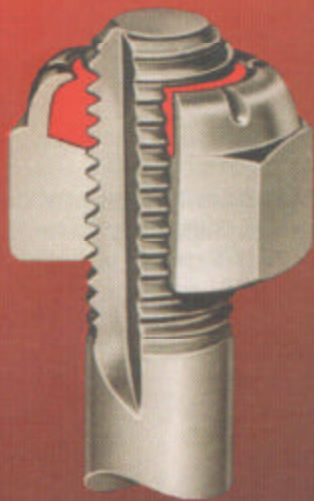


MACLEAN-ESNA

Torque- Tension Manual



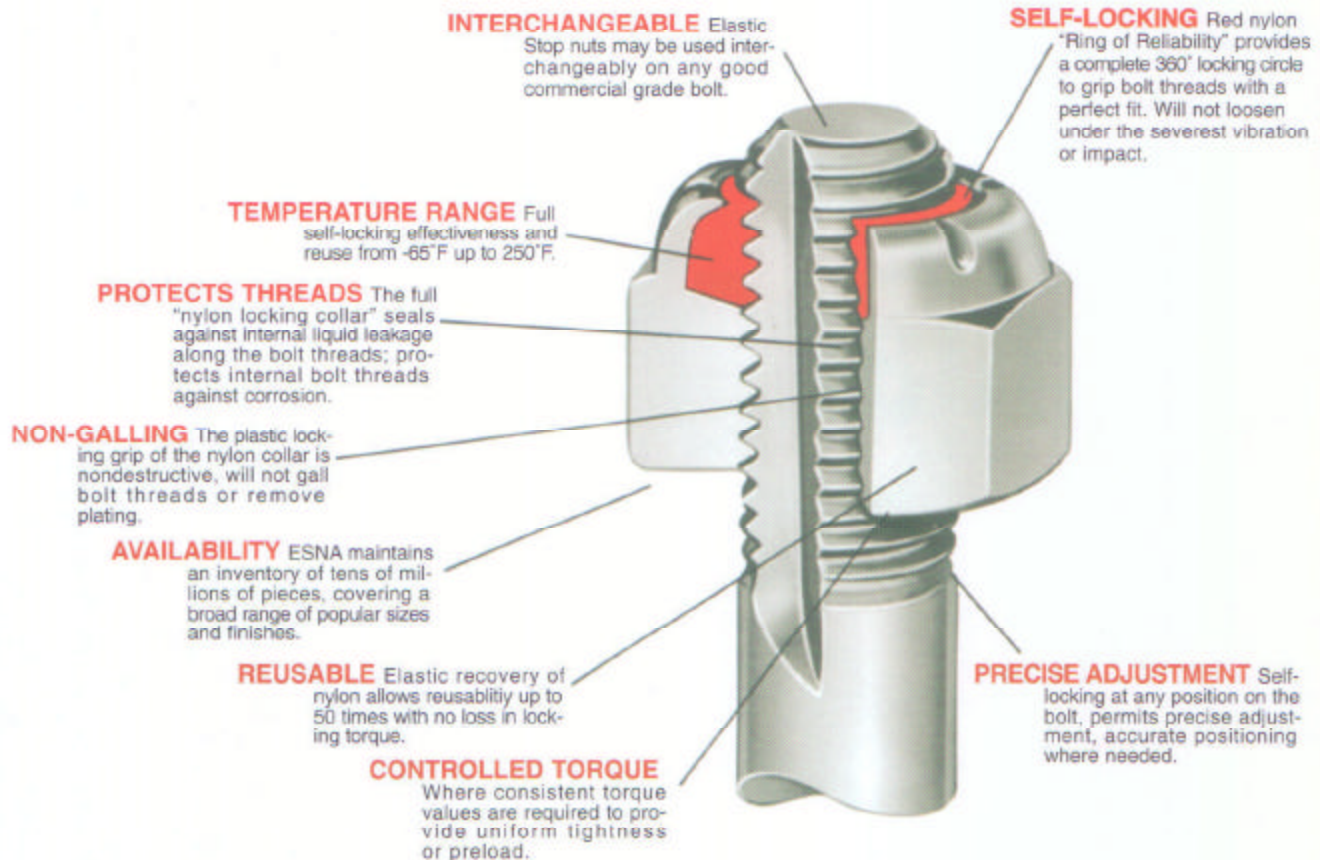
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MACLEAN-ESNA **ELASTIC STOP®** nuts

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TORQUE-TENSION PERFORMANCE NYLON INSERT HEX NUTS

To make a tight joint it is necessary to insure that the bolt and nut clamping forces are greater than the separation forces likely to be created by service loads. Since these separating forces are rarely known accurately, the best procedure is to use the highest tightening torque consistent with the strength of the nut and bolt combination.

The information offered in these data pages will help you to obtain full performance values from Elastic Stop[®] nuts by aiding you to install them correctly. The torque recommendations have been derived from the results of thousands of torque-tension tests conducted in ESNA's[®] laboratories. Small variations in the nuts, bolts, and bolted surfaces produce large variations in the clamping force, consequently, **conservative averages** were deliberately selected to avoid any possibility of overstressing the nut or bolt.

In view of this approach it is quite possible that there may be some cases, depending on the particular nut and bolt being used, where higher installation torques may be safely used. We suggest, however, that higher values be used only where tests have shown they are desirable for a particular combination.

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SELECTING SUITABLE TIGHTENING TORQUES

In a bolted joint the nut and bolt should be torqued to produce a clamping force greater than the force tending to separate the joint. Too small a torque may allow separation of the joint and result in bolt fatigue failure. Too large a torque may cause failure of the bolt or stripping of the nut and/or bolt threads.

Consideration should be given to the following points before selecting a tightening torque for a particular application:

- 1 — Some loss in clamping force will usually occur during the initial period of operation — break in period — of most machinery. Therefore, unless the nuts and bolts are to be retightened, the higher values of tightening torque may be selected — consistent with nut-bolt strength.
- 2 — Generally power wrenches will produce more variation in tightening torque on the high side than a hand operated torque wrench. Therefore, somewhat lower values might be selected if power wrenches are to be used in the assembly operation.
- 3 — The installation torques listed in the tables are identified with respect to lubrication as NONE and OILED. NONE describes parts cleaned in solvent, with all traces of lubricant removed. Parts cleaned in solvent represents a laboratory procedure to obtain limiting values. **In service some lubricant should always be used on the nut or bolt to prevent galling.** See page 5. OILED describes parts liberally coated with SAE 20 oil. Most actual assembly conditions are likely to be somewhere in between these two extremes. Therefore, the installation torque could be selected between the appropriate values listed to more nearly represent the actual assembly conditions.
- 4 — In each of the torque-tension tables, column 9 presents the torque value recommended when the bolt is of equal or greater strength than the nut. This value will give the highest practical clamping force for that combination. If the bolt is lower in strength than the nut, an installation torque should be selected to produce a bolt stress just under the proof load given in the **TABLE OF BOLT STRENGTHS**. Any installation torque less than this value may be used, depending on the bolt stress desired in the application. The strength of each element can be obtained by reference to (a) **TABLE OF BOLT STRENGTHS**, Page 21, or (b) Column 12 of the torque-tension tables for the strength of the nut.

