

Tightening Torques

for self-locking hexagon nuts

BMW N
113 49.0

Applicable only to nuts according to BMW N 113 48.0 and DIN 985.

Surface condition: Phosphate treated or galvanized bolts/screws, galvanized or unwaxed nuts.

Lubricated condition: either non-lubricated or lubricated with light coat of oil.

For cadmium plated bolts/screws or nuts the tightening torque must be $\approx 30\%$ less than value given in table when utilization factor of bolt material is the same.

Not applicable when surface or lubricated condition of threads is different, property class of bolt/screw is less than 8.8 (e.g. 6.9), in conjunction with expansion bolts/screws.

In such cases values will have to be determined separately.

Threads	Tightening Torque M_A					
	Nuts acc. to BMW N 113 48.0 Property Class			Nuts acc. to DIN 985 Property Class		
	8	10	12	8	10	12
M 6	1,1 ^{+0,1}	1,5 ^{+0,2}	1,8 ^{+0,2}	1,0 ^{+0,1}	1,3 ^{+0,2}	1,6 ^{+0,2}
M 8 M 8 x 1	2,5 ^{+0,3}	3,4 ^{+0,4}	4,0 ^{+0,5}	2,5 ^{+0,2}	3,3 ^{+0,3}	3,9 ^{+0,4}
M 10 M 10 x 1,25	4,9 ^{+0,5}	6,8 ^{+0,8}	8,0 ^{+0,9}	4,7 ^{+0,5}	6,4 ^{+0,7}	7,7 ^{+0,8}
M 12 M 12 x 1,5	8,1 ^{+0,9}	11,4 ^{+1,3}	13,5 ^{+1,5}	7,8 ^{+0,8}	10,9 ⁺¹	12,6 ^{+1,5}
M 14 M 14 x 1,5	13,0 ^{+1,5}	18,0 ⁺²	22,0 ⁺²	12,7 ^{+1,5}	17,0 ⁺²	21,0 ⁺²
M 16 M 16 x 1,5	22,5 ⁺²	28,0 ⁺³	33,0 ⁺⁴	19,5 ⁺²	26,0 ⁺³	31,0 ⁺⁴
M 18 M 18 x 1,5	27,0 ⁺³	38,0 ⁺⁴	44,0 ⁺⁵	26,0 ⁺³	36,0 ⁺⁴	42,0 ⁺⁵

Pertinent preload forces P_v (kp), corresponding with different property classes, are shown in "Tightening Torques and Preload Forces" table of BMW N 600 02.0.

Values given in this table shall apply to bolts/screws or nuts having the above mentioned properties. Tightening torque values including tolerances will only be given on layout or assembly drawings if operations require a value deviating from standards.

Bolts/screws or nuts subjected to high dynamic loads will have their tightening torque value determined by exact calculations and tests.

Conversion:

1 kpm x 7.233 = tightening torque in ft. lbs.

Tightening Torques and Preload Forces

Applicable only to bolts/screws according to DIN 912, 931, 933, 960, 961, 6912 and nuts having a nut height of $0.8 \times d$ according to DIN 934 and exclusively for $\mu_{\text{tot.}} = 0.14$.

(Phosphate treated bolts/screws, nuts without final treatment or galvanized. Lubricated condition: either non-lubricated or lubricated with oil.)

For cadmium plated bolts/screws or nuts ($\mu_{\text{tot.}} \approx 0.08$ to 0.09) the tightening torque must be $\approx 30\%$ less than value given in table when utilization factor of bolt material is the same.

Not applicable when a different surface or lubricated condition of the threads is used or if there is a deviation in nut height. In such cases values will have to be determined separately.

Not applicable to bolts/screws with expansion shanks, self-locking screws or screws used to hold parts made of different materials.

