GEDORE

TIGHTENING / TEST TORQUE

Suggested bolt tightening torque in N·m (Newton metres)

These torque levels are guideline values for metric standard threads in accordance with DIN ISO 261 and head sizes in accordance with DIN EN ISO 4762, DIN EN ISO 4032, DIN EN ISO 4014, and DIN 931-2, 6912, 7984 und 7990. These produce a 90 % utilisation of the bolt yield strength. The calculations are based on a friction coefficient of 0.14 (new bolt) without any after treatment, non-lubricated). Please note: in extreme cases, e.g. for bolts lubricated with MOS2 compound and with cadmium-plated connecting elements on both sides, the tightening torque should be reduced by around 20 %.

M	Tightening values for quality grade as per DIN 267					
	4.6	5.6	6.9	8.8	10.9	12.9
M 2	0,123	0,162	0,314	0,373	0,520	0,628
M 2,2	0,196	0,265	0,510	0,598	0,843	1,010
M 2,5	0,284	0,373	0,726	0,863	1,206	1,451
M 3	0,441	0,588	1,128	1,344	1,883	2,256
M 3,5	0,677	0,902	1,736	2,060	2,893	3,481
M 4	1,000	1,344	2,599	3,040	4,315	5,148
M 5	1,916	2,648	5,099	6,031	8,483	10,200
M 6	3,432	4,511	8,728	10,300	14,710	17,652
M 7	5,590	7,453	14,220	17,162	24,517	28,439
M 8	8,238	10,787	21,575	25,497	35,304	42,168
M 10	16,67	21,575	42,168	50,014	70,608	85,317
M 12	28,44	38,246	73,550	87,279	122,60	147,10
M 14	45,11	60,801	116,70	138,30	194,20	235,40
M 16	69,63	93,163	178,5	210,80	299,10	357,90
M 18	95,12	127,50	245,20	289,3	411,90	490,30
M 20	135,3	180,45	384,10	411,90	578,60	696,30
M 22	182,4	245,16	470,70	559,00	784,50	941,40
M 24	230,5	308,91	598,20	711,00	1000	1196
M 27	343,2	460,90	887,50	1049	1481	1775
M 30	465,8	622,72	1206	1422	2010	2403
M 33	632,5	848,30	1628	1932	2716	3266
M 36	814,0	1089	2099	2481	3491	4197
M 39	1059	1412	2716	3226	4531	5443
M 42	1304	1746	3364	3991	5609	6727
M 45	1638	2177	4207	4992	7012	8414
M 48	1981	2638	5080	6021	8473	10150
M 52	2540	3393	6541	7747	10885	13092
M 56	3168	4227	8149	9650	13582	16279
M 60	3932	5247	10101	11964	16867	20202
M 64	4737	6306	12160	14416	20300	24320

Wrench/spanner test torques in accordance with DIN ISO 1711-1 (minimum guaranteed values) N·m

mm	No. 2, 2A, 2B No. 1B, 308, 7	No. 4	No. 6, No. 1B, 7, 400	No. 25	No. 26 R No. 626	No. 35 A No. 35 B No. 3112	No. 894 No. 895
4			1,90				
4,5*			2,64				
5	11,5		3,55				
5,5	14,4		4,64		14,4		2,32
6*	17,6	7,4	5,92		17,6		2,96
7	25,2	11,4	9,12		25,2		4,56
8	34,5	16,6	13,3		34,5	34,5	6,65
9*	45,4	23	18,4		45,4	45,4	9,20
10	58,1	31	24,8	58,1	58,1	58,1	12,4
11	72,7	40,4	32,3	72,7	72,7	72,7	16,1
12*	89,1	51,5	41,2	89,1	89,1	89,1	20,6
13	107	64,5	51,6	107	107	107	25,8
14*	128	79,4	63,5	128	128	128	31,7
15	150	96,2	77,0	150	150	150	38,5
16	175	115	92,3	175	175	175	46,1
17*	201	134	107	201	201	201	53,5
18	230	160	128	230	230	230	64,0
19*	261	186	149	261	261	261	74,5
20*	294	215	172	294	294	294	86,0
21	330	247	198	330	330	330	99,0
22*	368	281	225	368	368	368	112
23*	408	319	255	408	408	408	127
24	451	359	287	451	451	451	143
25*	496	402	322	496	496	496	161
26*	544	449	359	544	544	544	179
27	594	499	399	594	594	594	199
28*	647	552	442	647	647	647	221
30	760	670	536	760	760	760	268
32*	884	804	643	884	884	884	321
34	1019	951	761	1019	1019	1019	381
36	1165	1117	894	1165	1165	1165	447
41	1579	1442	1154	1579	1579	1579	577
46	2067	1816	1453	2067	2067	2067	726
50	2512	2145	1716	2512	2512	2512	858
55	3140		2077	3140	3140	3140	1038
60	3849		2471	3849		3849	1235
65	4021		2900	4021		4021	1422
70	4658		3364	4658		4658	1618
75	5394		3862			5394	1765
80	6178		4394			6178	1912
85	6963					6963	2059
90	7845					7845	-
95	8336					8336	-

* These sizes are not included in DIN ISO 272

Note: In reference to the "spanner test torque as per DIN ISO 1711-1" column, we explicitly point out that these are minimum guarantee values.
Bolts from M39 in quality grades 4.6, 5.6, 6.9, 8.8, 10.9 and 12.9 are not standardised.

TIGHTENING / TEST TORQUE

		Wrench/spanner test torques in accordance with DIN ISO 1711-1 (minimum guaranteed values) N·m					Test torques for tightening tools for hexagon socket head screws							
		With internal square as per DIN 3120					DIN EN ISO 4762	No. 42T, DT42 No. 42, 42EL	No. IN 34	With hexagon head as per DIN 7422				
		6,3	10	12,5	20	25				6,3	10	12,5	20	25
		No. 20 No. D 20	No. 30 No. D 30	No. 19 No. D 19	No. 32 No. D 32	No. D 21				No. IN 20	No. IN30	No. IN 19	No. IN 32	No. IN 21
M	mm						mm							
		1/4"	3/8"	1/2"	3/4"	1"				1/4"	3/8"	1/2"	3/4"	1"
M 2	**4**	10,4					1,5	0,82						
M 2,2	**4,5***	12,6					2	1,9		1,9				
M 2,5	**5**	15,1												
M 3	**5,5**	17,8					2,5	3,8		3,8				
M 3,5	**6***	20,6	23,2											
M 4	**7**	26,8	33,2				3	6,6	6,6	6,6				
M 5	**8**	33,6	45,5	94,1			4	16	16	16	16	16		
	9*	41,1	59,9	119,2										
M 6	**10**	49,1	76,7	147			5	30	30	30	30	30		
M 7	**11**	57,8	96	178										
	12*	67,0	118	212										
M 8	**13**	68,6	141	249			6	52	52	52	52	52		
	14*	68,6	169	288			7	80			78	78		
M 10	**15**		198	331			8	120	120	120	120	120		
	16		225	377										
	17*		225	425			9	165				165		
M 12	**18**		225	477			10	220	220		220	220		
	19*		225	531										
	20*		225	569			12	370	370			370		
M 14	**21**		225	569										
	22*		225	569	569									
	23*			569	569									
M 16	**24**			569	569		14	590	590			590	590	
	25*			569	583									
	26*			569	624									
M 18	**27**			569	665									
	28*			569	707									
M 20	**30**			569	795		17	980	980			1000	1000	1000
M 22	**32***			569	888									
	34			569	984									
M 24	**36**				1084	1677	19	1360	1360			1400	1400	1400
M 27	**41**				1353	1910								
M 30	**46**				1569	2143	22	2110					2100	2100
M 33	**50**				1569	2329	24	2750						2700
M 36	**55**				1569	2562	27	3910						
M 39	**60**				1569	2795	30	4000						
M 42	**65**					2795	32	4000						
M 45	**70**					2795								
M 48	**75**					2795	36	4000						
M 52	**80**					2795								
M 56	**85**													
M 60	**90**													
M 64	**95**													