GENERAL NOTES APPLYING TO TORQUE-TENSION TABLES

- 1 — Torque-tension tables are based on use of an unplated commercial washer under the nut and an unplated SAE type bolt having equal or greater strength than the nut. The washers used for nuts having tensile strengths under 160,000 PSI were punched from cold finished steel strip. For nuts having a tensile strength over 160,000 PSI, quenched and tempered washers having a hardness of 35 to 45 Rockwell C in accordance with ASTM Specification A325-55T were used.
- 2 — In column 3, headed LUBRICATION, NONE describes parts cleaned in solvent removing all traces of oil. Parts cleaned in solvent represents a laboratory procedure to obtain limiting values. **In service some lubricant, (plating or oil, etc.), should always be used on the nut or bolt to prevent galling.** See page 5. OILED means bolt or nut threads and bearing surfaces of bolt head and nut coated with SAE 20 oil. For other conditions, see page 5 on USE OF LUBRICANTS.
- 3 — In columns 4 through 8, installation torques are shown only for bolt stresses which are less than the nut strength shown in column 12. Installation torques for stresses between the given column headings may be obtained by proportion. See EXAMPLE 2, page 4.
- 4 — Stresses noted in columns 4 through 8 and column 12 are based on Tensile stress Areas in accordance with Handbook H28. These are approximately the mean between pitch diameter area and root area. See Handbook H28 (1957)-Part 1, page 5, paragraph numbered 22, for details. These areas are listed on page 20.
- 5 — The torques listed in column 9, headed RECOMMENDED, produce bolt stresses approximately 65% of static nut strength. This recommendation is based on both experience and engineering analysis of factors involved.
- 6 — The torques listed in column 10, headed MAX LIMIT, are based on actual tests, and are the lowest torques at which nut failure was experienced. **They should not be construed as guaranteed values.**
- 7 — Columns 11 and 12, headed TYPICAL STRENGTH, are nut strengths determined in static tensile tests. The MAX LIMIT torques will produce bolt stresses somewhat below TYPICAL STRENGTH values because yielding occurs at a lower stress during wrenching than during a static test.

EXAMPLES OF USE OF TORQUE-TENSION TABLES

EXAMPLE 1: To find the installation torque for an oiled 3/4-16 nut (ESNA part 49NTE-126) on an oiled SAE Grade 2 bolt:

- a - From the Torque-Tension table on page 6, column 12, a 49NTE-126 nuts has a typical strength of 49,600 PSI.
- b - From the TABLE OF BOLT STRENGTHS, page 21 an SAE Grade 2 bolt has a tensile strength of 64,000 PSI.
- c - Since the bolt strength is greater than the nut strength, (See page 2, paragraph 4) the installation torque can be selected from column 9, headed RECOMMENDED, of the Torque-Tension table. **78 Ft. Lbs.**

It will be noted from the Torque-Tension table on page 6, the 78 Ft. Lbs. of torque corresponds to a bolt stress somewhat below the lowest stress of 40,000 PSI listed in column 4. This RECOMMENDED torque of 78 Ft. Lbs. will produce a bolt stress of approximately 65% of the static nut strength of 49,600 PSI as explained on page 3, GENERAL NOTES APPLYING TO TORQUE-TENSION TABLES, paragraph 5.

EXAMPLE 2: To find the installation torque for a 1/2-20 nut (ESNA part 59N1610-080) on an SAE Grade 8 bolt, both parts cleaned in solvent:

- a - From the Torque-Tension table, page 14, column 12, a 59N1610-080 nut has an typical strength of 198,000 PSI.
- b - From The TABLE OF BOLT STRENGTHS, page 21, an SAE Grade 8 bolt has a tensile strength of 150,000 PSI and a proof load of 120,000 PSI.
- c - Since the bolt stress is less than the nut strength, (See page 2, paragraph 4) the installation torque can be selected from column 7 of the Torque-Tension table. **120 Ft. Lbs.**

As seen from column 7 of the Torque-Tension table, 120 Ft. Lbs. of torque will produce a bolt tension of 110,000 PSI, which is near enough under the bolt proof load of 120,000 PSI to produce a reliable joint. If it is desired to stress to a value not shown in the table, in this case 120,000 PSI, it may be obtained by proportion using the closest data available in the table as shown below:

$$\frac{120,000 \text{ PSI (Desired Stress)}}{110,000 \text{ PSI (Stress From Table)}} = \frac{\text{Desired Torque}}{120 \text{ (Torque for 110,000 PSI)}}$$

Desired Torque For 120,000 PSI = **131 Ft. Lbs.**

EXAMPLE 3: To find the installation torque for an oiled 3/8-16 nut (ESNA part 29NU-066) on an oiled unplated bolt having a hardness of Rc 33 made of medium carbon steel:

- a - From the Torque-Tension table, page 17, column 12, a 29NU-066 has a typical strength of 179,000 PSI.
- b - From the TABLE OF BOLT STRENGTHS, page 21, a bolt having a hardness of Rc 33 will have a tensile strength of 140,000 PSI and a proof load of 110,000 PSI. Note that this could be an SAE Grade 6 bolt, or a socket head cap screw.
- c - Since the bolt strength is less than the nut strength, (See page 2, paragraph 4) the torque selected should produce a stress just under the proof load of the bolt. The torque required to produce the bolt proof load of 110,000 PSI can be found in column 7, of the Torque-Tension table. However, this torque, 30 Ft. Lbs., is in excess of the recommended torque in column 9. Therefore, the recommended torque, **28 Ft. Lbs.**, should be used.

USE OF LUBRICANTS

Lubricants may be used on threaded connections for the following reasons:

1. Reduce scatter in the torque-tension relationship.
2. Prevent galling.
3. Prevent seizures at elevated temperature.
4. Prevent corrosion.

The table below is compiled from many tests in ESNA's laboratories, and may be used as a general guide when lubricants are used. However, differences in formulation of the lubricants or finish of nuts and bolts may cause substantial variations in these factors.

To obtain the proper installation torque when a lubricant is used, multiply the installation torque for the OILED condition as shown in torque-tension tables by the factor shown in the table below for the particular lubricant being considered.

TABLE OF
INSTALLATION TORQUE CORRECTION FACTORS
FOR VARIOUS LUBRICANTS

Type of Lubricant	Correction Factor
Silicon Oils and Greases	2.00
Plated Bolt, Solvent Cleaned	1.25
Light Rust Preventing Oil	1.05
Turbine Oil	1.00
SAE 20 Oil	1.00
SAE 30 Oil	1.00
Molybdenum Disulfide and Oil	1.00
Powdered Aluminum and White Lead	0.90
Plated Bolt, OILED	0.90
Hard Wax	0.85
Dry Film (bonded molybdenum disulfide)	0.75
Copper Powder and Oil	0.75
White Lead and Oil	0.75
Graphite and Petrolatum	0.70

EXAMPLE: Find the installation torque using graphite petrolatum on nut and bolt threads and nut bearing surface of a 52NE-126 nut and an SAE Grade 8 bolt.

- a - From Torque-Tension Table, page 12, col. 9, the installation torque for the OILED condition is **335 Ft. Lbs.**
- b - From the table above the correction factor for graphite petrolatum is **0.70.**
- c - Multiplying 335 times 0.70 gives the installation torque for this combination - **235 Ft. Lbs.**

29NTE/49NTE UNF

NUT-HEX, LIGHT, THIN, STEEL-PLAIN, FINE THREAD

1 THREAD SIZE	2 PART NO.		3 LUBRI- CATION	4-9 INSTALLATION TORQUES (FOOT-POUNDS)						10 RECOM- MENDED MAX LIMIT	11-12 TYPICAL STRENGTH OF THE NUT			
	HEX SIZE	MAX HGT		4 TO PRODUCE BOLT STRESSES INDICATED			7 110,000PSI	8 130,000PSI	9 90,000PSI		6 60,000PSI	5 40,000PSI	POUNDS	PSI
				6 60,000PSI	7 90,000PSI	8 110,000PSI								
1/4-28	29NTE-048 7/16	.218	NONE* OILED	5	8				6	9	2,950	81,100		
													3	5
5/16-24	29NTE-054 1/2	.265	NONE* OILED	10	15				14	21	5,200	89,700		
													7	10
3/8-24	29NTE-064 9/16	.281	NONE* OILED	18	27				18	27	5,700	64,900		
													12	18
7/16-20	29NTE-070 5/8	.328	NONE* OILED	29	43				34	53	9,400	79,100		
													20	29
1/2-20	29NTE-080 3/4	.328	NONE* OILED	44	30				40	61	9,600	60,000		
													30	
9/16-18	29NTE-098 7/8	.374	NONE* OILED	63	43				62	95	13,100	64,500		
													43	
5/8-18	29NTE-108 15/16	.406	NONE* OILED	88	132				88	135	16,900	66,000		
													60	90
3/4-16	49NTE-126 1 1/16	.421	NONE* OILED	155	106				114	176	18,500	49,600		
													106	
7/8-14	49NTE-144 1 1/4	.484	NONE* OILED	247	168				190	292	26,300	51,600		
													168	
1-14	49NTE-164 1 7/16	.578	NONE* OILED	378	258				292	449	35,300	51,900		
													258	
1 1/8-12	49NTE-182 1 5/8	.672	NONE* OILED	535	364				446	687	48,000	55,400		
													364	
1 1/4-12	49NTE-202 1 13/16	.765	NONE* OILED	745	508				612	942	59,300	55,200		
													508	
1 3/8-12	49NTE-222 2	.797	NONE* OILED	1,000	684				721	1,110	63,800	48,500		
													684	
1 1/2-12	49NTE-242 2 3/16	.828	NONE* OILED	1,320	892				981	1,510	79,500	50,200		
													1,320	

*CAUTION: Some lubricant, (plating or oil, etc.), should be on nut or bolt to prevent galling.

