Fdrill Manual

Drilling manually (Operating by hand)

1 Choose the right tool (Diameter & Style)
2 Make sure your machine meets the tool requirements for speed and power
3 Assemble the tool holder correctly
4 Insert the Formdrill into the tool holder and tighten the nut very tightly
5 Insert the tool holder in the machine spindle
6 Clamp your work piece securely
7 Make sure the distance between work piece and drill bit is limited
8 Set the correct spindle speed for the tool
9 Set the correct drilling depth
10 Lubricate the tool
11 Perform the drilling operation in a constant downward motion (no dwelling!)
12 When depth is reached retract the tool as fast as possible
13 Observe cycle time and drill color
14 Adjust when needed the speed (See step 8 & 11)
To much heat: Lower Rpm or increase feedrate or both

Working with Flat style drills

Attention: A hot chip is produced - use a guard to protect machine operator and surroundings
When a Flat style Fdrill is used you need to accelerate the feedrate just before the cutting starts:
This acceleration will increase tool life of the cutters significantly
The length and shape of the produced chip is a good indication:See picture

Working with Flat style drills

FDRILL FLAT STYLE

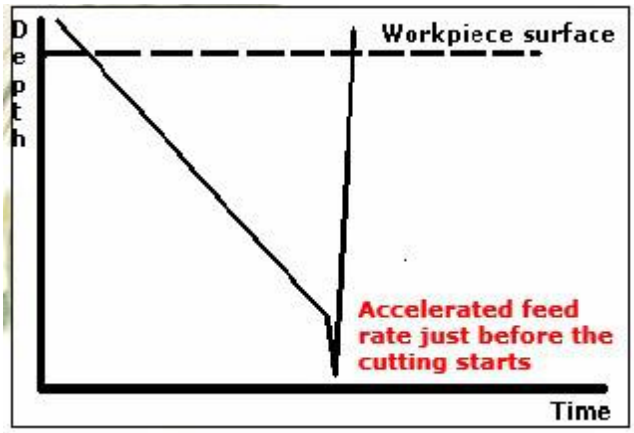
RIGHT

Short and heavy chip: OK

WRONG

Long and light chip: NOT OK

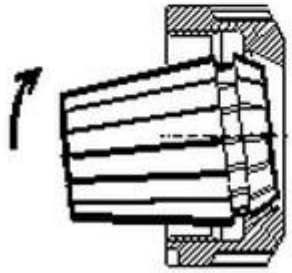
Feedrate acceleration improves tool life !



Tool holder assembly

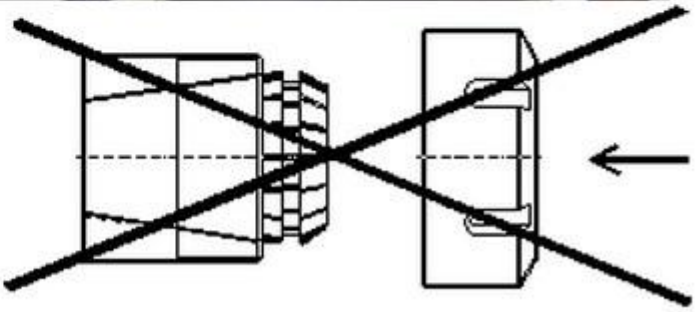
Assemble the tool holder correctly

RIGHT



Click the collet into the excentric nut first

WRONG



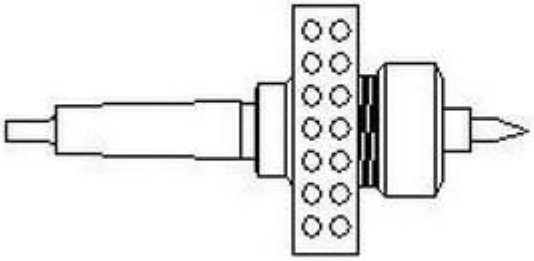
Don't put the collet in to the toolholder first

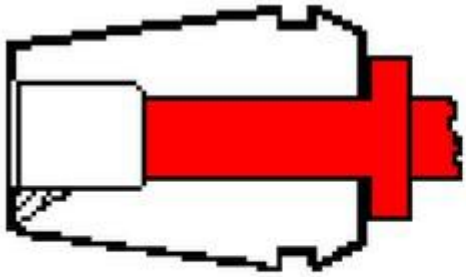
Correct tool holder assembly is essential !!!