Utilization factor of a bolt/screw with standard metric threads:

$$\sigma_{\text{red}} = 0,09 \cdot \sigma_{0,2}$$

Threads	Tightening Torque M_A (kpm)						Preload force P_V (kp)					
	Property Class acc. to DIN 267						Property Class acc. to DIN 267					
	5.6	6.8	6.9	8.8	10.9	12.9	5.6	6.8	6.9	8.8	10.9	12.9
M 6	0,4 ^{+0,1}	0,6 ^{+0,1}	0,7 ^{+0,1}	0,9 ^{+0,1}	1,2 ^{+0,2}	1,5 ^{+0,2}	425	600	685	855	1210	1440
M 8	1,0 ^{+0,1}	1,6 ^{+0,2}	1,8 ^{+0,2}	2,2 ^{+0,2}	3,0 ^{+0,3}	3,6 ^{+0,4}	740	1190	1330	1570	2170	2630
M 10	2,0 ^{+0,2}	3,2 ^{+0,4}	3,6 ^{+0,4}	4,3 ^{+0,5}	6,0 ^{+0,7}	7,3 ^{+0,8}	1160	1880	2090	2500	3480	4200
M 8x1	1,0 ^{+0,1}	1,0 ^{+0,2}	1,8 ^{+0,2}	2,2 ^{+0,2}	3,0 ^{+0,3}	3,6 ^{+0,4}	740	1190	1330	1610	2200	2670
M 10x1,25	2,0 ^{+0,2}	3,2 ^{+0,4}	3,6 ^{+0,4}	4,3 ^{+0,5}	6,0 ^{+0,7}	7,3 ^{+0,8}	1160	1900	2120	2520	3530	4250
M 12x1,25	3,4 ^{+0,4}	5,4 ^{+0,6}	6,1 ^{+0,7}	7,2 ^{+0,8}	10,3 ⁺¹	12,0 ^{+1,5}	1720	2710	3070	3610	5100	6090
M 12x1,5	3,4 ^{+0,4}	5,4 ^{+0,6}	6,1 ^{+0,7}	7,2 ^{+0,8}	10,3 ⁺¹	12,0 ^{+1,5}	1690	2670	3030	3570	5040	6000
M 14x1,5	5,4 ^{+0,6}	8,6 ⁺¹	9,8 ⁺¹	11,5 ^{+1,5}	16,0 ⁺²	20,0 ⁺²	2330	3720	4180	5030	6970	8510
M 16x1,5	8,3 ⁺¹	13,5 ^{+1,5}	15,5 ^{+1,5}	18,0 ⁺²	25,0 ⁺³	30,0 ⁺⁴	3240	5190	5840	6920	9710	11770
M 18x1,5	11,0 ^{+1,5}	18,0 ⁺²	20,0 ^{+2,5}	24,0 ⁺³	34,0 ⁺⁴	40,0 ⁺⁵	3890	6240	7020	8380	11800	13960
M 20x1,5	16,0 ⁺²	26,0 ⁺³	29,0 ^{+3,5}	34,0 ⁺⁴	49,0 ⁺⁵	59,0 ⁺⁶	5070	8170	9180	10680	15200	18250

Values given in this table shall apply to bolts/screws or nuts having the above mentioned properties. Tightening torque values including tolerances will only be given on layout or assembly drawings if

- a) operations require a value deviating from standards,
- b) or property class of bolt/screw and nut is not known.

Important! All deviations from this table are pointed out in the "Specifications".

Conversions: 1 mkp x 7.233 = tightening torque in ft. lbs.

1 kp x 2.2046 = preload force in lbs.

Bolts and Screws

Description	Head shape	DIN No.	Strength rating
Hexagon bolts		931	8.8 10.9 12.9
		933	
		960	
		961	
		70614	
		561	8.8
Cheese-head screws		84	4.8 8.8
		912 6912	8.8 10.9
Button-headed screws		7986	4.8
Carriage bolts		603	4.6 8.8
Countersunk screws		63	4.8 8.8
		7987	4.8 8.8
Oval-head screws		920 921	5.6 ⁴⁾
		7985	4.8
Oval-head countersunk screws		91	4.8 8.8
		7988	4.8
Cheese-head self-tapping screws		7971	1)
Hexagon self-tapping screws		7976	1)