29NTE/49NTE UNC

NUT-HEX, LIGHT, THIN, STEEL-PLAIN, COARSE THREAD

1 THREAD SIZE	2 PART NO.		3 LUBRI- CATION	4-9 INSTALLATION TORQUES (FOOT-POUNDS)						10 MAX LIMIT	11-12 TYPICAL STRENGTH OF THE NUT		
	HEX SIZE	MAX HGT		4 TO PRODUCE BOLT STRESSES INDICATED			7 110,000PSI	8 130,000PSI	9 RECOM- MENDED		11 POUNDS	12 PSI	
				40,000PSI	60,000PSI	90,000PSI							
1/4-20	29NTE-040		NONE*	4	7	10			7		11	3,600	113,000
	7/16	.218	OILED	3	5	7			5		8		
5/16-18	29NTE-058		NONE*	9	13				13		20	5,050	96,500
	1/2	.265	OILED	6	9				9		14		
3/8-16	29NTE-066		NONE*	16	24				17		26	5,500	71,000
	9/16	.281	OILED	11	16				12		18		
7/16-14	29NTE-074		NONE*	26	39				33		51	9,100	85,500
	5/8	.328	OILED	18	26				23		35		
1/2-13	29NTE-083		NONE*	39	59				38		59	9,240	66,200
	3/4	.328	OILED	27	40				26		40		
9/16-12	29NTE-092		NONE*	57	85				59		91	12,700	69,800
	7/8	.374	OILED	39	58				40		62		
5/8-11	29NTE-101		NONE*	78	118				84		130	16,300	72,100
	15/16	.406	OILED	53	80				58		89		
3/4-10	49NTE-120		NONE*	139					110		170	17,800	53,300
	1 1/16	.421	OILED	94					75		116		
7/8-9	49NTE-149		NONE*	224					183		282	25,400	55,000
	1 1/4	.484	OILED	153					125		192		
1-8	49NTE-168		NONE*	337					280		430	34,000	56,100
	1 7/16	.578	OILED	229					188		284		
1 1/8-7	49NTE-187		NONE*	477					430		661	46,200	60,600
	1 5/8	.672	OILED	325					293		451		
1 1/4-7	49NTE-207		NONE*	673					582		911	57,300	59,100
	1 13/16	.765	OILED	458					404		621		
1 3/8-7	49NTE-226		NONE*	875					695		1,070	62,000	53,600
	2	.797	OILED	601					474		730		
1 1/2-6	49NTE-246		NONE*	1,170					949		1,460	76,500	54,500
	2 3/16	.828	OILED	798					644		994		

*CAUTION: Some lubricant, (plating or oil, etc.), should be on nut or bolt to prevent galling.

29NE/49NE UNF
NUT-HEX, LIGHT, STEEL-PLAIN, FINE THREAD

1 THREAD SIZE	2 PART NO.		3 LUBRI- CATION	4-7 INSTALLATION TORQUES (FOOT POUNDS)							8-10 TO PRODUCE BOLT STRESSES INDICATED		11-12 TYPICAL STRENGTH OF THE NUT	
	HEX SIZE	MAX HGT.		4 40,000PSI	5 60,000PSI	6 90,000PSI	7 110,000PSI	8 130,000PSI	9 RECOM- MENDED	10 MAX LIMIT	11 POUNDS	12 PSI		
													4 40,000PSI	5 60,000PSI
1/4-28	29NE-048		NONE	5	7	11	13		9	14	4,680	132,000		
	7/16	.328	OILED	3	5	8	9		6	10				
5/16-24	29NE-054		NONE	10	15	22	27		18	28	6,990	123,000		
	1/2	.359	OILED	7	10	15	18		12	18				
3/8-24	29NE-064		NONE	18	27	40	49		36	56	12,200	141,000		
	9/16	.468	OILED	12	18	28	33		25	38				
7/16-20	29NE-070		NONE	28	43	64			47	73	13,700	117,000		
	5/8	.468	OILED	19	29	43			32	50				
1/2-20	29NE-080		NONE	44	65	98	120		86	133	21,900	139,000		
	3/4	.609	OILED	30	45	67	82		60	93				
9/16-18	29NE-098		NONE	63	93	140	172		120	185	27,000	135,000		
	7/8	.656	OILED	43	64	96	117		82	126				
5/8-18	29NE-108		NONE	88	132	198	241	285	185	285	35,900	142,000		
	15/16	.765	OILED	60	89	134	164	194	126	194				
3/4-16	49NE-126		NONE	153	230	346	423		309	475	49,600	134,000		
	1 1/16	.890	OILED	104	157	236	288		211	324				
7/8-14	49NE-144		NONE	244	367	551	673		474	730	65,400	130,000		
	1 1/4	.999	OILED	167	250	376	458		324	498				
1-14	49NE-164		NONE	374	561	842	1,030		670	1,030	80,800	120,000		
	1 7/16	1.078	OILED	255	383	574	704		458	704				
1 1/8-12	49NE-182		NONE	530	795	1,190	1,450		969	1,490	104,700	123,000		
	1 5/8	1.203	OILED	361	541	812	993		663	1,020				
1 1/4-12	49NE-202		NONE	738	1,110	1,660	2,030		1,350	2,080	131,000	123,000		
	1 13/16	1.422	OILED	504	756	1,120	1,380		923	1,420				
1 3/8-12	49NE-222		NONE	992	1,490	2,240	2,740		1,820	2,800	161,000	123,000		
	2	1.609	OILED	678	1,020	1,530	1,870		1,240	1,910				
1 1/2-12	49NE-242		NONE	1,310	1,960	2,940	3,590		2,390	3,680	194,000	123,000		
	2 3/16	1.640	OILED	892	1,330	2,000	2,440		1,640	2,520				