FDRILL ASSEMBLY

Correct assembly is essential !!!

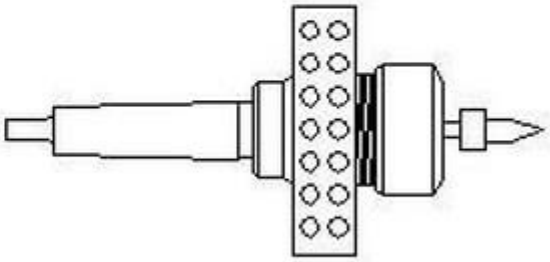
RIGHT

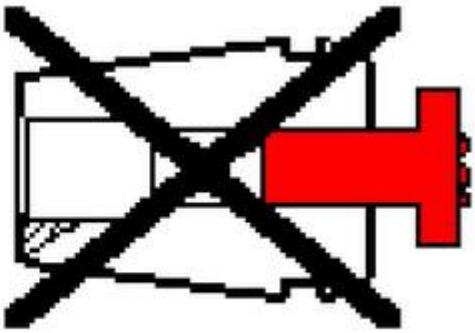




Insert the full lenght of the Formdrill in to the collet

WRONG





Don't insert the Formdrill partial

Correct assembly is essential !!!

Working Life - Influential factors

1.Fdrills are made of specially developed carbide. This will maintain its strength at high temperatures but is sensitive to thermal stress. Local cooling should be avoided.
2.Fdrills cannot withstand high mechanical shock. They should not be dropped and hard impact onto the surface of the workpiece, as well as welded spots should be avoided.
3.Avoid radial forces on the Fdrill
4.Torsional stability of the Fdrill is important. Too rapid release of
torsional load caused by fast break through (very high feed rate) can cause fatigue.
5.A similar condition can occur due to wind up if start pressure is too great.
6.DO NOT DRILL an unfinished hole, risking taper lock due to shrink-age.
7.Instability due to wear in machine spindle or collet can allow the Fdrill to wander. Stress caused by misalign-ment can break the Fdrill.
8.Finish -quality- in the Fdrilled hole will deteriorate when the Fdrill becomes worn.
9.Regular lubrication will increase life of Fdrill. Use Fdks for lubrication of the FD every 1-5 holes on the hot rotating FD.
10.Fdrill temperature should not exceed dark red colour.
11.Speed and axial force should be adjusted optimally under observation of the temperature of the FD (indicated by dark red colour).
12.Hole quality will be affected by build up of work-piece metal on the tool,also from film caused by anodised alumi-nium or zinc from galvanising.
13.Timely removal of built up material with diamond file.
14.Cleaning with a diamond file will extend tool life.
15.Don't dwell at depth when using Fdrills - especially flat Fdrills -dwelling reduces cutter life.
16.Protect the Fdrill and drilling machine spindle for overheating by using the special Fdrill toolholder with cooling fan.

Fdrill Parameters:

Below you will find the parameters for all standard thread sizes, these parameters apply to mild steel 2mm. Spindle speed is our recommend level however a variation of 20% plus or minus can be used, this may result in a shorter tool lifetime.
Stainless Steel reduce the RPM by 15%
Non-ferrous materials (copper, brass and aluminium) increace the RPM by 50%

1.Metric Thread Size

Thread Size	Fdrill			Form tap	
	Fdrillø [mm]	Spindle Speed [rpm]	Required Power [k/W]	Cycle Time [sec.]	Spindle Speed [rpm]
M2	1.8	3200	0.5	2	1600
M3	2.7	3000	0.6	2	1350
M4	3.7	2600	0.7	2	1000
M5	4.5	2500	0.8	2	800
M6	5.4	2400	1.0	2	650
M8	7.3	2200	1.3	2	500
M10	9.2	2000	1.5	3	400
M12	10.9	1800	1.7	3	330
M16	14.8	1400	2.2	4	250
M18	16.7	1300	2.5	5	220
M20	18.7	1200	2.7	5	200