Description	Head shape	DIN No.	Strength rating
Countersunk self-tapping screws		7982	1)
Oval-head self-tapping screws		7981	1)
Oval-head countersunk self-tapping screws		7983	1)
Stud bolts	—	833 835 836 838 939 940	8.8
Threaded pins		417 551 553	2) 4)
		438	4.8 ⁴⁾
Shoulder studs		427	5.8
Winged screws		316	4.6
Screw plugs		906 908	4.6
		910	5.6 ⁴⁾
		7604	
Hollow screws		7623 71436	6.8
Cap screws		3871	5.6 ⁴⁾
Slotted plugs		71022	5.6 ⁴⁾

Nuts

Description	shape	DIN No.	Strength rating
Hexagon nuts		439	5)
		985	8 10 ⁴⁾
		934	3)
		936	6G 8G
		70615 70616	8/10 ⁴⁾ 6G/8G ⁴⁾
Castellated nuts		935 937	8/10 6S/8G
Wing nuts		315	GTS

Description	shape	DIN No.	Strength rating
Square nuts		557	5-2
		562	4D-2
Cap nuts		986	8 ⁴⁾
		1587	6-2
Slotted nuts		70851 70852	6G ⁴⁾
Screw caps		3870 7606	5D-2 ⁴⁾
Knurled nuts		466 467	5-2
Ball collar nuts Flat collar nuts		74361	8/10

1) Case hardened steel, tempered file-hard, depth of case 0.1 ... 0.2 mm (0.004 ... 0.008")

2) up to M 10: 4.8, from M 12: 4.6

3) up to M 4: 5-2, from M 5: 8 and 10

4) The stipulated strength characteristics deviate from the DIN specification

5) up to M 8: 4D-2, for M 10: 5S-2

Tightening torques

for self-locking nuts

BMW N
113 49.0

Applicable only to nuts in accordance with BMW N 113 48.0 and DIN 985.

Surface condition: Bolt phosphate treated or galvanized, nut galvanized and not waxed.
Lubricated condition of bolt: either non-lubricated or lightly oiled.

For cadmium plated bolts or nuts the tightening torque, with the same utilization factor of the bolt material, must be $\approx 30\%$ less than the value in the table.

Not applicable in the case of another surface or lubricated condition of the thread, a strength rating of the bolt of less than 8.8 (e. g. 6.9) in conjunction with expansion bolts.

In such cases it is necessary to determine the values separately.

Thread	Tightening torque $M_A \frac{\text{mkp}}{\text{ft. lb}}$					
	Nuts as per BMW N 113 48.0 Strength rating			Nuts as per DIN 985 Strength rating		
	8	10	12	8	10	12
M 6	1.1+0.1 7.9+0.7	1.5+0.2 10.8+1.4	1.8+0.2 13.0+1.4	1.0+0.1 7.2+0.7	1.3+0.2 9.4+1.4	1.6+0.2 11.6+1.4
M 8 M 8 x 1	2.5+0.3 18.0+2.2	3.4+0.4 24.6+2.9	4.0+0.5 29.0+3.6	2.5+0.2 18.0+1.4	3.3+0.3 24.0+2.2	3.9+0.4 28.2+2.5
M 10 M 10 x 1.25	35.4+0.5 4.9+3.6	6.8+0.8 49.0+5.8	8.0+0.9 57.8+6.5	4.7+0.5 34.0+3.6	6.4+0.7 46.3+5	7.7+0.8 55.7+5.8
M 12 M 12 x 1.5	8.1+0.9 58.5+6.5	11.4+1.3 82.4+9.4	13.5+1.5 97.6+10.8	7.8+0.8 56.4+5.8	10.9+1 78.8+7.2	12.6+1.5 91.0+10.8
M 14 M 14 x 1.5	13.0+1.5 94.0+10.8	18.0+2 130.0+14.5	22.0+2 159.0+14.5	12.7+1.5 92.0+10.8	17.0+2 123.0+14.5	21.0+2 152.0+14.5
M 16 M 16 x 1.5	22.5+2 162.7+14.5	28.0+3 202.0+22	33.0+4 238.6+29	19.5+2 141.0+14.5	26.0+3 188.0+22	31.0+4 224.0+29
M 18 M 18 x 1.5	27.0+3 195.0+22	38.0+4 274.7+29	44.0+5 318.0+36	26.0+3 188.0+22	36.0+4 260.0+29	42.0+5 303.6+36

The respective preload forces P_v (kp/lb), according to the individual strength ratings, can be taken from the table "Tightening torques and preload forces" in BMW N 600 02.0.

