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SPECIFICATION OF TORQUE AND RETENTION REQUIREMENTS FOR THREADED HARDWARE

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REVISION NOTICE

Initial Release: 30 September 2010

Revision A: 2 December 2010

Revision B: 25 April 2011

Revision C: 15 January 2013

Revision D: 7 July 2015

Revision E: 29 March 2018

Updated Table 34. Added paragraphs 3.10.15 and 3.10.16. Updated section 3.10.4.2 subsections to refer to these new paragraphs and to indicate to manipulate connectors such that grounding features are fully engaged. Updated section 3.10.4 to indicate torque values for MIL SPEC connectors taken from SAE AIR 6151 as a guide. Modified Table 33 and Table 34 to move AS50151 3400 series to a new colum with torque values that match AIR6151. Removed PN 7184592 from Table 33 as it was a typo. Added SAE AIR6151 to section 2.3.

Revision F: 19 May 2021

Updated branding and copywright statements, updated official sector and segment specified company name.

Revision G: 30 July 2021

Removed operational/assembly directive instruction and verification section to place in procedural documentation.

Added requested segments per PRs associated to document; updated specific sections with engineering directed content. Incorporated document 6008315500 into the body of this document for consolidation. Updated the references in Appendix A to correspond to the added part numbers and associated torque values. Updated grammatical constructs throughout body of text.

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1 SCOPE

This standard establishes torque and retention requirements for threaded hardware used at L3Harris Technologies, Inc. (CSW). The values provided in this document are meant to cover the most common threaded joints that are not in the primary structural load path. For critical structural joints, torque values shall be formulated separately and explicitly provided on the face of the engineering drawing or specification. This document is not a design manual. All content included herein is intended to be used for assembly and inspection purposes.

2 APPLICABLE DOCUMENTS

The following documents, of the revision in effect on date of use, form a part of this document to the extent specified herein.

2.1 L3HARRIS TECHNOLOGIES, INC. (CSW) DOCUMENTS

Document	Title
IS-001	Use of Non-Specified Hardware/Material
W-392	Tightness and Torque Verification
W-572	Connector and Adapter Torque Application
P-553	Torque Application Procedure
60037425	Practices for EMC – Electromagnetic Compatibility

2.2 GOVERNMENT DOCUMENTS

Document	Title
None	

2.3 NON-GOVERNMENT DOCUMENTS

Document	Title
SAE AIR6151	Torque, Threaded Application, Electrical Connector, Accessory and Terminal Board Installation

2.4 DOCUMENT CONFLICTS

In the event of conflict between the documents referenced herein and the contractual requirements, the requirements of the contract shall be considered superseding requirements. If the conflict is between a contractually binding document and a document referenced herein, the contractually cited document shall govern. In the case of conflict between documents referenced herein and the contents of this standard, the contents of this standard shall be considered a superseding requirement.

3 REQUIREMENTS

3.1 DOCUMENTED TORQUE REQUIREMENTS

Tightened fasteners and connectors shall have torque applied or the tightening requirements performed in accordance with the requirements of Section 3 of this specification. This shall occur at initial assembly and after any subsequent disassembly due to test debug, engineering modification, or update (i.e. rework).

3.2 ORDER OF PRECEDENCE FOR DOCUMENTED TORQUE REQUIREMENTS

The applicable assembly torque value for every threaded hardware item shall be specified in at least one of the following three documents, which are listed in order of precedence:

1. Approved engineering drawing.
2. Approved problem report (PR) in Teamcenter that impacts this torque specification.
3. This torque specification (60083155).

All threaded hardware shall be tightened to the appropriate torque values listed in the governing document. In case of conflict between any of the items on the above list, the document higher on the list shall govern. The precedence guidance given in Section 2.4 shall also apply.

3.2.1 Manufacturer Torque Recommendations

Manufacturers often publish their own recommendations for installing or tightening a threaded hardware or connector item they produce. In the event of a conflict between the text of this document and the torque application/installation instructions provided by the hardware or connector manufacturer, the manufacturer's instructions will take precedence. Exceptions may be noted in this document or the applicable engineering drawing.

3.3 DETERMINING AND DOCUMENTING MISSING TORQUE REQUIREMENTS

When there is no applicable torque requirement specified for a given threaded hardware item, the missing requirement shall be determined by the mechanical design engineer responsible for the assembly that uses the item. Once determined, the torque requirement for the item shall be captured in a PR that impacts this specification (60083155) by the same engineer or an assigned delegate. Once approved by the current specification owner in Teamcenter, the new PR shall be the governing torque requirement until the information can be formally incorporated into this specification at a later revision. If the threaded hardware item is judged to be unique or uncommon, the new governing PR shall be written against the assembly that uses the item instead of this specification.

Note: When creating a PR for this specification, the latest released revision of specification 60083155 must be placed in the "Problem Items" pseudo-folder. This will allow the PR to be tracked and then implemented when it is finally incorporated into the specification through the Enterprise Change Request (ECR) process.

3.4 TORQUE SPECIFICATION REVISIONS AND EXISTING BUILD PROCESSES

Revisions to this specification shall, in general, not affect approved build processes that were developed and released while a previous revision was in effect. A revision to this document shall not be grounds for requiring that such build processes be correspondingly updated. An exception may be made for any

significant torque specification change that has the potential of creating a safety risk or major product malfunction, and shall be assessed on a case-by-case basis. These requirements do not apply to engineering drawing revisions.

3.5 TORQUE APPLICATION

3.5.1 Procedure for Applying Torque

All threaded hardware with a torque requirement shall be tightened per the following two-step procedure:

1. Run the hardware down until the bearing surface of the hardware is in full contact with the mating surface, tightening the hardware to clamp the junction so no perceptible play exists between the mating hardware threads.
2. Apply the assembly torque to the hardware at the specified value, using the appropriate tool.

The torque shall be applied to the nut, whenever possible. When the torque is applied to the fastener head, observe that no binding occurs between the shank of the fastener and the clearance hole or between the fastener head and the contact surface. Binding at either of these locations would affect the torque-induced preload.

If the hardware does not rotate when torque is applied in step #2, the assembly torque was achieved in step #1. This is an acceptable condition.

3.5.2 Torque Values and Tolerances

The torque values provided in this specification are installation or assembly torque values. Unless otherwise specified on the engineering drawing, the assembly torque applied to the threaded hardware during assembly shall be the listed value that matches the hardware type and thread material/size. When dissimilar thread materials are involved, the torque value shall be determined from the material type having the lower torque value.

Unless otherwise specified, the tolerance range for all torque values shall be ±10% of the listed torque value. This tolerance does not apply to tightening during step #1 of the procedure in Section 3.5.1. The tightening required to achieve a fully seated and clamped junction condition in step #1 may exceed the limits of the specified torque value and tolerance range used in step #2.

3.5.2.1 Correction Factors

If the threaded joint stackup includes any of the items listed in Table 1, the applicable torque value shall be adjusted by multiplying the torque value by the correction factor listed in the table. Only one factor should be used if the joint includes multiple listed items; Use the single correction factor that results in the lowest torque value for the threaded item within the joint stackup. No correction factors shall be used if the torque is specified on the engineering drawing. The correction factors in Table 1 shall not be used with the threaded pipe/hose fitting and adapter torque values or tightening instructions provided in Section 3.9.12.

Table 1: Torque correction factors for various threaded joint configurations.

Item Included in Joint Stackup	Correction Factor
External tooth lock washer	1.1
Internal tooth lock washer	0.8

Item Included in Joint Stackup	Correction Factor
Nylon washer	0.8
Fabric washer	0.8
Teflon washer	0.8
Epoxy glass laminates*	0.8
Bolt or nut threads coated with a lubricant**	0.8
Anti-seize added to bolt or nut threads	0.9
Spiralock® threads	See Section 3.9.4

* Applies to CCAs where the PCB material is FR-4 or similar.
** This correction factor also applies to thread locking compounds that act as lubricants before curing.

Note: No correction factors apply to a split ("helical spring") washer.

3.5.3 "Above Running Torque" Requirements

The engineering drawing shall clearly identify when the assembly torque value is to be a value that is "above running torque." The assembly torque shall be the measured running torque added to the torque value specified in this document or on the drawing.

When the drawing does not specify "above running torque," the specified assembly torque is understood to be the torque indicated by the torque tool at assembly. All torque values specified in this document fall into this category.

3.5.4 Threaded Hardware Accessibility Issues

When a threaded hardware item cannot be accessed with the tooling required to apply the proper torque, the engineering drawing shall specify: 1) the extent to which the inaccessible hardware should be tightened (e.g. "tighten 45 degrees from the finger tight position"), and 2) any special locking provisions that may be needed to comply with the requirements of Section 3.7.

3.6 TORQUE TOOLING

A calibrated torque wrench or driver covering the appropriate range of torque and the proper bit, wrench head, or socket size shall be used for applying torque.

3.7 LOCKING FEATURES

Threaded junctions may have additional locking features to retain hardware, often within dynamic environments. A properly preloaded joint is the primary feature that retains hardware and maintains fastener preload. Additional features may be used to supplement hardware retention; these features may be mechanical, adhesive or (friction modifying) prevailing-torque type locking features. Not all feature types retain fastener preload.

When not provided, all threaded joints should include a supplementary locking feature (as defined in section 6.2) excluding the conditions listed in Section 3.7.5. Any other exclusions should be noted on the

applicable engineering drawing.

3.7.1 Reuse and Replacement of Self-Locking Hardware

When a threaded junction uses self-locking hardware, the joint components may experience wear and deformation. If considering the components for reuse, identify excessively worn and/or damaged components visually or by observation of the prevailing torque required to drive down the fastener. When one or both components have wear, the junction may exhibit less prevailing torque than the minimum values or larger than the maximum values indicated in the applicable specifications for the locking feature. When worn, replace the worn/damaged components. The hardware manufacturer may recommend replacement of the component prior to observing wear, due to environmental or use conditions that the component is subjected to. It is generally not recommended to use a thread locking adhesive to supplement worn self-locking hardware or the mating hardware in the junction.

3.7.2 Use of Thread Locking Compounds

Internal specification IS-001 allows the addition of certain approved anaerobic thread locking compounds to threaded joints during build, when no other supplementary locking feature is provided. The approved compounds and their conditions and exclusions for their use are stated within IS-001. If this allowance is unacceptable, this allowance may be controlled as specified in IS-001; In addition, some hardware manufacturers discourage the use of thread locking compounds on their materials or finishes.

Though not required by IS-001, it is preferable to include any needed thread locking adhesive (and primer, if applicable) in the drawing/EBOM. The responsible mechanical design engineer or an assigned delegate may add the item(s) to an existing design by creating a PR against the applicable drawing/EBOM. An immediate ECR is not required to begin using the adhesive in build if the compound is on the approved compounds list that exists in IS-001.

Thread locking compounds are applied to the threaded joint per the manufacturer's instructions. It must be reapplied if the fastener is adjusted after cure. When thread locking compounds are applied after assembly, a wicking grade adhesive shall be chosen for application. Thread locking adhesive shall not be used when another substance in the joint (e.g. anti-seize, lubricating coatings) will interfere with or prevent the thread locking adhesive from curing properly.

Unless otherwise specified on the engineering drawing, the exceptions found in IS-001 shall be observed.