The matching test torques are derived from the theoretical load capability of the connecting square drive.

Note: Hand tightening sockets are unsuited to use with impact drivers. Inappropriate use poses an accident risk. Power driver sockets can be found on page 230.

GEDORE

HEAD WIDTHS AND THREAD DIAMETERS

Nominal size DIN ISO 272 normal (large) mm	Thread diameter Ø		Nominal size	Nominal size		Thread diameter Ø		Nominal size	
	Metric as per DIN ISO 272	Metric for high-tensile bolted structural joints as per EN 14399-4	"AF	Inch	mm	Whitw.	BS 916, 1083	Inch	mm
3,2 *(–)*	1,6								
4 *(–)*	2								
5 *(–)*	2,5		5/32	0,1562	3,97	8 BA		0,152	3,86
5,5 *(–)*	3					7 BA		0,172	4,37
			3/16	0,1875	4,76	6 BA		0,193	4,90
7 *(–)*	4		7/32	0,2187	5,56	5 BA		0,220	5,59
8 *(–)*	5		1/4	0,2500	6,35	4 BA		0,248	6,30
						1/16 W		0,256	6,90
10 *(–)*	6		9/32	0,2812	7,14	3 BA		0,282	7,16
11 *(–)*	7					3/32 W		0,297	7,54
			5/16	0,3125	7,94	2 BA		0,324	8,23
13 *(–)*	8		11/32	0,3438	8,73	1/8 W	(3/16)	0,340	8,64
16 *(–)*	10		3/8	0,3750	9,52	1 BA		0,365	9,27
			13/32	0,4062	10,32	0 BA	(7/32)	0,413	10,49
18 *(21)*	12		7/16	0,4375	11,11	3/16 W	1/4	0,445	11,30
21 *(24)*	14								
22		12	1/2	0,5000	12,70	1/4 W	5/16	0,525	13,34
24 *(27)*	16		9/16	0,5625	14,29				
27 *(30)*	18	16	19/32	0,5938	15,08	5/16 W	3/8	0,600	15,24
			5/8	0,6250	15,88				
30 *(34)*	20		11/16	0,6875	17,46				
32		20				3/8 W	7/16	0,710	18,03
34 *(36)*	22		3/4	0,7500	19,05				
36 *(41)*	24	22	25/32	0,7812	19,84				
41 *(46)*	27	24	13/16	0,8125	20,64	7/16 W	1/2	0,820	20,83
			7/8	0,8750	22,22				
46 *(50)*	30	27				1/2 W	9/16	0,920	23,37
50 *(55)*	33	30	15/16	0,9375	23,81				
			1.	1,0000	25,40				
55 *(60)*	36					9/16 W	5/8	1,010	25,65
60 *(65)*	39	36	1.1/16	1,0625	26,99				
						5/8 W	(11/16)	1,100	27,94
65	42		1.1/8	1,1250	28,58				
70	45		1.3/16	1,1875	30,16	11/16 W	3/4	1,200	30,48
			1.1/4	1,2500	31,75				
75	48		1.5/16	1,3125	33,34	3/4 W	7/8	1,300	33,02
80	52		1.3/8	1,3750	34,92	13/16 W	(15/16)	1,390	35,31
			1.7/16	1,4375	36,51				
85	56		1.1/2	1,5000	38,10	7/8 W	1.	1,480	37,59
90	60		1.5/8	1,6250	41,28				
			1.11/16	1,6875	42,86	1. W	1.1/8	1,670	42,42
95	64		1.3/4	1,7500	44,45				
100	68		1.13/16	1,8125	46,04				
			1.7/8	1,8750	47,62	1.1/8 W	1.1/4	1,860	47,24
105	72		2.	2,0000	50,80				
110	76		2.1/16	2,0625	52,39	1.1/4 W	1.3/8	2,050	52,07
			2.3/16	2,1875	55,56				
115	80		2.1/4	2,2500	57,15	1.3/8 W	1.1/2	2,220	56,39
120	85		2.3/8	2,3750	60,32				
			2.7/16	2,4375	61,91	1.1/2 W	1.5/8	2,410	61,21
130	90		2.9/16	2,5625	65,09	1.5/8 W	1.3/4	2,580	65,53
			2.5/8	2,3750	66,68				
			2.3/4	2,7500	69,85	1.3/4 W	2.	2,760	70,10
135	95		2.13/16	2,8125	71,44				
			2.15/16	2,9375	74,61				
			3	3,0000	76,20	(1.7/8W)			76,70
145	100		3.1/8	3,1250	79,38		2.1/4	3,150	80,01
			3.3/8	3,3750	85,72				
			3.1/2	3,5000	88,90		2.1/2	3,550	90,17
150	105		3.3/4	3,7500	95,25				
			3.7/8	3,8750	98,42		2.3/4	3,890	98,81
155	110		4.1/8	4,1250	104,78		3.	4,180	106,17
			4.1/4	4,2500	107,95				
			4.1/2	4,5000	114,30		3.1/4	4,530	115,06
165	115		4.5/8	4,6250	117,48				
			4.7/8	4,8750	123,82		3.1/2	4,850	123,19
			5.	5,0000	127,00				
170	120		5.1/4	5,2500	133,35		3.3/4	5,180	131,57
			5.3/8	5,3750	136,52				
			5.5/8	5,6250	142,88		4.	5,550	140,97
180	125		5.3/4	5,7500	146,05				
			6.	6,0000	152,40				
			6.1/8	6,1250	155,58		4.1/2	6,380	162,05
185	130								
200	140								
210	150								

