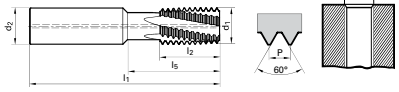
Universal thread milling cutters - UN threads

Series	3595	3596
Tool material	Solid Carbide	
Coating	TiCN*	TiCN*
Type	TMU SP	TMU SP
Shank	HA	HB
Coolant delivery	axial	axial

Material		Suitability
P	Steel	●
M	Stainless steel	●
K	Cast iron	●
N	Aluminum	●
S	Ni / Ti alloys	●
H	Hardened steel	○

●=Optimal ○=Secondary



** TiCN coated thread mills will transition to Sirius coating as stock is replenished*

TPI	D	d1	d2	l1	l5	l2	No. of flutes	Code no.	EDP Number	EDP Number
	Ø	mm	mm	mm	mm	mm				
24	≥ 1/2	9.95	10.00	70.00	25.00	16.00	4	10.240	**9035950102400**	**9035960102400**
16	≥ 5/8	11.95	12.00	80.00	31.00	20.00	4	12.160	**9035950121600**	**9035960121600**
18	≥ 5/8	11.95	12.00	80.00	31.00	20.00	4	12.180	**9035950121800**	**9035960121800**
20	≥ 11/16	11.95	12.00	80.00	31.00	20.00	4	12.200	**9035950122000**	**9035960122000**
24	≥ 5/8	11.95	12.00	80.00	31.00	20.00	5	12.240	**9035950122400**	**9035960122400**
14	≥ 7/8	15.95	16.00	90.00	40.00	25.00	5	16.140	**9035950161400**	**9035960161400**
16	≥ 7/8	15.95	16.00	90.00	40.00	25.00	5	16.160	**9035950161600**	**9035960161600**
18	≥ 7/8	15.95	16.00	90.00	40.00	25.00	5	16.180	**9035950161800**	**9035960161800**
20	≥ 13/16	19.95	16.00	90.00	40.00	25.00	5	16.200	**9035950162000**	**9035960162000**
8	≥ 1	19.95	20.00	105.00	50.00	33.00	5	20.080	**9035950200800**	**9035960200800**
12	≥ 1	19.95	20.00	105.00	50.00	33.00	5	20.120	**9035950201200**	**9035960201200**
14	≥ 1	19.95	20.00	105.00	50.00	33.00	5	20.140	**9035950201400**	**9035960201400**
16	≥ 1	19.95	20.00	105.00	50.00	33.00	5	20.160	**9035950201600**	**9035960201600**

See page 84 for machining parameters

See page 74 for tap/drill size info

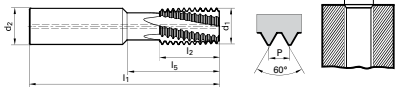
Universal thread milling cutters - ISO metric threads

Series	3541	3556
Tool material	Solid Carbide	
Coating	TiCN*	TiCN*
Type	TMU SP	TMU SP
Shank	HA	HB
Coolant delivery	axial	axial

NEW HB Shank

Material		Suitability
P	Steel	●
M	Stainless steel	●
K	Cast iron	●
N	Aluminum	●
S	Ni / Ti alloys	●
H	Hardened steel	○

●=Optimal ○=Secondary



** TiCN coated thread mills will transition to Sirius coating as stock is replenished*

P	D	d1	d2	l1	l5	l2	No. of flutes	Code no.	EDP Number	EDP Number
mm	Ø mm	mm	mm	mm	mm	mm				
1.00	≥ 12	9.95	10.00	70.00	25.00	16.00	4	10.100	**9035410101000**	**9035560101000**
1.25	≥ 14	9.95	10.00	70.00	25.00	16.00	4	10.125	**9035410101250**	**9035560101250**
1.50	≥ 14	9.95	10.00	70.00	25.00	16.00	4	10.150	**9035410101500**	**9035560101500**
1.00	≥ 16	11.95	12.00	80.00	31.00	20.00	4	12.100	**9035410121000**	**9035560121000**
1.25	≥ 16	11.95	12.00	80.00	31.00	20.00	4	12.125	**9035410121250**	**9035560121250**
1.50	≥ 16	11.95	12.00	80.00	31.00	20.00	4	12.150	**9035410121500**	**9035560121500**
1.00	≥ 18	15.95	16.00	90.00	40.00	25.00	5	16.100	**9035410161000**	**9035560161000**
1.50	≥ 20	15.95	16.00	90.00	40.00	25.00	5	16.150	**9035410161500**	**9035560161500**
2.00	≥ 22	15.95	16.00	90.00	40.00	25.00	5	16.200	**9035410162000**	**9035560162000**
3.00	≥ 24	19.95	18.00	102.00	50.00	33.00	5	18.300	**9035410183000**	**9035560183000**
1.00	≥ 24	19.95	20.00	105.00	50.00	33.00	5	20.100	**9035410201000**	**9035560201000**
1.50	≥ 26	19.95	20.00	105.00	50.00	33.00	5	20.150	**9035410201500**	**9035560201500**
2.00	≥ 26	19.95	20.00	105.00	50.00	33.00	5	20.200	**9035410202000**	**9035560202000**
2.50	≥ 26	19.95	20.00	105.00	50.00	33.00	5	20.250	**9035410202500**	**9035560202500**
3.00	≥ 27	19.95	20.00	105.00	50.00	33.00	5	20.300	**9035410203000**	**9035560203000**
3.50	≥ 30	19.95	20.00	105.00	50.00	33.00	5	20.350	**9035410203500**	**9035560203500**

See page 84 for machining parameters

See page 74 for tap/drill size info

Application recommendations thread milling cutters and micro thread milling cutters