3.7.3 Connector Jam Nut Retention

Panel-mounted jam nut connectors that do not include a locking feature should have thread locking adhesive applied to the mating threads. When applicable, the EMI/EMC requirements of Section 3.10.1 for jam nut connectors shall be met.

3.7.4 Use of Anti-Seize Compounds

Anti-seize compound shall not be used unless specified on the approved engineering drawing. It shall not be used on cable connector, cover, or access panel fasteners if the assembly was designed to meet lightning or EMP requirements, unless otherwise specified. Anti-seize compound shall not be used in conjunction with thread locking compounds (see Section 3.7.1) or self-locking patch fasteners unless otherwise specified on the drawing/EBOM.

3.7.5 Exceptions

3.7.5.1 Common Exceptions

The locking feature requirements of Section 3.7 do not apply to the exceptions listed in IS-001. The responsible mechanical design engineer may decide whether or not to include a locking feature in these situations.

3.8 CONVERSION OF TORQUE UNITS

All torque values and limits found in this specification may be converted to alternate units, as needed (in-lbs to in-ozs or in-lbs to ft-lbs, for example). The conversion factors listed in Table 2 are provided for convenience in making the conversions. When converting from one set of torque units to another, the torque value shall first be multiplied by the applicable conversion factor before rounding.

Table 2: Conversion factors for different torque units.

Torque unit		Times conversion factor*	Equals torque unit	
Inch-Pounds	(in-lbs)	16	Inch-Ounces	(in-ozs)
Foot-Pounds	(ft-lbs)	192	Inch-Ounces	(in-ozs)
Foot-Pounds	(ft-lbs)	12	Inch-Pounds	(in-lbs)
Foot-Pounds	(ft-lbs)	1.356	Newton-Meters	(N·m)
Newton-Meters	(N·m)	141.6	Inch-Ounces	(in-ozs)
Newton-Meters	(N·m)	8.851	Inch-Pounds	(in-lbs)
Inch-Ounces	(in-ozs)	7.062	Newton-Millimeters	(N·mm)

* Note: To convert from the units on the right to the units on the left, *divide* by the conversion factor.

3.9 TORQUE REQUIREMENTS FOR COMMON HARDWARE

This section provides torque requirements for threaded hardware of all types, except for connectors and connector backshells listed separately in Section 3.10. The requirements of this section apply when these requirements are not otherwise defined in engineering drawings or specifications. Hardware that is modified or otherwise dimensionally different (e.g. reduced diameter unthreaded shank) than common hardware may need the responsible design engineer to determine if hardware is unique and to provide an alternate torque value on the applicable engineering drawing.

3.9.1 Assembly Sequence for Multi-Fastener Joints

Threaded hardware in a multi-fastener joint shall be tightened in a sequence that provides even junction clamping using the fasteners that can be tightened sequentially. This sequence may be circular, star, spiral or other noted sequences that maximize an even compression on the joint.

3.9.2 Inch Series Fasteners

Standard inch series fasteners shall be tightened to the applicable torque values listed in Table 3 through Table 5. The provided torque values may require a correction factor (see Section 3.5.2.1).

3.9.3 Metric Series Fasteners

Standard metric series fasteners shall be tightened to the applicable torque values listed in Table 6 and Table 7. The provided torque values may require a correction factor (see Section 3.5.2.1).

3.9.4 Spiralock® Threads (Inch and Metric)

Unless otherwise specified, standard inch and metric series fasteners used with Spiralock® female threads shall be tightened to the applicable torque values listed in Table 8 through Table 11. If no applicable torque value is provided, a correction factor of 1.2 may be used in conjunction with a value found in Table 3 through Table 7 for the same thread material/size. See Section 3.5.2.1 for direction on using torque correction factors.

3.9.5 Inch Series Set Screws

Inch series set screws shall be tightened to the applicable torque values listed in Table 12. The provided torque values may require a correction factor (see Section 3.5.2.1).

3.9.6 Self-Sealing Screws

Self-sealing screws with elastomeric o-rings shall be tightened to the applicable torque values given in Table 13. The provided torque values may require a correction factor (see Section 3.5.2.1). Ensure the o-ring is seated correctly prior to applying torque.

Table 3: Inch series stainless steel fastener torque values [see Section 3.9.2].

Column No.:	I*	II	III*
Thread Material:	300-Series Stainless Steel (30 ksi Minimum Yield Strength)	Other Stainless Steel	A286 Heat and Corr. Resistant Steel (95 ksi Minimum Yield Strength)
Bolt Size	Install	Install	Install
#0 80 UNF	8 **in-ozs**	8 **in-ozs**	26 **in-ozs**
#1 64 UNC	14	13	2.9 **in-lbs**
72 UNF	16	18	3.1
#2 56 UNC	22	2.6 **in-lbs**	4.6
64 UNF	26	3.2	5.0
#3 48 UNC	38	4.0	7.5
56 UNF	42	4.6	8.2
#4 40 UNC	3.1 **in-lbs**	5.5	9.9
48 UNF	3.5	6.9	11.2
#6 32 UNC	6.0	10.1	18.9
40 UNF	6.9	12.7	21.8
#8 32 UNC	10.7	20.7	34
36 UNF	11.4	23.0	36
#10 24 UNC	15.5	24	49
32 UNF	18.4	30	54
1/4 20 UNC	37	79	116
28 UNF	44	99	138
5/16 18 UNC	78	138	246
24 UNF	89	147	280
3/8 16 UNC	137	247	432
24 UNF	160	271	506
7/16 14 UNC	216	393	685
20 UNF	249	418	787
1/2 13 UNC	336	542	89 **ft-lbs**
20 UNF	390	565	103
9/16 12 UNC	494	713	130
18 UNF	566	787	149
5/8 11 UNC	671	97 **ft-lbs**	177
18 UNF	783	108	207
3/4 10 UNC	100 **ft-lbs**	132	316
16 UNF	114	130	362
7/8 9 UNC	162	203	512
14 UNF	183	202	578
1 8 UNC	243	300	768
12 UNF	271	271	858

* Values in columns I and III were calculated using BOLTCALC software assuming a nut factor of K=0.2 and a target preload equivalent to 90% of material minimum yield strength when combined stress effects of tension and torsion were considered in the calculations.

Table 4: Inch series carbon and alloy steel fastener torque values [see Section 3.9.2].

Column No.:	I	II
Thread Material:	Low Carbon Steel	Alloy Steel
Bolt Size	Install	Install
#0 80 UNF	8 **in-ozs**	–
#1 64 UNC	13	37 **in-ozs**
72 UNF	18	38
#2 56 UNC	35	3.7 **in-lbs**
64 UNF	43	4.1
#3 48 UNC	3.5 **in-lbs**	5.7
56 UNF	4.0	6.1
#4 40 UNC	4.7	8.0
48 UNF	5.9	8.8
#6 32 UNC	8.7	15.2
40 UNF	10.9	16.8
#8 32 UNC	17.8	27
36 UNF	19.8	29
#10 24 UNC	21	40
32 UNF	30	46
1/4 20 UNC	65	96
28 UNF	90	109
5/16 18 UNC	129	196
24 UNF	139	216
3/8 16 UNC	212	350
24 UNF	232	400
7/16 14 UNC	338	560
20 UNF	361	625
1/2 13 UNC	465	850
20 UNF	487	960
9/16 12 UNC	613	103 **ft-lbs**
18 UNF	668	113
5/8 11 UNC	83 **ft-lbs**	142
18 UNF	95	158
3/4 10 UNC	105	250
16 UNF	103	279
7/8 9 UNC	160	400
14 UNF	159	450
1 8 UNC	236	600
12 UNF	214	679

Table 5: Torque values for inch series fasteners made from other materials [see Section 3.9.2].

Column No.:	I	II	III
Thread Material:	Brass	Aluminum*	Nylon
Bolt Size	Install	Install	Install
#0 80 UNF	–	–	–
#1 64 UNC	11 **in-ozs**	10 **in-ozs**	1.9 **in-ozs**
72 UNF	13	14	2.2
#2 56 UNC	32	22	5.8
64 UNF	40	27	8.0
#3 48 UNC	3.2 **in-lbs**	34	10
56 UNF	3.6	38	10
#4 40 UNC	4.3	2.9 **in-lbs**	13
48 UNF	5.4	3.6	16
#6 32 UNC	7.9	5.3	24
40 UNF	9.9	6.6	32
#8 32 UNC	18.8	10.8	3.5 **in-lbs**
36 UNF	18.0	12.0	4.0
#10 24 UNC	18.6	13.8	4.0
32 UNF	25.9	19.2	5.0
1/4 20 UNC	62	46	12.0
28 UNF	77	57	13.5
5/16 18 UNC	107	80	21
24 UNF	116	86	23
3/8 16 UNC	192	143	30
24 UNF	212	157	32
7/16 14 UNC	317	228	51
20 UNF	327	242	51
1/2 13 UNC	422	313	55
20 UNF	433	328	60
9/16 12 UNC	558	413	60
18 UNF	615	456	86
5/8 11 UNC	76 **ft-lbs**	715	84
18 UNF	85	798	120
3/4 10 UNC	104	980	160
16 UNF	102	958	210
7/8 9 UNC	159	125 **ft-lbs**	250
14 UNF	158	124	340
1 8 UNC	235	184	390
12 UNF	212	166	510

* Aluminum bolts may require the application of an anti-seize compound to prevent thread seizing. These values are for the dry condition. See anti-seize requirements and torque correction factor in Sections 3.7.4 and 3.5.2.1, respectively.

Table 6: Metric series stainless steel fastener torque values [see Section 3.9.3].

Column No.:	I*	II*
Thread Material:	300-Series Stainless Steel (30 ksi Minimum Yield Strength)	A286 Heat and Corr. Resistant Steel (95 ksi Minimum Yield Strength)
Bolt Size × Pitch	Install	Install
M1 × 0.25	2.0 **in-ozs**	6.2 **in-ozs**
M1 × 0.2	2.1	7.2
M1.1 × 0.25	2.5	8.8
M1.1 × 0.2	3.0	10.0
M1.2 × 0.2	4.0	14
M1.4 × 0.3	5.7	19
M1.4 × 0.2	7.1	23
M1.6 × 0.35	8.4	28
M1.6 × 0.2	10.8	37
M1.8 × 0.35	13	2.7 **in-lbs**
M1.8 × 0.2	16	3.4
M2 × 0.4	18	3.7
M2 × 0.25	22	4.6
M2.2 × 0.45	23	4.7
M2.2 × 0.25	29	6.1
M2.5 × 0.45	37	7.8
M2.5 × 0.35	41	8.7
M3 × 0.5	4.1 **in-lbs**	13.7
M3 × 0.35	4.7	15.7
M3.5 × 0.6	6.3	21
M3.5 × 0.35	7.6	26
M4 × 0.7	9.4	32
M4 × 0.5	10.7	36
M4.5 × 0.75	13.6	46
M4.5 × 0.5	15.8	53
M5 × 0.8	18.6	63
M5 × 0.5	21.9	74
M5.5 × 0.5	30	100
M6 × 1	32	108
M6 × 0.75	36	121
M7 × 1	55	184
M7 × 0.75	60	202
M8 × 1.25	78	262
M8 × 1	85	285
M9 × 1.25	117	421
M10 × 1.5	155	521
M10 × 1.25	166	558

Column No.:	**I***	**II***
Thread Material:	**300-Series Stainless Steel (30 ksi Minimum Yield Strength)**	**A286 Heat and Corr. Resistant Steel (95 ksi Minimum Yield Strength)**
Bolt Size × Pitch	**Install**	**Install**
M11 × 1.5	221	764
M12 × 1.75	268	75 **ft-lbs**
M12 × 1.25	300	84
M14 × 2	429	120
M14 × 1.5	471	132
M16 × 2	672	189
M16 × 1.5	728	205
M18 × 2.5	78 **ft-lbs**	258
M18 × 1.5	90	298
M20 × 2.5	109	367
M20 × 1.5	124	417
M22 × 2.5	152	504
M22 × 1.5	171	565
M24 × 3	186	628
M24 × 2	207	699
M27 × 3	283	930
M27 × 2	311	1,020

* Values in columns I and II were calculated using BOLTCALC software assuming a nut factor of K=0.2 and a target preload equivalent to 90% of material minimum yield strength when combined stress effects of tension and torsion were considered in the calculations.

