















TABLE OF STANDARD TIGHTENING TORQUES

- Use specified bolts and nuts, tightening them to the torques specified in this section unless otherwise stated.
- Threaded portions and bearing surfaces should be dry.
- Where the property class differs between the nut and bolt (or stud bolt), use the tightening torque specified in the table for the bolt.


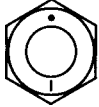



Hexagon Headed Bolt, Stud Bolt (Unit: N·m {ft.lbs, kgf·m})

Strength	4T		7T		8T			
Identification symbol								
Nominal diameter		(Stud)		(Stud)		(Stud)		
M5	2 to 3 {1.5 to 2.2, 0.2 to 0.3}	-	4 to 6 {3.0 to 4.4, 0.4 to 0.6}	-	5 to 7 {3.7 to 5.2, 0.5 to 0.7}	-		
M6	4 to 6 {3.0 to 4.4, 0.4 to 0.6}	-	7 to 10 {5.2 to 7.4, 0.7 to 1.0}	-	8 to 12 {5.9 to 8.9, 0.8 to 1.2}	-		
M8	9 to 13 {6.6 to 9.6, 0.9 to 1.3}	-	16 to 24 {12 to 18, 1.7 to 2.5}	-	19 to 28 {14 to 21, 2.0 to 2.9}	-		
M10	18 to 27 {13 to 20, 1.8 to 2.7}	17 to 25 {13 to 18, 1.8 to 2.6}	34 to 50 {25 to 37, 3.5 to 5.1}	32 to 48 {24 to 35, 3.3 to 4.9}	45 to 60 {33 to 44, 4.5 to 6.0}	37 to 55 {27 to 41, 3.8 to 5.7}		
M12	34 to 50 {25 to 37, 3.4 to 5.1}	31 to 45 {23 to 33, 3.1 to 4.6}	70 to 90 {52 to 66, 7.0 to 9.5}	65 to 85 {48 to 63, 6.5 to 8.5}	80 to 105 {59 to 77, 8.5 to 11}	75 to 95 {55 to 70, 7.5 to 10}		
M14	60 to 80 {44 to 59, 6.0 to 8.0}	55 to 75 {41 to 55, 5.5 to 7.5}	110 to 150 {81 to 110, 11 to 15}	100 to 140 {74 to 105, 11 to 14}	130 to 170 {96 to 125, 13 to 17}	120 to 160 {89 to 120, 12 to 16}		
M16	90 to 120 {66 to 89, 9 to 12}	90 to 110 {66 to 81, 9 to 11}	170 to 220 {125 to 160, 17 to 23}	160 to 210 {120 to 155, 16 to 21}	200 to 260 {145 to 190, 20 to 27}	190 to 240 {140 to 175, 19 to 25}		
M18	130 to 170 {96 to 125, 14 to 18}	120 to 150 {89 to 110, 12 to 16}	250 to 330 {185 to 245, 25 to 33}	220 to 290 {160 to 215, 23 to 30}	290 to 380 {215 to 280, 30 to 39}	250 to 340 {185 to 250, 26 to 35}		
M20	180 to 240 {130 to 175, 19 to 25}	170 to 220 {125 to 160, 17 to 22}	340 to 460 {250 to 340, 35 to 47}	310 to 410 {230 to 300, 32 to 42}	400 to 530 {295 to 390, 41 to 55}	360 to 480 {265 to 355, 37 to 49}		
M22	250 to 330 {185 to 245, 25 to 33}	230 to 300 {170 to 220, 23 to 30}	460 to 620 {340 to 455, 47 to 63}	420 to 560 {310 to 415, 43 to 57}	540 to 720 {400 to 530, 55 to 73}	490 to 650 {360 to 480, 50 to 67}		
M24	320 to 430 {235 to 315, 33 to 44}	290 to 380 {215 to 280, 29 to 39}	600 to 810 {440 to 595, 62 to 83}	540 to 720 {400 to 530, 55 to 73}	700 to 940 {515 to 695, 72 to 96}	620 to 830 {455 to 610, 63 to 85}		

Hexagon Headed Flange Bolt (Unit: N·m {ft.lbs, kgf·m})

Strength	4T		7T		8T	
Identification symbol						
Nominal diameter						
M6	4 to 6 {3.0 to 4.4, 0.4 to 0.6}	-	8 to 12 {5.9 to 8.9, 0.8 to 1.2}	-	10 to 14 {7.4 to 10, 1.0 to 1.4}	-
M8	10 to 15 {7.4 to 11, 1.0 to 1.5}	-	19 to 28 {14 to 21, 2.0 to 2.9}	-	22 to 33 {16 to 24, 2.3 to 3.3}	-
M10	21 to 31 {15 to 23, 2.1 to 3.1}	20 to 29 {15 to 21, 2.0 to 3.0}	45 to 55 {33 to 41, 4.5 to 5.5}	37 to 54 {27 to 40, 3.8 to 5.6}	50 to 65 {37 to 48, 5.0 to 6.5}	50 to 60 {37 to 44, 5.0 to 6.5}
M12	38 to 56 {28 to 41, 3.8 to 5.5}	35 to 51 {26 to 38, 3.5 to 5.2}	80 to 105 {59 to 77, 8.0 to 10.5}	70 to 95 {52 to 95, 7.5 to 9.5}	90 to 120 {66 to 89, 9 to 12}	85 to 110 {63 to 81, 8.5 to 11}

Hexagon Nuts (Unit: N·m {ft.lbs, kgf·m})

