

1. Tighting Torque

If the tightening torque **is not specified** in the drawings use the table attached at this procedure to the information on the final torque required for the bolt. Fastener material and lubrication must be taken in consideration.

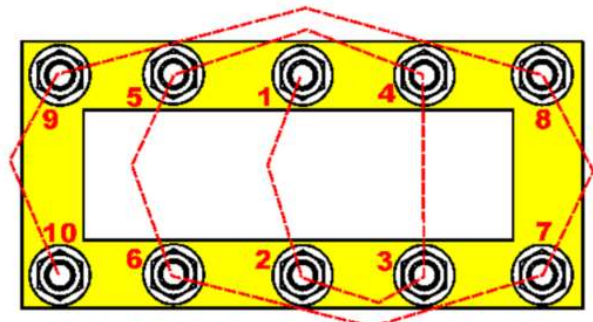
2. Torque Sequence

When torquing it is common to tighten only one bolt at a time, this can result in Point Loading and Load Scatter. To avoid this, torque is applied in stages following a prescribed pattern:

- Spanner tight ensuring that 2 - 3 threads extend above nut.
- Tighten each bolt to one-third of the final required torque following the pattern as shown above.
- Increase the torque to two thirds following the pattern shown above.
- Increase the torque to full torque following the pattern shown above.
- Perform one final pass on each bolt working clockwise from bolt 1, at the full final torque.
- After the torque, mark the screws heads with permanent red marker.



Criss-Cross Tightening Sequence for Circular Bolt Patterns



Spiral Tightening Sequence Starting in the Middle for Non-Circular Bolt Patterns.

3. Stainless Steel Bolt Lubrication

- Use Nickel Anti Seize Compound.
- Stir LOCTITE® Nickel Anti-Seize Lubricant well before using.
- For best results, remove dirt, oil and grease.
- Apply a light coating of LOCTITE® Nickel Anti-Seize Lubricant to bolt threads.
- Assemble parts with required torque.
- Wipe away excess lubricant.

Torque Bolts (Generic Assembly)

Nom. Dia. (in.)	SAE Grade 2			ASTM A307 Grade A			SAE J429 Grade 5			SAE J429 Grade 8			FNL Grade 9			18-8 Stainless Steel			316 Stainless Steel		
	Tightening Torque Lubricated	Tightening Torque Dry Condition	Galv. and Dry Condition	Tightening Torque Lubricated	Tightening Torque Zinc Plate and Dry Condition	Tightening Torque Plain and Dry Condition	Tightening Torque Lubricated	Tightening Torque Zinc Plate and Dry Condition	Tightening Torque Plain and Dry Condition	Tightening Torque Lubricated	Tightening Torque Zinc Plate and Dry Condition	Tightening Torque Plain and Dry Condition	Tightening Torque Lubricated	Tightening Torque Zinc Plate and Dry Condition	Tightening Torque Plain and Dry Condition	Tightening Torque Lubricated	Tightening Torque Zinc Plate and Dry Condition	Tightening Torque Plain and Dry Condition	Tightening Torque Lubricated	Tightening Torque Zinc Plate and Dry Condition	Tightening Torque Plain and Dry Condition
1/4	20	36 in-lbs	60 in-lbs	60 in-lbs	32 in-lbs	37 in-lbs	43 in-lbs	76 in-lbs	86 in-lbs	101 in-lbs	107 in-lbs	122 in-lbs	143 in-lbs	143 in-lbs	126 in-lbs	143 in-lbs	168 in-lbs	63.9 in-lbs	75.2 in-lbs	87 in-lbs	78.8 in-lbs
5/16	18	72	132	88	66	75	88	157	178	209	221	251	295	294	259	294	346	112	132	117	138
3/8	16	10 ft-lbs	20 ft-lbs	13 ft-lbs	10 ft-lbs	11 ft-lbs	13 ft-lbs	23 ft-lbs	26 ft-lbs	31 ft-lbs	33 ft-lbs	37 ft-lbs	44 ft-lbs	43 ft-lbs	38 ft-lbs	43 ft-lbs	51 ft-lbs	17 ft-lbs	20 ft-lbs	18 ft-lbs	21 ft-lbs
7/16	14	16	32	18	16	18	21	37	42	49	52	59	70	70	61	82	82	27	31	28	32.75
1/2	13	24	49	27	24	27	32	57	64	75	80	90	106	106	94	106	125	37	43	40	45
9/16	12	35	70	39	35	39	46	82	92	109	115	130	154	153	135	180	180	48	56	53	59
5/8	11	48	97	54	48	54	64	113	128	150	159	180	212	211	186	248	248	78	92	86	96
3/4	10	86	173	96	85	96	113	200	227	267	282	320	376	375	331	441	441	108	127	118	131
7/8	9	83	166	136	136	155	182	322	365	429	455	515	606	604	533	710	710	165	194	178	202
1	8	125	250	232	204	232	273	483	547	644	681	772	909	905	799	1065	1065	243	286	265	299
1 1/4	7	250	500	463	409	463	545	840	952	1121	1363	1545	1817	1810	1597	2130	2130	445	523	485	546
1 1/2	6	435	870	806	711	806	949	1462	1657	1950	2371	2688	3162	3150	2779	3706	3706	755	888	822	930
Unified Coarse Thread Series																					
Fine Thread Series																					
1/4	28	-	-	49 in-lbs	37 in-lbs	42 in-lbs	49 in-lbs	87 in-lbs	99 in-lbs	116 in-lbs	123 in-lbs	139 in-lbs	164 in-lbs	163 in-lbs	144 in-lbs	192 in-lbs	192 in-lbs	80 in-lbs	94 in-lbs	84 in-lbs	99 in-lbs
5/16	24	-	-	83	73	83	98	174	197	231	245	278	327	325	287	383	383	121	142	125	147
3/8	24	-	-	15 ft-lbs	11 ft-lbs	13 ft-lbs	15 ft-lbs	26 ft-lbs	30 ft-lbs	35 ft-lbs	37 ft-lbs	42 ft-lbs	49 ft-lbs	49 ft-lbs	43 ft-lbs	58 ft-lbs	58 ft-lbs	22 ft-lbs	18 ft-lbs	19 ft-lbs	23 ft-lbs
7/16	20	-	-	20	18	20	23	41	47	55	58	66	78	78	68	91	91	28	33	30	35
1/2	20	-	-	31	27	31	36	64	72	85	90	102	120	120	105	141	141	38	45	40	47
9/16	18	-	-	44	39	44	51	91	103	121	128	146	171	171	151	201	201	53	62	55	65
5/8	18	-	-	61	54	61	72	127	144	170	180	204	240	239	211	281	281	88	103	92	108
3/4	16	-	-	107	94	107	126	223	253	297	315	357	420	418	369	492	492	105	124	110	129
7/8	14	-	-	171	150	171	201	355	403	474	502	568	669	666	588	784	784	164	193	171	201
1	14	-	-	260	229	260	306	542	614	722	765	867	1020	1016	896	1195	1195	220	259	230	270
1 1/4	12	-	-	513	453	513	604	930	1055	1241	1509	1710	2012	2004	1768	2358	2358	408	480	428	504
1 1/2	12	-	-	907	800	907	1067	1645	1865	2194	2668	3024	3557	3544	3127	4169	4169	598	703	622	732