2.American Standard Coarse (UNC)

Thread Size	Fdrill			Form tap	
	Fdrillø [mm]	Spindle Speed [rpm]	Required Power [HP]	Cycle Time [sec.]	Spindle Speed [rpm]
#4-40	2.5	3100	1.0	4	1350
#5-40	2.9	2900	1.0	4	1350
#6-32	3.1	2800	1.0	4	1000
#8-32	3.8	2600	1.0	4-5	1000
#10-24	4.3	2500	1.0	4-5	800
#12-24	4.9	2500	1.0	4-5	650
1/4-20	5.7	2400	1.5	4-5	650
5/16-18	7.2	2200	2.0	4-5	500
3/8-16	8.7	2000	2.0	5-6	400
7/16-14	10.2	1900	2.5	5-6	330

1/2-13	11.7	1700	2.5	5-6	330
9/16-12	13.2	1600	3.0	5-7	250
5/8-11	14.7	1400	3.5	5-7	250
3/4-10	17.8	1300	4.0	6-8	200

3.American Standard Fine (UNF)

Thread Size	Fdrill		Form tap		
	Fdrillø [mm]	Spindle Speed [rpm]	Required Power [HP]	Cycle Time [sec.]	Spindle Speed [rpm]
#4-48	2.6	3100	1.0	4	1350
#5-44	2.9	2900	1.0	4	1350
#6-40	3.2	2800	1.0	4-5	1000
#8-36	4.4	2600	1.0	4-5	800
#10-32	5.0	2500	1.0	4-5	650
#12-28	5.9	2500	1.0	4-5	650
1/4-28	7.4	2400	1.5	4-5	500
5/16-24	9.0	2200	2.0	4-5	400
3/8-24	12.1	2000	2.0	5-6	330
1/2-20	13.6	1700	2.5	5-6	250
9-16-18	15.2	1600	3.0	5-7	230
5/8-18	18.3	1400	3.5	5-6	200
3/4-16	18.7	1200	4.0	6-8	200

4.Taper Pipe Taps (NPT)

Thread Size	Fdrill		Form tap		
	Fdrillø [mm]	Spindle Speed [rpm]	Required Power [HP]	Cycle Time [sec.]	Spindle Speed [rpm]
1/16-27	7.0	2200	1.5	4	400
1/8-27	9.4	2000	2.0	5	400
1/4-18	12.4	1700	3.0	5	360
3/8-18	15.8	1400	3.5	5	300
1/2-14	19.6	1200	4.5	6	270
3/4-14	24.9	900	5.5	7	200

5.British Standard Pipe (BSP/G)

Thread Size	Fdrill			Form tap	
	Fdrillø [mm]	Spindle Speed [rpm]	Required Power [k/W]	Cycle Time [sec.]	Spindle Speed [rpm]
BSP 1/8"	9.2	2000	1.5	3	400
BSP 1/4"	12.4	1600	2.0	3	360
BSP 3/8"	15.9	1400	2.3	4	300
BSP 1/2"	19.9	1200	3.0	5	270
BSP 3/4"	25.4	1000	3.5	6	200
BSP 1"	31.9	800	5.0	9	180