ISO		Hardness HRC	Hardness Brinell	Cutting speed SFM	Milling part diameter [d1] / feed per tooth [IPT] Ø1 mm	Ø2 mm	Ø3 mm	Ø4 mm	Ø5 mm	Ø6 mm	Ø7 mm	Ø8 mm	Ø9 mm	Ø10 mm	Ø12 mm	Ø14 mm	Ø16 mm	Ø18 mm	Ø20 mm	TM	TMC	TMU	MTM3	MTM1	MTMH3
P	Structural/free-cutting steels, Unalloyed heat-treatable-/ case hardened steels	< 22	< 220	300	0.0004	0.0008	0.0008	0.0010	0.0012	0.0014	0.0018	0.0020	0.0022	0.0024	0.0024	0.0026	0.0026	0.0028	0.0031	●	●	●	●	●	●
	Free-cutting steels, unalloyed case hardened steels, nitriding steels	< 30	< 290	260	0.0004	0.0008	0.0008	0.0010	0.0012	0.0014	0.0018	0.0020	0.0022	0.0024	0.0024	0.0026	0.0026	0.0028	0.0031	●	●	●	●	●	●
	Alloyed heat-treatable steels, heat-treatable steels, high speed steels	< 38	<350	230	0.0004	0.0008	0.0008	0.0010	0.0012	0.0014	0.0018	0.0020	0.0022	0.0024	0.0024	0.0026	0.0026	0.0028	0.0031	○	●	●	●	●	●
M	Stainless steel sulfured, austenitic	< 30	< 290	180	0.0004	0.0008	0.0010	0.0012	0.0012	0.0012	0.0014	0.0016	0.0020	0.0022	0.0024	0.0026	0.0026	0.0028	0.0030	○	●	●	●	●	●
	Stainless and acid-resit. steel steels, martensitic	< 30	< 290	165	0.0004	0.0008	0.0010	0.0012	0.0012	0.0012	0.0014	0.0016	0.0020	0.0022	0.0024	0.0026	0.0026	0.0028	0.0030	○	●	●	●	●	●
	duplex and super duplex	< 40	< 375	150	0.0004	0.0008	0.0010	0.0012	0.0012	0.0012	0.0014	0.0016	0.0020	0.0022	0.0024	0.0026	0.0026	0.0028	0.0030	○	●	●	●	●	●
K	cast iron		< 300	400	0.0004	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.002	0.0024	0.0026	0.0028	0.0031	0.0035	0.0039	0.0047	●	●	●	●	●	●
	Spher. graph. iron and mall. cast iron		< 350	330	0.0004	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.002	0.0024	0.0026	0.0028	0.0031	0.0035	0.0039	0.0047	●	●	●	●	●	●
	ADI, GGV		< 350	260	0.0004	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.002	0.0024	0.0026	0.0028	0.0031	0.0035	0.0039	0.0047	●	●	●	●	●	●
N	Aluminium and wrought alloys		30 - 150	820	0.0008	0.0012	0.0014	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028	0.0031	0.0033	0.0035	0.0039	0.0047	●	●	●	●	●	●
	Aluminium- cast alloys	6-12 % silicon content	– –	750	0.0008	0.0012	0.0014	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028	0.0031	0.0033	0.0035	0.0039	0.0047	●	●	●	●	●	●
	Magnesium alloys		< 150	600	0.0008	0.0012	0.0014	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028	0.0031	0.0033	0.0035	0.0039	0.0047	●	●	●	●	●	●
	Copper and copper alloys		≤ 120	425	0.0004	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028	0.0030	0.0031	0.0035	●	●	●	●	●	●
	Copper special alloys		< 410	525	0.0004	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.0020	0.0022	0.0024	0.0024	0.0026	0.0028	0.0030	0.0031	●	●	●	●	●	●
	Plastics [thermoplastics, duroplastics]		– –	1000	0.0008	0.0012	0.0016	0.0018	0.0020	0.0022	0.0024	0.0028	0.0031	0.0035	0.0035	0.0039	0.0047	0.0051	0.0059	●	●	●	●	●	●
S	Titanium and titanium alloys		< 350	130	0.0004	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028	●	●	●	●	●	●
	Nickel, cobalt, iron alloys		< 410	100	0.0004	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016	0.0016	0.0018	0.0020	0.0022	0.0024	0.0026	0.0028	●	●	●	●	●	●
H	High tensile steels, hardened steels		< 55	150	x	0.0004	0.0006	0.0008	0.001	0.0012	0.0012	0.0014	0.0016	0.0018	0.002	0.0022	0.0024	0.0026	0.0028	○	●	○	●	○	●
			< 62	165	x	0.0004	0.0006	0.0008	0.001	0.0012	0.0012	0.0014	0.0016	0.0018	0.002	0.0022	0.0024	0.0026	0.0028						●

● Optimal
○ Secondary

TMU SP – Universal thread milling cutters

GUHRING

CNC Data Sheet

Date 12.11.2019

Machining Task		Material			
Thread Dimension	1 1/4-12UNFx2.117 right	Cast aluminum alloys			
Length	1.30 Inch				
countersink ∢ = 90°	No				

Tool		Cutting Values			
Description	TMU Universalgewindefräser	**Milling**			
Milling cutter diameter	d1 = 0.785 Inch	**Vc**	9055 Inch/min	**n**	3670 1/min
Programmed Radius	0.391 Inch	**fz**	0.005 Inch/tooth		
Order-No	3596_20.120	**Vf**	87.00 Inch/min	**Vm**	32.22 Inch/min

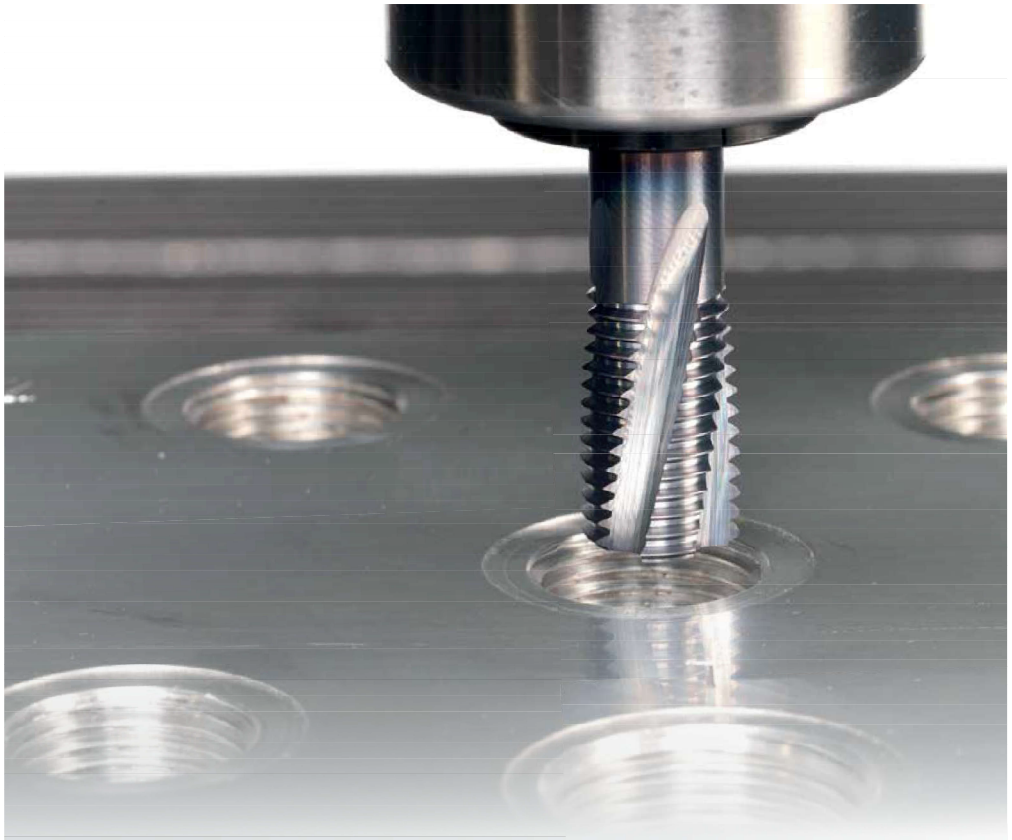
NC-Options		Cycle Time	
Machine Control	Sinumerik [DIN]	**Total Time**	4.76 sec.
Cutting Path	Center point path, incremental		
Milling process	Conventional milling		
No. of passes	One cut		