29NE/49NE UNC
NUT-HEX, LIGHT, STEEL-PLAIN, COARSE THREAD

1 THREAD SIZE	2 PART NO.		3 LUBRI- CATION	4 TO PRODUCE BOLT STRESS INDICATED							9 RECOM- MENDED	10 MAX LIMIT	11 POUNDS	12 PSI
	HEX SIZE	MAX HGT		INSTALLATION TORQUES (FOOT POUNDS)										
				40,000PSI	60,000PSI	90,000PSI	110,000PSI	130,000PSI						
1/4-20	29NE-040		NONE*	4	6	10	12	14		9	14	4,450	144,000	
	7/16	.328	OILED	3	4	7	8	9		6	9			
5/16-18	29NE-058		NONE*	9	13	20	24			17	26	6,770	132,000	
	1/2	.359	OILED	6	9	13	16			12	18			
3/8-16	29NE-066		NONE*	15	23	35	43	51		34	53	11,600	153,000	
	9/16	.468	OILED	10	16	24	30	35		23	36			
7/16-14	29NE-074		NONE*	24	37	55	67			44	67	12,700	126,000	
	5/8	.468	OILED	17	25	38	46			30	46			
1/2-13	29NE-083		NONE*	38	58	87	106	126		83	128	21,100	151,000	
	3/4	.609	OILED	26	40	59	73	85		57	87			
9/16-12	29NE-092		NONE*	56	83	126	153			117	165	24,100	134,000	
	7/8	.656	OILED	38	57	85	104			73	112			
5/8-11	29NE-101		NONE*	77	116	174	212	251		179	275	34,500	155,000	
	15/16	.765	OILED	53	79	118	145	171		122	188			
3/4-10	49NE-120		NONE*	138	206	309	378	448		298	458	47,900	145,000	
	1 1/16	.890	OILED	93	140	211	258	305		203	313			
7/8-9	49NE-149		NONE*	221	332	499	609			443	681	61,000	134,000	
	1 1/4	.999	OILED	151	227	341	415			302	464			
1-8	49NE-168		NONE*	333	499	748	908			625	962	75,300	126,000	
	1 7/16	1.078	OILED	227	341	510	623			426	656			
1 1/8-7	49NE-187		NONE*	472	707	1,060	1,300			871	1,340	94,800	126,000	
	1 5/8	1.203	OILED	322	483	723	884			598	920			
1 1/4-7	49NE-207		NONE*	666	992	1,490	1,830			1,270	1,960	124,000	129,000	
	1 13/16	1.422	OILED	454	682	1,020	1,250			865	1,330			
1 3/8-6	49NE-226		NONE*	868	1,310	1,960	2,400			1,750	2,690	154,000	134,000	
	2	1.609	OILED	595	892	1,330	1,630			1,200	1,840			
1 1/2-6	49NE-246		NONE*	1,160	1,730	2,610	3,180			2,300	3,540	186,000	133,000	
	2 3/16	1.640	OILED	791	1,180	1,780	2,170			1,570	2,420			

*CAUTION: Some lubricant, (plating or oil, etc.), should be on nut or bolt to prevent galling.

52NTE UNF

NUT-HEX, LIGHT, THIN, STEEL-CADMIUM, FINE THREAD

1 THREAD SIZE	2 PART NO.		3 LUBRI- CATION	4-10 INSTALLATION TORQUES (FOOT-POUNDS)							11 TYPICAL STRENGTH OF THE NUT	12 PSI		
	HEX SIZE	MAX HGT		TO PRODUCE BOLT STRESSES INDICATED										
				40,000PSI	60,000PSI	90,000PSI	110,000PSI	130,000PSI	RECOM- MENDED	MAX LIMIT				
1/4-28	52NTE-048		NONE	4	7						7	10	3,040	85,600
	7/16	.218	OILED	3	4						4	7		
5/16-24	52NTE-054		NONE	9	13						14	22	5,400	94,900
	1/2	.265	OILED	6	9						10	15		
3/8-24	52NTE-064		NONE	16	24						21	33	6,570	76,200
	9/16	.281	OILED	11	16						14	22		
7/16-20	52NTE-070		NONE	26	39						38	59	10,600	90,700
	5/8	.328	OILED	18	26						26	40		
1/2-20	52NTE-080		NONE	40	59						62	95	14,100	89,400
	3/4	.328	OILED	27	40						42	65		
9/16-18	52NTE-098		NONE	57	85						85	131	17,200	86,000
	7/8	.374	OILED	39	58						58	89		
5/8-18	52NTE-108		NONE	79	120	197					137	210	24,900	102,000
	15/16	.406	OILED	54	82	134					93	143		
3/4-16	52NTE-126		NONE	139	209						203	312	30,900	83,700
	1 1/16	.421	OILED	95	142						138	213		
7/8-14	52NTE-144		NONE	221	334						336	517	43,900	87,100
	1 1/4	.484	OILED	151	228						229	353		
1-14	52NTE-164		NONE	340	510						517	796	59,200	87,900
	1 7/16	.578	OILED	232	347						354	544		
1 1/8-12	52NTE-182		NONE	481	722	1,080					793	1,220	80,400	94,800
	1 5/8	.672	OILED	328	492	738					540	830		
1 1/4-12	52NTE-202		NONE	670	1,010	1,670					1,080	1,670	99,600	93,500
	1 13/16	.765	OILED	456	686	1,140					741	1,140		
1 3/8-12	52NTE-222		NONE	900	1,350						1,290	1,980	107,000	82,000
	2	.797	OILED	616	927						878	1,350		
1 1/2-12	52NTE-242		NONE	1,190	1,780						1,740	2,680	133,000	84,700
	2 3/16	.828	OILED	803	1,210						1,190	1,830		

52NTE UNC
NUT-HEX, LIGHT, THIN, STEEL-CADMIUM, COARSE THREAD

1 THREAD SIZE	2 PART NO.		3 LUBRI- CATION	4 INSTALLATION TORQUES (FOOT POUNDS)						9 RECOM- MENDED	10 MAX LIMIT	11 POUNDS	12 PSI
	HEX SIZE	MAX HGT		5 TO PRODUCE BOLT STRESSES INDICATED									
				40,000PSI	60,000PSI	90,000PSI	110,000PSI	130,000PSI	6			7	8
1/4-20	52NTE-040		NONE	4	6	10				8	12	3,750	121,000
	7/16	.218	OILED	3	4	7				5	8		
5/16-18	52NTE-058		NONE	8	12	18				14	22	5,220	102,000
	1/2	.265	OILED	5	8	13				10	15		
3/8-16	52NTE-066		NONE	14	22					20	31	6,320	83,000
	9/16	.281	OILED	10	14					14	21		
7/16-14	52NTE-074		NONE	23	35	52				37	57	10,200	102,000
	5/8	.328	OILED	16	23	36				25	39		
1/2-13	52NTE-083		NONE	35	53					43	66	10,400	74,500
	3/4	.328	OILED	24	36					29	45		
9/16-12	52NTE-092		NONE	51	76					66	102	14,200	79,300
	7/8	.374	OILED	35	52					46	70		
5/8-11	52NTE-101		NONE	70	106					96	147	18,400	82,600
	15/16	.406	OILED	48	72					65	100		
3/4-10	52NTE-120		NONE	125	187					142	218	22,800	69,100
	1 1/16	.421	OILED	85	128					97	149		
7/8-9	52NTE-149		NONE	202	303					237	364	32,600	71,500
	1 1/4	.484	OILED	138	206					161	248		
1-8	52NTE-168		NONE	303	454					361	555	43,600	72,800
	1 7/16	.578	OILED	206	310					247	380		
1 1/8-7	52NTE-187		NONE	428	643					514	790	55,500	73,500
	1 5/8	.672	OILED	292	439					350	538		
1 1/4-7	52NTE-207		NONE	605	909					709	1,090	69,000	71,800
	1 13/16	.765	OILED	412	618					484	745		
1 3/8-6	52NTE-226		NONE	787						832	1,280	73,500	64,200
	2	.797	OILED	541						567	872		
1 1/2-6	52NTE-246		NONE	1,050						1,130	1,740	91,900	66,000
	2 3/16	.828	OILED	718						774	1,190		