GEDORE

SPANNER SIZES TOLERANCE FOR BOLTS AND SOCKET WRENCHES

Nominal size /s in mm	Tolerance class 1 as per ISO 691 dimensions		Tolerance class 2[a] as per ISO 691 dimensions	
	min.	max.	min.	max.
2 ≤ s < 3	+ 0,02	+ 0,08	+ 0,02	+ 0,12
3 ≤ s < 4	+ 0,02	+ 0,10	+ 0,02	+ 0,14
4 ≤ s < 6	+ 0,02	+ 0,12	+ 0,02	+ 0,16
3 ≤ s < 10	+ 0,03	+ 0,15	+ 0,03	+ 0,19
10 ≤ s < 12	+ 0,04	+ 0,19	+ 0,04	+ 0,24
12 ≤ s < 14	+ 0,04	+ 0,24	+ 0,04	+ 0,30
14 ≤ s < 17	+ 0,05	+ 0,27	+ 0,05	+ 0,35
17 ≤ s < 19	+ 0,05	+ 0,30	+ 0,05	+ 0,40
19 ≤ s < 26	+ 0,06	+ 0,36	+ 0,06	+ 0,46
26 ≤ s < 33	+ 0,08	+ 0,48	+ 0,08	+ 0,58
33 ≤ s < 55	+ 0,10	+ 0,60	+ 0,10	+ 0,70
55 ≤ s < 75	+ 0,12	+ 0,72	+ 0,12	+ 0,92
75 ≤ s < 105	+ 0,15	+ 0,85	+ 0,15	+ 1,15
105 ≤ s < 150	+ 0,20	+ 1,00	+ 0,20	+ 1,40
150 ≤ s < 210	+ 0,25	+ 1,22	-	-

This tolerance class applies only to ring spanners or socket wrenches that have not been manufactured by material removal.

Spanner sizes in accordance with this international standard must be marked with:

a) Spanner head size
b) Reference to the international standard, i.e. ISO 691
c) Nominal size s in millimetres
d) Tolerance class 1 or 2

Conversion tables
Inch to decimal-inches and mm

in.	dec.in.	mm.
0	**0**	**0**
1/64	0.015625	0,3969
1/32	0.03125	0,7938
3/64	0.046875	1,1906
1/16	**0.0625**	**1,5875**
5/64	0.078125	1,9844
3/32	0.09375	2,3812
7/64	0.109375	2,7781
1/8	**0.125**	**3,1750**
9/64	0.140625	3,5719
5/32	0.15625	3,9688
11/64	0.171875	4,3656
3/16	**0.1875**	**4,7625**
13/64	0.203125	5,1594
7/32	0.21875	5,5562
15/64	0.234375	5,9531
1/4	**0.25**	**6,3500**
17/64	0.265625	6,7469
9/32	0.28125	7,1438
19/62	0.296875	7,5406
5/16	**0.3125**	**7,9375**
21/64	0.328125	8,3344
11/32	0.34375	8,7312
23/64	0.359375	9,1281
3/8	**0.375**	**9,5250**
25/64	0.390625	9,9219
13/32	0.40625	10,3188
27/64	0.421875	10,7156
7/16	**0.4375**	**11,1125**
29/64	0.453125	11,5094
15/32	0.46875	11,9062
31/64	0.484375	12,3031

in.	dec.in.	mm.
1/2	**0.5**	**12,7000**
33/64	0.515625	13,0969
17/32	0.53125	13,4938
35/64	0.546875	13,8906
9/16	**0.5625**	**14,2875**
37/64	0.578125	14,6844
19/32	0.59375	15,0812
39/64	0.609375	15,4781
5/8	**0.625**	**15,8750**
41/64	0.640625	16,2719
21/32	0.65625	16,6688
43/64	0.671875	17,0656
11/16	**0.6875**	**17,4625**
45/64	0.703125	17,8594
23/32	0.71875	18,2562
47/64	0.734375	18,6531
3/4	**0,75**	**19,0500**
49/64	0,765625	19,4469
25/32	0,78125	19,8438
51/62	0,796875	20,2406
13/16	**0,8125**	**20,6375**
53/64	0,828125	21,0344
27/32	0,84375	21,4312
55/64	0,859375	21,8281
7/8	**0,875**	**22,2250**
57/64	0,890625	22,6219
29/32	0,90625	23,0188
59/64	0,921875	23,4156
15/16	**0,9375**	**23,8125**
61/64	0,953125	24,2094
31/32	0,96875	24,6062
63/64	0,984375	25,0031
1	1	25,4000

GEDORE

TORQUE
CONVERSION TABLES

Units to be	Torque conversion factors								Corresponding unit
	= mN·m	= cN·m	= N·m	= ozf·in	= lbf·in	= lbf·ft	= gf·cm	= f·cm (kp·cm)	= kgf·m (kp·m)
1 mN·m	1	0,1	0,001	0,142	0,009	0,0007	10,2	0,01	0,0001
1 cN·m	10	1	0,01	1,416	0,088	0,007	102	0,102	0,001
1 N·m	1000	100	1	141,6	8,851	0,738	10197	10,2	0,102
1 ozf·in	7,062	0,706	0,007	1	0,0625	0,005	72	0,072	0,0007
1 lbf·in	113	11,3	0,113	16	1	0,083	1152,1	1,152	0,0115
1 lbf·ft	1356	135,6	1,356	192	12	1	13826	13,83	0,138
1 gf·cm	0,098	0,01	0,0001	0,014	0,0009	0,00007	1	0,001	0,00001
1 kgf·cm (kp·cm)	98,07	9,807	0,098	13,89	0,868	0,072	1000	1	0,01
1 kgf·m (kp·m)	9807	980,7	9,807	1389	86,8	7,233	100000	100	1

Application

Conversion formula:
Units to be converted x factor
= corresponding unit

Example:
Convert of 5 lbf·ft in cN·m

Solution:
5 x 135.6 = 678 cN·m

Conversion from N·m in kgf·m (kp·m) — 1N·m = 0,102 kgf·m

N·m	0	1	2	3	4	5	6	7	8	9
0	0,00	0,10	0,20	0,31	0,41	0,51	0,61	0,71	0,82	0,92
10	1,02	1,12	1,22	1,33	1,43	1,53	1,63	1,73	1,84	1,94
20	2,04	2,14	2,24	2,35	2,45	2,55	2,65	2,75	2,86	2,96
30	3,06	3,16	3,26	3,37	3,47	3,57	3,67	3,77	3,87	3,98
40	4,08	4,18	4,28	4,38	4,49	4,59	4,69	4,79	4,89	5,00
50	5,10	5,20	5,30	5,40	5,51	5,61	5,71	5,81	5,91	6,02
60	6,12	6,22	6,32	6,42	6,53	6,63	6,73	6,83	6,93	7,04
70	7,14	7,24	7,34	7,44	7,55	7,65	7,75	7,85	7,95	8,06
80	8,16	8,26	8,36	8,46	8,57	8,67	8,77	8,87	8,97	9,08
90	9,18	9,28	9,38	9,48	9,59	9,69	9,79	9,89	9,99	10,10
100	10,20	10,30	10,40	10,50	10,60	10,71	10,81	10,91	11,01	11,11