Note CNC-program serves as a programming example and should be tested by simulation before use on component.

CNC-Code

- Tool= TMU Universalgewindefräser 1 1/4-12UNFx2.117 right
- Material= N2
- Vc=9055 Inch/min
- fz=0.005 Inch/tooth
- Conventional milling
- One cut
- Thread Type= Internal Right-Hand Thread

Attention, for controls that refer to outer path, values in brackets to be used!



CNC-Code

```
N10 M6 T1
N20 G90 G54 G00 X0.0000 Y0.0000
N30 Z0.0787 S3670 M3 M8
N40 Z-1.1909
N50 G91
N60 G42 G01 X0.0000 Y0.3927 F16.11 ;(F43.34)
N70 G02 X0.0000 Y-1.0177 I0.0000 J-0.5089 Z-0.0125
N80 G02 X0.0000 Y0.0000 I0.0000 J0.6250 Z-0.0833 F32.22 ;(F86.69)
N90 G02 X0.0000 Y1.0177 I0.0000 J0.5089 Z-0.0125
N100 G40 G01 X0.0000 Y-0.3927
N110 G90
N120 G00 Z0.0787 M9
N130 M30
```

Attention, for controls that refer to outer path, values in brackets to be used!

Drill size for thread milling cutters

Std. ISO metric threads DIN 13

nom. Ø	pitch P mm	Tapping size hole Ø DIN 336 mm	core diameter of int. thread 6H* min. mm	core diameter of int. thread 6H* max. mm
M 1	0.25	**0,75**	0.729	0.785
M 1.1	0.25	**0.85**	0.829	0.885
M 1.2	0.25	**0.95**	0.929	0.985
M 1.4	0.30	**1.10**	1.075	1.142
M 1.6	0.35	**1,25**	1.221	1.321
M 1.8	0.35	**1.45**	1.421	1.521
M 2	0.40	**1.60**	1.567	1.679
M 2.2	0.45	**1.75**	1.713	1.838
M 2.5	0.45	**2,05**	2.013	2.138
M 3	0.50	**2,50**	2.459	2.599
M 3.5	0.60	**2.90**	2.850	3.010
M 4	0.70	**3.30**	3.242	3.422
M 4.5	0.75	**3.70**	3.688	3.878
M 5	0.80	**4,20**	4.134	4.334
M 6	1.00	**5,00**	4.917	5,153
M 7	1.00	**6.00**	5.917	6.153
M 8	1.25	**6.80**	6.647	6.912
M 9	1.25	**7,80**	7.647	7.912
M 10	1.50	**8.50**	8.376	8.676
M 11	1.50	**9.50**	9.376	9.676
M 12	1,75	**10.20**	10.106	10,441
M 14	2.00	**12,00**	11.835	12,210
M 16	2.00	**14,00**	13.835	14,210
M 18	2.50	**15,50**	15,294	15,744
M 20	2.50	**17.50**	17.294	17.744
M 22	2.50	**19,50**	19,294	19,744
M 24	3,00	**21,00**	20.752	21,252
M 27	3.00	**24,00**	23.752	24,252
M 30	3.50	**26.50**	26.211	26.771
M 33	3.50	**29.50**	29.211	29.771
M 36	4.00	**32,00**	31.670	32.270
M 39	4.00	**35,00**	34.670	35,270
M 42	4.50	**37.50**	37.129	37,799
M 45	4.50	**40.50**	40.129	40.799
M 48	5.00	**43,00**	42.587	43.297
M 52	5.00	**47,00**	46.587	47,297
M 56	5.50	**50.50**	50.046	50.796

ISO metric fine threads DIN 13

nom.- Ø	x pitch P mm	Tapping size hole Ø DIN 336 mm	core diameter of int. thread 6H min. mm	core diameter of int. thread 6H max. mm
M 2.5	x 0.35	**2.15**	2.121	2.221
M 3.0	x 0.35	**2.65**	2.621	2.721
M 3.5	x 0.35	**3.15**	3.121	3.221
M 4.0	x 0.50	**3,50**	3.459	3.599
M 4.5	x 0.50	**4.00**	3.959	4.099
M 5,0	x 0,50	**4.50**	4.459	4.599
M 5.5	x 0.50	**5.00**	4.959	5.099
M 6.0	x 0.75	**5,20**	5.188	5.378
M 7.0	x 0.75	**6,20**	6.188	6.378
M 8.0	x 0.50	**7.50**	7.459	7.599
M 8.0	x 0.75	**7.20**	7.188	7.378
M 8.0	x 1.00	**7.00**	6.917	7.153
M 9.0	x 0.75	**8,20**	8.188	8.378
M 9.0	x 1.00	**8,00**	7.917	8.153
M 10	x 0.75	**9,20**	9.188	9,378
M 10	x 1.00	**9.00**	8.917	9.153
M 10	x 1,25	**8.80**	8.647	8.912
M 11	x 0.75	**10.20**	10.188	10.378
M 11	x 1.00	**10.00**	9.917	10.153
M 12	x 1.00	**11.00**	10.917	11.153
M 12	x 1.25	**10.80**	10.647	10.912
M 12	x 1.50	**10.50**	10.376	10.676
M 14	x 1.00	**13,00**	12.917	13,153
M 14	x 1,25	**12,80**	12.647	12.912
M 14	x 1.50	**12.50**	12.376	12.676
M 15	x 1.00	**14.00**	13.917	14.153
M 15	x 1.50	**13.50**	13.376	13.676
M 16	x 1.00	**15.00**	14.917	15.153
M 16	x 1.25	**14,80**	14.647	14.912
M 16	x 1.50	**14,50**	14.376	14.676
M 17	x 1.00	**16.00**	15.917	16.153
M 17	x 1.50	**15.50**	15.376	15.676
M 18	x 1.00	**17.00**	16.917	17.153
M 18	x 1.50	**16.50**	16.376	16.676
M 20	x 1.00	**19.00**	18.917	19.153
M 20	x 1.50	**18.50**	18.376	18.676
M 20	x 2.00	**18.00**	17.835	18.210
M 22	x 1.00	**21,00**	20.917	21.153
M 22	x 1.50	**20.50**	20.376	20.676
M 22	x 2.00	**20,00**	19.835	20.210
M 24	x 1,00	**23,00**	22,917	23,153
M 24	x 1,50	**22,50**	22,376	22,676
M 24	x 2.00	**22.00**	21,835	22,210
M 25	x 1.00	**24.00**	23,917	24,153
M 25	x 1.50	**23,50**	23,376	23,676
M 25	x 2.00	**23,00**	22,835	23,210
M 27	x 1.00	**26.00**	25,917	26,153
M 27	x 1.50	**25.50**	25,376	25,676
M 27	x 2.00	**25.00**	24,835	25,210
M 28	x 1.00	**27,00**	26,917	27,153
M 28	x 1.50	**26,50**	26,376	26,676
M 28	x 2.00	**26.00**	25,835	26,210
M 30	x 1.00	**29.00**	28,917	29,153
M 30	x 1.50	**28.50**	28,376	28,676
M 30	x 2.00	**28.00**	27,835	28,210
M 30	x 3.00	**27.00**	26,752	27,252
M 32	x 1.50	**30.50**	30,376	30,676
M 32	x 2.00	**30.00**	29,835	30,210
M 33	x 1.50	**31.50**	31,376	31,676
M 33	x 2.00	**31.00**	30,835	31,210
M 33	x 3.00	**30,00**	29,752	30,252
M 35	x 1.50	**33,50**	33,376	33,676
M 36	x 1.50	**34.50**	34,376	34,676

