 14	1.50	13.36	10	32	4.49
M 4	0.70	3.70	M 14	2.00	13.15	12	24	5.04
M 4.5	0.75	4.18	M 15	1.00	14.58	12	28	5.10
M 5	0.50	4.79	M 15	1.50	14.36	1/4	20	5.81
M 5	0.80	4.66	M 16	1.00	15.58	1/4	28	5.96
M 5.5	0.50	5.29	M 16	1.50	15.36	5/16	18	7.34
M 6	0.75	5.68	M 16	2.00	15.15	5/16	24	7.49
M 6	1.00	5.58	M 17	1.00	16.58	3/8	16	8.85
M 7	0.75	6.68	M 17	1.50	16.36	3/8	24	9.08
M 7	1.00	6.58	M 18	1.00	17.58	7/16	14	10.34
M 8	0.75	7.68	M 18	1.50	17.36	7/16	20	10.57
M 8	1.00	7.58	M 18	2.00	17.15	1/2	13	11.87
M 8	1.25	7.47	M 18	2.50	16.94	1/2	20	12.16
M 9	0.75	8.68	M 20	1.00	19.58	9/16	12	13.39
M 9	1.00	8.58	M 20	2.50	18.94	9/16	18	13.69
M 9	1.25	8.47				5/8	11	14.89
						5/8	18	15.28
						3/4	10	17.97
						3/4	16	18.38
						7/8	9	21.03
						7/8	14	21.45
						1	8	24.05
						1	12	24.50

Technical Information

DRILL SIZE FOR THREAD FORMING @ 65% THREAD

Metric Threads			Metric Threads			UNC / UNF Threads		
Tap Dia.	Pitch mm	Drill size mm	Tap Dia.	Pitch mm	Drill size mm	Tap Size	TPI	Drill size mm
M 1	0.25	0.89	M 10	0.75	9.67	2	56	1.98
M 1.1	0.25	0.99	M 10	1.00	9.56	2	64	2.01
M 1.2	0.25	1.09	M 10	1.25	9.45	3	48	2.28
M 1.4	0.30	1.27	M 10	1.50	9.34	3	56	2.31
M 1.6	0.35	1.45	M 11	0.75	10.67	4	40	2.56
M 1.7	0.35	1.55	M 11	1.00	10.56	4	48	2.61
M 1.8	0.35	1.65	M 11	1.50	10.34	5	40	2.89
M 2	0.40	1.82	M 12	1.00	11.56	5	44	2.92
M 2.2	0.45	2.00	M 12	1.25	11.45	6	32	3.15
M 2.3	0.40	2.12	M 12	1.50	11.34	6	40	3.22
M 2.5	0.45	2.30	M 12	1.75	11.23	8	32	3.81
M 2.6	0.45	2.40	M 14	1.00	13.56	8	36	3.85
M 3	0.50	2.78	M 14	1.25	13.45	10	24	4.36
M 3.5	0.60	3.23	M 14	1.50	13.34	10	32	4.48
M 4	0.70	3.69	M 14	2.00	13.12	12	24	5.02
M 4.5	0.75	4.17	M 15	1.00	14.56	12	28	5.09
M 5	0.50	4.78	M 15	1.50	14.34	1/4	20	5.79
M 5	0.80	4.65	M 16	1.00	15.56	1/4	28	5.95
M 5.5	0.50	5.28	M 16	1.50	15.34	5/16	18	7.31
M 6	0.75	5.67	M 16	2.00	15.12	5/16	24	7.47
M 6	1.00	5.56	M 17	1.00	16.56	3/8	16	8.82
M 7	0.75	6.67	M 17	1.50	16.34	3/8	24	9.06
M 7	1.00	6.56	M 18	1.00	17.56	7/16	14	10.31
M 8	0.75	7.67	M 18	1.50	17.34	7/16	20	10.55
M 8	1.00	7.56	M 18	2.00	17.12	1/2	13	11.84
M 8	1.25	7.45	M 18	2.50	16.90	1/2	20	12.14
M 9	0.75	8.67	M 20	1.00	19.56	9/16	12	13.35
M 9	1.00	8.56	M 20	2.50	18.90	9/16	18	13.66
M 9	1.25	8.45				5/8	11	14.85
						5/8	18	15.25
						3/4	10	17.93
						3/4	16	18.35
						7/8	9	20.98
						7/8	14	21.42
						1	8	24.00
						1	12	24.46