Conversion from kgf·m (kp·m) in N·m — 1 kgf·m (kp·m) = 9,807 N·m

kgf·m(kp·m)	0	1	2	3	4	5	6	7	8	9
0	0,00	9,81	19,61	29,42	39,23	49,03	58,84	68,65	78,45	88,26
10	98,07	107,87	117,68	127,49	137,29	147,10	156,91	166,71	176,52	186,33
20	196,13	205,94	215,75	225,55	235,36	245,17	254,97	264,78	274,59	284,39
30	294,20	304,01	313,81	323,62	333,43	343,23	w353,04	362,85	372,65	382,46
40	392,27	402,07	411,88	421,69	431,49	441,30	451,11	460,91	470,72	480,53
50	490,33	500,14	509,95	519,75	529,56	539,37	549,17	558,98	568,79	578,59
60	588,40	598,21	608,01	617,82	627,63	637,43	647,24	657,05	666,85	676,66
70	686,47	696,27	706,08	715,89	725,69	735,50	745,31	755,11	764,92	774,73
80	784,53	794,34	804,15	813,95	823,76	833,57	843,37	853,18	862,99	872,79
90	882,60	892,41	902,21	912,02	921,83	931,63	941,44	951,25	961,05	970,86
100	980,67	990,47	1000,28	1010,08	1019,89	1029,70	1039,50	1049,31	1059,12	1068,92

Conversion from N·m in lbf·ft — 1N·m=0,7376 lbf·ft

N·m	0	1	2	3	4	5	6	7	8	9
0	0,00	0,74	1,48	2,21	2,95	3,69	4,43	5,16	5,90	6,64
10	7,38	8,11	8,85	9,59	10,33	11,06	11,80	12,54	13,28	14,01
20	14,75	15,49	16,23	16,96	17,70	18,44	19,18	19,91	20,65	21,39
30	22,13	22,86	23,60	24,34	25,08	25,81	26,55	27,29	28,03	28,76
40	29,50	30,24	30,98	31,72	32,45	33,19	33,93	34,67	35,40	36,14
50	36,88	37,62	38,35	39,09	39,83	40,57	41,30	42,04	42,87	43,52
60	44,25	44,99	45,73	46,47	47,20	47,94	48,68	49,42	50,15	50,89
70	51,63	52,37	53,10	53,84	54,58	55,32	56,05	56,79	57,53	58,27
80	59,00	59,74	60,48	61,22	61,96	62,69	63,43	64,17	64,91	65,64
90	66,38	67,12	67,86	68,59	69,33	70,07	70,81	71,54	72,28	73,02
100	73,76	74,49	75,23	75,97	76,71	77,44	78,18	78,92	79,66	80,39

Conversion from lbf·ft in N·m — 1 lbf·ft = 1,356 N·m

lbf·ft	0	1	2	3	4	5	6	7	8	9
0	0,00	1,36	2,71	4,07	5,42	6,78	8,13	9,49	10,85	12,20
10	13,56	14,91	16,27	17,63	18,98	20,34	21,69	23,05	24,40	25,76
20	27,12	28,47	29,83	31,18	32,54	33,90	35,25	36,61	37,96	39,32
30	40,67	42,03	43,39	44,74	46,10	47,45	48,81	50,16	51,52	52,88
40	54,23	55,59	56,94	58,30	59,66	61,01	62,37	63,72	65,08	66,43
50	67,79	69,15	70,50	71,86	73,21	74,57	75,93	77,28	78,64	79,99
60	81,35	82,70	84,06	85,42	86,77	88,13	89,48	90,84	92,20	93,55
70	94,91	96,26	97,62	98,97	100,33	101,69	103,04	104,40	105,75	107,11
80	108,46	109,82	111.18	112,53	113,89	115,24	116,60	117,96	119,31	120,67
90	122,02	123,38	124,73	126,09	127,45	128,80	130,16	131,51	132,87	134,23
100	135,58	136,94	138,29	139,65	141,00	142,36	143,72	145,07	146,43	147,78

Conversion from N·m in lbf·in — 1 N·m = 8,851 lbf·in

N·m	0	1	2	3	4	5	6	7	8	9
0	0,00	8,85	17,70	26,55	35,40	44,25	53,10	61,96	70,81	79,66
10	88,51	97,36	106,21	115,06	123,91	132,76	141,61	150,46	159,31	168,16
20	177,02	185,87	194,72	203,57	212,42	221,27	230,12	238,97	247,82	256,67
30	265,52	274,37	283,22	292,08	300,93	309,78	318,63	327,48	336,33	345,18
40	354,03	362,88	371,73	380,58	389,43	398,28	407,14	415,99	424,84	433,69
50	442,54	451,39	460,24	469,09	477,94	486,79	495,64	504,49	513,34	522,20
60	531,05	539,90	548,75	557,60	566.45	575,30	584,15	593,00	601,85	610,70
70	619,55	628,40	637,26	646,11	654,96	663,81	672,66	681,51	690,36	699,21
80	708,06	716,91	725,76	734,61	743,46	752,32	761,17	770,02	778,87	787,72
90	796,57	805,42	814,27	823,12	831,97	840,82	849,67	858,52	867,38	876,23
100	885,08	893,93	902,78	911,63	920,48	929,33	938,18	947,03	955,88	964,73

Conversion from lbf·in in N·m — 1 lbf·in = 0,113 N·m

lbf·in	0	1	2	3	4	5	6	7	8	9
0	0,00	0,11	0,23	0,34	0,45	0,56	0,68	0,79	0,90	1,02
10	1,13	1,24	1,36	1,47	1,58	1,69	1,81	1,92	2,03	2,15
20	2,26	2,37	2,49	2,60	2,71	2,82	2,94	3,05	3,16	3,28
30	3,39	3,50	3,62	3,73	3,84	3,95	4,07	4,18	4,29	4,41
40	4,52	4,63	4,75	4,86	4,97	5,08	5,20	5,31	5,42	5,54
50	5,65	5,76	5,87	5,99	6,10	6,21	6,33	6,44	6,55	6,67
60	6,78	6,89	7,00	7,12	7,23	7,34	7,46	7,57	7,68	7,80
70	7,91	8,02	8,13	8,25	8,36	8,47	8,59	8,70	8,81	8,93
80	9,04	9,15	9,26	9,38	9,49	9,60	9,72	9,83	9,94	10,06
90	10,17	10,28	10,39	10,51	10,62	10,73	10,58	10,96	11,07	11,19
100	11,30	11,41	11,52	11,64	11,75	11,86	11,98	12,09	12,20	12,31

Important prefix characters

Giga	G	1.000.000.000	$= 10^9$
Mega	M	1.000.000	$= 10^6$
Kilo	k	1.000	$= 10^3$
Hecto	H	100	$= 10^2$
Deca	Da	10	$= 10^1$
Deci	d	0,1	$= 10^{-1}$
Centi	c	0,01	$= 10^{-2}$
Milli	m	0,001	$= 10^{-3}$
Micro	µ	0,000001	$= 10^{-6}$
Nano	n	0,000000001	$= 10^{-9}$