Table 7: Metric carbon and alloy steel fastener torque values [see Section 3.9.3].

Column No.:	**I***	**II***	**III***
Thread Material:	**Class 4.6**	**Class 4.8**	**Class 5.8**
Bolt Size × Pitch	**Install**	**Install**	**Install**
M1.6 × 0.35	–	13 **in-ozs**	–
M2 × 0.4	–	27	–
M2.5 × 0.45	–	55	–
M3 × 0.5	–	99	–
M3.5 × 0.6	–	10.0 **in-lbs**	–
M4 × 0.7	–	14.0	–
M5 × 0.8	21 **in-lbs**	29	36 **in-lbs**
M6 × 1	35	50	61
M8 × 1.25	88	120	144
M10 × 1.5	180	240	288
M12 × 1.75	300	420	516
M14 × 2	480	660	816
M16 × 2	756	86 **ft-lbs**	105 **ft-lbs**
M20 × 2.5	122 **ft-lbs**	–	206
M24 × 3	212	–	356
M30 × 3.5	418	–	–
M36 × 4	733	–	–

* Torque values were calculated assuming a target preload of 75% of the proof load values listed in Table 5 of ASTM specification F 568-87 for Method No. 1 (length measurement) and a nut factor of K = 0.2. The listed material classes are as defined in ISO 898-1 and ASTM F568M.

Table 7 (continued): Metric carbon and alloy steel fastener torque values [see Section 3.9.3].

Column No.:	IV*	V*	VI*
Thread Material:	Class 8.8	Class 9.8	Class 10.9
Bolt Size × Pitch	Install	Install	Install
M1.6 × 0.35	–	28 **in-ozs**	–
M2 × 0.4	–	3.6 **in-lbs**	–
M2.5 × 0.45	–	7.3	–
M3 × 0.5	–	13.0	–
M3.5 × 0.6	–	21	–
M4 × 0.7	–	30	–
M5 × 0.8	–	61	79 **in-lbs**
M6 × 1	–	104	133
M8 × 1.25	–	252	324
M10 × 1.5	–	504	636
M12 × 1.75	–	876	93 **ft-lbs**
M14 × 2	–	116 **ft-lbs**	148
M16 × 2	167 **ft-lbs**	181	230
M20 × 2.5	325	–	448
M24 × 3	563	–	779
M30 × 3.5	1,120	–	1,549
M36 × 4	1,955	–	2,703

* Torque values were calculated assuming a target preload of 75% of the proof load values listed in Table 5 of ASTM specification F 568-87 for Method No. 1 (length measurement) and a nut factor of K = 0.2. The listed material classes are as defined in ISO 898-1 and ASTM F568M.

Table 8: Inch series stainless steel Spiralock® thread torque values [see Section 3.9.4].

Column No.:	I*	II*	III*
Thread Material:	300-Series Stainless Steel (30 ksi Minimum Yield Strength)	Other Stainless Steel	A286 Heat and Corr. Resistant Steel (95 ksi Minimum Yield Strength)
Bolt Size	Install	Install	Install
#0 80 UNF	10 **in-ozs**	10 **in-ozs**	31 **in-ozs**
#1 64 UNC	17	15	3.4 **in-lbs**
72 UNF	19	21	3.7
#2 56 UNC	28	3.1 **in-lbs**	5.5
64 UNF	30	3.8	5.9
#3 48 UNC	2.8 **in-lbs**	4.8	8.9
56 UNF	3.1	5.5	9.8
#4 40 UNC	3.8	6.6	11.9
48 UNF	4.2	8.3	13.4
#6 32 UNC	7.2	12.1	23
40 UNF	8.3	15.2	26
#8 32 UNC	12.8	25	41
36 UNF	13.7	28	43
#10 24 UNC	18.6	29	59
32 UNF	22.0	36	65
1/4 20 UNC	44	95	139
28 UNF	52	119	165
5/16 18 UNC	93	166	295
24 UNF	106	176	336
3/8 16 UNC	164	296	519
24 UNF	192	325	607
7/16 14 UNC	260	472	822
20 UNF	298	502	945
1/2 13 UNC	403	650	106 **ft-lbs**
20 UNF	469	678	124
9/16 12 UNC	592	856	156
18 UNF	679	944	179
5/8 11 UNC	805	116 **ft-lbs**	212
18 UNF	940	130	248
3/4 10 UNC	120 **ft-lbs**	158	379
16 UNF	137	156	434
7/8 9 UNC	194	243	615
14 UNF	219	242	694
1 8 UNC	291	360	921
12 UNF	325	325	1030

* Values in columns I, II, and III were calculated by multiplying the corresponding values in Table 3 by a correction factor of 1.2 to account for the effects of the unique Spiralock® thread form.

Table 9: Inch series carbon and alloy steel Spiralock® thread torque values [see Section 3.9.4].

Column No.:	I*	II*	III*
Thread Material:	Grade 2 Low Carbon Steel (55 ksi Proof Load Stress)	Grade 5 Carbon Steel (85 ksi Proof Load Stress)	Grade 8 Medium Carbon or Alloy Steel (120 ksi Proof Load Stress)
Bolt Size	Install	Install	Install
#0 80 UNF	16 **in-ozs**	25 **in-ozs**	36 **in-ozs**
#2 56 UNC	3.0 **in-lbs**	4.7 **in-lbs**	6.6 **in-lbs**
64 UNF	3.2	5.0	7.0
#3 48 UNC	4.6	7.1	10.0
56 UNF	4.9	7.6	10.8
#4 40 UNC	6.4	10.0	14.0
48 UNF	7.0	10.9	15.5
#6 32 UNC	11.9	18.4	26
40 UNF	13.3	20.5	29
#8 32 UNC	22	34	48
36 UNF	23	36	50
#10 24 UNC	32	49	69
32 UNF	36	56	79
1/4 20 UNC	76	117	165
28 UNF	87	134	188
5/16 18 UNC	156	240	336
24 UNF	174	264	378
3/8 16 UNC	276	426	600
24 UNF	312	480	678
7/16 14 UNC	438	678	81 **ft-lbs**
20 UNF	492	762	90
1/2 13 UNC	678	87 **ft-lbs**	123
20 UNF	756	98	138
9/16 12 UNC	81 **ft-lbs**	125	177
18 UNF	90	140	197
5/8 11 UNC	112	173	244
18 UNF	127	196	276
3/4 10 UNC	199	307	433
16 UNF	222	342	483
7/8 9 UNC	320	494	698
14 UNF	352	545	769
1 8 UNC	479	740	1045
12 UNF	524	810	1144

* Values in columns I, II, and III were adapted from torque values published by Spiralock Corporation. The original values were calculated assuming a tensile load equivalent to 75% of the fastener's proof load and a nut factor of K = 0.2 (dry). The Spiralock® thread form factored into the calculations. The listed material grades are as defined in SAE J995.

Table 10: Metric series stainless steel Spiralock® thread torque values [see Section 3.9.4].

Column No.:	**I***	**II***
Thread Material:	**300-Series Stainless Steel (30 ksi Minimum Yield Strength)**	**A286 Heat and Corr. Resistant Steel (95 ksi Minimum Yield Strength)**
Bolt Size × Pitch	**Install**	**Install**
M1 × 0.25	2.4 **in-ozs**	7.5 **in-ozs**
M1 × 0.2	2.6	8.7
M1.1 × 0.25	3.1	11
M1.1 × 0.2	3.6	12
M1.2 × 0.2	4.8	16
M1.4 × 0.3	6.8	23
M1.4 × 0.2	8.5	28
M1.6 × 0.35	10	33
M1.6 × 0.2	13	44
M1.8 × 0.35	16	3.2 **in-lbs**
M1.8 × 0.2	20	4.1
M2 × 0.4	21	4.4
M2 × 0.25	26	5.5
M2.2 × 0.45	27	5.6
M2.2 × 0.25	35	7.3
M2.5 × 0.45	2.8 **in-lbs**	9.4
M2.5 × 0.35	3.1	10.5
M3 × 0.5	4.9	16.4
M3 × 0.35	5.6	18.8
M3.5 × 0.6	7.5	25
M3.5 × 0.35	9.1	31
M4 × 0.7	11.2	38
M4 × 0.5	12.9	43
M4.5 × 0.75	16.3	55
M4.5 × 0.5	19.0	64
M5 × 0.8	22	75
M5 × 0.5	26	88
M5.5 × 0.5	36	120
M6 × 1	39	130
M6 × 0.75	43	146
M7 × 1	66	221
M7 × 0.75	72	243
M8 × 1.25	93	314
M8 × 1	102	342
M9 × 1.25	141	506
M10 × 1.5	186	626
M10 × 1.25	199	669

Column No.:	I*	II*
Thread Material:	300-Series Stainless Steel (30 ksi Minimum Yield Strength)	A286 Heat and Corr. Resistant Steel (95 ksi Minimum Yield Strength)
Bolt Size × Pitch	Install	Install
M11 × 1.5	265	917
M12 × 1.75	322	90 **ft-lbs**
M12 × 1.25	359	101
M14 × 2	514	144
M14 × 1.5	565	159
M16 × 2	806	226
M16 × 1.5	874	246
M18 × 2.5	94 **ft-lbs**	309
M18 × 1.5	108	357
M20 × 2.5	131	441
M20 × 1.5	149	500
M22 × 2.5	183	605
M22 × 1.5	205	678
M24 × 3	224	754
M24 × 2	249	838
M27 × 3	340	1115
M27 × 2	373	1224

* Values in columns I and II were calculated by multiplying the corresponding values in Table 6 by a correction factor of 1.2 to account for the effects of the unique Spiralock® thread form.

Table 11: Metric carbon and alloy steel Spiralock® thread torque values [see Section 3.9.4].