UNC-threads ASME B1.1

nom. Ø	threads per inch	Tapping size hole Ø DIN 336 mm	core diameter of int. thread 2B min. mm	core diameter of int. thread 2B max. mm
Nr. 1	- 64	**1,55**	1,425	1,580
Nr. 2	- 56	**1,85**	1,694	1,872
Nr. 3	- 48	**2,10**	1,941	2,146
Nr. 4	- 40	**2.35**	2,157	2,385
Nr. 5	- 40	**2.65**	2,487	2,698
Nr. 6	- 32	**2,85**	2,642	2,896
Nr. 8	- 32	**3.50**	3.302	3.531
Nr. 10	- 24	**3.90**	3.683	3.937
Nr. 12	- 24	**4.50**	4.343	4.597
1/4	- 20	**5.10**	4.978	5.258
5/16	- 18	**6.60**	6.401	6.731
3/8	- 16	**8,00**	7.798	8,153
7/16	- 14	**9.40**	9.144	9.550
1/2	- 13	**10.80**	10.592	11.024
9/16	- 12	**12.20**	11.989	12.446
5/8	- 11	**13.50**	13.386	13.868
3/4	- 10	**16,50**	16.307	16.840
7/8	- 9	**19,50**	19.177	19.761
1	- 8	**22.25**	21.971	22.606
1 1/8	- 7	**25.00**	24.638	25.349
1 1/4	- 7	**28.00**	27.813	28.524
1 3/8	- 6	**30,75**	30.353	31.115
1 1/2	- 6	**34,00**	33.528	34.290
1 3/4	- 5	**39.50**	38.938	39.802
2	- 4.5	**45.00**	44.679	45.593

UNJC-threads ISO 3161

nom. Ø	threads per inch	tapping size hole Ø mm	core diameter of int. threads 3B min. mm	core diameter of int. threads 3B max. mm
Nr. 6	- 32	**2,85**	2,733	2,939
Nr. 8	- 32	**3.55**	3,393	3,599
Nr. 10	- 24	**4.00**	3,795	4,064
Nr. 12	- 24	**4.60**	4.455	4.704
1/4	- 20	**5,30**	5.113	5.387
5/16	- 18	**6,75**	6.563	6.833
3/8	- 16	**8.20**	7.978	8.255
7/16	- 14	**9.60**	9.346	9,639
1/2	- 13	**11.00**	10.798	11.095
9/16	- 12	**12,40**	12.228	12.482
5/8	- 11	**13,80**	13.627	13.904

UNJF-Threads ISO 3161

nom. Ø	threads per inch	tapping size hole Ø mm	Kern-Ø Innengewinde 3B min. mm	Kern-Ø Innengewinde 3B max. mm
Nr. 6	- 40	**3.00**	2,888	3,053
Nr. 8	- 36	**3.60**	3.480	3.663
Nr. 10	- 32	**4,20**	4.054	4.255
Nr. 12	- 28	**4,75**	4.602	4.816
1/4	- 28	**5.60**	5.466	5.662
5/16	- 24	**7.00**	6.906	7.109
3/8	- 24	**8.60**	8,494	8,679
7/16	- 20	**10,00**	9,876	10,084
1/2	- 20	**11,60**	11.463	11.661
9/16	- 18	**13.00**	12.913	13.122
5/8	- 18	**14.60**	14.501	14.702

(Whitworth - BSPP) threads (DIN-ISO 228-1)

nom. Ø inch	threads per inch	tapping size hole Ø mm	core diameter of int. thread min. mm	core diameter of int. thread max. mm
G 1/16	28	**6.80**	6.561	6.843
G 1/8	28	**8.80**	8.566	8.848
G 1/4	19	**11.80**	11.445	11.890
G 3/8	19	**15.25**	14.950	15.395
G 1/2	14	**19.00**	18.631	19.172
G 5/8	14	**21,00**	20.587	21,128
G 3/4	14	**24.50**	24.117	24.658
G 7/8	14	**28.25**	27.877	28,418
G 1	11	**30.75**	30.291	30.931
G 1 1/8	11	**35.50**	34.939	35.579
G 1 1/4	11	**39,50**	38.952	39.592
G 1 1/2	11	**45,25**	44.845	45,485
G 1 3/4	11	**51.00**	50.788	51,428
G 2	11	**57.00**	56.656	57.296