Important SI units with conversions to old but still commonly used units

Length	metre	m		
Masa	kilogramme			
Time	second	s		
Force	newton	N	$= m/s^2$	1 N = 0,102 kp
Torque	newton metre	N·m		9,81 N·m = 1 kp·m
Energy (work)	joule	J	= N·m	
Heat quantity	joule	J		1 J = 0,239 cal
Power	watt	W	= N·m/s	1 kW = 1,36 PS = 860 kcal/h
Pressure	pascal	Pa	$= N/m^2$	100 000 Pa = 1 bar = 10 mWS
Electrical current	ampere	A		
Temperature	kelvin	K		1 K = 1 °C

Conversion table, mass and weight

1 megagramme	(Mg)	= 1.000 kg	= 10.000 hg	= 100.000 dag	= 1.000.000 g
1 ton	(to.)	= 1.000 kg			
1 kilogramme	(kg)		= 10 hg	= 100 dag	= 1000 g
1 hectogramme	(hg)			= 10 dag	= 100 g
1 decagramme	(dag)				= 10 g
1 gramme	(g)	= 10 dg	= 100 cg	= 1000 mg	
1 decigramme	(dg)		= 10 cg	= 100 mg	
1 centigramme	(cg)			= 10 mg	
1 miligramme	(mg)			= 1 mg	

Conversion table, force and torque

1 newton	= 0,102 kp
1 kilopond	= 9,81 N
1 kilopond metre	= 9,81 N·m

Material properties

	Density g/cm³	Expansion 1/°C	Melting point °C	Modulus of elasticity N/mm
Aluminium	2,7	0,000024	660,1	72 000
Lead	11,3	0,000029	327,3	16 000
Iron (Steel)	7,86	0,000012	1540	210 000
Gold	19,3	0,000014	1063	79 000
Copper	8,9	0,000017	1083	126 000
Zinc	7,1	0,000026	419	94 000
Glass	2,2–2,9	0,000008	800–1500	68 000
Air	0,0013	0,0036		
Wood	0,5–0,7			10 000
Plastics / synthetic materials:				
PS,	1,05	0,00008		3 400
PP,	0,9	0,00018		1 200
ABS	1,05	0,00010		2 500

Examples

Example 1:
Expansion of a steel body of 100 mm in length at a temperature of 10 °C. Length y expansion coefficient x °C exp. = 100 mm x 0,000012 x 10 = 0,012 mm = 12 µm

Example 2:
Elastic expansion e = s/E. A body of 100 mm in length made of ABS is stretched with s = 50 N/mm². e = 50 N/mm²: 2500 N/mm² = 0.02. The expansion is: 100 mm x 0.02 = 2 mm.

Example 3:
Two steel plates with a total thickness of 20 mm are pre-stressed by means of a screw connection of s = 50 N/mm²: e = 50: 210000 = 0.00024. The compression in the surrounding area of the screw is 20 mm x 0.00024 = 0,0048 mm = 5 µm.

The elastic compression induces a continuous pre-tension of the screw connection.
A properly tensed screw connection is selfinhibiting.

Comparison table of Vickers-Brinell-Rockwell hardness and tensile strength

Vickers hardness HV 30	Brinell hardness HB 30	Rockwell hardness HRB	Rockwell hardness HRC	Tensile strength sB N/mm²
80	80,7	36,4	–	270
85	85	42,4	–	290
90	90	47,4	–	310
95	95	52,0	–	320
100	100	56,4	–	340
105	105	60,0	–	360
110	110	63,4	–	380
115	115	66,4	–	390
120	120	69,4	–	410
125	125	72,0	–	420
130	130	74,4	–	440
135	135	76,4	–	460
140	140	78,4	–	470
145	145	80,4	–	490
150	150	82,2	–	500
155	155	83,8	–	520
160	160	85,4	–	540
165	165	86,8	–	550
170	170	88,2	–	570
175	175	89,6	–	590
180	180	90,8	–	600
185	185	91,8	–	620
190	190	91,5	–	640
195	195	94,0	–	660
200	200	95,0	–	670
205	205	95,8	–	680
210	210	96,6	–	710
215	215	97,4	–	720
220	220	98,2	–	730
225	225	99,0	–	750
230	230	–	19,2	760
235	235	–	20,2	780
240	240	–	21,2	800
245	245	–	22,1	820
250	250	–	23,0	830
255	255	–	23,8	850
260	260	–	24,6	870
265	265	–	25,4	880
270	270	–	26,9	900
275	275	–	27,1	920
280	280	–	27,6	940
285	285	–	28,3	950
290	290	–	29,0	970
295	295	–	29,6	990
300	300	–	30,3	1010
310	310	–	31,5	1040
320	320	–	32,7	1080
330	330	–	33,8	1110
340	340	–	34,9	1140
350	350	–	36,0	1170
360	359	–	37,0	1200
370	368	–	38,0	1230
380	376	–	38,9	1260
390	385	–	39,8	1290
400	392	–	40,7	1320
410	400	–	41,5	1350
420	408	–	42,4	1380
430	415	–	43,2	1410
440	423	–	44,0	1430
450	430	–	44,8	1460
460	–	–	45,6	(1490)
470	–	–	46,3	(1520)
480	–	–	47,0	(1550)
490	–	–	47,7	(1580)
500	–	–	48,3	(1600)
510	–	–	49,1	(1630)
520	–	–	49,7	(1660)
530	–	–	50,4	(1690)
540	–	–	51,0	(1710)
550	–	–	51,6	(1740)
560	–	–	52,2	(1770)
570	–	–	52,8	(1790)
580	–	–	53,3	(1820)
590	–	–	53,9	(1850)
600	–	–	54,4	(1870)
610	–	–	55,0	(1900)
620	–	–	55,5	(1930)
630	–	–	56,0	(1950)
640	–	–	56,5	(1980)
650	–	–	57,0	(2000)
660	–	–	57,5	(2030)
670	–	–	58,0	(2050)
680	–	–	58,5	(2080)
690	–	–	59,0	(2110)
700	–	–	59,5	(2130)
720	–	–	60,4	(2170)
740	–	–	61,2	(2220)
760	–	–	62,0	(2260)
780	–	–	62,8	(2300)
800	–	–	63,6	–
820	–	–	64,3	–
840	–	–	65,0	–
860	–	–	65,7	–
880	–	–	66,3	–
900	–	–	66,9	–
920	–	–	67,5	–
940	–	–	68,0	–

GUIDELINE VALUES
FOR THE COEFFICIENT OF FRICTION µ

Screw thread / Nut thread				Steel				
				blackened or Zinc-phosphate				
				pressed rolled	rolled cut	sharpened	cadmium-plated 6 µ	zinc-plated 6 µ
Steel	ground		Slightly oiled	0,14	0,10	0,16	0,10	0,10
Steel	sharpened		Slightly oiled	0,16	0,10	0,16	0,10	0,10
Steel	ground sharpened	Zinc-phosphate	Slightly oiled	0,14		0,10		
Steel	turned sharpened	Zinc-phosphate	Slightly oiled	0,10				
Steel	turned sharpened		Slightly oiled	0,10		0,10	0,10	0,10
Steel	cadmium-plated	6 µ	Slightly oiled				0,14	
Steel	zinc-plated	6 µ	Slightly oiled					0,10
Steel	cadmium-plated	6 µ	Dry	0,10		0,10	0,14	
Steel	zinc-plated	6 µ	Dry	0,10		0,10		0,14

Choosing the right friction value

In order to exactly define the pre-tension force and the tightening torque, it is essential to know the coefficient friction.