Column No.:	I*	II*	III*
Thread Material:	**Class 9.8 (650 MPa Proof Load Stress)**	**Class 10.9 (830 MPa Proof Load Stress)**	**Class 12.9 (970 MPa Proof Load Stress)**
Bolt Size × Pitch	**Install**	**Install**	**Install**
M2.5 × 0.45	8.4 **in-lbs**	11.1 **in-lbs**	12.8 **in-lbs**
M3 × 0.5	15.0	19.5	22
M3.5 × 0.6	23	30	35
M4 × 0.7	35	44	52
M4.5 × 0.75	51	65	76
M5 × 0.8	70	90	105
M6 × 1	119	153	179
M7 × 1	200	256	299
M8 × 1.25	291	371	434
M8 × 1	311	397	464
M9 × 1.25	430	549	641
M10 × 1.5	575	735	858
M10 × 1.25	607	775	907
M12 × 1.75	83 **ft-lbs**	107 **ft-lbs**	125 **ft-lbs**
M12 × 1.25	91	117	136
M14 × 2	133	170	200
M14 × 1.5	144	184	215
M16 × 2	207	265	309
M16 × 1.5	221	282	330
M18 × 2.5	287	366	427
M18 × 1.5	322	411	481
M20 × 2.5	405	517	604
M20 × 1.5	449	573	670
M22 × 2.5	552	705	823
M22 × 1.5	601	767	896
M24 × 3	700	894	1,044
M27 × 3	1,026	1,310	1,531

* Values in columns I, II, and III were adapted from torque values published by Spiralock Corporation. The original values were calculated assuming a tensile load equivalent to 75% of the fastener's proof load and a nut factor of K = 0.2 (dry). The Spiralock® thread form factored into the calculations. The listed material classes are as defined in ISO 898-2 and ASTM A563M.

Table 12: Inch series set screw torque values [see Section 3.9.5].

Column No.:	I	II
Thread Material:	**Stainless Steel Set Screw**	**Alloy Steel Set Screw**
Bolt Size	**Install**	**Install**
#0 80 UNF	–	–
#1 64 UNC	19 **in-ozs**	24 **in-ozs**
72 UNF	19	24
#2 56 UNC	19	24
64 UNF	19	24
#3 48 UNC	4.0 **in-lbs**	5.0 **in-lbs**
56 UNF	4.0	5.0
#4 40 UNC	4.0	5.0
48 UNF	4.0	5.0
#6 32 UNC	7.0	9.0
40 UNF	7.0	9.0
#8 32 UNC	16.0	20
36 UNF	16.0	20
#10 24 UNC	26	33
32 UNF	26	33
1/4 20 UNC	70	87
28 UNF	70	87
5/16 18 UNC	132	165
24 UNF	132	165
3/8 16 UNC	230	290
24 UNF	230	290
7/16 14 UNC	340	430
20 UNF	340	430
1/2 13 UNC	500	620
20 UNF	500	620
9/16 12 UNC	500	620
18 UNF	500	620
5/8 11 UNC	980	102 **ft-lbs**
18 UNF	980	102
3/4 10 UNC	142 **ft-lbs**	177
16 UNF	142	177
7/8 9 UNC	333	417
14 UNF	333	417
1 8 UNC	467	583
12 UNF	467	583

Table 13: Inch series self-sealing screw torque values [see Section 3.9.6].

Column No.:	I
Thread Material:	**18-8 Stainless Steel Self-Sealing Screw with Silicone Rubber O-Ring**
Bolt Size	**Install**
#0 80 UNF	–
#1 64 UNC	–
72 UNF	–
#2 56 UNC	2.5 **in-lbs**
64 UNF	3.0
#3 48 UNC	3.9
56 UNF	4.4
#4 40 UNC	5.2
48 UNF	6.6
#6 32 UNC	9.6
40 UNF	12.1
#8 32 UNC	19.8
36 UNF	22.0
#10 24 UNC	23
32 UNF	32
1/4 20 UNC	75
28 UNF	94
5/16 18 UNC	132
24 UNF	142
3/8 16 UNC	236
24 UNF	259
7/16 14 UNC	376
20 UNF	400
1/2 13 UNC	517
20 UNF	541
9/16 12 UNC	682
18 UNF	752
5/8 11 UNC	93 **ft-lbs**
18 UNF	104
3/4 10 UNC	128
16 UNF	124
7/8 9 UNC	194
14 UNF	193
1 8 UNC	–
12 UNF	–

3.9.7 Stud-Mounted Components

Torque values for stud-mounted components shall be as given in Table 14. The provided torque values may require a correction factor (see Section 3.5.2.1).

Table 14: Stud-mounted component torque values.

Stud Size	Install
#2	29 **in-ozs**
#4	3.0 **in-lbs**
#6	5.3
#8	8.0
#10	12.5
1/4	21.0
5/16	55
3/8	85
1/2	200

3.9.8 Single-Thread Engaging Spring Nuts

When single-thread engaging spring nuts are to be used, the torque values in Table 15 shall apply. The provided torque values may require a correction factor (see Section 3.5.2.1).

Table 15: Single-thread spring nut torque values (in-lbs).

Screw Type:	Machine Screws	Tapping Screws
Bolt Size	**Install**	**Install**
#6	5.5	12.0
#8	7.5	19.0
#10	13.0	34
1/4	33	53

3.9.9 Terminal Board (Barrier Strip) Fasteners

Torque values for machine screws used on terminal boards shall be as shown in Table 16. The provided torque values may require a correction factor (see Section 3.5.2.1).

Table 16: Terminal board fastener torque values (in-lbs).

Screw Size	Install
#5	6.0
#6	7.5
#8	15.0
#10	22.0

Screw Size	Install
1/4	55

3.9.10 Self-Tapping Screws

Self-tapping screws shall be installed using the torque values given in Table 17. The *inspect* torque is 75% of the listed *install* value. The provided torque values may require a correction factor (see Section 3.5.2.1).

Table 17: Install torque values for self-tapping screws.

Sheet Material:	Aluminum		Steel		Plastic		
Screw Size (Max. DIA)	T < 1D	T ≥ 1D	T < 1D	T ≥ 1D	T ≤ 1½D	1½D < T < 2½D	T ≥ 2½D
#6 (Ø.138)	3.5 **in-lbs**	4.0 **in-lbs**	5.5 **in-lbs**	7.5 **in-lbs**	16 **in-ozs**	19 **in-ozs**	24 **in-ozs**
#8 (Ø.164)	5	6	12.0	15.5	24	32	50
#10 (Ø.190)	6	8	15	18	3.5 **in-lbs**	4.1 **in-lbs**	4.7 **in-lbs**
1/4 (Ø.250)	24	32	48	63	8	10	12

T = Sheet Material Thickness
D = Screw Maximum Diameter

3.9.11 Segmented Card Retainers ("Wedgelok" Type)

Torque values for segmented card retainers (commonly called "wedgeloks") shall be as given in Table 18. In all cases, the listed torque values apply to the actuator screw.

Table 18: Segmented card retainer ("wedgelok") torque values (in-lbs unless otherwise specified).

L3Harris Part Number	Brand	Series Name	Install
40008490-ALL	Birtcher	Wedge-Lok® Series 44-5	16
40014111-ALL	Birtcher	Wedge-Lok® Series 48-5	4
40013070-ALL	Calmark	"Card-Lok" Series 265 (no locking element)	6
		"Card-Lok" Series 265 (with locking element)	8
40015234-000	Wakefield-Vette	"C" Style Shock and vibration resistant	20
7175619-ALL	Birtcher	Wedge-Lok® Series 42	7.2
7175620-ALL	Birtcher	Wedge-Lok® Series 42-5	7.2
7182542-ALL	Birtcher	Wedge-Lok® Series 40-5	7.2
7183517-ALL	Fairchild	Wedg-Tite® 53S Series (torque limiter ratchet)	Until clicks
7185732-000, -001	Calmark	"Card-Lok" Series 230 (no locking element)	6
		"Card-Lok" Series 230 (with locking element)	8
7185732-002 through -005, -007	Calmark	"Card-Lok" Series 260 (no locking element)	6
		"Card-Lok" Series 260 (with locking element)	8

L3Harris Part Number	Brand	Series Name	Install
7185732-006	Calmark	“Card-Lok” custom design	6
7918940-ALL	Calmark	“Card-Lok” Series 225 (no locking element)	6
		“Card-Lok” Series 225 (with locking element)	8
1000383575	Wavetherm	“SolidWedge” Jumbo	15 +/- 1
1000437750	Wakefield-Vette	“C” Style Shock and vibration resistant	6
1000437750	Shroff/Nvent	Wedge-Lok® Series 40-5 (similar to Birtcher)	7

3.9.12 Threaded Pipe/Hose Fittings and Adapters

Threaded pipe/hose fittings and adapters shall use the torque/tightening values per this section. Ensure that the fitting/adapter torque or tightening values are compatible with the any special installation instructions or lubricant recommendations provided by the fitting manufacturer.

3.9.12.1 Threaded Pipe/Hose Fitting Torque Requirement Order of Precedence

In the event of a conflict between the text of this document and the torque/tightening values provided by the threaded fitting manufacturer, the manufacturer’s requirements shall take precedence, unless exceptions are made on the engineering drawing.

3.9.12.2 Torque/Retention Requirement Exceptions

The torque/retention requirements found in this specification apply to threaded pipe/hose fittings and adapters, with the following exceptions:

- The torque application steps in Section 3.5.1 do not apply to any threaded connections that are tightened to a certain number of turns (or portions of a turn) rather than a single torque value.
- The correction factors listed in Section 3.5.2.1 do not apply.
- Locking features per Section 3.7 are not required.
- Thread locking compounds (see Section 3.7.2) or other friction-modifying compounds shall not be used unless specified by the fitting manufacturer or the drawing.
- Anti-seize compound (see Section 3.7.4) shall not be used unless specified by the fitting manufacturer or the drawing.

3.9.12.3 Use of Reference Marks

Fittings and adapters tightened to a specified number of turns (or portions of a turn) may use reference marks to mark the nut position relative to the body. When the joint is tightened, a secondary mark may be used. The marks serve as a check that there is an offset from the starting position, indicating that tightening has occurred. The second mark may also act as a reference for the tightened position if the joint must be loosened and reassembled for any reason.

Figure 1: Typical Reference Mark on nut and Tube Body

3.9.12.4 Parallel (Straight) Thread Ports

This section applies to the installation of metal port end assemblies with the following type of threads:

- SAE straight threads (SAE J1926)

This type of fitting shall be installed using torque values given in Table 19. The *inspect* torque is 75% of the listed value. To calculate torque values for fittings made from materials other than steel, a correction factor is provided below the table.

Table 19: Steel straight thread port end assembly *install* torque values.

Column No.:		I*		II*		III*	
SAE Dash Size	Thread Size (UN/UNF)	Non-Adjustable		Adjustable		Plugs	
		O-Ring Face Seal (ORFS)	37° Flare, 24° Flareless Bite	O-Ring Face Seal (ORFS)	37° Flare, 24° Flareless Bite	Hollow Hex	Hex Head
2	5/16-24	–	85 **in-lbs**	–	60 **in-lbs**	30 **in-lbs**	85 **in-lbs**
3	3/8-24	–	155	–	100	55	155
4	7/16-20	310 **in-lbs**	260	180 **in-lbs**	180	120	260
5	1/2-20	360	280	360	250	170	280
6	9/16-18	420	350	420	350	410	350
8	3/4-16	720	620	720	620	720	620
10	7/8-14	100 **ft-lbs**	85 **ft-lbs**	100 **ft-lbs**	85 **ft-lbs**	100 **ft-lbs**	85 **ft-lbs**
12	1 1/16-12	135	135	135	135	135	135
14	1 3/16-12	175	175	175	175	175	175
16	1 5/16-12	200	200	200	200	200	200
20	1 5/8-12	250	250	250	250	250	250
24	1 7/8-12	305	305	305	305	305	305
32	2 1/2-12	375	375	375	375	375	375

* Values in the table are for steel fittings in steel ports. For stainless steel fittings, multiply the listed torque values by a correction factor of 1.05. For fittings made from brass, aluminum, or other soft metals, use a correction factor of 0.65. Lubricate the threads before assembly per the manufacturer's recommendations.