MJ threads DIN ISO 5855

nom. Ø	x pitch P mm	tapping size hole Ø mm	core diameter of int. threads 5H* min. mm	core diameter of int. threads 5H* max. mm
MJ 3	x 0.50	**2,60**	2.513	2.653
MJ 4	x 0.70	**3.40**	3.318	3.498
MJ 5	x 0,80	**4,30**	4.221	4.421
MJ 6	x 0.50	**5.55**	5.513	5.625
MJ 6	x 0.75	**5.35**	5.269	5.419
MJ 6	x 1.00	**5,10**	5.026	5.216
MJ 8	x 0.50	**7,55**	7.513	7.625
MJ 8	x 0.75	**7.35**	7.269	7.419
MJ 8	x 1.00	**7.10**	7.026	7.216
MJ 8	x 1,25	**6.90**	6.782	6.994
MJ 10	x 1.00	**9,10**	9.026	9.216
MJ 10	x 1,25	**8,90**	8.782	8.994
MJ 10	x 1.50	**8.60**	8.539	8.775
MJ 12	x 1.75	**10.40**	10.295	10.560
MJ 16	x 2.00	**14.20**	14.051	14.351

* M 1.1 up to M 1.4 tapping size hole of int. thread 5H

Drill size for thread milling cutters

UNF-threads ASME B1,1

nom. Ø	threads per inch	tapping size hole Ø DIN 336 mm	core diameter of int. thread 2B min. mm	core diameter of int. thread 2B max. mm
Nr. 1	- 72	**1,55**	1.473	1.610
Nr. 2	- 64	**1.85**	1.755	1.910
Nr. 3	- 56	**2.15**	2.024	2.197
Nr. 4	- 48	**2.40**	2.271	2.459
Nr. 5	- 44	**2,70**	2.550	2.741
Nr. 6	- 40	**2,95**	2.819	3.023
Nr. 8	- 36	**3.50**	3.404	3.607
Nr. 10	- 32	**4.10**	3.962	4.166
Nr. 12	- 28	**4.60**	4.496	4.724
1/4	- 28	**5,50**	5.359	5.588
5/16	- 24	**6.90**	6.782	7.036
3/8	- 24	**8.50**	8.382	8.636
7/16	- 20	**9.90**	9.728	10.033
1/2	- 20	**11.50**	11.328	11.608
9/16	- 18	**12,90**	12,751	13,081
5/8	- 18	**14,50**	14,351	14,681
3/4	- 16	**17.50**	17,323	17,678
7/8	- 14	**20.40**	20,269	20,650
1	- 12	**23,25**	23,114	23,571
1 1/8	- 12	**26.50**	26,289	26,746
1 1/4	- 12	**29,50**	29,464	29,921
1 3/8	- 12	**32,75**	32,639	33,096
1 1/2	- 12	**36.00**	35,814	36,271

UNC (UNC-STI) EG-threads for wire thread inserts ASME B18.29.1

nom. Ø	threads per inch	tapping size hole Ø mm	core diameter of int. thread min. mm	core diameter of int. thread max. mm
EG Nr. 6	- 32	**3,80**	3,678	3,879
EG Nr. 8	- 32	**4,40**	4,338	4,524
EG Nr. 10	- 24	**5,20**	5,055	5,283
EG Nr. 12	- 24	**5.80**	5,715	5,944
EG 1/4	- 20	**6.70**	6,624	6,868
EG 5/16	- 18	**8.40**	8,242	8,489
EG 3/8	- 16	**10.00**	9,868	10,127
EG 7/16	- 14	**11.60**	11,506	11,783
EG 1/2	- 13	**13.30**	13,122	13,393
EG 9/16	- 12	**14.90**	14,747	15,032
EG 5/8	- 11	**16.50**	16,375	16,673

EG UNF (UNF-STI) threads for wire thread inserts ASME B18.29.1

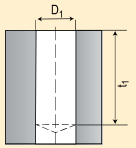
nom. Ø	threads per inch	tapping size hole Ø mm	core diameter of int. thread min. mm	core diameter of int. thread max. mm
EG Nr. 6	- 40	**3.70**	3.644	3.818
EG Nr. 8	- 36	**4.40**	4.321	4.498
EG Nr. 10	- 32	**5,10**	4,999	5,184
EG Nr. 12	- 28	**5.70**	5,682	5,809
EG 1/4	- 28	**6.60**	6,546	6,721
EG 5/16	- 24	**8.25**	8,166	8,352
EG 3/8	- 24	**9.80**	9.754	9,931
EG 7/16	- 20	**11.50**	11,389	11,585
EG 1/2	- 20	**13,10**	12,974	13,172
EG 9/16	- 18	**14,70**	14,592	14,798
EG 5/8	- 18	**16.25**	16,180	16,386

Metric/metric fine EG-threads (EG M14 x 1,25) for wire thread inserts DIN 8140

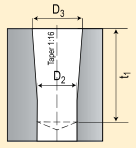
nom. Ø	x pitch P mm	tapping size hole Ø mm	core diameter of int. thread min. mm	core diameter of int. thread max. mm
EG M 4	0.70	**4,20**	4.152	4.292
EG M 5	0.80	**5,25**	5.174	5.334
EG M 6	1.00	**6.30**	6.217	6.407
EG M 8	1.25	**8.40**	8,271	8,483
EG M10	1,50	**10.50**	10,324	10,560
EG M12	1.75	**12,50**	12,379	12,644
EG M14 x	1.25	**14,40**	14,271	14,483
EG M16	2.00	**16.50**	16,433	16.733

Tapered Pipe Drill Sizes

Drilling cylindrically without using a reamer



Drilling cylindrically and reaming conically using a reamer



NPT

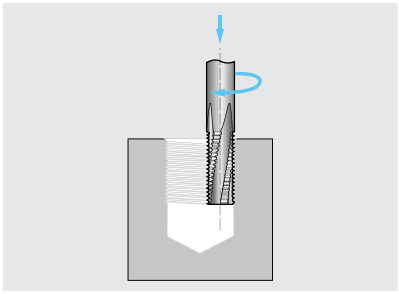
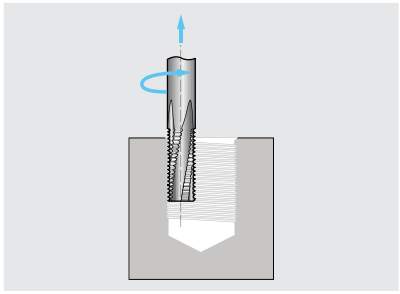
Nominal Size	Threads per Inch	D1 inch	D2 inch	D3 inch	t1 inch
1/16	27	0.2421	0.2343	0.2516	0.4724
1/8	27	0.3346	0.3248	0.3441	0.4724
1/4	18	0.4331	0.4232	0.4472	0.6890
3/8	18	0.5709	0.5551	0.5827	0.6929
1/2	14	0.7028	0.6890	0.7213	0.9016
3/4	14	0.9134	0.8937	0.9319	0.9055
1	11 1/2	1.1417	1.1260	1.1689	1.0787
1 1/4	11 1/2	1.4882	1.4685	1.5138	1.1063
1 /2	11 1/2	1.7323	1.7087	1.7528	1.1181
2	11 1/2	2.2047	2.1850	2.2268	1.1181