DRILL SIZE FOR THREAD FORMING @ 67.5% THREAD

Metric Threads			Metric Threads			UNC / UNF Threads		
Tap Dia.	Pitch mm	Drill size mm	Tap Dia.	Pitch mm	Drill size mm	Tap Size	TPI	Drill size mm
M 1	0.25	0.89	M 10	0.75	9.66	2	56	1.98
M 1.1	0.25	0.99	M 10	1.00	9.54	2	64	2.00
M 1.2	0.25	1.09	M 10	1.25	9.43	3	48	2.27
M 1.4	0.30	1.26	M 10	1.50	9.31	3	56	2.31
M 1.6	0.35	1.44	M 11	0.75	10.66	4	40	2.55
M 1.7	0.35	1.54	M 11	1.00	10.54	4	48	2.60
M 1.8	0.35	1.64	M 11	1.50	10.31	5	40	2.88
M 2	0.40	1.82	M 12	1.00	11.54	5	44	2.91
M 2.2	0.45	1.99	M 12	1.25	11.43	6	32	3.14
M 2.3	0.40	2.12	M 12	1.50	11.31	6	40	3.21
M 2.5	0.45	2.29	M 12	1.75	11.20	8	32	3.80
M 2.6	0.45	2.39	M 14	1.00	13.54	8	36	3.84
M 3	0.50	2.77	M 14	1.25	13.43	10	24	4.34
M 3.5	0.60	3.22	M 14	1.50	13.31	10	32	4.46
M 4	0.70	3.68	M 14	2.00	13.08	12	24	5.00
M 4.5	0.75	4.16	M 15	1.00	14.54	12	28	5.07
M 5	0.50	4.77	M 15	1.50	14.31	1/4	20	5.77
M 5	0.80	4.63	M 16	1.00	15.54	1/4	28	5.93
M 5.5	0.50	5.27	M 16	1.50	15.31	5/16	18	7.29
M 6	0.75	5.66	M 16	2.00	15.08	5/16	24	7.45
M 6	1.00	5.54	M 17	1.00	16.54	3/8	16	8.80
M 7	0.75	6.66	M 17	1.50	16.31	3/8	24	9.04
M 7	1.00	6.54	M 18	1.00	17.54	7/16	14	10.28
M 8	0.75	7.66	M 18	1.50	17.31	7/16	20	10.53
M 8	1.00	7.54	M 18	2.00	17.08	1/2	13	11.80
M 8	1.25	7.43	M 18	2.50	16.85	1/2	20	12.12
M 9	0.75	8.66	M 20	1.00	19.54	9/16	12	13.32
M 9	1.00	8.54	M 20	2.50	18.85	9/16	18	13.64
M 9	1.25	8.43				5/8	11	14.82
						5/8	18	15.23
						3/4	10	17.88
						3/4	16	18.32
						7/8	9	20.93
						7/8	14	21.39
						1	8	23.94
						1	12	24.43