However, it would seem almost impossible to specify definite values for the coefficients of friction for the large variety of possible surface and lubrication conditions and above all for their variance. Added to this are the variances of the various different tightening methods which also constitute a greater or lesser factor of uncertainty. For this reason, it is only possible to make recommendations on the choise of the coefficient of friction. 80 % of the tightening-torque values apply for countersunk head screws on account of the remaining base thickness.

Guideline values for the coefficient of friction µ

In order to exactly define the pre-tension force and the tightening torque, it is essential to know the coefficient of friction. However, it would seem almost impossible to specify definite values for the coefficients of friction for the large variety of possible surface and lubrication conditions and above all for their variance.

The following circumstances influence the friction value:
The surfaces and the nature of the materials being screwed, the method of lubrication, the sliding path due to the flexibility and the tightening method, i.e. the number and the speed of the tightening cycles and finally the tightening path - the so-called hard or soft screw case. The sum total of these items represents a greater or lesser factor of uncertainty. Even DIN-equivalent screws con differ considerably in their friction value because of being delivered by different suppliers, depending on the screw lot and depending on their storage and, in particalar, on the oiling or greasing performed in the course of installation. Please note that around 80 to 90% of the tightening torque in most tightening procedures is required for overcoming the friction in the screw.

Important remark:
For this reason, it is only possible to give recommendations on the choice of the friction value. We point out explicitly that the following tables only contain guideline values. In all cases, a detailed screw calculation is more reliable than these tables! That applies particularly for parts which are relevant to safety, are subject to official regulations or perform sealing functions. The tables should only be utilised where the manufacturer of the screws or elements being connected has made no specifications on the required tightening torques.

GEDORE

FRICTION VALUE μ_{ges} 0,10 AND 0,14

Friction value μ_{ges} 0,10

Shank screws with metric ISO medium threads in accordance with DIN ISO 261

		4.6		5.6		6.8		8.8		10.9		12.9	
μ_{celk} 0,10	P mm	F_{sp} N	M_A N·m	F_{sp} N	M_A N·m	F_{sp} N	M_A N·m	F_{sp} N	M_A N·m	F_{sp} N	M_A N·m	F_{sp} N	M_A N·m
M 2	0,4	367	0,108	459	0,135	734	0,216	979	0,288	1.376	0,405	1.651	0,486
M 2,5	0,45	610	0,221	763	0,276	1.221	0,441	1.628	0,588	2.289	0,827	2.747	0,993
M 3	0,5	915	0,392	1.144	0,491	1.830	0,785	2.441	1,047	3.432	1,472	4.118	1,766
M 3,5	0,6	1.228	0,617	1.535	0,771	2.456	1,234	3.274	1,645	4.605	2,313	5.526	2,776
M 4	0,7	1.587	0,914	1.983	1,142	3.173	1,827	4.231	2,436	5.950	3,426	7.139	4,111
M 4,5	0,75	2.059	1,325	2.574	1,656	4.118	2,649	5.491	3,532	7.722	4,967	9.266	5,961
M 5	0,8	2.593	1,843	3.242	2,304	5.187	3,686	6.915	4,915	9.725	6,912	11.670	8,294
M 6	1	3.661	3,140	4.576	3,925	7.322	6,280	9.762	8,373	13.728	11,775	16.473	14,130
M 8	1,25	6.713	7,609	8.391	9,511	13.426	15,218	17.901	20,291	25.173	28,534	30.208	34,240
M 10	1,5	10.683	15,06	13.354	18,82	21.366	30,11	28.488	40,15	40.061	56,46	48.073	67,75
M 12	1,75	15.571	26,24	19.463	32,80	31.142	52,48	41.522	69,97	58.390	98,39	70.068	118,07
M 14	2	21.377	41,92	26.721	52,40	42.753	83,83	57.004	111,78	80.162	157,19	96.195	188,62
M 16	2	29.373	64,80	36.717	81,01	58.747	129,61	78.329	172,81	110.150	243,02	132.180	291,62
M 18	2,5	35.742	89,80	44.678	112,25	71.484	179,60	95.312	239,46	134.033	336,75	160.840	404,09
M 20	2,5	45.896	126,57	57.370	158,21	91.792	253,14	122.389	337,52	172.109	474,64	206.531	569,57
M 22	2,5	57.312	172,1	71.640	215,1	114.623	344,2	152.831	459,0	214.919	645,4	257.902	774,5
M 24	3	66.090	218,7	82.612	273,4	132.180	437,4	176.240	583,2	247.837	820,2	297.405	984,2
M 27	3	86.922	319,7	108.653	399,6	173.845	639,3	231.793	852,4	325.959	1.198,7	391.150	1.438,4
M 30	3,5	105.686	434,0	132.107	542,5	211.371	868,0	281.828	1.157,3	396.321	1.627,4	475.585	1.952,9
M 33	3,5	131.646	589,0	164.557	736,3	263.292	1.178,1	351.056	1.570,8	493.672	2.208,9	592.407	2.650,7
M 36	4	154.529	757,7	193.161	947,1	309.057	1.515,4	412.076	2.020,5	579.482	2.841,4	695.379	3.409,6
M 39	4	185.617	978	232.021	1.223	371.233	1.957	494.978	2.609	696.062	3.669	835.275	4.403
M 42	4,5	212.619	1.212	265.774	1.515	425.238	2.424	566.983	3.232	797.321	4.545	956.785	5.454
M 45	4,5	248.834	1.510	311.043	1.888	497.669	3.020	663.559	4.027	933.129	5.663	1.119.755	6.795
M 48	5	279.956	1.819	349.945	2.274	559.912	3.638	746.550	4.850	1.049.836	6.821	1.259.803	8.185
M 52	5	335.711	2.346	419.639	2.932	671.422	4.692	895.229	6.256	1.258.916	8.797	1.510.700	10.557
M 56	5,5	387.206	2.919	484.007	3.649	774.412	5.839	1.032.549	7.785	1.452.022	10.948	1.742.427	13.137
M 60	5,5	452.319	3.632	565.399	4.540	904.639	7.265	1.206.185	9.686	1.696.198	13.621	2.035.438	16.345
M 64	6	511.800	4.392	639.751	5.490	1.023.601	8.784	1.364.801	11.713	1.919.252	16.471	2.303.102	19.765
M 68	6	586.272	5.319	732.840	6.649	1.172.545	10.638	1.563.393	14.184	2.198.521	19.947	2.638.225	23.936