Rc

Nominal Size	Threads per Inch	D1 inch	D2 inch	D3 inch	t1 inch
Rc 1/16	28	0.2421	0.2402	0.2583	0.4370
Rc 1/8	28	0.3209	0.3189	0.3374	0.4370
Rc 1/4	19	0.4272	0.4232	0.4508	0.6417
Rc 3/8	19	0.5630	0.5610	0.5886	0.6575
Rc 1/2	14	0.7008	0.6969	0.7335	0.8780
Rc 3/4	14	0.9134	0.9094	0.9496	0.9291
Rc 1	11	1.1496	1.1457	1.1925	1.1142

NPTF

Nominal Size	Threads per Inch	D1 inch	D2 inch	D3 inch	t1 inch
1/16	27	0.2402	0.2343	0.2524	0.4724
1/8	27	0.3327	0.3248	0.3449	0.4724
1/4	18	0.4291	0.4232	0.4488	0.6890
3/8	18	0.5630	0.5551	0.5843	0.6929
1/2	14	0.6929	0.6890	0.7217	0.9016
3/4	14	0.9055	0.8937	0.9323	0.9055
1	11 1/2	1.1319	1.1260	1.1701	1.0787
1 1/4	11 1/2	1.4764	1.4685	1.5150	1.1063
1 /2	11 1/2	1.7224	1.7087	1.7539	1.1181
2	11 1/2	2.1949	2.1850	2.2280	1.1181

Reverse rotation milling	Synchronous milling
clockwise, with G02	counter clockwise, with G03
	
Reverse rotation milling is preferentially applied for the machining of harder materials or to remedy taper threads.	Synchronous milling is applied with thread depths smaller than 1.5xD. Advantage: A better surface finish is achieved.

Thread production with one tool

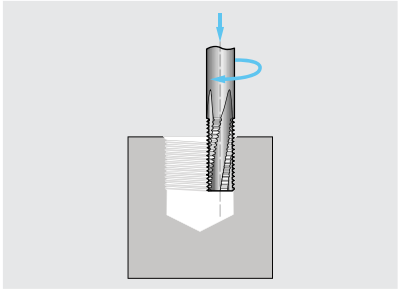
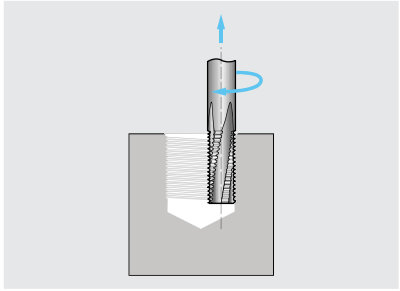
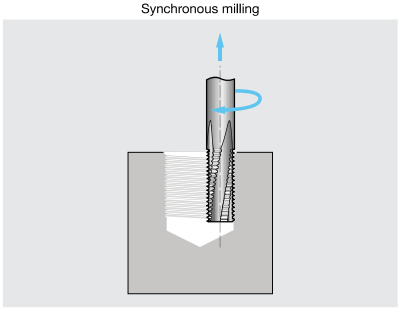
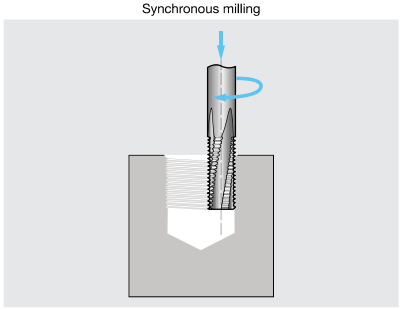
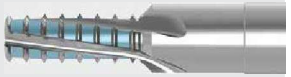
Right-hand thread	Left-hand thread
Reverse rotation milling	Reverse rotation milling
	
Tool rotates clockwise from top to bottom	Tool rotates clockwise from bottom to top
Right-hand thread	**Left-hand thread**
Synchronous milling	Synchronous milling
	
Tool rotates clockwise from bottom to top	Tool rotates clockwise from top to bottom

Illustration	Modification	Effect
	Cooling slots on shank	Targeted cooling, without weakening the tool cross-section in the cutting edge area
	Radial coolant exits	Targeted cooling with through hole threads
	Threads removed	Reduced cutting forces but longer machining time because two cycles are required
	De-burring cutting edge	Removing the incomplete threads at the thread run-in without additional operating step
	First thread profile lengthened at the face	Chamfering a tapping size hole
	Grinding collar	Enables axial distribution of cuts – useful for deep threads

Thread milling programming

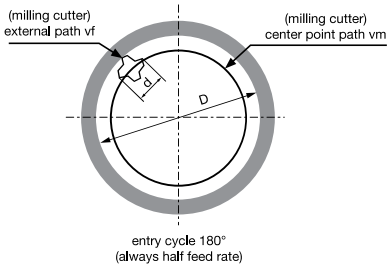
Program specifications

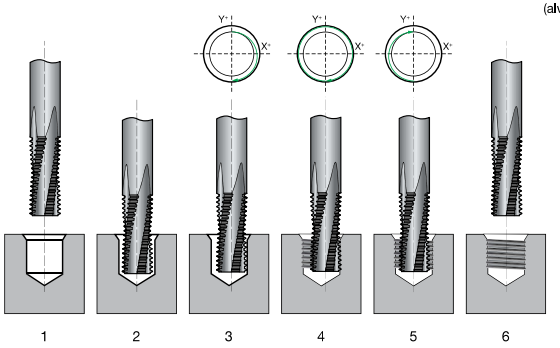
Thread milling functions

G00	Rapid movement	**G90**	Absolute dimension
G01	Feed	**G91**	Incremental dimension
G02	Circular interpolation (clockwise)	**M03**	Spindle on (clockwise rotation)
G03	Circular interpolation (anti-clockwise)	**M05**	Spindle stop
G17	Layer selection x-y axis	**M08**	Coolant on
G18	Layer selection z-x axis	**X**	Axis
G19	Layer selection y-z axis	**Y**	Axis
G40	Cancel tool correction	**Z**	Axis
G41	Tool path correction (left of contour)	**I**	Thread pitch parallel to X-axis
G42	Tool path correction (right of contour)	**J**	Thread pitch parallel to Y-axis
G43	Tool length compensation (call-up)	**S**	Spindle speed
G49	Tool length compensation (deselect)	**F**	Feed
G54	Work offset		