3.9.12.5 Tapered Thread Ports

This section applies to the installation of metal port end assemblies with the following types of threads:

- NPT – American Standard Taper Pipe Thread (ANSI B1.20.1)
- NPTF – Dryseal American Standard Taper Pipe Thread (SAE J476, ANSI B1.20.3)
- BSPT or JIS "PT" – British Standard Pipe, Tapered (BS21, JIS B 0203, ISO 7)
    - Also known as "R" for male and "Rc" for female

Tapered threaded connectors shall be tightened to the applicable number of turns from finger tight (T.F.F.T.), specified in Table 20.

Table 20: *Install* T.F.F.T. values for steel, stainless steel, and brass tapered pipe fittings.

Tapered Pipe Thread Size		T.F.F.T.
BSPT	**NPTF**	
1/8-28	1/8-27	2 - 3
1/4-19	1/4-18	2 - 3
3/8-19	3/8-18	2 - 3
1/2-14	1/2-14	2 - 3
3/4-14	3/4-14	2 - 3
1-11	1-11 1/2	1.5 - 2.5
1 1/4-11	1 1/4-11 1/2	1.5 - 2.5
1 1/2-11	1 1/2-11 1/2	1.5 - 2.5
2-11	2-11 1/2	1.5 - 2.5

3.9.12.6 O-Ring Face Seal (ORFS) Fittings

This section applies to the installation of the following type of threaded metal fittings:

- ORFS – O-Ring Face Seal fittings (SAE J1453)

These fittings shall be installed per the manufacturer's recommendations and using the torque values given in Table 21.

Table 21: Torque values for installing O-Ring Face Seal (ORFS) fittings.

				Column No.:	**I**	**II**	**III**
O.D.		**SAE Dash Size**	**Tube Side Thread Size (UN/UNF)**	**Zinc-Plated Steel**	**Stainless Steel, Monel**	**Brass, Aluminum, Other Soft Metals**	
(in)	**(mm)**			**Install**	**Install**	**Install**	
1/4	6	-4	9/16-18	220 **in-lbs**	231 **in-lbs**	143 **in-lbs**	
3/8	8, 10	-6	11/16-16	360	378	234	
1/2	12	-8	13/16-16	480	504	312	
5/8	14, 15, 16	-10	1-14	720	756	468	
3/4	18, 20	-12	1 3/16-12	85 **ft-lbs**	89 **ft-lbs**	663	

Column No.:				I	II	III
O.D.		SAE Dash Size	Tube Side Thread Size (UN/UNF)	Zinc-Plated Steel	Stainless Steel, Monel	Brass, Aluminum, Other Soft Metals
(in)	(mm)			Install	Install	Install
1	22, 25	-16	1 7/16-12	110	116	858
1 1/4	28, 30, 32	-20	1 11/16-12	150	158	98 **ft-lbs**
1 1/2	35, 38	-24	2-12	230	242	150
2	50	-32	2 1/2-12	375	394	244

3.9.12.7 37° Flare Fittings

This section applies to the installation of the following type of threaded metal fittings:

- JIC 37° Flare Fittings (SAE J514/ISO 8434-2)

These fittings are tightened to a specific number of flats from wrench resistance (F.F.W.R.), specified in Table 22.

Table 22: *Install* F.F.W.R. values for 37° flare fittings.

Column No.:		I	II
SAE Dash Size	Thread Size	Tube Connection F.F.W.R.	Swivel Nut or Hose Connection F.F.W.R.
-2	5/16-24	Torque to 35 in-lbs*	Torque to 35 in-lbs*
-3	3/8-24	Torque to 65 in-lbs*	Torque to 65 in-lbs*
-4	7/16-20	2 1/2	2
-5	1/2-20	2	2
-6	9/16-18	2	1 1/2
-8	3/4-16	2	1 1/2
-10	7/8-14	1 1/2	1 1/2
-12	1 1/16-12	1 1/2	1 1/4
-14	1 3/16-12	1 1/2	1 1/4
-16	1 5/16-12	1 1/2	1
-20	1 5/8-12	1	1
-24	1 7/8-12	1	1
-32	2 1/2-12	1	1
-40	3-12	1	1

* No F.F.W.R. values are available for the indicated sizes. For steel and stainless steel fittings, torque to the value specified. For brass and aluminum fittings, multiply the listed torque value by a correction factor of 0.65.

3.9.12.8 Bulkhead Locknut Assembly

- ORFS (SAE J1453), Bulkhead locknut
- JIC 37° Flare Fittings (SAE J514), bulkhead locknut
- 24° Flareless Fittings, Bite Type (SAE J514), bulkhead locknut

This section applies to various types of panel-mounted bulkhead fittings used to pass tube or hose through a panel. The locknuts on these types of fittings shall be installed using the torque values listed in Table 23.

Table 23: Bulkhead locknut assembly torque values.

Column No.:	I	II
Thread Size (UN/UNF)	O-Ring Face Seal (ORFS) Type Bulkhead Fittings	37° Flare and 24° Flareless Bite Type Bulkhead Fittings
	Install	Install
3/8-24	–	100 **in-lbs**
7/16-20	–	155
1/2-18	–	250
9/16-18	180 **in-lbs**	300
11/16-16	300	–
3/4-16	–	600
13/16-16	660	–
7/8-14	–	85 **ft-lbs**
1-14	85 **ft-lbs**	–
1 1/16-12	–	135
1 3/16-12	135	170
1 5/16-12	170	200
1 7/16-12	200	–
1 5/8-12	–	245
1 11/16-12	145	–
1 7/8-12	–	270
2-12	270	–
2 1/2-12	–	310

3.9.12.9 Pipe Swivel Assembly (NPSM)

- NPSM (SAE J514)

NPSM pipe swivel assemblies connect with a male NPT/NPTF pipe thread with a 30° machined seat per SAE J514. These assemblies are tightened against the mating threads to a specific number of flats from

finger tight (F/F.F.T.), specified in Table 24.

Table 24: F.F.F.T. values for NPSM pipe swivel assemblies.

NPSM Size (in)	F.F.F.T.
1/8	1.0 - 1.5
1/4	1.0 - 1.5
3/8	1.0 - 1.5
1/2	1.0 - 1.5
3/4	2.0 - 2.5
1	2.0 - 2.5
1 1/4	2.0 - 2.5
1 1/2	2.0 - 2.5
2	2.0 - 2.5

3.9.13 Gasketed Joint Fastener Torque

This section applies to bolted joints that include a gasket of any type in the stackup. If the joint includes mechanical hard-stops, the standard torque values found in this specification shall apply unless otherwise specified. When mechanical hard-stops are not included, the hardware torque values shall be determined by the responsible mechanical design engineer and specified on the approved engineering drawing. The installation torques required to achieve vendor-recommended flat gasket pressures are often much higher than the standard torque values found herein. When the gasketed joint includes more than one fastener within the junction, the conditions within Section 3.9.1, the "Assembly Sequence for Multi-Fastener Joints" section will apply.

Some examples of gasket types that may be used without mechanical hard-stops:

- EMI/RFI flat gaskets
  - Wire mesh type
  - Electrically conductive elastomeric shielding gaskets per MIL-DTL-83528
- Thermal gap pads (i.e. thermal interface material)
- Form-in-place (FIP)/cure-in-place (CIP) gaskets

3.9.14 Adjustment Screws and Tuning Hardware

In some instances, threaded hardware is used for tuning or adjustment and is not intended to be tightened completely. This hardware may include waveguide tuning screws, hardware used in antenna tensioning belts, belt tensioner assemblies, and adjustment screws that are tightened only until acceptable EMI performance of the component or device is achieved. This type of hardware does not have a torque applied or tightened after the final tuning has been performed. Threaded hardware items that belong in this category should be clearly identified on the approved engineering drawing and the build documentation.

3.9.15 Stud/Turret Terminals

Threaded PCB-mounted stud and turret terminals shall be installed using the torque values listed in Table

25.

Table 25: PCB-mounted stud and turret terminal torque values (in-lbs unless otherwise specified).

L3Harris Part Number	Item Being Tightened	Install
AA59126/109H02	6-32 screw into brass threads	6.3*
M55155/095H04	Brass nut on 4-40 stud threads	3.4*
M55155/10-02	6-32 screw into brass threads	6.3*
M55155/195H01	4-40 screw into brass threads	3.4*
M55155/219H01	Brass nut on 4-40 stud threads	3.4*
MS17172-6	Nut on 4-40 brass stud threads	4.3
SE095E02	Brass nut on 6-32 stud threads	6.3*
SE095E03	Brass nut on 4-40 stud threads	3.4*
SE095E04	Brass nut on 4-40 stud threads	3.4*
SE095E05	Brass nut on 4-40 stud threads	3.4*
SE096E02	Brass nut on 6-32 stud threads	6.3*
SE099E02	Brass nut on 6-32 stud threads	6.3*
SE099E04	Brass nut on 4-40 stud threads	3.4*
7905627-ALL	Nut on 2-56 brass stud threads	24 in-ozs

* The indicated install torque was calculated by applying a correction factor of 0.8 (for the PCB material, per Table 1) to the corresponding brass torque value found in Table 5, Column I.

3.9.16 Panel-Mounted Hardware

Indicator lights, toggle switches, rotating switches, potentiometers, and other panel-mounted components shall be tightened to the torque values listed in this section. Components that are not listed require that torque values be determined on an individual basis and listed on the engineering drawing or added to this specification, if the component is determined to be common, per Section 3.3. It is recommended that the applicable component vendor be consulted regarding the installation torque for new components; It is incorrect to determine torque values based on thread size and material alone. The provided torque values may require a correction factor (see Section 3.5.2.1). Note that panel-mounted jam nut connectors are covered in Section 3.10.

Note: When all dash numbers for a particular component use the same mounting torque value, the suffix "-ALL" is used after the base part number. Any necessary clarification of what the listed torque value applies to is indicated in the "item being tightened" column.

3.9.16.1 Connectors

See Section 3.10 for all connector torque requirements.

3.9.16.2 Switches and Dials

Panel-mounted switches and dials shall be installed using the torque values listed in Table 26.

Table 26: Panel-mounted switch/dial torque values (in-lbs unless otherwise specified).

L3Harris Part Number	Item Being Tightened	Install
M8805/99-026, -011	–	13.5
M8805/110-3XXX, -6XXX	–	Finger tight
MS21027-A331	Jam nut	12.5
MS21346-221, -231, -E221	Jam nut	12.5
MS21347-221, -231, -331, -E221	Jam nut	12.5
MS24523-22, -26	–	12.5
MS24524-22	–	25
MS24525-27	–	25
MS25089-3GR	–	16.5
MS25308-222	Mounting hardware	15
	Terminal hardware	3
MS27408-1A	–	12.5
MS35059-23	–	25
2842934-000	–	3
40007274-ALL	–	11
40009159-002	–	16.5
40009252-000	–	12.5
40010777-ALL	–	13.2
40010975-000, -001	–	13.2
40010978-ALL	–	13.2
40011902-001	–	11
7181237-000	–	8
7184595-000	–	5
7184698-000	–	15
7185452-000	–	42
7186928-005	–	24 in-ozs
7187221-000	–	2.2
7190041-000, -001	–	9
7190417-000, -010	–	16.5
7190528-ALL	–	8
7191581-000 through -003, -006, -007	–	15
7192007-000	–	16.5

3.9.16.3 Circuit Breakers

Panel-mounted circuit breakers shall be installed using the torque values listed in Table 27.

