

FASTENER INSTALLATION AND TORQUING PROCEDURE (EXCLUDING SHOULDER SCREWS)

GENERAL

- This standard applies only to Property Class 10.9 hex head and 12.9 socket head cap screws when used in steel, unlubed and where the head bears against a metal surface. Where the bearing surface is not a metal (e.g. UHMW plastic), the tightening specification for any fastener shall be "snug fit then 1/4 turn".
- For purposes of uniformity in clamp loading, the calculations for the recommended installation torques listed below are based upon $K = 0.20$ for uncoated screws and $K = 0.15$ for blue coated screws.
- Testing by reputable fastener manufacturers has proven that the use of split lockwashers under heads of hardened screws may prevent achieving or retaining the desired preload in bolted joints.

INSTALLATION PROCEDURE

1. Use only new fasteners for first-time assembly.
2. Before installing the fastener, be sure that it is free of flaws and it is the correct property class. Fasteners with flaws shall be marked with a white line drawn across the threads and discarded.
3. Fasteners may be tightened with any appropriate fastening device. Final torquing shall be done with a calibrated torque wrench to the required value as follows:

Nominal Diameter and Thread Pitch	Recommended Installation Torque (Nm)				
	Uncoated			Coated	
	*Property Class 8.8	Property Class 10.9	Property Class 12.9	Property Class 10.9	Property Class 12.9
M6 x 1.0	8	16	19	12	14
M8 x 1.25	19	39	45	29	34
M10 x 1.5	50	76	89	58	68
M12 x 1.75	88	134	156	100	120
M16 x 2.0	218	331	387	250	290
M20 x 2.5	426	644	760	485	570
M24 x 3.0	736	1120	1308	840	985
M30 x 3.5	1463	2226	2595	1670	1960

* : FOR SERVICING COMMERCIAL COMPONENTS WITH COMPONENT MANUFACTURE'S APPROVAL.

4. After torquing is completed, draw a straight line (match mark) from the wall of the fastener head onto the seating surface using a white steel paint pen. Ensure that the line is easily visible for periodic inspection.
5. A fastener suspected of being over-torqued shall be marked as described in item 2 and discarded.
6. Do not torque fasteners at machine break points until final installation.
7. Where safety wiring is specified, do not safety wire any screws until they have passed the torque audit.
8. If fasteners are in a position that a torque wrench cannot be used, the following steps shall be used:
 - a) Tighten the fastener until the joint surfaces have established a snug fit.
 - b) Mark the position of the fastener to the surface with a white steel paint pen.
 - c) Tighten the fastener 1/3 of a turn (120).
 - d) After torquing is completed, draw a straight line (match mark) from the wall of the fastener head onto the seating surface using a white steel paint pen. Ensure that the line is easily visible for periodic inspection.

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TORQUE AUDIT PROCEDURE

- Applies only to screws installed per the NAAMS Fastener Installation and Torquing Procedure.
 - The method for checking the fastener torque is the Static Torque Method, which is defined as the torque required to start a previously tightened fastener into motion in the direction of tightening.
1. Audit samples shall be a random selection consisting of thirty (30) fasteners from each type/size property class fastener used. Where a sample of thirty is not obtainable, a 100% audit of that type/size/property class fastener is required.
 2. Do not audit at machine break points.
 3. Record the applicable torque values from each of the samples on the NAAMS Torque Data Sheet.
 4. A fastener shall be deemed to have passed the audit if the torque is within the following limits. High and low auditing torque limits are $\pm 10\%$ of the recommended installation torque.

Nominal Diameter and Thread Pitch	Torque Audit range (Nm)			
	Uncoated		Coated	
	Property Class 10.9	Property Class 12.9	Property Class 10.9	Property Class 12.9
M6 x 1.0	14.4-17.6	16.7-20.5	10.8-13.2	12.6-15.4
M8 x 1.25	35-43	41-50	26-32	31-38
M10 x 1.5	69-84	80-100	52-64	61-74
M12 x 1.75	121-147	140-172	90-110	106-130
M16 x 2.0	300-365	350-425	225-275	260-320
M20 x 2.5	580-710	685-835	435-535	515-630
M24 x 3.0	1010-1230	1180-1440	760-930	890-1090
M30 x 3.5	2000-2450	2340-2860	1500-1840	1760-2160

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5. When a fastener fails the audit:
 - a. Due to over-torquing: it shall be marked with a white line drawn across the threads and discarded.
 - b. Due to under-torquing:
 - i) If the fastener is free of flaws it is suitable for re-use.
 - ii) When the fastener is flawed, it shall be marked with a white line drawn across the threads and discarded.
6. When the fastener passes the audit, a straight line (match mark) shall be drawn from the wall of the fastener head onto the seating surface using a green steel paint pen. Ensure that the line is easily visible for periodic inspection.
7. When all of the fasteners in the sample pass the audit, the data sheet shall be marked to so indicate.
8. If one of the fasteners in the audit fails the audit:
 - a. All fasteners of that type/size/property class shall be re-tightened. (Fasteners that passed the audit may be excluded.)
 - b. A new sample shall be selected for re-auditing using the criteria in No. 1. However, fasteners that passed a previous audit shall not be included in the sample for a subsequent audit.
9. Fastener Torque Quality Audit Steps
 - a. Bench Build Audit: Every unit shall pass the audit before it may leave the bench. Multiple units may be combined to achieve the sample size of thirty fasteners.
 - b. Unit-to-Base Audit: Audits shall be performed at periodic stages of the assembly process to ensure that any possible failures are corrected and passing audits are achieved while ensuring accessibility to all fasteners.
 - c. Final Audit: The final audit shall be performed after all engineering changes have been made and all adjustments are complete.

NAAMS FASTENER INSTALLATION AND TORQUING PROCEDURE

(EXCLUDING SHOULDER SCREWS)

Torque Data Sheet

Audit Method: Static
(Updated 07/11/08)

Auditor's name _____ Date _____

Assembly Plant _____ Program/System _____

Builder/Leader _____ Tool # _____

Unit/Station _____ Job # _____

Audit Type: Bench _____ Unit-to-Base _____ Final _____

Pass / Fail Uncoated / Blue				Pass / Fail Uncoated / Blue			
10.9 12.9		M____ sh hh		10.9 12.9		M____ sh hh	
Samp. #	Torque Nm	Samp. #	Torque Nm	Samp. #	Torque Nm	Samp. #	Torque Nm
1		16		1		16	
2		17		2		17	
3		18		3		18	
4		19		4		19	
5		20		5		20	
6		21		6		21	
7		22		7		22	
8		23		8		23	
9		24		9		24	
10		25		10		25	
11		26		11		26	
12		27		12		27	
13		28		13		28	
14		29		14		29	
15		30		15		30	