Spindle Speed and Power

Fdrill diameter (mm)	Spindle Speed RPM		Power KW
	Steel	Stainless Steel	
2,0-2,9	3000	2600	0.8
3,0-3,9	3000	2600	0.8
4,0-4,9	2800	2500	1
5,0-5,9	2800	2500	1
6,0-6,9	2800	2500	1.2
7,0-7,9	2500	2100	1.5
8,0-8,9	2500	2100	1.5
9,0-9,9	2200	1900	1.8
10,0-10,9	2000	1800	2
11,0-11,9	2000	1800	2
12,0-12,9	2000	1800	2
13,0-13,9	1800	1600	2.2
14,0-14,9	1600	1400	2.5
15,0-15,9	1500	1350	2.5
16,0-16,9	1500	1350	2.5
17,0-17,9	1500	1350	3
18,0-18,9	1200	1100	3
19,0-19,9	1000	900	3
20,0-20,9	1000	900	3
21,0-21,9	1000	900	3.5
22,0-22,9	1000	900	3.5
23,0-23,9	900	850	3.8
24,0-24,9	900	850	4
25,0-25,4	800	800	4

Fdrill diameter (mm)	Spindle Speed RPM			Power KW
	Copper	Brass	Aluminum	
2,0-2,9	4200	4800	6000	1.2
3,0-3,9	4200	4800	6000	1.2
4,0-4,9	3900	4500	5600	1.5
5,0-5,9	3900	4500	5600	1.5
6,0-6,9	3900	4500	5600	1.8
7,0-7,9	3500	4000	5000	2.2
8,0-8,9	3500	4000	5000	2.2
9,0-9,9	3100	3500	4400	2.7
10,0-10,9	2800	3200	4000	3
11,0-11,9	2800	3200	4000	3
12,0-12,9	2800	3200	4000	3
13,0-13,9	2500	2900	3600	3.3
14,0-14,9	2250	2550	3200	3.7
15,0-15,9	2100	2400	3000	3.7
16,0-16,9	2100	2400	3000	3.7
17,0-17,9	2100	2400	3000	4.5
18,0-18,9	1700	1900	2400	4.5
19,0-19,9	1400	1600	2000	4.5
20,0-20,9	1400	1600	2000	4.5
21,0-21,9	1400	1600	2000	5.2
22,0-22,9	1400	1600	2000	5.2
23,0-23,9	1250	1450	1800	5.7
24,0-24,9	1250	1450	1800	6
25,0-25,4	1100	1250	1600	6

Standard Fdrill maximum material thickness
Maximum material thickness for thread holes
Indication in mm

Thread	Fdrill Diameter	Max.materialthickness				Collet ø	Totallength working part	
		Short	Short/Flat	Long	Long/Flat		Short	Long
M2	1.8	1.6	1.8	2.2	3.2	6	5.8	7.8
M2.5	2.3	1.6	1.9	2.3	3.5	6	6.1	8.1
M3	2.7	1.7	2	2.4	3.7	6	6.7	8.7
M4	3.7	1.8	2.2	2.6	4.2	6	8.1	10.3
M4x0.5	3.8	1.8	2.2	2.6	4.2	6	8.2	10.5
M5	4.5	1.9	2.4	2.7	4.6	6	9.2	11.8
M5x0.5	4.8	1.9	2.4	2.7	4.7	6	9.6	12.4
M6	5.3	2	2.5	2.9	5	8	10.3	13.8
M6x0.75	5.6	2	2.5	2.9	5	8	11	14.5
M6x0.5	5.8	2	2.6	3	5.2	8	11.2	14.7
M8	7.3	2.2	2.9	3.3	5.9	8	13.5	18.1
M8x1	7.5	2.3	2.9	3.4	6	8	14	18.7
M8x0.75	7.6	2.3	2.9	3.4	6	8	14.1	18.8
M10	9.2	2.6	3.2	3.7	6.6	10	16.8	22.5
M10x1.25	9.3	2.6	3.3	3.7	6.7	10	17	22.8
M10x1	9.5	2.6	3.3	3.8	6.7	10	17.3	23.2
M12	10.9	2.8	3.5	4	7.2	12	19.8	26.4
M12x1.5	11.2	2.8	3.6	4.1	7.3	12	20.3	27.1
M12x1	11.5	2.9	3.6	4.2	7.3	12	20.8	27.8
M14	13	3	3.9	4.5	7.9	14	23.5	31.3
M14x1.5	13.2	3.1	4	4.6	8	14	23.8	31.6
M16	14.8	3.3	4.2	4.8	8.5	16	26.9	35.4
M16x1.5	15.2	3.4	4.3	4.9	8.7	16	27.6	36.3
M18	16.7	3.5	4.6	5.2	9.2	18	30.4	39.7
M18x1	17.5	3.7	4.8	5.6	9.5	18	31.9	41.5
M20	18.7	3.8	5	5.7	9.9	18	34.1	44.3
M20x1.5	19.2	3.9	5.1	5.8	10	18	35.1	45.5
M20x1	19.5	3.9	5.2	5.8	10	18	35.6	46.2
G1/16	7.3	2.3	2.9	3.3	5.9	8	13.5	18.1
G1/8	9.2	2.6	3.2	3.7	6.6	10	16.8	22.5
G1/4	12.4	2.9	3.8	4.3	7.8	12	22.4	29.8
G3/8	15.9	3.4	4.5	5	8.9	16	28.9	37.9
G1/2	19.9	4	5.2	5.9	10	18	36.3	47