DRILL SIZE FOR THREAD FORMING @ 70% THREAD

Metric Threads			Metric Threads			UNC / UNF Threads		
Tap Dia.	Pitch mm	Drill size mm	Tap Dia.	Pitch mm	Drill size mm	Tap Size	TPI	Drill size mm
M 1	0.25	0.88	M 10	0.75	9.64	2	56	1.97
M 1.1	0.25	0.98	M 10	1.00	9.52	2	64	2.00
M 1.2	0.25	1.08	M 10	1.25	9.41	3	48	2.26
M 1.4	0.30	1.26	M 10	1.50	9.29	3	56	2.30
M 1.6	0.35	1.43	M 11	0.75	10.64	4	40	2.54
M 1.7	0.35	1.53	M 11	1.00	10.52	4	48	2.59
M 1.8	0.35	1.63	M 11	1.50	10.29	5	40	2.87
M 2	0.40	1.81	M 12	1.00	11.52	5	44	2.90
M 2.2	0.45	1.99	M 12	1.25	11.41	6	32	3.13
M 2.3	0.40	2.11	M 12	1.50	11.29	6	40	3.20
M 2.5	0.45	2.29	M 12	1.75	11.17	8	32	3.79
M 2.6	0.45	2.39	M 14	1.00	13.52	8	36	3.83
M 3	0.50	2.76	M 14	1.25	13.41	10	24	4.32
M 3.5	0.60	3.21	M 14	1.50	13.29	10	32	4.45
M 4	0.70	3.67	M 14	2.00	13.05	12	24	4.98
M 4.5	0.75	4.14	M 15	1.00	14.52	12	28	5.05
M 5	0.50	4.76	M 15	1.50	14.29	1/4	20	5.75
M 5	0.80	4.62	M 16	1.00	15.52	1/4	28	5.92
M 5.5	0.50	5.26	M 16	1.50	15.29	5/16	18	7.27
M 6	0.75	5.64	M 16	2.00	15.05	5/16	24	7.43
M 6	1.00	5.52	M 17	1.00	16.52	3/8	16	8.77
M 7	0.75	6.64	M 17	1.50	16.29	3/8	24	9.02
M 7	1.00	6.52	M 18	1.00	17.52	7/16	14	10.25
M 8	0.75	7.64	M 18	1.50	17.29	7/16	20	10.51
M 8	1.00	7.52	M 18	2.00	17.05	1/2	13	11.77
M 8	1.25	7.41	M 18	2.50	16.81	1/2	20	12.10
M 9	0.75	8.64	M 20	1.00	19.52	9/16	12	13.28
M 9	1.00	8.52	M 20	2.50	18.81	9/16	18	13.62
M 9	1.25	8.41				5/8	11	14.78
						5/8	18	15.20
						3/4	10	17.84
						3/4	16	18.29
						7/8	9	20.88
						7/8	14	21.36
						1	8	23.89
						1	12	24.39

