Torque & Fastener Matching Information

In most race car chassis and aircraft airframe applications, the bolts used are loaded in shear. The torque values given in the NAS torque chart (opposite page) are adequate and appropriate for this type of usage. For aerospace bolt applications subjected to high tensile loadings and for aerospace nuts and bolts matched to fasteners of other grades and thread classes, see the notes below:

A.) For applications requiring high installation torque values and using standard NAS bolts: achievable torque is dependent on plating, length of thread engagement, class of mating threads and lubricant (if any). For maximum fatigue resistance and clamping force in the bolted assembly, we want to produce a level of installed tensile stress that is just below the yield strength of the bolt material (typically around 85% of the ultimate tensile strength). Achieving this ensures that the stresses encountered in the assembly/tightening process will be the most the bolt ever sees. At the yield point, the bolt will undergo “plastic” deformation (permanent stretch). **Bolts for critical applications should be test-torqued to determine the point of measurable permanent stretch. As a rule, approximately 90% of this value will give the best performance in a bolted assembly.** Example: ’93 INDY-LOLA ring gear bolts NAS 1307-4H – with light lubrication, these bolts stretch permanently on a consistent basis between 105 and 110 ft/lbs of installed torque. 90% of this value gives an assembly torque of 95 ft/lbs.

B.) The mating of aerospace spec (MS•NAS•AN) bolts and nuts to fasteners of other specifications and thread classes can cause problems. Nut splitting failures are primarily caused by overtorquing and/or thread class mismatches. Generally, NAS wrenching torque values should be reduced when aerospace nuts are matched with non-aerospace bolts or studs. Wrench torque values in the NAS nut tables below are achieved under laboratory conditions using aerospace spec bolts (Class 3 threads) of higher strength than the nuts they are mated to. THE TABLES DO NOT STATE, NOR SHOULD ONE INFER THAT THIS PERFORMANCE CAN BE DUPLICATED WITH OTHER TYPES OF FASTENERS AND/OR CLASSES OF THREADS. For applications requiring high clamping forces, 12 point nuts should be used whenever possible. Their greater thread contact area and higher rated strength make higher wrenching torque values possible. **As a general rule, the wrenching torque values for aerospace spec nuts should be reduced approximately 25% as a starting point when these nuts are mated to non-aerospace bolts or studs.**

NUT SIZE	WRENCH TORQUE, INCH POUNDS 160 KSI NAS NUTS *	WRENCH TORQUE, INCH POUNDS 180 & 220 KSI NAS NUTS *
#6 - 32	20	N/A
#8 - 32	30	N/A
#10 - 32	60	70 / 85
1/4 - 28	150	170 / 210
5/16 - 24	330	370 / 450
3/8 - 24	530	600 / 730
7/16 - 20	825	880 / 1100
1/2 - 20	1125	1225 / 1400
9/16 - 18	1550	1700 / 2000
5/8 - 18	2000	2200 / 2600
3/4 - 16	N/A	3800 / 4400

**** Above values for alloy steel nuts. For A286 stainless multiply them by 0.694***

Recommended Torque Values for Nut & Bolt Combinations

for shear loads without lubrication

	Steel Tension Bolts				Steel Tension Bolts				Aluminum Bolts			
	AN3 through AN20 AN42 through AN49 AN73 through AN81 MS20033 through MS20046 MS20073 and MS20074 AN509 AN525 MS24694 and MS27039				MS20004 through MS20024 NAS144 through NAS158 NAS333 through NAS340 NAS583 through NAS590 NAS624 through NAS644 NAS1303 through NAS1320 NAS172 and NAS174 NAS517				AN3DD through AN20DD AN173DD through AN186DD AN509DD AN525DD MS27039D MS24694DD			
	Steel Nuts				Steel Nuts				Aluminum Nuts			
	Tension		Shear		Tension		Shear		Tension		Shear	
	AN310 & AN315 AN363 & AN365 NAS1021 MS20365 MS21042 MS21045 NAS679		AN320 AN364 NAS1022 MS17826 MS20364		AN310 & AN315 AN363 & AN365 NAS1021 MS20365 MS21042 MS21045 NAS679		AN320 AN364 NAS1022 MS17826 MS20364		AN310D AN365D NAS1021D		AN320D AN364D NAS1022D	
Torque Limits for Fine Threaded Series in Inch-Pounds												
Series	**From**	**To**	**From**	**To**	**From**	**To**	**From**	**To**	**From**	**To**	**From**	**To**
#8-36	12	15	7	9					5	10	3	6
#10-32	20	25	12	15	25	30	15	20	10	15	5	10
1/4-28	50	70	30	40	80	100	50	60	30	45	15	30
5/16-24	100	140	60	85	120	145	70	90	40	65	25	40
3/8-24	160	190	95	110	200	250	120	150	75	110	45	70
7/16-20	450	500	270	300	520	630	300	400	180	280	110	170
1/2-20	480	690	290	410	770	950	450	550	280	410	160	260
9/16-18	800	1000	480	600	1100	1300	650	800	380	580	230	360
5/8-18	1100	1300	660	780	1250	1550	750	950	550	670	270	420
3/4-16	2300	2500	1300	1500	2650	3200	1600	1900	950	1250	560	880
7/8-14	2500	3000	1500	1800	3550	4350	2100	2600	1250	1900	750	1200
1-14	3700	4500	2200	3300	4500	5500	2700	3300	1600	2400	950	1500
1 1/8-12	5000	7000	3000	4200	6000	7300	3600	4400	2100	3200	1250	2000
1 1/4-12	9000	11000	5400	6600	11000	13400	6600	8000	3900	5600	2300	3650

Customized & Modified Aircraft & Aerospace Bolts

Shortening, drilling, grinding, machining, thread rolling to your print or specifications. From standard AN•MS•NAS fasteners. Contact us for technical assistance and recommendations. Combinations of the above operations can be simple or elaborate. For example, a 7/16 diameter MS21250 bolt (pp. 22-23) was used to manufacture custom, rolled-thread (J-type), metric (M10 x 1.0) transmission bolts with heads drilled for safety wire and head base diameter turned down for clearance. Total turn around time was four weeks for a fastener of higher quality than the German-made equivalent at one-third to one-half the price.