The values stipulated in the table apply to a screw connection which corresponds to the above mentioned conditions. The tightening torque including tolerance is only given on the layout or assembly drawing if a value different from the Standard sheet is necessary for operational reasons.

In the case of a screw connection which is highly stressed dynamically an exact examination by means of calculations and tests is essential.

Tightening torques

for self-locking nuts

BMWN
113 49.0

Applicable only to nuts in accordance with BMW N 113 48.0 and DIN 985.

Surface condition: Bolt phosphate treated or galvanized, nut galvanized and not waxed.
Lubricated condition of bolt: either non-lubricated or lightly oiled.

For cadmium plated bolts or nuts the tightening torque, with the same utilization factor of the bolt material, must be $\approx 30\%$ less than the value in the table.

Not applicable in the case of another surface or lubricated condition of the thread, a strength rating of the bolt of less than 8.8 (e. g. 6.9) in conjunction with expansion bolts.

In such cases it is necessary to determine the values separately.

Thread	Tightening torque M_A $\frac{mkp}{ft. lb}$					
	Nuts as per BMW N 113 48.0 Strength rating			Nuts as per DIN 985 Strength rating		
	8	10	12	8	10	12
M 6	1.1+0.1 7.9+0.7	1.5+0.2 10.8+1.4	1.8+0.2 13.0+1.4	1.0+0.1 7.2+0.7	1.3+0.2 9.4+1.4	1.6+0.2 11.6+1.4
M 8 M 8 x 1	2.5+0.3 18.0+2.2	3.4+0.4 24.6+2.9	4.0+0.5 29.0+3.6	2.5+0.2 18.0+1.4	3.3+0.3 24.0+2.2	3.9+0.4 28.2+2.5
M 10 M 10 x 1.25	35.4+0.5 4.9+3.6	6.8+0.8 49.0+5.8	8.0+0.9 57.8+6.5	4.7+0.5 34.0+3.6	6.4+0.7 46.3+5	7.7+0.8 55.7+5.8
M 12 M 12 x 1.5	8.1+0.9 58.5+6.5	11.4+1.3 82.4+9.4	13.5+1.5 97.6+10.8	7.8+0.8 56.4+5.8	10.9+1 78.8+7.2	12.6+1.5 91.0+10.8
M 14 M 14 x 1.5	13.0+1.5 94.0+10.8	18.0+2 130.0+14.5	22.0+2 159.0+14.5	12.7+1.5 92.0+10.8	17.0+2 123.0+14.5	21.0+2 152.0+14.5
M 16 M 16 x 1.5	22.5+2 162.7+14.5	28.0+3 202.0+22	33.0+4 238.6+29	19.5+2 141.0+14.5	26.0+3 188.0+22	31.0+4 224.0+29
M 18 M 18 x 1.5	27.0+3 195.0+22	38.0+4 274.7+29	44.0+5 318.0+36	26.0+3 188.0+22	36.0+4 260.0+29	42.0+5 303.6+36

The respective preload forces P_v (kp/lb), according to the individual strength ratings, can be taken from the table "Tightening torques and preload forces" in BMW N 600 02.0.

The values stipulated in the table apply to a screw connection which corresponds to the above mentioned conditions. The tightening torque including tolerance is only given on the layout or assembly drawing if a value different from the Standard sheet is necessary for operational reasons.

In the case of a screw connection which is highly stressed dynamically an exact examination by means of calculations and tests is essential.