DRILL SIZE FOR THREAD FORMING @ 72.5% THREAD

Metric Threads			Metric Threads			UNC / UNF Threads		
Tap Dia.	Pitch mm	Drill size mm	Tap Dia.	Pitch mm	Drill size mm	Tap Size	TPI	Drill size mm
M 1	0.25	0.88	M 10	0.75	9.63	2	56	1.96
M 1.1	0.25	0.98	M 10	1.00	9.51	2	64	1.99
M 1.2	0.25	1.08	M 10	1.25	9.38	3	48	2.25
M 1.4	0.30	1.25	M 10	1.50	9.26	3	56	2.29
M 1.6	0.35	1.43	M 11	0.75	10.63	4	40	2.53
M 1.7	0.35	1.53	M 11	1.00	10.51	4	48	2.58
M 1.8	0.35	1.63	M 11	1.50	10.26	5	40	2.86
M 2	0.40	1.80	M 12	1.00	11.51	5	44	2.89
M 2.2	0.45	1.98	M 12	1.25	11.38	6	32	3.11
M 2.3	0.40	2.10	M 12	1.50	11.26	6	40	3.19
M 2.5	0.45	2.28	M 12	1.75	11.14	8	32	3.77
M 2.6	0.45	2.38	M 14	1.00	13.51	8	36	3.82
M 3	0.50	2.75	M 14	1.25	13.38	10	24	4.30
M 3.5	0.60	3.20	M 14	1.50	13.26	10	32	4.43
M 4	0.70	3.65	M 14	2.00	13.01	12	24	4.96
M 4.5	0.75	4.13	M 15	1.00	14.51	12	28	5.04
M 5	0.50	4.75	M 15	1.50	14.26	1/4	20	5.72
M 5	0.80	4.61	M 16	1.00	15.51	1/4	28	5.90
M 5.5	0.50	5.25	M 16	1.50	15.26	5/16	18	7.24
M 6	0.75	5.63	M 16	2.00	15.01	5/16	24	7.42
M 6	1.00	5.51	M 17	1.00	16.51	3/8	16	8.74
M 7	0.75	6.63	M 17	1.50	16.26	3/8	24	9.00
M 7	1.00	6.51	M 18	1.00	17.51	7/16	14	10.22
M 8	0.75	7.63	M 18	1.50	17.26	7/16	20	10.49
M 8	1.00	7.51	M 18	2.00	17.01	1/2	13	11.74
M 8	1.25	7.38	M 18	2.50	16.77	1/2	20	12.07
M 9	0.75	8.63	M 20	1.00	19.51	9/16	12	13.24
M 9	1.00	8.51	M 20	2.50	18.77	9/16	18	13.59
M 9	1.25	8.38				5/8	11	14.74
						5/8	18	15.18
						3/4	10	17.80
						3/4	16	18.27
						7/8	9	20.83
						7/8	14	21.33
						1	8	23.84
						1	12	24.36

FORM TAPS

Material group	Approximate Rc	Approximate HB	Recommended SFM		
			HSS-E	HSS-E-PM	Solid carbide
Structural steels, free-cutting steels		<180	45-70	60-90	90-120
Unalloyed case hardened steels	<20	<230	40-65	55-80	75-100
Unalloyed heat-treatable steels	<25	<250	30-55	50-75	65-95
Structural steels, free-cutting steels	<20	<230	40-65	55-80	75-100
Case hardened steels, heat-treatable steels	<25	<250	30-55	50-75	65-95
Nitriding steels, spheroidal graphite iron	<30	<280	25-45	40-70	60-85
	<35	<320	20-35	35-60	50-75
	<38	<380	-	-	-
Stainless- and acid-resistant steels, sulphured		<180	40-50	45-60	50-70
austenitic	<25	<250	35-50	40-55	45-60
martensitic	<30	<280	25-40	35-50	40-55
	<35	<320	-	25-40	30-45
Alloyed case hardened steels	<25	<250	25-45	40-60	55-80
Alloyed heat-treatable steels	<30	<280	20-40	35-55	50-70
Alloyed tool steels	<35	<320	15-30	30-50	40-60
High speed tool steels	<38	<380	-	-	-
	<44	<415	-	-	-
	<60		-	-	-
Cast iron		<180	-	-	-
Spheroidal graphite iron	<25	<250	40-65	60-80	75-130
Malleable cast iron	<35	<320	40-65	60-80	75-130
Aluminium and Al-alloys	Silicon Content	Wrought Aluminum			
Al cast alloys	<10%	n/a	60-75	70-140	100-165
	>10%	n/a	-	-	-
Al wrought alloys	n/a	30-80	80-100	100-150	150-200
	n/a	75-150	80-100	100-150	150-200
Titanium and Ti-alloys		<320	7-26	7-26	20-35
		>320	-	-	-
Nickel and Ni-alloys		<320	7-26	7-26	20-35
		>320	-	-	-
Plastics			-	-	-
Magnesium-alloys			-	-	-
Brass, short-chipping		<180	35-50	50-65	75-100
long-chipping		<180	40-65	60-80	80-120

Fluteless taps and thread forming

Fluteless taps are used for the forming of internal threads without chip removal. In contrast to conventional tapping where material is cut from the workpiece, thread forming is a pressure deformation process without chip removal for the production of internal threads. During the process the material is cold formed without interrupting the grain flow.