52NE UNF

NUT-HEX, LIGHT, STEEL-CADMIUM, FINE THREAD

1 THREAD SIZE	2 PART NO.		3 LUBRI- CATION	4-7 TO PRODUCE BOLT STRESSES INDICATED							8 110,000PSI		9 RECOM- MENDED		10 MAX LIMIT		11 TYPICAL STRENGTH OF THE NUT		12
	HEX SIZE	MAX HGT		40,000PSI	60,000PSI	90,000PSI	110,000PSI	130,000PSI	110,000PSI	130,000PSI	RECOM- MENDED	MAX LIMIT	POUNDS	PSI					
				9	13	20	24	28							6,990	123,000			
5/16-24	52NE-054		NONE	9	13	20	24				18								
	1/2	.359	OILED	6	9	13	16				12								
3/8-24	52NE-064		NONE	16	24	36	44				36								
	9/16	.468	OILED	11	16	25	40				25								
7/16-20	52NE-070		NONE	23	39	58	69				68								
	5/8	.468	OILED	17	26	39	48				47								
1/2-20	52NE-080		NONE	40	58	88	108				86								
	3/4	.609	OILED	27	40	60	74				60								
9/16-18	52NE-098		NONE	57	84	126	155				120								
	7/8	.656	OILED	39	58	86	105				82								
5/8-18	52NE-108		NONE	79	119	177	217				185								
	15/16	.765	OILED	54	80	121	148				126								
3/4-16	52NE-126		NONE	138	207	311	381				491								
	1 1/16	.890	OILED	94	141	212	259				335								
7/8-14	52NE-144		NONE	221	330	496	606				754								
	1 1/4	.999	OILED	150	225	340	413				516								
1-14	52NE-164		NONE	337	506	759	918				1,070								
	1 7/16	1.078	OILED	229	345	517	632				728								
1 1/8-12	52NE-182		NONE	477	715	1,070	1,310				1,550								
	1 5/8	1.203	OILED	325	488	731	884				1,050								
1 1/4-12	52NE-202		NONE	665	999	1,490	1,830				2,150								
	1 13/16	1.422	OILED	454	680	1,020	1,240				1,470								
1 3/8-12	52NE-222		NONE	894	1,340	2,220	2,460				3,070								
	2	1.609	OILED	611	918	1,380	1,680				2,090								
1 1/2-12	52NE-242		NONE	1,180	1,760	2,650	3,230				4,020								
	2 3/16	1.640	OILED	804	1,200	1,800	2,210				2,740								

52NE UNC
NUT-HEX, LIGHT, STEEL-CADMIUM, COARSE THREAD

1 THREAD SIZE	2 PART NO.		3 LUBRI- CATION	INSTALLATION TORQUES (FOOT-POUNDS)											10 RECOM- MENDED		11 POUNDS	12 TYPICAL STRENGTH OF THE NUT PSI
	HEX SIZE	MAX HGT		TO PRODUCE BOLT STRESSES INDICATED											MAX LIMIT			
				4 40,000PSI	5 60,000PSI	6 90,000PSI	7 110,000PSI	8 130,000PSI	9 130,000PSI	10 130,000PSI	11 130,000PSI	12 130,000PSI	13 130,000PSI	14 130,000PSI		15 130,000PSI		
5/16-18	52NE-058 1/2	.359	NONE OILED	8	12	18	22	26						17	26	6,770	132,000	
				55	8	12	14	18							12			18
3/8-16	52NE-066 9/16	.468	NONE OILED	14	21	31	39	46					34	53	11,600	153,000		
				9	14	22	27	31						23			36	
7/16-14	52NE-074 5/8	.468	NONE OILED	22	33	49	60						44	67	12,700	126,000		
				15	22	34	41							30			46	
1/2-13	52NE-083 3/4	.609	NONE OILED	34	52	79	95	113					83	128	21,000	151,000		
				23	36	53	66	76						57			87	
9/16-12	52NE-092 7/8	.656	NONE OILED	50	75	113	138	164					117	165	24,100	134,000		
				34	51	76	94	111						73			112	
5/8-11	52NE-101 15/16	.765	NONE OILED	69	104	157	192	226					201	309	38,700	174,000		
				48	71	106	130	154						137			211	
3/4-10	52NE-120 1 1/16	.890	NONE OILED	124	185	278	340	402					384	590	61,700	187,000		
				84	126	190	232	274						262			403	
7/8-9	52NE-149 1 1/4	.999	NONE OILED	199	299	448	548	648					572	880	78,800	173,000		
				136	204	306	373	442						390			600	
1-8	52NE-168 1 7/16	1.078	NONE OILED	300	449	673	817	972					806	1,240	97,100	162,000		
				204	306	459	561	663						549			845	
1 1/8-7	52NE-187 1 5/8	1.203	NONE OILED	425	637	854	1,160	1,380					1,050	1,620	113,000	150,000		
				290	435	651	795	936						715			1,100	
1 1/4-7	52NE-207 1 13/16	1.422	NONE OILED	599	893	1,340	1,650	1,940					1,525	2,340	148,000	154,000		
				409	614	918	1,130	1,330						1,040			1,600	
1 3/8-7	52NE-226 2	1.609	NONE OILED	780	1,180	1,760	2,160	2,550					2,940	4,530	244,000	213,000		
				535	803	1,200	1,470	1,740						2,000			3,080	
1 1/2-6	52NE-246 2 3/16	1.640	NONE OILED	1,040	1,560	2,350	2,860	3,390					3,870	5,950	294,000	211,000		
				712	1,060	1,600	1,950	2,310						2,640			4,060	

59N1610 UNF

NUT-HEX, HIGH TENSILE, STEEL-PLAIN, FINE THREAD

1 THREAD SIZE	2 PART NO.		3 LUBRI- CATION	INSTALLATION TORQUES (FOOT-POUNDS)												10 MAX LIMIT	11 POUNDS	12 PSI
	HEX SIZE	MAX HGT		TO PRODUCE BOLT STRESSES INDICATED														
				4 40,000PSI	5 60,000PSI	6 90,000PSI	7 110,000PSI	8 130,000PSI	9 RECOM- MENDED	10 MAX LIMIT								
1/4-28	59N1610-048		NONE*	5	7	11	13	16	16	16	16	16	16	24	7,150	201,000		
	7/16	.328	OILED	3	5	8	9	11	11	10	10	16	16	16				
5/16-24	59N1610-054		NONE*	10	15	22	27	32	32	32	27	27	27	42	9,880	173,000		
	1/2	.359	OILED	7	10	15	18	22	22	18	18	18	28	28				
3/8-24	59N1610-064		NONE*	18	27	40	49	58	58	58	40	40	40	55	16,800	195,000		
	9/16	.468	OILED	12	18	28	33	40	40	38	40	58	58	58				
7/16-20	59N1610-070		NONE*	28	43	64	78	92	92	92	64	64	64	132	22,400	192,000		
	5/8	.468	OILED	19	29	43	53	63	63	56	63	90	90	90				
1/2-20	59N1610-080		NONE*	44	65	98	120	142	142	142	98	98	98	210	31,200	198,000		
	3/4	.609	OILED	30	45	67	82	97	97	93	97	143	143	143				
9/16-18	59N1610-098		NONE*	63	93	140	172	203	203	203	140	140	140	316	41,700	208,000		
	7/8	.656	OILED	43	64	96	117	138	138	140	140	216	216	216				
5/8-18	59N1610-108		NONE*	88	140	198	241	285	285	285	198	198	198	419	49,700	196,000		
	15/16	.765	OILED	60	89	134	164	194	194	186	194	286	286	286				
3/4-16	59N1610-126		NONE*	153	230	346	423	499	499	499	346	346	346	895	88,500	240,000		
	1 1/16	.890	OILED	102	157	237	288	340	340	397	340	611	611	611				
7/8-14	59N1610-144		NONE*	244	367	551	673	796	796	796	551	551	551	1,300	110,000	218,000		
	1 1/4	.999	OILED	167	250	376	459	543	543	576	543	886	886	886				
1-14	59N1610-164		NONE*	374	562	842	1,030	1,220	1,220	1,220	842	842	842	1,830	136,000	202,000		
	1 7/16	1.078	OILED	255	383	574	702	829	829	813	829	1,250	1,250	1,250				
1 1/8-12	59N1610-182		NONE*	530	795	1,030	1,450	1,720	1,720	1,720	1,030	1,030	1,030	2,640	174,000	205,000		
	1 5/8	1.203	OILED	361	542	813	992	1,170	1,170	1,170	1,170	1,800	1,800	1,800				
1 1/4-12	59N1610-202		NONE*	739	1,110	1,660	2,030	2,400	2,400	2,400	1,660	1,660	1,660	3,700	219,000	206,000		
	1 13/16	1.402	OILED	504	756	1,130	1,380	1,630	1,630	1,640	1,630	2,520	2,520	2,520				
1 3/8-12	59N1610-222		NONE*	992	1,490	2,240	2,730	3,230	3,230	3,230	2,240	2,240	2,240	4,480	242,000	185,000		
	2	1.609	OILED	679	1,020	1,530	1,870	2,210	2,210	1,990	2,210	3,060	3,060	3,060				
1 1/2-12	59N1610-242		NONE*	1,310	1,960	2,940	3,590	4,250	4,250	4,250	2,940	2,940	2,940	6,550	325,000	207,000		
	2 3/16	1.640	OILED	892	1,330	2,000	2,450	2,890	2,890	2,410	2,890	4,480	4,480	4,480				

*CAUTION: Some lubricant, (plating or oil, etc.), should be on nut or bolt to prevent galling.