G3/4	25.4	4.8	6.2	7	10.4	20	46.4	59.6

Thread tables

Metric thread（M）		
Thread	Pitch/mm	Fdrill diameter
M 2	0.4	1.8
M 2.5	0.45	2.3
M 3	0.5	2.7
M 4	0.7	3.7
M 5	0.8	4.5
M 6	1	5.3(5.4)
M 8	1.25	7.3(7.4)
M 10	1.5	9.2(9.3)
M 12	1.75	10.9
M 14	2	13
M 16	2	14.8
M 18	2.5	16.7
M 20	2.5	18.7

Metric thread fine（M）		
Thread	Pitch/mm	Fdrill diameter
M 4	0.5	3.8
M 5	0.5	4.8
M 6	0.75	5.6
M 6	0.5	5.8
M 8	1	7.5
M 8	0.75	7.6
M 10	1.25	9.3
M 10	1	9.5
M 12	1.5	11.2
M 12	1	11.5
M 12	1	11.5
M 14	1.5	13.2
M 16	1.5	15.2
M 16	1	15.5
M 18	1.5	17.2
M 20	1.5	19.2
M 20	1	19.5

US thread UNF		
Thread	Thread perinch	Fdrill diameter
No. 4	48	2.6
No. 5	44	2.9
No. 6	40	3.2
No. 8	36	3.9
No. 10	32	4.4
No. 12	28	5
1/4	28	5.9
5/16	24	7.4
3/8	24	9
7/16	20	10.4
1/2	20	12.1
9/16	18	13.6

US thread UNC		
Thread	Thread perinch	Fdrill diameter
No. 4	40	2.5
No. 5	40	2.9
No. 6	32	3.1
No. 8	32	3.8
No. 10	24	4.3
No. 12	24	4.9
1/4	20	5.7
5/16	18	7.2
3/8	16	8.7
7/16	14	10.2
1/2	13	11.7
9/16	12	13.2

