



## TORQUE DATA – MAINTENANCE PRACTICES

### 1. General

- A. This page block gives the standard practices for torque loading nut and bolt combinations. Specific data for torque locating is given in individual maintenance tasks.
- B. Before final assembly make a check of the effectiveness of locking devices of self locking nuts in this way:
  - Screw the nut onto the bolt until a minimum of three bolt threads are clear of the locking mechanism of the nut.
  - Use a torque wrench to measure the torque necessary to unscrew the nut.
  - If the torque value is less than the value given in Table 201 replace the nut.
- C. When it is necessary to torque tighten from the bolt head, first measure the torque required to turn the bolt inside its fitting. This value must be added to the specified torque value.
- D. When it is necessary to align a locking hole for installation of a locking device tighten the nut to the minimum value and increase the torque until the holes align. If the holes will not align before the maximum torque limit it will be necessary to add washers or shims as necessary to obtain the correct value.

### 2. Use of Torque Wrenches

- A. Always set the required torque value on a calibration tool before use. If a calibration tool is not available use only certified equipment.
- B. Always give a smooth, even pull on the wrench. When the correct torque value is set it should be possible to continue to tighten the nut. If the nut stops suddenly it can be because it has reached the end of the available thread on the bolt.
- C. When it is necessary to use an adapter on the drive end of the wrench use the formula given in Fig. 201 to calculate the required wrench setting.

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3. Standard Torque Values

- A. Standard torque values for nut and bolt combination are given in Table 202 and 203. They are given in lbf. in. in Table 202 and in Nm in Table 203.

BOLT SIZE	MINIMUM BREAKAWAY TORQUE VALUE
8-32	1.5 Inch-Pounds
10-32	2.0 Inch-Pounds
1/4-28	3.5 Inch-Pounds
5/16-24	6.5 Inch-Pounds
3/8-24	9.5 Inch-Pounds
7/16-20	14.0 Inch-Pounds
1/2-20	18.0 Inch-Pounds
9/16-18	24.0 Inch-Pounds
5/8-18	32.0 Inch-Pounds
3/4-16	50.0 Inch-Pounds
7/8-14	70.0 Inch-Pounds
1-14	92.0 Inch-Pounds

**NOTE:** Replace nuts which fall below values shown for unscrewing nut from bolts.

Table 201 - Breakaway Torque Values



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**NOTES ON APPLICATION**

This table gives torque limits in pounds force inches (lbf. in.). For conversion to Newton meters refer to Table 202.

Run nut down to near contact with washer or bearing surface and check torque required to turn nut. Add rundown torque to applicable torque limits.

STEEL TENSION BOLTS			
AN3 thru AN20 AN42 thru AN49 AN73 thru AN 81 AN173 thru AN186 AN509/NK9 AN525/NK525 MS20033 thru MS20046 MS20073 and MS20074 MS24694 MS27039	MS20004 thru MS20024 NAS144 thru NAS158 NAS333 thru NAS340 NAS583 thru NAS590 NAS624 thru NAS644 NAS1303 thru NAS1320 NAS172 NAS174 NAS517	STEEL SHEAR BOLT NAS464	
NUTS		NUTS	
STEEL TENSION	STEEL SHEAR	STEEL TENSION	STEEL SHEAR
AN310 AN315 AN363 AN365 MS17825 MS20365 MS20500 MS21045 NAS679 NAS1021	AN320 AN364 MS17826 MS20364 NAS1022	AN310 AN315 AN363 AN365 MS17825 MS20365 MS21045 NAS679 NAS1021 NAS1291	AN320 AN364 MS17826 MS20364 NAS1022

THREAD SIZES		FINE THREAD SERIES							
mm EQUIV.	UNIFIED	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
4.0	8-36	12	15	7	9				
4.8	10-32	20	25	12	15	25	30	15	20
6.4	1/4-28	50	70	30	40	80	100	50	60
7.9	5/16-24	100	140	60	85	120	145	70	90
9.5	3/8-24	160	190	95	110	200	250	120	150
11.1	7/16-20	450	500	270	300	520	630	300	400
12.7	1/2-20	480	690	290	410	770	950	450	550
14.3	9/16-18	800	1,000	480	600	1,100	1,300	650	800
15.9	5/8-18	1,100	1,300	660	780	1,250	1,550	750	950
19.0	3/4-16	2,300	2,500	1,300	1,500	2,650	3,200	1,600	1,900
22.2	7/8-14	2,500	3,000	1,500	1,800	3,550	4,360	2,100	2,600
25.4	1-14	3,700	4,500	2,200	3,300	4,500	5,500	2,700	3,300
28.6	1 1/8-12	5,000	7,000	3,000	4,200	6,000	7,300	3,600	4,400
32.8	1 1/4-12	9,000	11,000	5,400	6,600	11,000	13,000	6,000	8,000
		COARSE THREAD SERIES							
4.0	8-32	12	15	7	9				
4.8	10-24	20	25	12	15				
6.4	1/4-20	40	50	25	30				
7.9	5/16-18	80	90	48	55				
9.5	3/8-16	160	185	95	110				
11.1	7/16-14	235	255	140	155				
12.7	1/2-13	400	480	240	290				
14.3	9/16-12	500	700	300	420				
15.9	5/8-11	700	900	420	540				
19.0	3/4-10	1,150	1,600	700	950				
22.2	7/8-9	2,200	3,000	1,300	1,800				
25.4	1-8	3,700	5,000	2,200	3,000				
28.6	1 1/8-8	5,500	6,500	3,300	4,000				
32.8	1 1/4-8	6,500	8,000	4,000	5,000				