Bolts and Screws

Description	Head shape	DIN No.	Strength rating
Hexagon bolts		931	8.8 10.9 12.9
		933	
		960	
		961	
		70614	
		561	8.8
Cheese-head screws		84	4.8 8.8
		912 6912	8.8 10.9
Button-headed screws		7986	4.8
Carriage bolts		603	4.6 8.8
Countersunk screws		63	4.8 8.8
		7987	4.8 8.8
Oval-head screws		920 921	5.6 ⁴⁾
		7985	4.8
Oval-head countersunk screws		91	4.8 8.8
		7988	4.8
Cheese-head self-tapping screws		7971	1)
Hexagon self-tapping screws		7976	1)

Description	Head shape	DIN No.	Strength rating
Countersunk self-tapping screws		7982	1)
Oval-head self-tapping screws		7981	1)
Oval-head countersunk self-tapping screws		7983	1)
Stud bolts	-	833 835 836 838 939 940	8.8
Threaded pins		417 551 553	2) 4)
		438	4.8 ⁴⁾
Shoulder studs		427	5.8
Winged screws		316	4.6
Screw plugs		906 908 910 7604	4.6 5.6 ⁴⁾
Hollow screws		7623 71436	6.8
Cap screws		3871	5.6 ⁴⁾
Slotted plugs		71022	5.6 ⁴⁾

Nuts

Description	shape	DIN No.	Strength rating
Hexagon nuts		439	5)
		985	8 10 ⁴⁾
		934	3)
		936	6G 8G
		70615 70616	8/10 ⁴⁾ 6G/8G ⁴⁾
Castellated nuts		935 937	8/10 6S/8G
Wing nuts		315	GTS

Description	shape	DIN No.	Strength rating
Square nuts		557	5-2
		562	4D-2
Cap nuts		986	8 ⁴⁾
		1587	6-2
Slotted nuts		70851 70852	6G ⁴⁾
Screw caps		3870 7606	5D-2 ⁴⁾
Knurled nuts		466 467	5-2
Ball collar nuts Flat collar nuts		74361	8/10

1) Case hardened steel, tempered file-hard, depth of case 0.1 ... 0.2 mm (0.004 ... 0.008")

2) up to M 10: 4.8, from M 12: 4.6

3) up to M 4: 5-2, from M 5: 8 and 10

4) The stipulated strength characteristics deviate from the DIN specification

5) up to M 8: 4D-2, for M 10: 5S-2

Tightening torques

for self-locking hexagon nuts

BMW N
113 49.0

Valid only for nuts to BMW N 113 48.0 and DIN 985 standards.

Surface treatment: bolt/screw phosphatised or galvanized, nut galvanized, not waxed. Bolt/screw lubrication: lightly oiled or dry.

For cadmium-plated screws or nuts the tightening torque for the same utilisation of the screw material's strength rating must be $\approx 30\%$ lower than the table value.

Not valid if the thread has any other surface treatment or lubrication, if the bolt/screw has a strength rating lower than 8.8 (e.g. 6.9) or when used with expansion bolts.

In such cases, the values must be determined individually.