Table 27: Panel-mounted circuit breaker torque values (in-lbs unless otherwise specified).

L3Harris Part Number	Item Being Tightened	Install
M39019/01-ALL	–	23
M39019/03-ALL	–	23
M39019/05-ALL	–	23
M55629/1 (all options)	10-32 terminal hex nut	18.4
M55629/5 (all options)	10-32 terminal hex nut	18.4
M55629/20 (all options)	Panel-mounting jam nut	25
	8-32 terminal screw	10.7
M55629/22 (all options)	Panel-mounting jam nut	25
	8-32 terminal screw	10.7
MS22073-15	–	40
40009928-000, -001	½-32 hex nut	30
	6-32 mounting screw	7
	10-32 stud terminal hex nuts	13.5
40011521-000	–	25
40013012-ALL	6-32 mounting screws	7
	1/2-32 mounting bushing	33
45001111-ALL	6-32 mounting screws	7
	1/2-32 mounting bushing	33
7184590-000, -001, -003, -005	–	17.5
7187224-ALL	–	15
7185010-000	6-32 terminal screw	7

3.9.16.4 Light Emitting Diodes (LEDs) and Other Indicator Lights

Panel-mounted LEDs and other indicator lights shall be installed using the torque values listed in Table 28.

Table 28: Panel-mounted LED/indicator light torque values (in-lbs unless otherwise specified).

L3Harris Part Number	Item Being Tightened	Install
MS25331-ALL	Jam nut	40
	Dimmer cap	Finger tight
JTXM19500/52104	–	2.5
2842260-ALL	–	16.5
2842424-001	–	2.7
2842517-001	–	2.7
2842522-001	–	2.7
40006157-ALL	Jam nut	2.7

L3Harris Part Number	Item Being Tightened	Install
40009289-ALL	–	15
40009795-000	–	6
40011019-000	–	12
40012566-000	–	20
40015374-000	Jam nut	12
7181260-ALL	–	16.5
1000189524	Panel-mount jam nut	5.7 in-ozs.
1000188602	Panel-mount jam nut	5.7 in-ozs.
1000188647	Panel-mount jam nut	5.7 in-ozs.

3.9.16.5 Adapters and Couplers

Panel-mounted adapters and couplers shall be installed using the torque values listed in Table 29.

Table 29: Panel-mounted adapter and coupler torque values (in-lbs unless otherwise specified).

L3Harris Part Number	Item Being Tightened	Install
M55339/13-00492	–	35
M55339/28-30001	–	39
1000406048	Panel-mounting jam nut	4
40007840-000	Panel-mounting jam nut	22
40009999-006	Panel-mounting jam nut	8
40010718-001	10-32 panel-mount jam nut	4
40010748-ALL	Adapter threaded directly into tapped aluminum	8
40011387-000	–	8
40011525-000	Panel-mounting jam nut	17.5
40012265-000	Panel-mounting jam nut	32
40012347-000	–	8
40014029-000	Panel-mounting jam nut	17.5
7183400-000	–	38
7183515-004, -005	–	30
7183515-021, -023	–	40
7183660-000	–	9
7186179-007	–	11
7187131-000	–	8.5
7190729-ALL	Adapter threaded directly into tapped aluminum	8
7192551-000, -001	–	170
8119	–	16.5
953-122-5003	–	48

3.9.16.6 Filters

Panel-mounted filters shall be installed using the torque values listed in Table 30.

Table 30: Panel-mounted filter torque values (in-lbs unless otherwise specified).

L3Harris Part Number	Item Being Tightened	Install
M15733/38-0006	–	3
M15733/39-0014	–	3
M15733/49-ALL	–	2.8
M15733/61-004	Jam nut	4
M28861/01-011	–	3
1000405601	Jam nut	4
7184058-000	–	4
7184058-001	–	6
7185289-000	8-32 nut	15.5
	¾-20 nut	130
7185702-000	–	4
7910622-000	–	3.5
7918315-ALL	–	7

3.9.17 Other Miscellaneous Threaded Items

Installation torque values for many other miscellaneous threaded items have been captured in Table 31.

Table 31: Torque values for other miscellaneous threaded items (in-lbs unless otherwise specified).

L3Harris Part Number	Description	Item Being Tightened	Install
LH89/1	Lens Holder	–	12.5
M3933/25-64N, -64S, -88N	RF Attenuator	–	8.5
MS18014-1	Pressure Equalizing Valve	–	30
MS25036-156	Insulated Crimping Terminal	–	8.9
MS91528-1N2B	Control Knob	4-40 set screw	4
2214903-002	Electrical Box Connector	Die cast zinc locknut (3/4-14 NPTS Threads)	Finger Tight + ¼ Turn with tool
2280455-000	Banana Jack Insulated Solder Terminal	Jam nut	3
40008387-000	Time Meter	Jam nut	65
40008387-004	Time Meter	Jam nut	93
40008388-001	Time Meter	Jam nut	25
40008389-002	Time Meter	Jam nut	65

L3Harris Part Number	Description	Item Being Tightened	Install
40008624-ALL	Ferrite Inductor	Mounting screw (not included)	3
40008657-000	Flanged DC-DC Converter	2X #2 mounting screws	8 in-ozs
40008658-000	Flanged EMI Filter Module	2X #2 mounting screws	8 in-ozs
40008706-All	AC to DC Power Supply	Wire terminal clamp screws	12
40011756-ALL	Floor-Mounted EMI Filter	Terminal and ground studs	5.3
40011995-000	Fan Guard Installation Kit	4-40 Nylon locknut	13
40012951-000	Terminal Strip	Wire terminal clamp screws	12
40013998-000	Calibrated Variable Attenuator	Panel-mounting jam nut	16.5
40015061-000	Flange-Mounted Capacitor	Mounting screw (not included)	30
60070832-000	Altered Item Shoulder Screw	–	11.5
7184594-000	Right Angle DIP Switch	Mounting nut	5
7186354-001	AC to DC Power Supply	Wire terminal clamp screws	4
7187082-001	General-Purpose Filter	Nuts on studs	9
7190162-000	Desiccant Container	Hex nut on plug assembly	38
7190177-000	Knurled Aluminum Knob	Set screws	7
7191055-004 & -005	Electrical Box Breather Vent	-005 backing nut	10
7191289-000	Ground Stud	–	23
7192020-000	Relay Socket	Wire terminal clamp screws	7.3
7910131-001	Captive Screw Assembly	–	18.5
7910131-002	Captive Screw Assembly	–	21
1000212541	Rotary Switch	Jam nut	13.5
1000429590	Breather Vent	Breather Vent	5.4-10.6

3.9.18 Fastener Part Number / Torque Table Cross-Reference

Many common fasteners and other threaded hardware are contained in this specification; while some are not listed explicitly by part number, they may have a value present in this document. For convenience in looking up torque values of less common items, a cross reference is provided in Table 46 within Appendix A. This table is a cross-reference that maps both Military style and L3 part numbers to the applicable document sections and torque tables based on the hardware type and material.

3.10 TORQUE REQUIREMENTS FOR CONNECTORS

This section provides torque requirements for connectors, connector components, accessories and backshells when these requirements are not otherwise defined in engineering drawings, specifications, quality documentation, or workmanship standards. See Section 3.7 for applicable locking feature requirements.

3.10.1 Connector EMI/EMC Requirements

When required for EMI/EMC, specification 60037425 shall be observed for cleaning and preparing panel-

mounted jam nut connectors and flange mount connectors.

3.10.1.1 Jam Nut Connectors

Specification 60037425 requires a milliohm resistance verification after tightening a connector jam nut. The requirements of Section 3.7.3 apply when thread locking compound is used with panel-mounted jam nut connectors. The final milliohm resistance check is performed after thread locking compound is fully cured.

3.10.1.2 Flange Mount Connectors

The torque value for hardware that secures flange mount connectors using a flat EMI gasket in the joint shall be determined by the responsible mechanical design engineer and specified on the approved engineering drawing, if a mechanical hard-stop is not provided (See Section 3.9.13). This type of gasket may be a single-use item that should be replaced if the joint is ever disassembled. Fasteners are typically tightened in two stages to compress the gasket evenly, using a sequence described in Section 3.9.1.

Notes: The use of flange mount connectors is discouraged by Signal Integrity. When their use is required or unavoidable, metal gaskets similar to Av-DEC® gasket p/n 40013747-XXX should be used.

The installation torques required to achieve vendor-recommended EMI gasket pressures are often much higher than the standard torque values found herein and typically require the use of high-strength fasteners (e.g. A286 CRES or similar).

3.10.2 Common Connector Torque Exceptions

Some connectors and accessories do not require application of a specific installation torque. Such items shall be identified on the engineering drawing. Unless otherwise specified, connector dust caps do not require a torque and are to be hand-tightened only until the cap sealing surfaces are compressed against the face of the connector and there is no perceptible play between the threads.

3.10.3 Radio Frequency (RF) Connectors

Unless otherwise specified, RF connectors shall be tightened to the torque values given in Table 32. The "coupling torque" values listed in the table are to be used when mating two RF connectors together. The "jam nut torque" values apply to the jam nut on panel-mounted or bulkhead-mounted RF connectors. RF connector jam nuts typically require additional locking provisions per Section 3.7.3. A supplementary locking feature, however, is not required for coupled RF connections that are threaded (SMA-to-SMA, for example). See Section 3.7.5.1.

Note: Some RF connectors are barrel type by design (no hex head) and will require a special holding strap wrench or grips to accomplish the specified coupling torque.

Table 32: RF connector torque values (in-lbs unless otherwise specified).

Connector Type / Material	Plug Type / Nut Size	Thread Size	Coupling Torque	Jam Nut Torque
			Install	Install
Type N	Ø.825 knurl	.625-24 UNEF-2	13.5	–
Type N Brass	.75 hex	.625-24 UNEF-2	–	38
Type N St-St	.75 hex	.625-24 UNEF-2	–	43

Connector Type / Material	Plug Type / Nut Size	Thread Size	Coupling Torque	Jam Nut Torque
			Install	Install
TNC (OST)	Ø.65 max knurl	.4375-28 UNEF-2	13.5	–
TNC (OST) Brass	.562 hex	.4375-28 UNEF-2	–	25
TNC (OST) St-St	.625 hex	.500-28 UNEF-2	–	25
BNC	Ø.65 max knurl	.4375-28 UNEF-2	13.5	–
BNC Brass	.562 hex	.4375-28 UNEF-2	–	25
BNC St-St	.625 hex	.500-28 UNEF-2	–	25
ZMA	Ø.65 max knurl	.4375-28 UNEF-2	13.5	–
ZMA Brass	.562 hex	.4375-28 UNEF-2	–	25
ZMA St-St	.625 hex	.500-28 UNEF-2	–	25
SMA Brass	.312 hex	.250-36 UNS-2	4	11
SMA (OSM) Steel	.312 hex	.250-36 UNS-2	8.5	16.5
SMA (OSM) and OSP	.375 hex	.312-32 UNS-2	–	19
SMA (OSM)	.437 hex	.375-40 UNEF-2 SMA	–	16.5
Type K Brass	.312 hex	.250-36 UNS-2	4	11
Type K Steel	.312 hex	.250-36 UNS-2	8.5	16.5
Type K	.375 hex	.312-32 UNS-2	–	19
Type K	.437 hex	.375-40 UNEF-2	–	16.5
2.9 mm Brass	.312 hex	.250-36 UNS-2	4	16.5
2.9 mm Steel	.312 hex	.250-36 UNS-2	8.5	16.5
2.9 mm	.375 hex	.312-32 UNS-2	–	19
2.9 mm	.437 hex	.375-40 UNEF-2	–	16.5
SSMA (OSSM)	.250 hex	.190-36 UNS-2	4	11
SSMA (OSSM)	.312 hex	.250-36 UNS-2	–	16.5
OSMM	.187 hex	.138-40 UNF-2	2.8	4
SMC	.234 hex	.190-32 UNF-2	2.5	–
SMC	.250 hex	.190-32 UNF-2	–	4
SMC Brass	.375 hex	.312-32 UNEF-2	–	8.4
OS 2.4 (OS-50)	.312 hex	M7.0 X 0.75-6g	8.5	–
OS-50P	.218 hex	.190-36 UNS-2	–	11
OSSP	.250 hex Plug	.190-36 UNS-2	–	11
OSSP	.312 hex Jack	.250-36 UNF-2	–	16.5
OSP	.437 hex	.375-32 UNEF-2 OSP	–	16.5

3.10.4 Circular MIL Connectors

L3Harris part numbers for circular MIL connectors include those listed in Table 33. These torque values were derived using SAE AIR6151B as a basis. This table may be used to cross-reference the part number with the applicable connector MIL-spec and series, to determine the applicable torque value in the following Table. Circular MIL connectors and connector backshells shall be tightened to the appropriate torque values given in Table 34. Many connectors of this type do not require a coupling torque, as explained in Section 3.10.4.1.

