



Assembly of screwed fastenings

Preloads and tightening torque for fasteners of steel

Preloads and tightening torque for steel shank screws with head contact area sizes like DIN 912, 931, 933, 934, ISO 4762, 4014, 4017, 4032 ...*

The following are taken into account in table values for M_A :

- a) Friction coefficient $\mu_{\text{total}} = 0.14^*$
 - b) Utilisation of the minimum yield strength = 90%
 - c) Torsion torque when tightening
- (* The friction coefficient of $\mu_{\text{total}} = 0.14$ is generally assumed for screws and nuts in standard commercial deliveries)

Additional lubrication of the thread considerably changes the friction coefficient and brings about unspecified tightening ratios!
Tightening methods and tools have different spreads (→ Tab. 1 / VDI 2230-1, Tab. A8).
All figures are non-binding typical values.

Table 4: Coarse thread, friction coefficient $\mu_{\text{total}} = 0.14$

Dimensions	P	Stress area A_s (mm ²)	Preloads F_v (kN) for property class					Tightening torque M_A (Nm) for property class				
			4.6	5.6	8.8	10.9	12.9	4.6	5.6	8.8	10.9	12.9
M 4	0.7	8.78	1.28	1.71	4.30	6.30	7.40	1.02	1.37	3.3	4.8	5.6
M 5	0.8	14.2	2.10	2.79	7.00	10.3	12.0	2	2.7	6.5	9.5	11.2
M 6	1.0	20.1	2.96	3.94	9.90	14.5	17.0	3.5	4.6	11.3	16.5	19.3
M 8	1.25	36.6	5.42	7.23	18.1	26.6	31.1	8.4	11	27.3	40.1	46.9
M 10	1.5	58.0	8.64	11.5	28.8	42.2	49.4	17	22	54	79	93
M 12	1.75	84.3	12.6	16.8	41.9	61.5	72	29	39	93	137	160
M 14	2.0	115	17.3	23.1	57.5	84.4	98.8	46	62	148	218	255
M 16	2.0	157	23.8	31.7	78.8	115.7	135.4	71	95	230	338	395
M 18	2.5	193	28.9	38.6	99.0	141	165	97	130	329	469	549
M 20	2.5	245	37.2	49.6	127	181	212	138	184	464	661	773
M 22	2.5	303	46.5	62.0	158	225	264	186	250	634	904	1057
M 24	3.0	353	53.6	71.4	183	260	305	235	315	798	1136	1329
M 27	3.0	459	70.6	94.1	240	342	400	350	470	1176	1674	1959
M 30	3.5	561	85.7	114	292	416	487	475	635	1597	2274	2662
M 33	3.5	694	107	142	363	517	605	645	865	2161	3078	3601
M 36	4.0	817	125	167	427	608	711	1080	1440	2778	3957	4631
M 39	4.0	976	151	201	512	729	853	1330	1780	3597	5123	5994
M 42	4.5	1117	212	265	584	832	974	1605	2006	4413	6285	7354
M 45	4.5	1302	249	311	684	974	1140	2005	2506	5512	7851	9187
M 48	5.0	1468	280	350	770	1096	1283	2424	3030	6667	9495	11112
M 52	5.0	1753	335	419	922	1314	1537	3116	3896	8570	12206	14284
M 56	5.5	2024	387	484	1064	1516	1774	3883	4854	10678	15208	17797
M 60	5.5	2356	452	565	1242	1770	2071	4818	6022	13249	18870	22082
M 64	6.0	2669	511	639	1406	2003	2344	5802	7252	15955	22724	26592
M 68	6.0	3047	585	732	1610	2293	2683	7012	8765	19282	27462	32137
M 72	6.0	3451	665	831	1828	2603	3046	8379	10474	23043	32819	38405
M 76	6.0	3881	749	936	2059	2933	3432	9903	12378	27232	38785	45387
M 80	6.0	4335	838	1047	2304	3282	3840	11610	14514	31930	45476	53216
M 90	6.0	5580	1083	1353	2977	4240	4962	16796	20995	46188	65783	76980
M 100	6.0	6983	1359	1698	3736	5322	6227	23381	29226	64297	91574	107161

Table 5: Fine pitch thread, friction coefficient $\mu_{\text{total}} = 0.14$

Dimensions	P	Stress area A_s (mm ²)	Preloads F_v (kN) for property class			Tightening torque M_A (Nm) for property class		
			8.8	10.9	12.9	8.8	10.9	12.9
M 8	1.0	39.2	19.7	28.9	33.9	29.2	42.8	50.1
M 10	1.25	61.2	30.8	45.2	52.9	57	83	98
M 12	1.25	92.1	46.8	68.7	80.4	101	149	174
M 12	1.5	88.1	44.3	65.1	76.2	97	143	167
M 14	1.5	125	63.2	92.9	109	159	234	274
M 16	1.5	167	85.5	126	147	244	359	420
M 18	1.5	216	115	163	191	368	523	613
M 20	1.5	272	144	206	241	511	728	852
M 22	1.5	333	178	253	296	692	985	1153
M 24	2	384	204	290	339	865	1232	1442
M 27	2	496	264	375	439	1262	1797	2103
M 30	2	621	331	472	552	1756	2502	2927
M 33	2	761	407	580	678	2352	3350	3921
M 36	2	915	490	698	817	3082	4390	5137
M 39	2	1082	581	828	969	3953	5631	6589

Tables 4 and 5: up to M39 extract from VDI 2230-1: 2003-02, above M39 calculation based on VDI guideline 2230-1: 2003-02