CNC internal thread milling

1. Moving to start position
2. Moving to thread depth in bore
3. 180° descending loop to contour
4. 360° full circular movement of thread milling cutter
5. 180° exit loop to center of bore
6. Rapid movement from bore to start position





Formula of calculation

$$v_c = \frac{d \cdot \pi \cdot n}{1000}$$

$$n = \frac{v_c \cdot 1000}{d \cdot \pi}$$

$$v_f = n \cdot z \cdot f_z$$

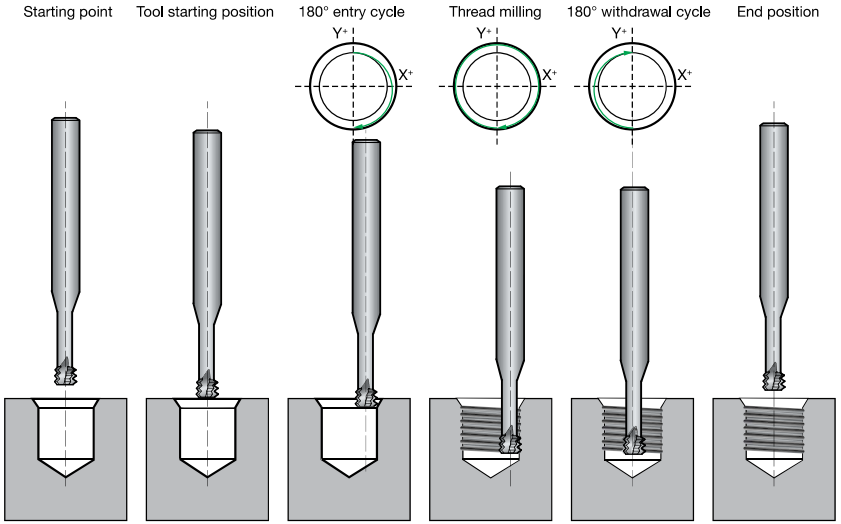
$$v_m = \frac{v_f \cdot (D - d)}{D}$$

$$v_b = n \cdot f_b$$

vc = cutting speed
vf = contour feed
vm = centre point path feed
n = revolutions
z = number of teeth
fz = feed per tooth
fb = feed per drill per revolution* vb = drill feed rate*
D = Ø nom. of thread [mm]
d = milling cutter nom. Ø [mm]
* for drill/thread milling

Thread milling programming

Programming process for micro-thread milling (right-hand thread in reverse rotation)

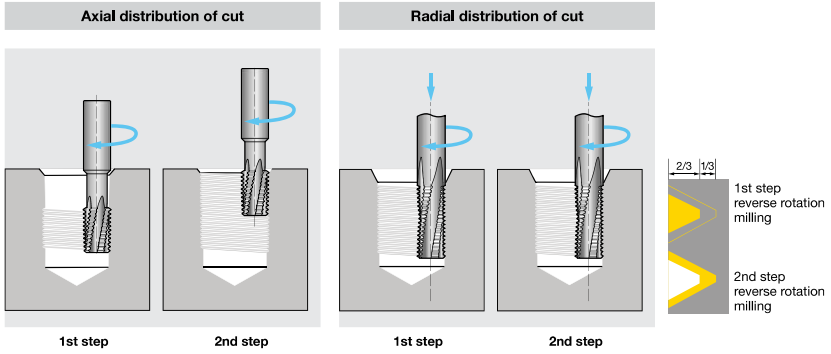


Possibilities to reduce radial forces

To reduce radial forces cut distribution can be undertaken:

Advantage:
- for larger thread depths
- counteracts taper threads
- for unstable clamping conditions

Disadvantage:
- increased tool wear
- longer production time



Selecting the correct clamping chuck

Correct tool clamping also plays a essential role with thread milling. Thread milling cutters should as a rule be clamped as short as possible. A compact and mechanical clamping force is preferable. The error in concentricity should not exceed 0.02 millimeters.

Power chucks

A power chuck excels thanks to extremely accurate concentricity. The high clamping forces and optimal smooth running are a perfect prerequisite for the production of threads in all materials including a high pitch.

max. permissible error in concentricity: 0.003 mm

Side lock holders

A side lock holder for HB and HE shanks is a robust, cost-efficient clamping chuck with a maximum clamping force. The clamping surface prevents the tool twisting or being pulled out during machining. Therefore, side lock holders are suitable for the production in all materials including a high pitch.

max. permissible error in concentricity: 0.002 mm

Shrink fit chucks

A shrink fit chuck creates a rigid connection with the shrink fitted tool. Incorrect shrink fitting or older shrink fit chucks can result in the pulling out of the tool. Tool breakage and possible loss of the component would be the consequence. Therefore, the shrink fit chuck is only suitable for a thread pitch < P=1.5 mm.

max. permissible error in concentricity: 0.005 mm

Hydraulic chucks

A hydraulic chuck, similar to the shrink fit chuck, has only limited suitability for thread milling. Especially with high radial forces this clamping chuck reaches its limits. Therefore, the hydraulic chuck is recommended for softer materials such as aluminum and a thread pitch < P=1.5 mm.

max. permissible error in concentricity: 0.005 mm

Collet holders

Collet chucks are very well suited for micro-thread milling because only axial stresses are created. The low clamping forces only permit the milling of softer materials. Consequently, collet holders are not suitable for conventional thread milling.

max. permissible error in concentricity: 0.01 mm

Practical application of thread milling cutters

1.) Tool clamping:
good concentricity is important, therefore clamping as short and rigid as possible

2.) Enter tool data in machine memory
1.) Tool length from the front face, take drill/thread milling cutters (DTMC) rom point.
2.) Measure tool radius with tool pre-setting equipment. General rule: measured radius - 0.022 x pitch provides the input value in machine memory.

3.) Input of CNC program in control
(preferably integrated as sub-program at corresponding positions)
a.) Call-up of a self-controlling cycle (procedures should be known)
b.) Integration of data file from our threadmill-software (DIN or Haidenhain).

4.) Trial run over workpiece
a) Tool length dimension in memory extending by an approximate value dependent on contact length (i.e. 30 mm) or offset zero point.
b) Run program in single set, visual check of travel path.
c) Allow program to run in automatic mode.

Attention:
With controls where it is not definitely clear what milling path is assigned it must be clarified if the feed is positioned on the external path vf or at the center path vm. As a rule we specify the milling center point path vm.