According to DIN 8583, thread forming is described as “pressing the thread into the workpiece with a tool possessing a spiral working area”. The spiral threaded, polygonal portion of the fluteless tap is “screwed” into the pre-drilled workpiece with an appropriate constant feed rate equal to the thread pitch. The thread profile is pressed gradually via the forming lead into the material of the workpiece so to speak. Subsequently, the pressure in the deformation zone exceeds the compression limit, the workpiece becomes ductile and is deformed. The material yields radially, “flows” along the thread profile in the unoccupied base of the tool and forms the minor diameter of the nut thread. The flow process creates the process specific form pockets (claws).

The tapping size hole diameter is heavily dependent on the formability of the material, the workpiece geometry and the required effective depth of the thread. In comparison to conventional tapping, a larger diameter tapping size hole should be selected. With a larger diameter tapping size hole the load on the tool is reduced while increasing the tool life. Thanks to the uninterrupted grain flow, the loading capacity of the thread remains sufficient with a 50% effective thread depth.

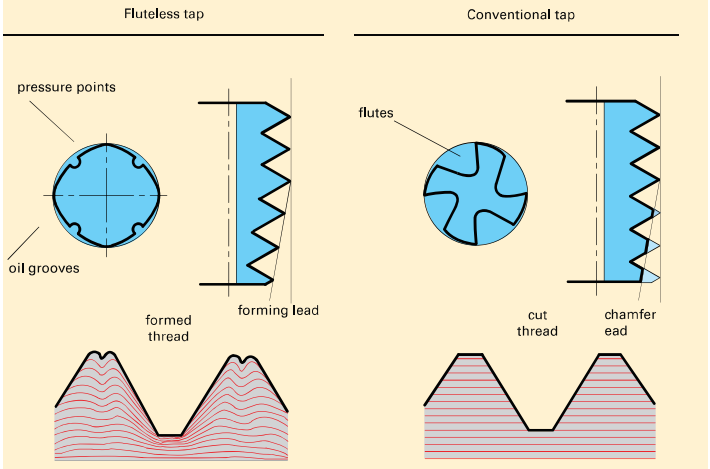
The partially formed crests of the thread with decreasing effective thread depth are a typical characteristic of threads produced by the thread forming process. With the flanks of the thread fully formed, they have no influence on the tensile strength of the thread. If necessary, the required deformation level of the thread should be determinded by performing a test.

Lubrication is of significant importance. The lubrication prevents material from building up on the thread flanks and ensures that the necessary torque for the forming process is not too high. Therefore, under no circumstances should there ever be a break-down in lubrication! Preference should be given to lubricants such as cooling agents of oils containing graphite such as those used in rolling processes. Always follow the rule: “The better the lubrication the easier the thread forming process.”

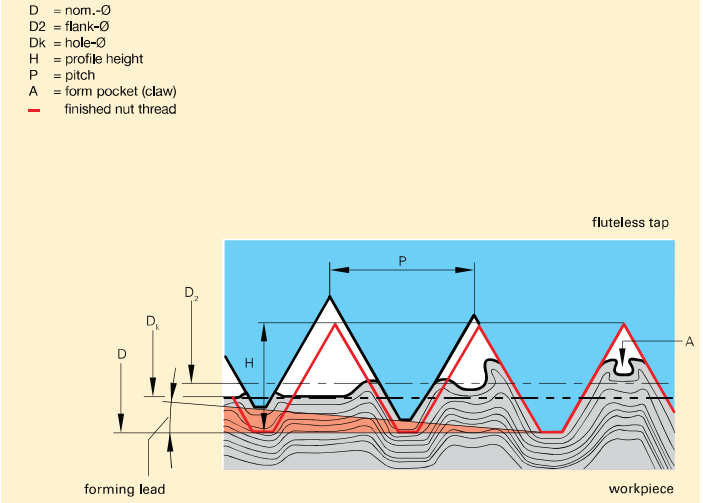
It offers the following advantages:

- no chip formation.
- one tool for the production of threads in through and blind holes.
- application in wide range of materials.
- no cutting errors.
- pitch and angle of thread errors that can occur with thread cutting are eliminated.
- internal threads produced by thread forming possess a higher tensile strength particularly at the thread flanks thanks to the so-called “uninterrupted grain flow” and the cold forming process.
- the surface of the thread is improved.
- fluteless taps can be applied at higher speeds because the formability of many materials increases with the forming speed. This does not have a negative effect on the tool life.
- reduced danger of breakage through rigid design

Process
The production of internal threads without chip removal (thread forming) in comparison to conventional tapping



Flow characteristics of the material during thread forming and the deformation process



Guhring's fluteless taps - Characteristics and advantages

Conventional fluteless taps, produced by a grinding process only, show traces of microscopic, very fine grinding marks on the surface of the tool. This also applies to the threaded portion of the tool required to perform the thread forming operation.

This surface topography (structure) has a negative effect on the friction between the tool and the material to be re-formed as well as on the herewith associated heat development, on the necessary torque and last but not least on the wear of the pressure points of the fluteless tap. In addition, the "grinding marks" encourage the build-up of the material to be re-formed in the thread flanks of the fluteless tap. This is also called cold welding.

Thanks to a special process to improve the surface topography (structure), Guhring's new Profile fluteless taps no longer possess these "grinding marks". This has been confirmed in research and tool life studies in varying materials under production conditions.

For the user, a longer tool life and increased cutting speeds are the benefits of this special process. The tool life can be increased considerably depending on the material to be machined and the application condi-tions. A 100% increase in tool life is not unusual.

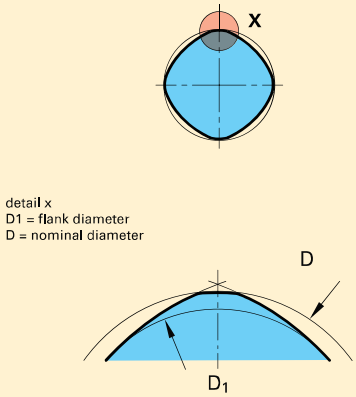
The improved surface topography is not only of benefit to tools with bright finish. Particularly coated tools also benefit from the new process. Outer contour and forming lead greatly determine the performance of the fluteless tap. Numerous tests have shown that fluteless taps with optimal pressure point geometry and quantity achieve increased tool life and dimensional accuracy.

Further improvements in quality are achieved when the fluteless tap is produced completely in one setting and with one grinding wheel - set-up with a special roll. Pitch errors between the thread crests and former lead transition area do not occur as with the conventional grinding process.