**NOTES ON APPLICATION (Cont'd)**

The torque limits specified on this table are applicable only to unlubricated bolt-nut combinations. Reduce the torque limits by 10% if threads are cadmium plated or if threads are additionally lubricated with conventional oil (without graphite or molybdenum disulphide), and by 20% if threads are lubricated with graphite or molybdenum disulphide.

Table 202 - Recommended Torque Limits for Nut-Bolt Combinations - Lbf. in.

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P-180 AVANTI  
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**NOTES ON  
APPLICATION**

This table gives torque limits in deca Newton meters (Nm) and is a direct conversion from Table 201 which gives torque limits in pounds force inches (lbf. in.).

Run nut down to near contact with washer or bearing surface and check torque required to turn nut. Add rundown torque to applicable torque limits.

STEEL TENSION BOLTS			
AN3 thru AN20 AN42 thru AN49 AN73 thru AN81 AN173 thru AN186 AN509/NK9 AN525/NK525 MS20033 thru MS20046 MS20073 and MS20074 MS24694 MS27039		MS20004 thru MS20024 NAS144 thru NAS158 NAS333 thru NAS340 NAS583 thru NAS590 NAS624 thru NAS644 NAS1303 thru NAS1320 NAS172 NAS174 NAS517	
		STEEL SHEAR BOLT NAS464	
NUTS		NUTS	
STEEL TENSION	STEEL SHEAR	STEEL TENSION	STEEL SHEAR
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THREAD SIZES		FINE THREAD SERIES							
mm EQUIV.	UNIFIED	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
4.0	8-36	1.4	1.7	0.8	1.0				
4.8	10-32	2.3	2.8	1.4	1.7	2.8	3.4	1.7	2.3
6.4	1/4-28	5.6	7.9	3.4	4.5	9.0	11.3	5.6	6.8
7.9	5/16-24	11.3	15.8	6.8	9.6	13.6	16.4	7.9	10.2
9.5	3/8-24	18.1	21.5	10.7	12.4	22.6	28.2	13.6	16.9
11.1	7/16-20	50.8	56.5	30.5	33.9	58.8	71.2	33.9	45.2
12.7	1/2-20	54.2	78.0	32.8	46.3	87.0	107.3	50.8	62.1
14.3	9/16-18	90.4	113.0	54.2	67.8	124.3	146.9	73.4	90.4
15.9	5/8-18	124.3	146.9	74.6	88.1	141.2	175.1	84.7	107.3
19.0	3/4-16	259.9	282.5	146.9	169.5	299.4	361.6	180.8	214.7
22.2	7/8-14	282.5	339.0	169.5	203.4	401.1	491.5	237.3	293.8
25.4	1-14	418.0	508.4	288.6	372.9	508.4	621.4	305.1	372.9
28.6	1 1/8-12	564.9	700.9	339.0	474.5	677.9	824.8	406.7	497.1
32.8	1 1/4-12	1016.9	1242.8	610.1	745.7	1242.8	1514.0	745.7	903.9
		COARSE THREAD SERIES							
4.0	8-32	1.4	1.7	0.8	1.0				
4.8	10-24	2.3	2.8	1.4	1.7				
6.4	1/4-20	4.5	5.6	2.8	3.4				
7.9	5/16-18	9.0	10.2	5.4	6.2				
9.5	3/8-16	18.1	20.9	10.7	12.4				
11.1	7/16-14	26.6	28.8	15.8	17.5				
12.7	1/2-13	45.2	54.2	27.1	32.8				
14.3	9/16-12	56.5	79.1	33.9	47.5				
15.9	5/8-11	79.1	101.7	47.5	61.0				
19.0	3/4-10	129.9	180.8	79.1	107.3				
22.2	7/8-9	248.6	339.0	146.9	203.4				
25.4	1-8	418.0	564.9	248.6	339.0				
28.6	1 1/8-8	621.4	734.4	372.9	451.9				
32.8	1 1/4-8	734.4	903.9	451.9	564.9				

**NOTES ON APPLICATION (Cont'd)**

The torque limits specified on this table are applicable only to unlubricated bolt-nut combinations. Reduce the torque limits by 10% if threads are cadmium plated or if threads are additionally lubricated with conventional oil (without graphite or molybdenum disulphide), and by 20% if threads are lubricated with graphite or molybdenum disulphide.

Table 203 - Recommended Torque Limits for Nut-Bolt Combinations - Nm

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