59N 1610 UNC
NUT-HEX, HIGH TENSILE, STEEL-PLAIN, COARSE THREAD

1 THREAD SIZE	2 PART NO. HEX SIZE MAX HGT		3 LUBRI- CATION	4 INSTALLATION TORQUES (FOOT-POUNDS)										10 RECOM- MENDED		11 TYPICAL STRENGTH OF THE NUT	
				5 TO PRODUCE BOLT STRESSES INDICATED			7	8	9	10	11	12					
	40,000PSI	60,000PSI		90,000PSI	110,000PSI	130,000PSI							MAX LIMIT	POUNDS	PSI		
1/4-20	59N1610-040	NONE*	3	5	9	11	14	14	14	14	21	6,720	211,000				
	7/16 .328	OILED	2	4	7	8	10	10	10	14	14	6,720	211,000				
5/16-18	59N1610-058	NONE*	10	14	21	26	31	31	31	40	40	9,660	184,000				
	1/2 .359	OILED	7	9	14	17	21	21	21	26	26	9,660	184,000				
3/8-16	59N1610-066	NONE*	15	23	33	41	49	49	49	70	70	16,500	213,000				
	9/16 .468	OILED	10	15	24	28	34	34	34	50	50	16,500	213,000				
7/16-14	59N1610-074	NONE*	26	40	60	73	86	86	86	125	125	22,000	207,000				
	5/8 .468	OILED	18	27	40	49	59	59	59	85	85	22,000	207,000				
1/2-13	59N1610-083	NONE*	39	58	87	106	126	126	126	186	186	24,700	174,000				
	3/4 .609	OILED	27	40	59	73	86	86	86	126	126	24,700	174,000				
9/16-12	59N1610-092	NONE*	56	83	126	154	182	182	182	283	283	38,000	209,000				
	7/8 .656	OILED	39	57	86	104	124	124	124	194	194	38,000	209,000				
5/8-11	59N1610-101	NONE*	78	124	175	213	252	252	252	370	370	40,000	177,000				
	15/16 .765	OILED	53	80	115	145	170	170	170	250	250	40,000	177,000				
3/4-10	59N1610-120	NONE*	140	205	310	380	450	450	450	800	800	59,000	177,000				
	1 1/16 .890	OILED	90	140	210	260	300	300	300	550	550	59,000	177,000				
7/8-9	59N1610-149	NONE*	220	335	500	610	725	725	725	1,180	1,180	82,000	177,000				
	1 1/4 .999	OILED	150	225	340	420	490	490	490	800	800	82,000	177,000				
1-8	59N1610-168	NONE*	340	510	770	940	1,120	1,120	1,120	1,675	1,675	125,000	206,000				
	1 7/16 1.078	OILED	230	350	525	640	760	760	760	1,140	1,140	125,000	206,000				
1 1/8-7	59N1610-187	NONE*	470	710	920	1,300	1,525	1,525	1,525	2,350	2,350	134,500	176,000				
	1 5/8 1.203	OILED	320	480	725	880	1,040	1,040	1,040	1,600	1,600	134,500	176,000				
1 1/4-7	59N1610-207	NONE*	670	1,000	1,500	1,825	2,150	2,150	2,150	3,350	3,350	171,000	176,000				
	1 13/16 1.422	OILED	450	675	1,025	1,250	1,475	1,475	1,475	2,275	2,275	171,000	176,000				
1 3/8-6	59N1610-226	NONE*	875	1,300	1,975	2,400	2,850	2,850	2,850	2,950	2,950	200,000	173,000				
	2 1.609	OILED	600	900	1,350	1,650	1,950	1,950	1,950	2,700	2,700	200,000	173,000				
1 1/2-6	59N1610-246	NONE*	1,150	1,750	2,600	3,200	3,775	3,775	3,775	5,800	5,800	248,000	177,000				
	2 3/16 1.640	OILED	800	1,175	1,775	2,175	2,550	2,550	2,550	3,975	3,975	248,000	177,000				

*CAUTION: Some lubricant (plating or oil, etc.) should be on nut or bolt to prevent galling.

29NTU/49NTU UNC

NUT-HEX, HEAVY, THIN, STEEL-PLAIN, COARSE THREAD

1 THREAD SIZE	2 PART NO.		3 LUBRI- CATION	4 TO PRODUCE BOLT STRESSES INDICATED						5 TO PRODUCE BOLT STRESSES INDICATED			9 RECOM- MENDED	10 MAX LIMIT	11 TYPICAL STRENGTH OF THE NUT		12
	HEX SIZE	MAX HGT		40,000PSI	60,000PSI	90,000PSI	110,000PSI	130,000PSI	8	13	POUNDS	PSI					
															4	5	
1/4-20	29NTU-040	NONE*	4	7	10	12			8	13	4,200	132,000	11	12	12		
	1/2	.296	OILED	3	5	7	8		6	9	5,520	105,000					
5/16-18	29NTU-058	NONE*	9	13	20				14	21	8,560	110,000	11	12	12		
	9/16	.328	OILED	6	9	14			9	14	12,900	121,000					
3/8-16	29NTU-066	NONE*	16	24	36				25	39	19,700	139,000	11	12	12		
	11/16	.421	OILED	11	16	25			18	27	22,600	124,000					
7/16-14	29NTU-074	NONE*	26	39	58	71			47	72	27,100	120,000	11	12	12		
	3/4	.453	OILED	18	26	40	48		32	49	35,600	106,000					
1/2-13	29NTU-083	NONE*	39	59	88	106			82	126	48,200	104,000	11	12	12		
	7/8	.546	OILED	27	40	60	73		56	86	63,000	104,000					
9/16-12	29NTU-092	NONE*	57	85	128	156			105	162	77,400	101,000	11	12	12		
	15/16	.578	OILED	38	58	87	106		72	111	99,200	102,000					
5/8-11	29NTU-101	NONE*	78	118	176	213			141	217	120,000	103,000	11	12	12		
	1 1/16	.624	OILED	53	80	120	145		93	143	183,000	96,300					
3/4-10	49NTU-120	NONE*	139	208	313				3,320	5,100	211,000	84,300	11	12	12		
	1 1/4	.718	OILED	94	142	214			1,750	2,690	286,000	88,000					
7/8-9	49NTU-149	NONE*	224	337	505				5,020	7,730			11	12	12		
	1 7/16	.796	OILED	153	229	344			3,420	5,270							
1-8	49NTU-168	NONE*	337	505	757				7,790	11,530			11	12	12		
	1 5/8	.922	OILED	229	344	516			5,310	7,940							
1 1/8-7	49NTU-187	NONE*	477	715	1,070				6,960	10,070			11	12	12		
	1 13/16	1.000	OILED	325	487	732			4,770	7,340							
1 1/4-7	49NTU-207	NONE*	672	1,010	1,510				9,940	14,530			11	12	12		
	2	1.140	OILED	458	687	1,030			6,760	10,040							
1 3/8-6	49NTU-226	NONE*	875	1,320	1,980				13,300	20,040			11	12	12		
	2 13/16	1.211	OILED	600	900	1,350			9,030	13,390							
1 1/2-6	49NTU-246	NONE*	1,170	1,750	2,630				17,400	26,680			11	12	12		
	2 3/8	1.344	OILED	798	1,190	1,790			11,190	18,300							
1 3/4-5	49NTU-285	NONE*	1,840	2,760					25,700	39,950			11	12	12		
	2 3/4	1.532	OILED	1,260	1,880				1,750	2,690							
2-4 1/2	49NTU-324	NONE*	2,780	4,160					3,320	5,100			11	12	12		
	3 1/8	1.735	OILED	1,890	2,830				2,580	3,470							
2 1/4-4 1/2	49NTU-364	NONE*	4,060	6,090					5,020	7,730			11	12	12		
	3 1/2	2.001	OILED	2,770	4,150				3,420	5,270							

*CAUTION: Some lubricant, (plating or oil, etc.), should be on nut or bolt to prevent galling.