3.10.4.1 Coupling Torque

When applicable, the coupling torque values listed in Table 34 shall be used when mating two compatible circular MIL connectors. A coupling torque value of "N/A" indicates that the connectors from the corresponding series do not require a specific coupling torque to fully mate the connectors. These types of connectors are designed to mate without tools and are hand-tightened only.

3.10.4.2 Backshell Torque Values

Backshells shall be installed using the applicable torque values found in this section.

3.10.4.2.1 Torque Values for Single-Stage Backshells

The following torque values shall be used for single-stage connector backshells:

1. Torque values provided in Table 34.

3.10.4.2.2 Torque Values for Multi-Stage Non-Environmental Backshells

The following torque values shall be used for multi-stage non-environmental connector backshells:

1. Torque values provided in Table 34.
2. For backshells that use a style 2 reducer refer to paragraph 3.10.15.
3. For backshells that use a cable clamp, refer to paragraph 3.10.16.

3.10.4.2.3 Torque Values for Multi-Stage Environmental Backshells

The following torque values shall be used for multi-stage environmental connector backshells:

1. Torque values are listed in Table 34 for the connector type and size, with the appropriate backshell.
2. For style 2 backshells that use a reducer refer to paragraph 3.10.15.
3. For backshells that use a cable clamp, refer to paragraph 3.10.16.

3.10.4.2.4 Torque Values for Angled Backshells

The following torque values shall be used for angled connector backshells:

1. Torque values are listed in Table 34 for the connector type and size, with the appropriate backshell.
2. For style 2 backshells that use a reducer refer to paragraph 3.10.15.
3. For backshells that use a cable clamp, refer to paragraph 3.10.16

3.10.4.2.5 Torque Value Exceptions

Hexashield type adapters and those otherwise stated in the design documentation are exempt from a torque value requirement.

Table 33: L3Harris part numbers for circular MIL connectors (not all-inclusive, reference only).

MIL-DTL-38999			MIL-DTL-26482 Series I, Integral Backshell	MIL-DTL-26482 Series II, MIL-DTL-83723 Series II	MIL-DTL-28840	SAE AS50151 (MIL-DTL-5015) 3100 Series	MIL-C-81511	MIL-DTL-26500, MIL-DTL-83723 Series III	MIL-DTL-22992	SAE AS50151 (MIL-DTL-5015) 3400 Series
Series I	Series II	Series III, Series IV								
Row I	*Row II*	*Row III*	*Row IV*	*Row V*	*Row VI*	*Row VII*	*Row VIII*	*Row IX*	*Row X*	*Row XI*
MS27466	MS27472	D38999/20	MS3110	MS3470	M28840/10	MS3100	MIL-C-81511/X	MS24264	MS90555	MS3400
MS27467	MS27473	D38999/21	MS3111	MS3471	M28840/11	MS3101		MS24265	MS90556	MS3401
MS27468	MS27474	D38999/22	MS3112	MS3472	M28840/12	MS3102		MS24266	MS90557	MS3402
MS27469	MS27475	D38999/23	MS3114	MS3474	M28840/14	MS3103		MS27613	MS90558	MS3404
MS27470	MS27476	D38999/24	MS3115	MS3475	M28840/16	MS3106		MS27614	MS17343	MS3406
MS27471	MS27477	D38999/25	MS3116	MS3476	M28840/17	MS3108		MS27615	MS17344	MS3408
MS27496	MS27478	D38999/26	MS3119	M83723/17	M28840/18	40009064		M83723/71	MS17345	MS3409
MS27505	MS27479	D38999/27	MS3122	M83723/18	M28840/19	7192161		M83723/73	MS17346	MS3412
MS27515	MS27480	D38999/29	MS3124	M83723/19	M28840/20			M83723/75	MS17347	MS3436
MS27652	MS27481	D38999/30	MS3126	M83723/20	M28840/21			M83723/76	MS18062	MS3441
MS27653	MS27484	D38999/31		M83723/21	M28840/26			M83723/77	MS17348	MS3450
MS27654	MS27497	D38999/34		M83723/22	M28840/28			M83723/78	MS18062	MS3451
MS27656	MS27499	D38999/35		M83723/23	M28840/29			M83723/82		MS3452
MS27661	MS27500	D38999/40		M83723/24				M83723/83		MS3454
MS27662	MS27504	D38999/41						M83723/84		MS3456
	MS27508	D38999/42						M83723/85		
	MS27513	D38999/43						M83723/86		
		D38999/44						M83723/87		
		D38999/45						M83723/95		
		D38999/46						M83723/96		
		D38999/47								
		D38999/48								
		D38999/49								
		D38999/50								
		40008509								
		40008695								
		40008841								
		40008868								

Table 34: Circular MIL connector torque values (in-lbs with +/- 5 in-lbs tolerance).

Row No.	MIL Spec.	Shell Size	Adapter Torque	Jam Nut Torque	Coupling Torque*
			Install	Install	Install
I	MIL-DTL-38999 Series I	9	71	33	N/A
		11	80	43	N/A
		13	120	58	N/A
		15	120	73	N/A
		17	144	83	N/A
		19	144	93	N/A
		21	180	105	N/A
		23	180	115	N/A
		25	180	125	N/A
II	MIL-DTL-38999 Series II	8	35	48	N/A
		10	35	58	N/A
		12	40	73	N/A
		14	40	83	N/A
		16	40	93	N/A
		18	40	105	N/A
		20	80	115	N/A
		22	80	125	N/A
		24	80	145	N/A
III	MIL-DTL-38999 Series III, Series IV	A (9)	56	33	N/A
		B (11)	76	43	N/A
		C (13)	108	58	N/A
		D (15)	116	73	N/A
		E (17)	116	83	N/A
		F (19)	116	93	N/A
		G (21)	136	105	N/A
		H (23)	136	115	N/A
		J (25)	136	125	N/A
IV	MIL-DTL-26482 Series I, Integral Backshell	8	20	N/A	N/A
		10	25	N/A	N/A
		12	30	N/A	N/A
		14	30	N/A	N/A
		16	30	N/A	N/A
		18	30	N/A	N/A
		20	35	N/A	N/A
		22	35	N/A	N/A
		24	35	N/A	N/A
V	MIL-DTL-26482 Series II, MIL-DTL-83723	8	56	29	N/A
		10	76	33	N/A
		12	108	48	N/A

Row No.	MIL Spec.	Shell Size	Adapter Torque	Jam Nut Torque	Coupling Torque*
			Install	Install	Install
	Series II	14	116	58	N/A
		16	116	73	N/A
		18	116	83	N/A
		20	136	93	N/A
		22	136	105	N/A
		24	136	115	N/A
VI	**MIL-DTL-28840**	A (11)	76	48	12
		B (13)	108	58	16
		C (15)	116	78	20
		D (17)	116	83	24
		E (19)	116	105	28
		F (23)	136	115	36
		G (25)	136	125	40
VII	**SAE AS50151 (MIL-DTL-5015) 3100 Series**	8	35	23	8
		10	35	29	12
		12	40	37	16
		14	40	48	20
		16	40	58	24
		18	40	73	28
		20	80	83	32
		22	80	93	36
		24	80	105	36
		28	120	125	40
		32	120	155	40
		36	120	175	40
VIII	**MIL-C-81511**	8	35	–	N/A
		10	35	–	N/A
		12	40	–	N/A
		14	40	–	N/A
		16	40	–	N/A
		18	40	–	N/A
		20	80	–	N/A
		22	80	–	N/A
		24	80	–	N/A
IX	**MIL-DTL-26500, MIL-DTL-83723 Series III**	8 / 9	35	33	N/A
		10 / 11	35	35	N/A
		12 / 13	40	53	N/A
		14 / 15	40	58	N/A
		16 / 17	40	73	N/A

Row No.	MIL Spec.	Shell Size	Adapter Torque	Jam Nut Torque	Coupling Torque*
			Install	Install	Install
		18 / 19	40	83	N/A
		20 / 21	80	93	N/A
		22 / 23	80	105	N/A
		24 / 25	80	115	N/A
X	MIL-DTL-22992	8	56	–	8
		10	76	–	12
		12	108	58	16
		14	116	–	20
		16	116	–	24
		18	116	83	28
		20	136	–	32
		22	136	–	36
		24	136	–	36
		28	148	–	40
XI	SAE AS50151 (MIL-DTL-5015) 3400 Series	8	56	27	10
		10	76	31	12
		12	108	37	14
		14	116	48	18
		16	116	57	21
		18	116	73	24
		20	136	83	36
		22	136	93	41
		24	136	105	49
		28	148	125	59
		32	148	155	70
		36	148	175	83

* A value of "N/A" in the "Coupling Torque" column indicates that the connector series does not require a specific coupling torque to fully mate the connectors. These are to be coupled per the guidelines given in Section 3.10.4.1.

3.10.5 Glenair® Mighty Mouse Connectors

A sample of L3Harris part numbers that consist of a single series of Glenair® Mighty Mouse connectors are listed in Table 35. This table can be used to cross-reference the part number with the applicable 80X series number. Other unlisted L3Harris part numbers may have multiple series within the base part number and are not present on the reference Table.

This type of connector shall be tightened using the appropriate torque values listed in Table 36.

The coupling torque values in Table 37 shall be used for mating 802 connectors only. No specified coupling torque is required to properly mate Series 801, 803, 804, 805, and 807.

Note: Series 807 is an internal custom line of connectors. Each connector in this series may be based on either Series 801 or 804; the torque should be chosen accordingly.

Table 35: Sample L3Harris part numbers for Mighty Mouse connectors (not all-inclusive).