5.) Application in workpiece
Re-set the tool extension or the zero point. Then allow the program to run in the workpiece the feed regulation must be 100% selected. Should the thread not be true to gauge, the tool radius requires correction in the tool memory:
Example:
- thread too tight: Radius correction – input
- thread too large: Radius correction + input

	Material group	Examples
P	Common structural steels	A283, A516, Gr50, 30, 35, 42, 45, 50, 55, 60, 65, 70, 75 , 80, 85, 90, 100, 110, 135, 140, 145, 150, 160
	Free-cutting steels	1151, 1215, L10, 10L10, 10L15, 10L17, 10L20, 10L23, 10L25, 10L30, 10L35, 10L40, 10L42, 10L45, 10L49, 10L50, 10L55, 11L15, 11L16, 11L17, 11L37, 11L38, 11L39, 11L41, 11L44, 11L46, 12L11, 12L12, 12L13, 12L14, 12L15, 41L25, 41L30, 41L35, 41L40, 41L42, 41L47, 41L50 51L15, 51L17, 51L20, 86L20, 86L40
	Unalloyed heat-treatable steels	1005, 1006, 1008, 1009, 1010, 1011, 1012, 1013, 1015, 1016, 1017, 1018, 1019, 1020, 1021, 1022, 1023, 1025, 1026, 1029, 1030, 1033, 1035, 1037, 1038, 1039, 1040, 1042, 1043, 1044, 1045, 1046, 1049, 1050, 1053, 1055, 1059, 1060, 1064, 1065, 1069, 1070, 1071, 1074, 1075, 1078, 1080, 1084, 1085, 1086, 1090, 1095
	Alloyed heat-treatable steels	1330, 1335, 1340, 1345, 2340, 3140, 3145, 3150, 3230, 3240, 3335, 3340, 3435, 3450, 4032, 4037, 4063, 4130, 4135, 4137, 4140, 4142, 4145, 4147, 4150, 4161, 4337, 4340, 4640, 5045, 5046, 5060, 5130, 5132, 5135, 5140, 5145, 5157, 5150, 5155, 5160, 6130, 6135, 6140, 6145, 6150, 7140, 6145, 6150, 7140, 8630, 8632, 8635, 8637, 8640, 8642, 8645, 8650, 8650, 8660, 8735, 8740, 8742, 9250, 9254, 9255, 9260, 9262, 9840, 9850
	Unalloyed case hardened steels	1005, 1006, 1008, 1009, 1010, 1011, 1012, 1013, 1015, 1016, 1017, 1018, 1019, 1020, 1021, 1022, 1023, 1025, 1026, 1029, 1030, 1033, 1035, 1037, 1038, 1039, 1040, 1042, 1043, 1044, 1045, 1046, 1049, 1050, 1053, 1055, 1059, 1060, 1064, 1065, 1069, 1070, 1071, 1074, 1075, 1078, 1080, 1084, 1085, 1086, 1090, 1095
	Alloyed case hardened steels	2317, 2512, 2515, 2517, 3115, 3120, 3215, 3220, 3312, 3316, 3325, 4012, 4023, 4024, 4027, 4028, 4118, 4119, 4125, 4317, 4320, 4419, 4422, 4427, 4608, 4615, 4617, 4620, 4621, 4626, 4718, 4720, 4815, 4817, 4820, 5015, 5115, 5117, 5120, 6115, 6118, 6120, 6125, 8115, 8615, 8617, 8620, 8622, 8625, 8627, 8720, 8822, 9310, 9315, 9317
	Nitriding steels	1132, 1137, 1138, 1139, 1140, 1141, 1144, 1145, 1146, 1151
	Tool steels	A2, A3, A4, A5, A6, A8, A9, A10, O1, O2, O6, O7, A7, D2, D3, D4, D5, D7, H10, H11, H12, H13, H14, H19, H20, H21, H22, H23, H24, H25, H26, H41, H42, H43, L1, L3, W1, W2, W5
	High speed steels	M1, M2, M3-1, M3-2, M4, M6, M7, M10, M30, M33, M34, M36, M41, M42, M43, M44, M46, M47, T1, T2, T4, T5, T6, T8, T15
	Spring steels	5150, 5155, 6145, 6150, 9255
H	Hardened steels >48-60 Rc	Heat Treated Steels
M	Stainless steels, sulphured	203 Ez, 303 Se, 303 Ma, 303 Pb, 303 PlusX, 430F Se, 416 Se, 416 PlusX, 420F, 420F Se, 440F, 440F Se
	austenitic	201, 202, 301, 302B, 303, 304, 304L, 305, 308, 309, 309S, 310, 310S, 314, 316, 316L, 317, 321, 330, 347, 348, 384, 385, Nitronic 32, Nitronic 33, Nitronic 40, Nitronic 50, Nitronic 60, 17-7PH
	martensitic	403, 405, 410, 414, 416, 420, 422, 430, 431, 440A, 440B, 440C, 446, 501, 502, 630, Greek Ascoloy
K	Cast iron	A48-20 B, A48-30 B, A48-40 B, A48-50B, A159G1800, A159G2500, A159G3000, A159G3500, A159G4000
	Spheroidal graphite iron and malleable cast iron	60-10-18, 60-40-18, 65-45-12, 80-55-06, 100-70-03, 120-90-02, 32510, 35018, 40010, 50005, 60004, 70003, 80002, 90001, A220-70003, A220-8002, A536
	Chilled cast iron	
S	Special alloys	Inconel, Hastelloy, Monel, Nimonic, MAR-M246, DS-Ni, Waspalloy, Rene41
	Ti and Ti-alloys	Ti6AL4V, 5390A, TiCu2
N	Aluminium and Al-alloys	EC 1060, 1100, 1145, 1175, 1235, 2011, 2014, 2017, 2018, 2021, 2024, 2025, 2117, 2218, 2219, 2618, 3003, 3004, 3005, 4032, 4032-T6, 5005, 5050, 5052, 5056, 5083, 5086, 5154, 5252, 5254, 5454, 5456, 5457, 5652, 5657, 6053, 6061, 6061-T6, 6063, 6066, 6070, 6101, 6151, 6253, 6262, 6463, 6951, 7001, 7004, 7005, 7039, 7049, 7050, 7075, 7075-T6, 7079, 7175, 7178
	Al wrought alloys	1100-0, 3003-H18, 5056-0, 2024-T4, 4043-H18
	Al cast alloys	295-T6, 319-F, 356-T6, 380-F, 384-F, 390-F, 443-F, 413-F, 518-F, 713-TS, 850-TS
	Magnesium alloys	AZ31B, AZ63A, AZ80A, AZ91C, EZ33A, HK31A, QE22A, ZK60A
	Copper, low-alloyed	C10100, C27000, C71500, C52400, C77000, C17200, C71500, C95500, C86500
	Brass, short-chipping	CUZn10, CUZn20