29NU/49NU UNC

NUT-HEX, HEAVY, STEEL-PLAIN, COARSE THREAD

1 THREAD SIZE	2 PART NO. HEX SIZE MAX HGT		3 LUBRI- CATION	INSTALLATION TORQUES (FOOT-POUNDS)										10 MAX LIMIT		11 TYPICAL STRENGTH OF THE NUT POUNDS PSI		12
				TO PRODUCE BOLT STRESSES INDICATED														
	40,000PSI	60,000PSI		90,000PSI	110,000PSI	130,000PSI	8	9	10	11	12	13	14	15	16	17	18	19
1/4-20	29NU-040	NONE*	4	6	10	12	14	13	20	6,590	207,000	11	12					
	1/2 .390	OILED	3	4	6	8	9	9	14									
5/16-18	29NU-058	NONE*	9	13	20	24	29	23	36	9,410	179,000	11	12					
	9/16 .453	OILED	6	9	13	16	20	16	24									
3/8-16	29NU-066	NONE*	15	23	35	43	51	41	63	13,900	179,000	11	12					
	11/16 .562	OILED	10	16	24	30	35	28	43									
7/16-14	29NU-074	NONE*	24	37	55	67	79	73	113	20,300	191,000	11	12					
	3/4 .609	OILED	17	25	38	46	54	50	77									
1/2-13	29NU-083	NONE*	38	58	87	106	126	108	166	27,200	191,000	11	12					
	7/8 .718	OILED	26	40	59	72	85	73	113									
9/16-12	29NU-092	NONE*	56	83	126	153	182	176	271	37,800	208,000	11	12					
	15/16 .812	OILED	38	57	85	104	123	120	185									
5/8-11	29NU-101	NONE*	77	116	174	212	251	229	353	44,100	195,000	11	12					
	1 1/16 .874	OILED	53	79	118	145	171	156	240									
3/4-10	49NU-120	NONE*	138	206	309	377	446	357	549	59,200	177,000	11	12					
	1 1/4 1.015	OILED	93	140	211	257	304	243	374									
7/8-9	49NU-149	NONE*	221	332	498	609	720	563	866	80,100	173,000	11	12					
	1 7/16 1.140	OILED	151	227	304	416	491	384	591									
1-8	49NU-168	NONE*	332	499	748	908	1,080	845	1,300	105,000	173,000	11	12					
	1 5/8 1.322	OILED	226	340	510	623	736	575	885									
1 1/8-7	49NU-187	NONE*	472	707	1,060	1,290	1,530	1,200	1,850	132,000	173,000	11	12					
	1 13/16 1.463	OILED	322	483	723	883	1,040	819	1,260									
1 1/4-7	49NU-207	NONE*	665	992	1,490	1,830	2,160	1,800	2,620	169,000	174,000	11	12					
	2 1.672	OILED	454	681	1,020	1,250	1,480	1,160	1,790									
1 3/8-6	49NU-226	NONE*	867	1,310	1,960	2,400	2,830	2,300	3,540	207,000	179,000	11	12					
	2 3/16 1.828	OILED	595	892	1,330	1,630	1,930	1,570	2,410									
1 1/2-6	49NU-246	NONE*	1,160	1,730	2,610	3,180	3,770	2,900	4,460	240,000	171,000	11	12					
	2 3/8 1.953	OILED	791	1,180	1,780	2,170	2,570	1,980	3,040									
1 3/4-5	49NU-285	NONE*	1,830	2,740	4,120	5,030	5,940	4,760	7,330	339,000	178,000	11	12					
	2 3/4 2.376	OILED	1,240	1,870	2,810	3,420	4,050	3,250	5,000									
2-4 1/2	49NU-324	NONE*	2,750	4,130	6,190	7,560	8,570	5,690	8,570	356,000	142,000	11	12					
	3 1/8 2.469	OILED	1,880	2,820	4,230	5,160	5,840	3,800	5,840									
2 1/4-4 1/2	49NU-364	NONE*	4,030	6,040	9,020	11,100	13,070	8,500	13,070	483,000	149,000	11	12					
	3 1/2 2.876	OILED	2,740	4,120	6,180	7,560	8,570	5,790	8,910									

*CAUTION: Some lubricant, (plating or oil, etc.), should be on nut or bolt to prevent galling.

49NU UN

NUT-HEX, HEAVY, STEEL-PLAIN, 8 AND 12 PITCH THREADS.

1 THREAD SIZE	2 PART NO.		3 LUBRI- CATION	4 TO PRODUCE BOLT STRESSES INDICATED						5 INSTALLATION TORQUES (FOOT-POUNDS)			10 RECOM- MENDED MAX LIMIT	11 TYPICAL STRENGTH OF THE NUT	
	HEX SIZE	MAX HGT.		40,000PSI	60,000PSI	90,000PSI	110,000PSI	130,000PSI	7	8	9	POUNDS		PSI	
															4
1 1/2-8	49NU-2408		NONE*	1,230	1,850	2,770	3,390	4,000	2,960	4,550	245,000	164,000			
	2 3/8	1.953	OILED	840	1,260	1,890	2,310	2,730	2,020	3,100					
1 3/4-12	49NU-2812		NONE*	2,110	3,170	4,760	5,360	6,870	4,990	7,680	355,000	162,000			
	2 3/4	2.376	OILED	1,440	2,160	3,240	3,960	4,690	3,400	5,230					
1 7/8-8	49NU-3008		NONE*	2,500	3,750	5,620	6,870	8,110	5,790	8,910	384,000	159,000			
	2 15/16	2.422	OILED	1,700	2,550	3,830	4,680	5,530	3,950	6,080					
2-8	49NU-3208		NONE*	3,050	4,580	6,860	8,400	-	5,750	8,850	369,000	133,000			
	3 1/8	2.469	OILED	2,080	3,120	4,680	5,730	-	3,930	6,040					
2-12	49NU-3212		NONE*	3,190	4,790	7,180	8,830	-	5,840	8,980	373,000	129,000			
	3 1/8	2.469	OILED	2,180	3,270	4,900	6,030	-	3,980	6,120					
2 1/4-8	49NU-3608		NONE*	4,410	6,630	9,960	12,150	-	8,750	13,460	497,000	140,000			
	3 7/16	2.876	OILED	3,010	4,520	6,780	8,290	-	5,970	9,130					
2 1/2-8	49NU-4008		NONE*	5,130	9,210	13,800	16,850	20,000	13,240	20,370	694,000	156,000			
	4	3.204	OILED	4,180	6,280	9,410	11,500	13,650	9,250	14,230					
2 5/8-8	49NU-4208		NONE*	7,140	10,700	16,050	19,700	-	13,250	20,390	648,000	131,000			
	4	3.204	OILED	4,870	7,310	10,950	13,400	-	9,040	13,900					

*CAUTION: Before assembling large size nuts in the 8 and 12 pitch series, care should be taken to prevent galling by inspecting the nut and bolt threads for damage, burrs, or the presence of foreign material. Furthermore, the use of a lubricant, (plating or oil, etc.), is practically essential to prevent galling.

MACHINE SCREW SIZES (2-56 THREAD THRU 1/4-28)

To obtain the desired bolted results, especially on these small delicate sizes, consideration should be given to the following points:

1) All torque values given in the chart were obtained on non-lubricated cadmium plated steel AN bolts with a Class 2A thread fit for sizes # 2 thru # 8 and a Class 3A fit on # 10 and 1/4" thread size.