Shank screws with metric ISO fine-pitch thread in accordance with DIN ISO 261

M 8	1	7.343	8,10	9.179	10,13	14.687	16,20	19.582	21,60	27.537	30,38	33.045	36,45
M 10	1	12.288	16,57	15.360	20,71	24.576	33,14	32.768	44,19	46.080	62,14	55.297	74,57
M 12	1,5	16.522	27,34	20.653	34,17	33.045	54,68	44.060	72,91	61.959	102,52	74.351	123,03
M 14	1,5	23.624	44,89	29.530	56,11	47.249	89,78	62.998	119,70	88.591	168,33	106.309	202,00
M 16	1,5	31.988	68,63	39.984	85,79	63.975	137,26	85.300	183,01	119.953	257,36	143.944	308,83
M 18	1,5	41.612	99,49	52.015	124,36	83.223	198,98	110.965	265,30	156.044	373,08	187.253	447,70
M 20	1,5	52.497	138,4	65.621	173,0	104.993	276,8	139.991	369,1	196.862	519,0	236.235	622,8
M 22	1,5	64.642	186,3	80.803	232,8	129.284	372,6	172.379	496,7	242.408	698,5	290.890	838,3
M 24	1,5	78.048	244,1	97.560	305,1	156.096	488,1	208.129	650,8	292.681	915,2	351.217	1.098,3

Friction value μ_{ges} 0,14

Shank screws with metric ISO medium threads in accordance with DIN ISO 261

		4.6		5.6		6.8		8.8		10.9		12.9	
μ_{celk} 0,10	P mm	F_{sp} N	M_A N·m	F_{sp} N	M_A N·m	F_{sp} N	M_A N·m	F_{sp} N	M_A N·m	F_{sp} N	M_A N·m	F_{sp} N	M_A N·m
M 2	0,4	338	0,130	422	0,163	675	0,261	901	0,348	1.267	0,489	1.520	0,587
M 2,5	0,45	563	0,269	703	0,336	1.125	0,537	1.500	0,716	2.110	1,007	2.532	1,209
M 3	0,5	845	0,480	1.056	0,600	1.689	0,961	2.253	1,281	3.168	1,801	3.801	2,161
M 3,5	0,6	1.133	0,754	1.416	0,942	2.266	1,507	3.021	2,009	4.248	2,826	5.098	3,391
M 4	0,7	1.463	1,115	1.829	1,393	2.927	2,229	3.902	2,972	5.487	4,180	6.585	5,016
M 4,5	0,75	1.901	1,621	2.376	2,026	3.801	3,242	5.068	4,323	7.127	6,079	8.553	7,295
M 5	0,8	2.395	2,261	2.994	2,827	4.790	4,523	6.387	6,030	8.982	8,480	10.778	10,176
M 6	1	3.379	3,843	4.224	4,803	6.758	7,685	9.011	10,247	12.671	14,410	15.205	17,292
M 8	1,25	6.202	9,349	7.753	11,686	12.404	18,698	16.539	24,931	23.258	35,059	27.909	42,070
M 10	1,5	9.876	18,54	12.345	23,18	19.752	37,09	26.336	49,45	37.034	69,54	44.441	83,44
M 12	1,75	14.400	32,37	18.000	40,46	28.801	64,74	38.401	86,32	54.001	121,38	64.801	145,66
M 14	2	19.775	51,77	24.719	64,71	39.551	103,54	52.734	138,06	74.158	194,14	88.989	232,97
M 16	2	27.221	80,62	34.027	100,77	54.443	161,24	72.591	214,98	102.080	302,32	122.497	362,78
M 18	2,5	33.078	111,09	41.347	138,86	66.155	222,17	88.207	296,23	124.041	416,58	148.850	499,89
M 20	2,5	42.534	157,46	53.167	196,82	85.067	314,91	113.423	419,88	159.501	590,46	191.401	708,55
M 22	2,5	53.175	215,1	66.469	268,9	106.350	430,2	141.800	573,7	199.406	806,7	239.288	968,0
M 24	3	61.248	272,1	76.560	340,1	122.497	544,2	163.329	725,6	229.681	1.020,3	275.617	1.224,4
M 27	3	80.670	399,9	100.837	499,9	161.339	799,9	215.119	1.066,5	302.512	1.499,7	363.014	1.799,7
M 30	3,5	98.027	541,7	122.533	677,2	196.054	1.083,4	261.405	1.444,6	367.600	2.031,5	441.120	2.437,7
M 33	3,5	122.241	738,5	152.801	923,2	244.482	1.477,1	325.976	1.969,4	458.404	2.769,5	550.084	3.323,4
M 36	4	143.413	948,0	179.266	1.185,0	286.826	1.896,0	382.434	2.528,0	537.798	3.555,0	645.358	4.265,9
M 39	4	172.420	1.229	215.525	1.536	344.839	2.457	459.786	3.276	646.574	4.607	775.888	5.529
M 42	4,5	197.407	1.519	246.758	1.899	394.813	3.038	526.417	4.050	740.275	5.696	888.329	6.835
M 45	4,5	231.206	1.898	289.007	2.373	462.412	3.796	616.549	5.062	867.022	7.118	1.040.426	8.541
M 48	5	260.008	2.282	325.010	2.853	520.015	4.565	693.354	6.086	975.029	8.559	1.170.035	10.211
M 52	5	312.056	2.954	390.070	3.692	624.112	5.907	832.149	7.876	1.170.209	11.076	1.404.251	13.292
M 56	5,5	359.843	3.672	449.804	4.591	719.686	7.345	959.581	9.793	1.349.411	13.772	1.619.293	16.526
M 60	5,5	420.651	4.582	525.813	5.728	841.301	9.164	1.121.735	12.219	1.577.440	17.183	1.892.928	20.619
M 64	6	475.860	5.536	594.825	6.920	951.720	11.071	1.268.960	14.762	1.784.476	20.759	2.141.371	24.911
M 68	6	545.427	6.720	681.784	8.400	1.090.855	13.440	1.454.473	17.919	2.045.353	25.199	2.454.423	30.239

Shank screws with metric ISO fine-pitch thread in accordance with DIN ISO 261

M 8	1	6.805	10,08	8.507	12,60	13.611	20,15	18.148	26,87	25.520	37,79	30.624	45,35
M 10	1	11.418	20,83	14.272	26,04	22.835	41,66	30.447	55,55	42.816	78,11	51.379	93,73
M 12	1,5	15.312	34,01	19.140	42,51	30.624	68,02	40.832	90,69	57.420	127,54	68.904	153,05
M 14	1,5	21.934	56,25	27.418	70,32	43.868	112,51	58.491	150,01	82.253	210,96	98.703	253,15
M 16	1,5	29.741	86,50	37.177	108,12	59.483	172,99	79.310	230,66	111.530	324,36	133.836	389,23
M 18	1,5	38.733	125,95	48.417	157,44	77.467	251,91	103.289	335,88	145.250	472,33	174.300	566,80
M 20	1,5	48.910	175,9	61.138	219,8	97.820	351,7	130.427	468,9	183.413	659,4	220.096	791,3
M 22	1,5	60.272	237,4	75.340	296,8	120.543	474,8	160.724	633,1	226.019	890,3	271.223	1.068,3
M 24	1,5	72.818	311,8	91.022	389,8	145.635	623,7	194.180	831,6	273.066	1.169,4	327.680	1.403,3