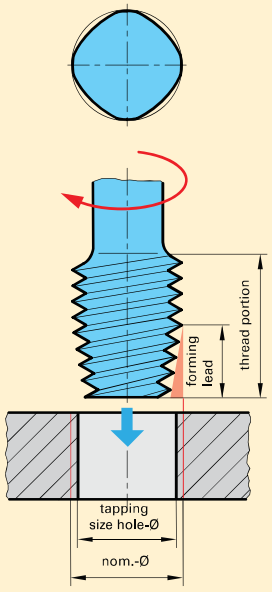
Surface of a conventional fluteless tap

Optimized surface of a Guhring Profile fluteless tap

Cross section of fluteless tap



The principle



Types of tapping size hole

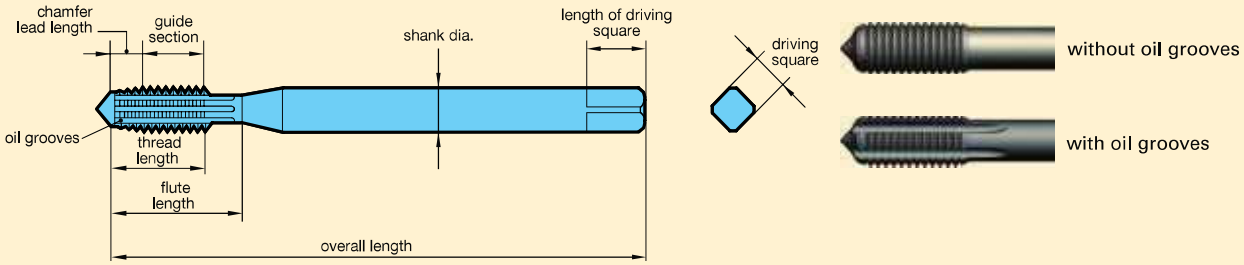
with fluteless taps without oil grooves for thread depth ≤ 1 x D

for thread depth ≥ 1 x D

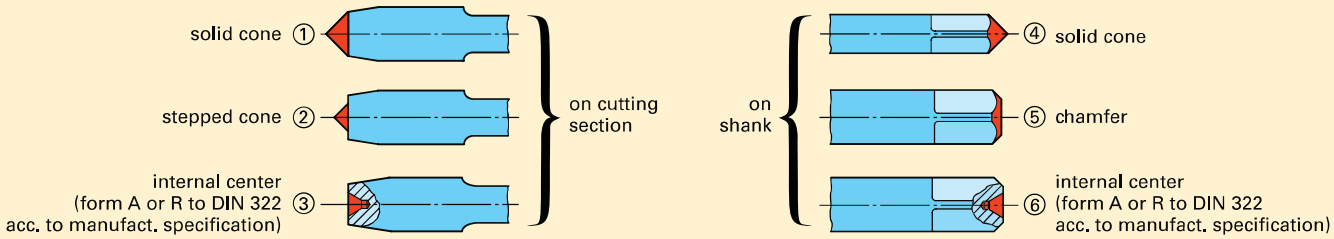
with fluteless taps with oil grooves for all thread depths

Definitions, angles, centers, thread tolerances and fits

Thread portion



Types of centres (standard, to DIN 2197/DIN 2175)



Thread dia. range mm	Center on cutting section: with chamfer forms A, C, D, E	Center on cutting section: with chamfer form B	Center on shank
≤ 5.6	①	①	④ ⑤ ⑥
> 5.6 ... 12.8	① ② ③	① ② ③	④ ⑤ ⑥
> 12.8	③	③	⑥

Thread tolerances and fits

Fits between internal and external threads are separated by a diagonal stroke, as for example 6H/6g (internal/external thread). The fit has to be selected in conjunction with the appropriate thread connection.
The tolerance zones of the tolerance classes fine, medium and coarse are allocated to three screw-in lengths short (S), normal (N) and long (L). Generally, the following rules apply for selecting a tolerance class:

Fine tolerance zone (S):
For precision threads, when only a small variation in the fit is permitted.

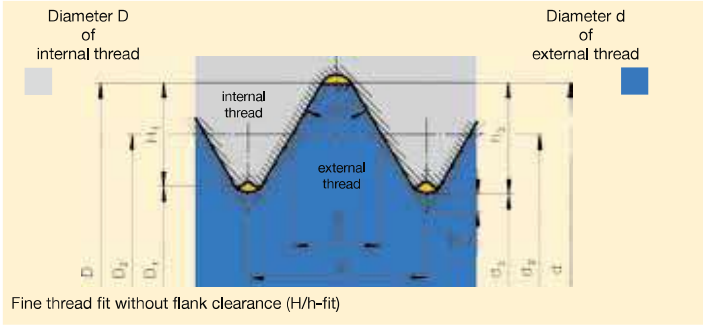
Screw-in lengths:
The quality of thread connection is also affected by the screw-in length. The ISO tolerance system was, especially as regards the pitch diameter, divided into three groups, i.e.