2) The setting torque should be selected as that which induce a stress equal to approximately 65% of the minimum strength of the bolt. If the bolt strength category is unknown a fair approximation of the bolt strength may be made by wrenching several parts to failure and comparing the failing torques with torque values listed for the various stress levels, found in "psi" on the chart.

3) The torque values listed will not normally apply when a lubricant is used. If lubricants are necessary to prevent galling, reduce scatter or prevent corrosion, then it is preferable to establish torque values on the basis of actual

test results. Therefore, for lubricated assemblies, it is suggested that several nut-bolt combinations be wrenched to failure and the seating torque, for that particular lubricant; be established as equal to approximately 65% of the average failing torque.

4) Some loss in clamping force will usually occur during the initial period of operation, the break-in period of most machinery. Therefore, unless the nuts and bolts are to be retightened, the higher values of tightening torque may be selected, consistent with nut-bolt strength.

5) Generally, power wrenches will produce more variation in tightening torque on the high side than a hand operated torque wrench. Therefore, somewhat lower values might be selected if power wrenches are to be used in the assembly operation.

22NM/42NE

NUT-HEX, LIGHT, STEEL-CADMIUM, NON-LUBRICATED, COARSE AND FINE THREAD

THREAD SIZE	PREVAILING ON TORQUE INCH-LB	APPROXIMATE INSTALLATION TORQUE IN INCH POUNDS REQUIRED TO PRODUCE THE BOLT LOADING INDICATED BELOW (AVERAGE OF FIVE PIECES TESTED)				
		20,000 PSI	40,000 PSI	60,000 PSI	80,000 PSI	100,000 PSI
2-56	0.5	1.8	3.5	*	—	—
2-64	0.5	1.8	3.5	*	—	—
3-48	0.7	2.3	4.0	*	—	—
3-56	0.7	2.3	4.0	*	—	—
4-40	1.1	4.0	7.0	*	—	—
4-48	1.0	4.0	7.0	*	—	—
6-32	2.2	5.0	8.5	10.0	*	—
6-40	2.1	5.0	8.5	10.0	*	—
8-32	3.7	6.0	10.0	15.5	22.0	*
8-36	3.3	6.0	10.0	18.0	24.0	*
10-24	6.5	13.0	19.0	27.5	35.0	42.5
10-32	7.2	13.0	22.5	32.5	45.0	52.5
12-24	7.5	15.0	25.0	32.5	42.5	62.5
12-28	7.5	15.0	27.0	35.0	50.0	65.0
1/4-20	12.2	25.0	45.0	67.5	100.0	125.0
1/4-28	16.8	32.5	57.5	80.0	110.0	140.0

* — BOLT FAILURE

STEEL BOLTS: AN3, AN4, AN500, AN510, AN515

THREAD FIT: #2 THRU #8 CLASS 2A; #10 THRU 1/4 CLASS 3A

**TABLE OF STRESS AREAS
UNIFIED AND AMERICAN THREADS**

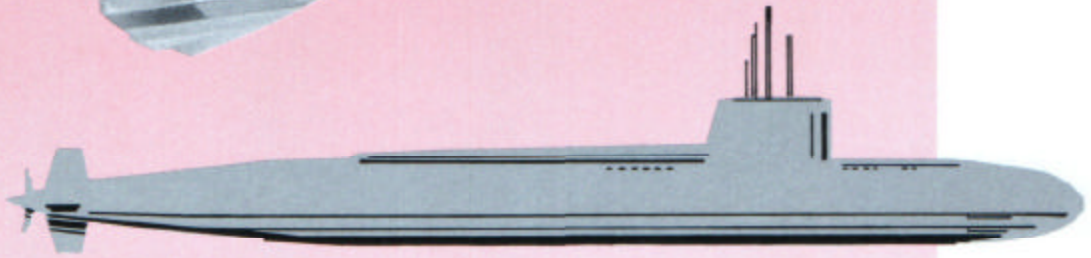
COARSE THREAD SERIES			FINE THREAD SERIES			8 PITCH THREAD SERIES		
THREAD SIZE	STRESS AREA, SQ. INCHES		THREAD SIZE	STRESS AREA, SQ. INCHES		THREAD SIZE	STRESS AREA, SQ. INCHES	
	UP TO 100,000PSI	OVER 100,000PSI		UP TO 100,000PSI	OVER 100,000PSI		UP TO 100,000PSI	OVER 100,000PSI
1/4-20	0.0318	0.0309	1/4-28	0.0364	0.0355			
5/16-18	0.0524	0.0512	5/16-24	0.0580	0.0569			
3/8-16	0.0775	0.0759	3/8-24	0.0878	0.0863			
7/16-14	0.1063	0.1007	7/16-20	0.1187	0.1168			
1/2-13	0.1419	0.1394	1/2-20	0.1599	0.1577			
9/16-12	0.182	0.179	9/16-18	0.203	0.200			
5/8-11	0.226	0.223	5/8-18	0.256	0.253			
3/4-10	0.334	0.330	3/4-16	0.373	0.369			
7/8-9	0.462	0.456	7/8-14	0.509	0.504			
1-8	0.606	0.599	1-12	0.663	0.657			
			1-14(NS)	0.680	0.674			
1 1/8-7	0.763	0.755	1 1/8-12	0.856	0.848			
1 1/4-7	0.969	0.960	1 1/4-12	1.073	1.065			
1 3/8-7	1.155	1.143	1 3/8-12	1.315	1.305			
1 1/2-6	1.405	1.392	1 1/2-12	1.581	1.570	1 1/2-8	1.49	1.48
1 3/4-5	1.90	1.88	1 3/4-12	2.19	2.18			
						1 7/8-8	2.41	2.40
2-4 1/2	2.50	2.48	2-12	2.89	2.88	2-8	2.77	2.75
2 1/4-4 1/2	3.25	3.23	2 1/4-12	3.69	3.68	2 1/4-8	3.56	3.54
						2 1/2-8	4.44	4.42
						2 5/8-8	4.92	4.90

TABLE OF BOLT STRENGTHS

GM NUMBER	SAE CLASSIFICATION	HEAD MARKING (RADIAL-LINES)	BOLT OR STUD DIAMETER (INCHES)	TENSILE STRENGTH MIN PSI	PROOF LOAD PSI	HARDNESS		CHEMICAL COMPOSITION
						BRINELL	ROCKWELL	
GM 250-M	GRADE 0	NONE	-----	----	----	----	----	
GM 255-M	GRADE 1	NONE	ALL	55,000		207 MAX	B95 MAX	ANY STEEL STANDARD WITH MANUFACTURER
GM 260-M	GRADE 2	NONE	UP TO 1/2 INCL.	69,000	55,000	163-241	B85-100	
			OVER 1/2 TO 3/4 INCL.	64,000	52,000	163-241	B85-100	
			OVER 3/4	55,000	28,000	207 MAX	B95 MAX	
NONE	GRADE 3	2 AT 180°	UP TO 1/2 INCL.	110,000	85,000	207-269	B95-104	MEDIUM CARBON STEEL
			OVER 1/2 TO 5/8 INCL.	100,000	80,000	207-269	B95-104	
			UP TO 3/4 INCL.	120,000	85,000	241-302	C23-32	
GM 280-M	GRADE 5	3 AT 120°	OVER 3/4 TO 1 INCL.	115,000	78,000	235-302	C22-32	
			OVER 1 TO 1-1/2 INCL.	105,000	74,000	223-285	C19-30	
			UP TO 5/8 INCL.	140,000	110,000	285-331	C30-36	
NONE	GRADE 6	4 AT 90°	OVER 5/8 TO 3/4 INCL.	133,000	105,000	269-331	C28-36	FINE GRAIN MEDIUM CARBON ALLOY STEEL
			ALL	133,000	105,000	269-321	C28-34	
			ALL	150,000	120,000	302-352	C32-38	
NONE	NONE	NONE	ALL	180,000	-----	362-415	C39-44	
			ALL	220,000	-----	426-472	C45-49	
GM 455-M	NONE	2 AT 90°	ALL	55,000	40,000	143 MIN	B79 MIN	STAINLESS STEEL MIN 12% CR



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