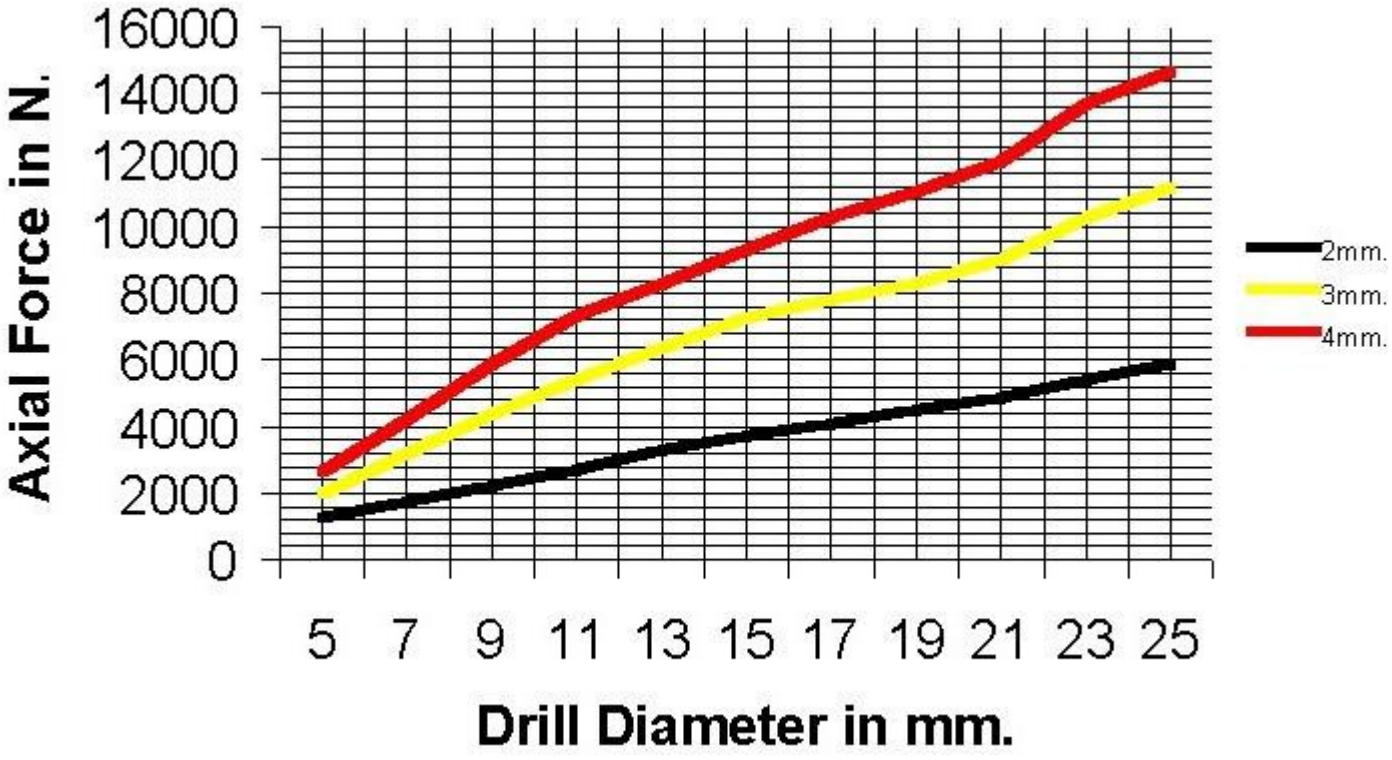
5/8	18	15.2
3/4	16	18.3

5/8	11	14.7
3/4	10	17.8

BSP thread		
Thread	Thread perinch	Fdrill diameter
G1/16"	28	7.3
G1/8"	28	9.2
G1/4"	19	12.4
G3/8"	19	15.9
G1/2"	14	19.9
G3/4"	14	25.4
G1"	11	31.9

US thread NPT		
Thread,	Thread perinch	Fdrill diameter
1/16"	27	7
1/8"	27	9.4
1/4"	18	12.4
3/8"	18	15.8
1/2"	14	19.6
3/4"	14	24.9
1"	11.5	31.4