Thread	Tightening torque M_A (kpm)					
	Nuts to BMW N 113 48.0 Strength category			Nuts to DIN 985 Strength category		
	8	10	12	8	10	12
M 6	$1.1 \cdot 10^1$	$1.5 \cdot 10^2$	$1.8 \cdot 10^2$	$1.0 \cdot 10^1$	$1.3 \cdot 10^2$	$1.6 \cdot 10^2$
M 8 M 8x1	$2.5 \cdot 10^2$	$3.4 \cdot 10^4$	$4.0 \cdot 10^5$	$2.5 \cdot 10^2$	$3.3 \cdot 10^3$	$3.9 \cdot 10^4$
M 10 M 10x1.25	$4.9 \cdot 10^2$	$6.8 \cdot 10^4$	$8.0 \cdot 10^5$	$4.7 \cdot 10^2$	$6.4 \cdot 10^3$	$7.7 \cdot 10^4$
M 12 M 12x1.5	$8.1 \cdot 10^2$	$11.4 \cdot 10^4$	$13.5 \cdot 10^5$	$7.8 \cdot 10^2$	$10.9 \cdot 10^3$	$12.6 \cdot 10^4$
M 14 M 14x1.5	$13.0 \cdot 10^2$	$18.0 \cdot 10^4$	$22.0 \cdot 10^5$	$12.7 \cdot 10^2$	$17.0 \cdot 10^3$	$21.0 \cdot 10^4$
M 16 M 16x1.5	$22.5 \cdot 10^2$	$28.0 \cdot 10^4$	$33.0 \cdot 10^5$	$19.5 \cdot 10^2$	$26.0 \cdot 10^3$	$31.0 \cdot 10^4$
M 18 M 18x1.5	$27.0 \cdot 10^3$	$38.0 \cdot 10^4$	$44.0 \cdot 10^5$	$26.0 \cdot 10^3$	$36.0 \cdot 10^4$	$42.0 \cdot 10^5$

The corresponding preload forces P_v in kp for the various strength categories are shown in the table "Tightening torques and preload forces" in BMW N 600 02.0.

For a threaded connection in accordance with the conditions described above, the values in the table are applicable. The tightening torque including the tolerance will only be indicated on general arrangement or assembly drawings if a value differing from those on this sheet is needed for functional reasons.

For a threaded connection subject to high dynamic loadings, accurate calculation and experimental work must always be carried out.

Bolts and Screws

Description	Head Shape	DIN No.	Strength class
Hex. head screws		931	8.8
		933	
		960	
		961	
		70614	12.9
Fillister head Cap screws		561	8.8
		84	4.8
		84	8.8
Round head		912	8.8
		6912	10.9
Mushroom head screws		7986	4.8
Countersunk screws		63	4.8
		63	8.8
		7987	4.8
Oval head screws		920	5.6 ¹⁾
		921	5.6 ¹⁾
		7985	4.8
Oval head countersunk screws		91	4.8
		91	8.8
Fillister head self-tapping screws		7988	4.8
Hexagon head self-tapping screws		7971	1)
		7976	1)

Description	Head Shape	DIN No.	Strength class
Countersunk self-tapping screws		7982	1)
Oval head self-tapping screws		7981	1)
Oval head countersunk self-tapping screws		7983	1)
Studs.		833	8.8
		835	
		836	
		838	
		939	
		940	
Threaded pins		417	2) 1)
		551	
		553	
Grub screws		438	4.8 ¹⁾
Winged screws		427	5.8
Plugs		316	4.6
		906	4.6
		908	
		910	5.6 ¹⁾
Hollow screws		7604	6.8
		7623	
Cap screws		71436	5.6 ¹⁾
Slotted plugs		3871	5.6 ¹⁾
		71022	5.6 ¹⁾

Nuts

Description	Shape	DIN No.	Property class
Hexagon nuts		439	5
		985	8
		985	10 ¹⁾
		934	3)
		936	6G
		936	8G
		70615	8/10 ¹⁾
Castle nuts		70616	6G/8G ¹⁾
		935	8/10
Wing nuts		937	6S/8G
		315	GTS

Description	Shape	DIN No.	Property class
Square nuts		557	5-2
		562	4D-2
Cap nuts		986	8 ¹⁾
		1587	6-2
Slotted nuts		70851	6G ¹⁾
		70852	
Screw caps		3870	5D-2 ¹⁾
		7606	
Knurled nuts		466	5-2
		467	
Ball collar nuts		74361	8/10
Flat collar nuts			

¹⁾ Case hardened steel, tempered file-hard, depth of case 0.1 ... 0.2 mm (0.004 ... 0.008")

²⁾ up to M 10 4.8; from M 12: 4.6

³⁾ up to M 4 5-2; from M 5: 8 and 10

⁴⁾ The stipulated property characteristics deviate from the DIN specification

⁵⁾ up to M 8 4D-2; for M 10: 5S-2

BMW CLUB TOOL HIRE

- 3 JAN 1987

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