Strength	4T		6T			
Identification symbol						
Nominal diameter	Standard screw thread	Coarse screw thread	Standard screw thread	Coarse screw thread		
M5	2 to 3 {1.5 to 2.2, 0.2 to 0.3}	–	4 to 6 {3.0 to 4.4, 0.4 to 0.6}	–		
M6	4 to 6 {3.0 to 4.4, 0.4 to 0.6}	–	7 to 10 {5.2 to 7.4, 0.7 to 1.0}	–		
M8	9 to 13 {6.6 to 9.6, 0.9 to 1.3}	–	16 to 24 {12 to 18, 1.7 to 2.5}	–		
M10	18 to 27 {13 to 20, 1.8 to 2.7}	17 to 25 {13 to 18, 1.8 to 2.6}	34 to 50 {25 to 37, 3.5 to 5.1}	32 to 48 {24 to 35, 3.3 to 4.9}		
M12	34 to 50 {25 to 37, 3.4 to 5.1}	31 to 45 {23 to 33, 3.1 to 4.6}	70 to 90 {52 to 66, 7.0 to 9.5}	65 to 85 {48 to 63, 6.5 to 8.5}		
M14	60 to 80 {44 to 59, 6.0 to 8.0}	55 to 75 {41 to 55, 5.5 to 7.5}	110 to 150 {81 to 110, 11 to 15}	100 to 140 {74 to 105, 11 to 14}		
M16	90 to 120 {66 to 89, 9 to 12}	90 to 110 {66 to 81, 9 to 11}	170 to 220 {125 to 160, 17 to 23}	160 to 210 {120 to 155, 16 to 21}		
M18	130 to 170 {96 to 125, 14 to 18}	120 to 150 {89 to 110, 12 to 16}	250 to 330 {185 to 245, 25 to 33}	220 to 290 {160 to 215, 23 to 30}		
M20	180 to 240 {130 to 175, 19 to 25}	170 to 220 {125 to 160, 17 to 22}	340 to 460 {250 to 340, 35 to 47}	310 to 410 {230 to 300, 32 to 42}		
M22	250 to 330 {185 to 245, 25 to 33}	230 to 300 {170 to 220, 23 to 30}	460 to 620 {340 to 455, 47 to 63}	420 to 560 {310 to 415, 43 to 57}		
M24	320 to 430 {235 to 315, 33 to 44}	290 to 380 {215 to 280, 29 to 39}	600 to 810 {440 to 595, 62 to 83}	540 to 720 {400 to 530, 55 to 73}		

Hexagon Flange Nuts (Unit: N·m {ft.lbs, kgf·m})

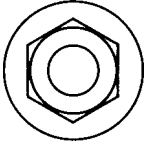
Strength	4T	
Identification symbol		
Nominal diameter	Standard screw thread	Coarse screw thread
M6	4 to 6 {3.0 to 4.4, 0.4 to 0.6}	–
M8	10 to 15 {7.4 to 11, 1.0 to 1.5}	–
M10	21 to 31 {15 to 23, 2.1 to 3.1}	20 to 29 {15 to 21, 2.0 to 3.0}
M12	38 to 56 {28 to 41, 3.8 to 5.6}	35 to 51 {26 to 38, 3.5 to 5.2}

TABLE OF STANDARD TIGHTENING TORQUES

Tightening Torque for General-Purpose Flare Nut (Unit: N·m {ft.lbs, kgf·m})

Pipe diameter	φ4.76 mm {0.19 in.}	φ6.35 mm {0.25 in.}	φ8 mm {0.31 in.}	φ10 mm {0.39 in.}	φ12 mm {0.47 in.}	φ15 mm {0.59 in.}
Tightening torque	17 {13, 1.7}	25 {18, 2.6}	39 {29, 4.0}	59 {44, 6.0}	88 {65, 9.0}	98 {72, 10}

Tightening Torque for General-Purpose Air Piping Nylon Tube (DIN Type) (Unit: N·m {ft.lbs, kgf·m})

Nominal diameter × wall thickness	6 × 1 mm {0.24 × 0.039 in.}	10 × 1.25 mm {0.39 × 0.049 in.}	12 × 1.5 mm {0.47 × 0.059 in.}	15 × 1.5 mm {0.59 × 0.059 in.}
Tightening torque	20 ⁺⁶ ₀ {15 ^{+4.4} ₀ 2.0 ^{+0.6} ₀ }	34 ⁺¹⁰ ₀ {25 ^{+7.4} ₀ 3.5 ^{+1.0} ₀ }	49 ⁺¹⁰ ₀ {36 ^{+7.4} ₀ 5.0 ^{+1.0} ₀ }	54 ⁺⁵ ₀ {40 ^{+3.7} ₀ 5.5 ^{+0.5} ₀ }

Tightening Torque for General-Purpose Air Piping Nylon Tube (SAE Type) (Unit: N·m {ft.lbs, kgf·m})

Nominal diameter	1/4 in.	3/8 in.	1/2 in.	5/8 in.
Tightening torque	13 ⁺⁴ ₀ {9.6 ^{+3.0} ₀ 1.3 ^{+0.4} ₀ }	29 ⁺⁵ ₀ {21 ^{+3.7} ₀ 3.0 ^{+0.5} ₀ }	49 ⁺⁵ ₀ {36 ^{+3.7} ₀ 5.0 ^{+0.5} ₀ }	64 ⁺⁵ ₀ {47 ^{+3.7} ₀ 6.5 ^{+0.5} ₀ }