Axial force



Form tap Tapping speeds

Thread size	Steel	Stainless Steel
Metric	**Peripheral speed 7–10 m/min.**	**Peripheral speed 3–5 m/min.**
M3X0.5	800 Rpm.	400 Rpm.
M4X0.7	700 Rpm.	350 Rpm.
M5X0.8	600 Rpm.	300 Rpm.
M6X1.0	500 Rpm.	250 Rpm.
M8X1.25	400 Rpm.	200 Rpm.
M10X1.5	320 Rpm.	160 Rpm.
M12X1.75	270 Rpm.	130 Rpm.
M14X2.0	230 Rpm.	120 Rpm.
M16X2.0	200 Rpm.	100 Rpm.
M18X2.5	180 Rpm.	100 Rpm.
M20X2.5	160 Rpm.	90 Rpm.
BSP		
1/8BSP	320 Rpm.	160 Rpm.
1/4 BSP	270 Rpm.	130 Rpm.
3/8 BSP	200 Rpm.	100 Rpm.
1/2 BSP	160 Rpm.	90 Rpm.
3/4 BSP	140 Rpm.	80 Rpm.
1/1 BSP	120 Rpm.	60 Rpm.
UNC		
N°5 UNC (40)	800 Rpm.	400 Rpm.
N°6 UNC (32)	800 Rpm.	400 Rpm.
N°8 UNC (32)	700 Rpm.	350 Rpm.
N°10 UNC (24)	700 Rpm.	350 Rpm.
N°12 UNC (24)	600 Rpm.	300 Rpm.
1/4 UNC (20)	500 Rpm.	250 Rpm.
5/16 UNC (18)	400 Rpm.	200 Rpm.
3/8 UNC (16)	350 Rpm.	175 Rpm.
7/16 UNC (14)	320 Rpm.	160 Rpm.
1/2 UNC (13)	270 Rpm.	130 Rpm.
9/16 UNC (12)	230 Rpm.	120 Rpm.
5/8 UNC (11)	200 Rpm.	100 Rpm.

3/4 UNC (10)	180 Rpm.	100 Rpm.
Metric Fine		
M6X0.75	500 Rpm.	250 Rpm.
M6X0.5	500 Rpm.	250 Rpm.
M8X1.0	400 Rpm.	200 Rpm.
M8X0.75	400 Rpm.	200 Rpm.
M10X1.25	320 Rpm.	160 Rpm.
M10X1.0	320 Rpm.	160 Rpm.
M12X1.5	270 Rpm.	130 Rpm.
M12X1.0	270 Rpm.	130 Rpm.
M16X1.5	200 Rpm.	100 Rpm.
M16X1.0	200 Rpm.	100 Rpm.
M18X1.5	180 Rpm.	100 Rpm.
UNF		
N°5 UNF (44)	800 Rpm.	400 Rpm.
N°6 UNF (40)	800 Rpm.	400 Rpm.
N°8 UNF (36)	700 Rpm.	350 Rpm.
N°10 UNF (32)	700 Rpm.	350 Rpm.
N°12 UNF (28)	600 Rpm.	300 Rpm.
1/4 UNF (28)	500 Rpm.	250 Rpm.
5/16 UNF (24)	400 Rpm.	200 Rpm.
3/8 UNF (24)	350 Rpm.	175 Rpm.
7/16 UNF (20)	320 Rpm.	160 Rpm.
1/2 UNF (20)	270 Rpm.	130 Rpm.
9/16 UNF (18)	230 Rpm.	120 Rpm.
5/8 UNF (18)	200 Rpm.	100 Rpm.
3/4 UNF (16)	180 Rpm.	100 Rpm.

Fdrill Test results

Thread size	Wall thickness in mm	DIN Weld nuts Pull out force in N	Fdrill Results Pull out force in N	Torque in Nm	Class
M4	1.0	5.250	5.260	5.0	6
M4	2.0	8.750	8.280	9.0	8
M5	1.0	8.500	9.550	8.0	6
M5	1.5	11.400	12.250	11.0	8
M5	2.0	14.200	14.940	13.0	10
M6	1.5	12.000	13.400	16.0	6
M6	2.0	16.000	17.350	20.0	8
M6	3.0	24.000	+24.000	26.0	12
M8	2.0	22.000	26.000	27.0	6
M8	3.0	36.500	40.000	51.0	10
M8	4.0	43.000	+45.000	65.0	12
M10	3.0	46.000	51.700	64.0	8
M10	4.0	69.500	69.800	96.0	12
M12	3.0	50.500	66.000	134.0	6
M12	4.0	84.000	86.800	161.0	10
M12	5.0	84.000	97.000	267.0	10
M16	3.0	94.000	94.220	–	6
M16	4.0	94.000	107.300	–	6
M16	5.0	126.000	134.400	–	8
M20	3.0	122.000	136.000	–	5
M20	4.0	147.000	151.800	–	6
M20	5.0	196.000	+200.000	–	8