GEDORE

FRICTION VALUE μ_{ges} 0,16

Friction value μ_{ges} 0,16 — **Shank screws with metric ISO medium threads in accordance with DIN ISO 261**

		4.6		5.6		6.8		8.8		10.9		12.9	
	P	F_{sp}	M_A	F_{sp}	M_A	F_{sp}	M_A	F_{sp}	M_A	F_{sp}	M_A	F_{sp}	M_A
0,16	mm	N	N·m	N	N·m	N	N·m	N	N·m	N	N·m	N	N·m
M 2	0,4	324	0,140	405	0,175	647	0,280	863	0,373	1.214	0,525	1.456	0,630
M 2,5	0,45	539	0,289	674	0,361	1.079	0,578	1.439	0,770	2.023	1,083	2.428	1,300
M 3	0,5	810	0,517	1.013	0,647	1.620	1,035	2.161	1,380	3.038	1,940	3.646	2,328
M 3,5	0,6	1.086	0,811	1.358	1,014	2.173	1,622	2.897	2,163	4.074	3,042	4.889	3,650
M 4	0,7	1.403	1,199	1.754	1,499	2.806	2,398	3.742	3,198	5.262	4,497	6.314	5,396
M 4,5	0,75	1.823	1,746	2.279	2,182	3.646	3,492	4.861	4,656	6.836	6,547	8.204	7,857
M 5	0,8	2.298	2,438	2.872	3,047	4.596	4,875	6.127	6,500	8.617	9,141	10.340	10,969
M 6	1	3.241	4,139	4.051	5,173	6.482	8,277	8.643	11,036	12.154	15,520	14.584	18,623
M 8	1,25	5.951	10,083	7.438	12,603	11.901	20,165	15.868	26,887	22.315	37,809	26.778	45,371
M 10	1,5	9.477	20,01	11.847	25,02	18.955	40,03	25.273	53,37	35.540	75,05	42.648	90,06
M 12	1,75	13.821	34,96	17.277	43,69	27.642	69,91	36.857	93,22	51.830	131,08	62.195	157,30
M 14	2	18.982	55,93	23.728	69,91	37.964	111,86	50.619	149,15	71.183	209,74	85.419	251,69
M 16	2	26.145	87,30	32.682	109,13	52.291	174,61	69.721	232,81	98.045	327,39	117.654	392,87
M 18	2,5	31.755	120,08	39.694	150,10	63.510	240,15	84.680	320,20	119.081	450,29	142.897	540,34
M 20	2,5	40.852	170,52	51.065	213,14	81.704	341,03	108.939	454,71	153.195	639,43	183.834	767,32
M 22	2,5	51.093	233,3	63.867	291,7	102.187	466,6	136.249	622,2	191.600	875,0	229.921	1.050,0
M 24	3	58.827	294,7	73.534	368,3	117.654	589,3	156.872	785,7	220.601	1.104,9	264.721	1.325,9
M 27	3	77.519	433,9	96.899	542,4	155.038	867,9	206.717	1.157,2	290.696	1.627,2	348.835	1.952,7
M 30	3,5	94.179	587,3	117.724	734,2	188.358	1.174,6	251.144	1.566,2	353.172	2.202,5	423.806	2.642,9
M 33	3,5	117.488	801,9	146.860	1.002,3	234.977	1.603,8	313.302	2.138,3	440.581	3.007,0	528.697	3.608,5
M 36	4	137.811	1.028,6	172.264	1.285,7	275.623	2.057,2	367.497	2.742,9	516.793	3.857,2	620.152	4.628,6
M 39	4	165.738	1.335	207.172	1.668	331.475	2.669	441.967	3.559	621.516	5.005	745.819	6.006
M 42	4,5	189.724	1.649	237.155	2.061	379.448	3.298	505.930	4.397	711.465	6.183	853.758	7.420
M 45	4,5	222.267	2.063	277.834	2.578	444.534	4.125	592.712	5.500	833.501	7.735	1.000.201	9.282
M 48	5	249.916	2.479	312.395	3.099	499.833	4.958	666.444	6.610	937.186	9.296	1.124.624	11.155
M 52	5	300.035	3.212	375.043	4.014	600.069	6.423	800.093	8.564	1.125.130	12.043	1.350.156	14.452
M 56	5,5	345.954	3.992	432.442	4.990	691.908	7.984	922.544	10.645	1.297.327	14.969	1.556.793	17.963
M 60	5,5	404.516	4.985	505.645	6.232	809.031	9.970	1.078.709	13.294	1.516.934	18.695	1.820.321	22.433
M 64	6	457.571	6.021	571.964	7.526	915.142	12.042	1.220.189	16.056	1.715.891	22.579	2.059.069	27.095
M 68	6	524.576	7.315	655.720	9.143	1.049.152	14.629	1.398.869	19.506	1.967.160	27.430	2.360.592	32.916

Shank screws with metric ISO fine-pitch thread in accordance with DIN ISO 261

M 8	1	6.536	10,91	8.170	13,64	13.073	21,83	17.430	29,10	24.511	40,92	29.413	49,11
M 10	1	10.976	22,64	13.720	28,29	21.952	45,27	29.270	60,36	41.161	84,88	49.393	101,86
M 12	1,5	14.707	36,83	18.383	46,04	29.413	73,66	39.218	98,22	55.150	138,12	66.180	165,74
M 14	1,5	21.080	61,07	26.351	76,34	42.161	122,14	56.214	162,86	79.052	229,02	94.862	274,82
M 16	1,5	28.598	94,08	35.748	117,60	57.196	188,16	76.262	250,88	107.243	352,80	128.692	423,35
M 18	1,5	37.260	137,20	46.575	171,50	74.519	274,40	99.359	365,87	139.724	514,51	167.669	617,41
M 20	1,5	47.065	191,8	58.831	239,7	94.130	383,6	125.506	511,4	176.494	719,2	211.792	863,0
M 22	1,5	58.014	259,2	72.517	324,0	116.027	518,4	154.703	691,2	217.551	971,9	261.062	1.166,3
M 24	1,5	70.106	340,7	87.632	425,9	140.212	681,5	186.949	908,6	262.897	1.277,7	315.477	1.533,3

Specifications given without warranty.

Legend

μ_{ges} = Average friction value for thread and underhead seat

P = Pitch of the thread

F_{sp} = Axial pre-tension force in the screw for 90% utilisalion of the screw yield point (determined in accordance with the shape-changing-energy hypothesis)

M_A = Tightening torque during installation

Important remarks

Please make sure to read our information relating to the guideline values of the thread friction values on page 640. Taking into consideration the friction values, the above-specified table values only apply for headless screws (expanding screws generally require lower tightening values). The effective friction diameter in the screw underhead seat was defined as 1.3 x ecternal thread diameter.
For this reason, it is only possible to use them in the case of normal shank screws, generally hexagon-headed and cylindrical-head screws (e.g. DIN EN ISO 4014, 4017, 4764, DIN 7984). When screws of high strengths (8.8 to 12.9) and tensed parts made of "soft" construction materials are used, a verification of the interfacial pressure under the screw head is strongly recommended.