Medium tolerance zone (N):
General application

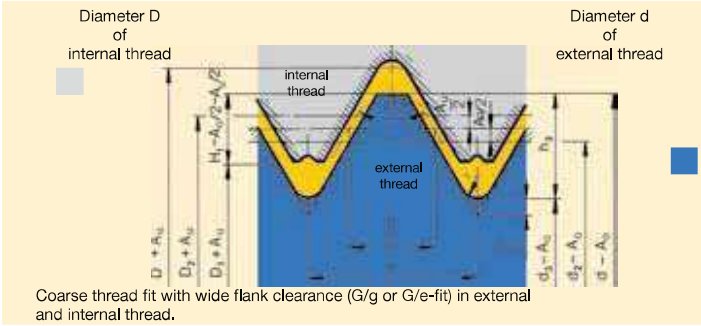
Coarse tolerance zone (L):
There are no special precision requirements and in cases where production difficulties may occur, e.g. thread production in hot-rolled rods, deep blind holes or plastic components.

The following fit should be selected for normal screw-in length N:
To ensure a tighter fit of thread connections, we recommend for short screw-in lengths a narrower fit.

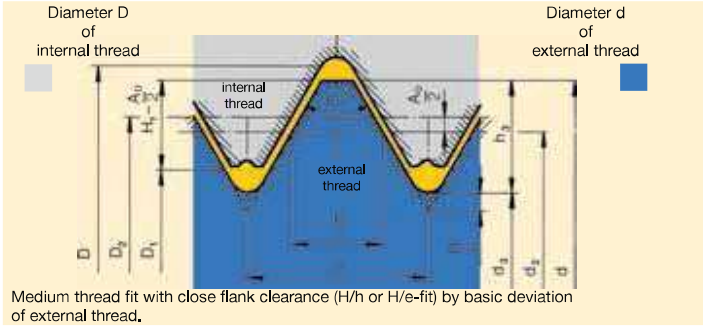
Thread fit with varying flank clearance



Fine thread fit without flank clearance (H/h-fit)



Coarse thread fit with wide flank clearance (G/g or G/e-fit) in external and internal thread.



Medium thread fit with close flank clearance (H/h or H/e-fit) by basic deviation of external thread.

Explanation of symbols

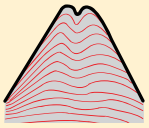
D	= major diameter of internal thread
D1	= nominal diameter of tapping size hole
D2	= effective diameter of internal thread
d	= major diameter of external thread
d2	= effective diameter of external thread
d3	= root diameter of external thread
P	= pitch
s	= pitch angle
H	= peak to valley height of thread profile
Ao	= positive tolerance
Au	= negative tolerance

Tapping size hole diameter

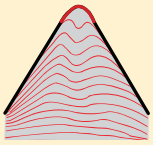
With fluteless tapping, the tapping size hole diameter influences the distinction of the formed thread. A too small tapping size hole diameter results in an over-forming of the thread which must definitely be prevented because this can lead to tool breakage. A too large tapping size hole is acceptable with certain tolerances because formed threads have a sufficient loading capacity from a 50% bearing depth.

Tapping size hole diameter is too large:
- thread not formed
- large form pocket (claw)
- height of profile too low

Optimal tapping size hole diameter:
- thread fully formed
- small form pocket (claw)
- optimal height of profile



Tapping size hole too small:
- thread over-formed
- no form pocket (claw)
- profile too high



Cooling lubricants with fluteless taps

With fluteless taps the main task of the coolant is lubrication. The better the lubrication with the maximum concentration, the longer the tool life.

There are two different types of lubricant:

Oil based lubricants

These are mineral oils with the best lubricating characteristics. They reduce friction and achieve optimal life.

Soluble lubricants

Soluble, or emulsion, lubricants are concentrates mixed with water. Where a 6% emulsion is typically fine for most cutting processes, a higher level of lubricity is needed for thread forming. A content of 12% is ideal for forming threads. It should be noted that 50% of the success of thread forming is based on proper lubrication.