Series 801	Series 802	Series 803	Series 804	Series 805	Series 807
40006585 45001065 40006359 45001066 40007625	–	40006612 40006684	40006352 40007126 40006357 40010936 40006629	40010350 40011559 40010630 40011631 40011382 40015251 40011554	40006352 40006357 40007126 40007163

Table 36: Mighty Mouse connector torque values (in-lbs).

Shell Size Series 801, 802, 803, 804, 807	Shell Size Series 805	Adapter Torque	Secondary Torque	Jam Nut Torque
		Install	Install	Install
5	–	14	10	23
6	8	16	11	23
7	9	18	13	23
8	10	20	14	23
9	11	22	15	23
10	12, 13	24	17	28
12, 13	15	30	21	28
14, 16	18	30	21	28
15, 17	19, 21	30	21	28
19, 21	23	30	21	28

Table 37: Mighty Mouse Series 802 coupling torque values (in-lbs).

Shell Size Series 802	Coupling Torque
	Install
5	18
6	20
7	22
8	24
9	26
10	28
12, 13	34
14, 16	40
15, 17	42
19, 21	50

3.10.6 Glenair® D-Sub EMI Backshell (Glenair® 550-003; L3Harris P/N 7192151)

This section applies to L3Harris base part number 7192151, a Glenair® 550-003 D-sub EMI backshell. Unlike most other D-sub backshells, this particular backshell has three torque requirements, as shown in Table 38 and Figure 2. All three torque values listed for each dash number shall be used for tightening this type of connector backshell.

Table 38: Glenair® D-sub EMI backshell torque values (in-lbs).

Dash No.	Shell Size	"A" Thread		"B" Thread		"C" Thread	
		Thread Size	Install	Thread Size	Install	Thread Size	Install
-001	3	7/8-20	48	7/8-20	48	3/4-20	37
-002	4	7/8-20	48	7/8-20	48	7/8-20	48
-003							
-004	6	1 1/8-18	73	–	–	1 1/8-18	73

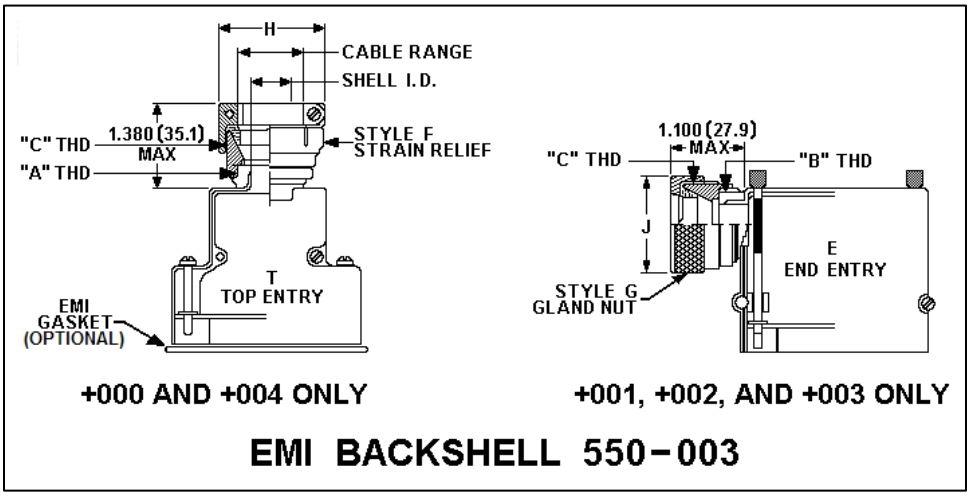

Figure 2: Diagram of the Glenair® D-sub EMI backshell

3.10.7 Raychem® Connectors

The jam nuts used to mount Raychem® connectors shall be tightened to a torque value of 15.0 in-lbs.

3.10.8 LEMO® Connectors

The mounting nut on LEMO® type connectors shall be tightened to the applicable torque value found in Table 39. L3Harris base part numbers for this connector type include 40012301 and 40012304. L3Harris base part number 40012290 connectors have MIL-DTL-38999 Series III and Series IV shell side adapter threads listed below; While they have this style threads, the connectors have differing strength threshholds than their military counterparts. The adapters are tightened to the torque values for the corresponding shell code per Table 34, Row III.

Table 39: LEMO® connector mounting nut torque values (in-lbs unless otherwise specified).

M-Series and FM-Series Connector Size	FM-Series Shell Size Code (MIL-DTL-38999, Series III, IV)*	F-Series Connector Size	Install
–	–	FF	2.2
0M	–	0F	8.9

M-Series and FM-Series Connector Size	FM-Series Shell Size Code (MIL-DTL-38999, Series III, IV)*	F-Series Connector Size	Install
1M	A	1F	13.3
2M	B	2F	17.7
3M	C	3F	22
TM	D	–	35
4M	E	4F	44
LM	F	LF	55
5M	G	5F	71

* The adapter torque values given in Section 3.10.4.2, Table 34, Row III may be different than the values presented here.

3.10.9 ODU® Mini-Snap Type Connectors (L3Harris P/N 40009751)

This section applies to L3Harris base part number 40009751, a miniature cylindrical connector with push-pull locking (series L, K, and B). The back nut on this connector shall be tightened to the applicable torque value found in Table 40.

Table 40: ODU® Mini-Snap connector back nut torque values (in-lbs).

Connector Series Size	Install
00	4.4
0	5.3
1	8.9
2	17.7
3	31
4	35

3.10.10 Thor® Connectors

Table 41 lists cable assemblies that include connectors from Thor Electronics®. These connectors shall be tightened to the applicable torque values listed in Table 41.

Table 41: Thor® connector torque values (in-lbs).

L3Harris Part Number	Item Being Tightened	Install
40008161-ALL	Item 1 (J2 and J3) connector jam nut	20
40008328-ALL	Item 1 (P1) connector coupling torque	8
40008332-ALL	Item 1 or 4 (J1) connector jam nut	18
40008333-000	Item 1 (J8) connector jam nut	18
40009087-000	Connector coupling torque	14
40009408-004	Connector coupling torque	10

3.10.11 Fiber Optic Connectors

TFOCA-I® and TFOCA-II® Amphenol fiber optic connectors shall be tightened to the applicable torque values listed in Table 42.

Table 42: TFOCA-I/-II® fiber optic connector torque values (in-lbs).

Connector Size	Coupling Torque	Jam Nut Torque
	Install	Install
4-channel	30	100
12-channel		
24-channel		
72-channel		

3.10.12 MIL-Spec Jackposts and Mating Jackscrews

This section applies to the MIL-spec hardware used with microminiature D (MDM) connectors per MIL-DTL-83513 (connector part numbers M83513/01 through /04, and /06 through /09). When any combination of M83513/05 hardware is used, the jackposts and mating jackscrews shall be tightened to the applicable torque values listed in Table 43 and Table 44, respectively.

Table 43: M83513/05 jackpost mounting torque values (in-lbs unless otherwise specified).

MIL-Spec Part Number	Jackpost Thread Size	Metal Connector Shell	Plastic Connector Shell
		Install	Install
M83513/05-07	2(Ø.086)-56	3.5	2.5
M83513/05-17	4(Ø.112)-40	5.5	N/A

Table 44: M83513/05 jackscrew mating torque values (in-lbs unless otherwise specified).

MIL-Spec Part Number	Jackscrew Thread Size	Metal Connector Shell	Plastic Connector Shell
		Install	Install
M83513/05-02, -03, -05, -06	2(Ø.086)-56	28 in-ozs	22 in-ozs
M83513/05-12, -13, -15, -16	4(Ø.112)-40	4.3	N/A

3.10.13 Other Miscellaneous Connectors and Accessories

Torque values for other miscellaneous connectors and connector accessories are listed in Table 45.

Table 45: Torque values for miscellaneous connectors/accessories (in-lbs unless otherwise specified).

L3Harris Part Number	Description	Item Being Tightened	Install
M24308/26	4-40 Female Screwlock Assembly	Jackpost installation torque	5.5
		Mating jackscrew torque	4
M28840/14BB1P1	Jam Nut Connector Receptacle	Panel-mounting jam nut	110
M28840/14BD1S1	Jam Nut Connector Receptacle	Panel-mounting jam nut	170
M28840/14BE1S1	Jam Nut Connector Receptacle	Panel-mounting jam nut	224
M28876/11C1S1	Fiber Optic Connector Receptacle	Cable jam nut	83
M39024/10-ALL	Insulated Test Point Jack	Panel-mounting jam nut	18
M39030/3-01S	SMA Coaxial Dummy Load	–	8.5
M55116/4-4	Miniature Audio Plug Connector	Adapter	50
		Hex nut	25
M55116/9-0	Miniature Audio Plug Connector	Brass coupling nut	40
		SS panel-mounting jam nut	83
M55116/10-0	Miniature Audio Plug Connector	Brass coupling nut	40
		SS panel-mounting jam nut	83
M83513/01, /02, /03, /04, /06, /07, /08, /09	MDM Connector	Jackposts and mating jackscrews	See Section 3.10.12
M85049/1712W03	Environmental Backshell Adapter	Adapter clamshell screws	4
M85049/49-2-10N	MIL-DTL-38999 Series I or II Backshell	Strain relief portion	35
1000377995	Nylon Cable Grip	Nylon jam nut	88.5
40006364-000	Round Connector Receptacle	–	23
40006364-001, -003, -005	Round Connector Receptacle	–	28
40006761-000 through -013	MDM Connector w/ EMI Gasket	Mounting jackposts	2.5
40006761-014, -015	MDM Connector w/ EMI Gasket	Mounting jackposts	4
40007176-000	Fiber Optic Cable Assembly	Jam nut	115
40007746-085	D-Sub Connector Backshell	Backshell	34
40008284-001	Microminiature Circular Connector	Backshell	35
40008844-016, -017	Micro-D Right Angle PCB Connector	Mounting jackposts	4
40009044-000	Custom Mounting Screw	Screw	1.8 **
40009408-002	Jam Nut Connector Receptacle	–	18
40009891-000	Fiber Optic Cable Assembly	Jam nut	28
		Glenair composite	35

L3Harris Part Number	Description	Item Being Tightened	Install
		backshell 450FS029XW16	
40010763-000	Fiber Optic Cable Assembly	Face nut	50
		Face nut screw	25
40010864-000	BNC Straight PCB Mount Jack	Panel-mounting jam nut	9
40010893-000	Panel-Mounted RJ45 Receptacle	Jam nut	58
40011496-000, -006	M55116/10 Type Connector w/ Backshell	Brass coupling nut	40
		SS panel-mounting jam nut	83
40011496-002	Round Audio Conn. w/ Backshell	–	45
40011496-004	Panel-mounted audio connector	Panel-mounting jam nut	70
40011904-000	Triax Board Mount Connector	Panel-mounting jam nut	38
40015169-ALL	PRO BEAM Sr. EB Connector	Panel-mounting jam nut	354
40015189-ALL	PRO BEAM Sr. EB Connector	Panel-mounting jam nut	354
7183591-ALL	Prewired Nanonics Connector	M1 mounting screws	2.5 in-ozs
7183836-ALL	TNC Dummy Load	–	13.5
7184114-ALL	Adapter, Micro-D Backshell	2-56 clamshell screws	2.3
7184525-000	Type TRS Twinax/Triax Plug Connector	–	2.5
7185102-000	TPS Type Subminiature Coax Plug	Cable entry hex nut	25
7185316-000	GFCI Duplex Power Receptacle	Terminal screws	13 +/- 1
7185688-001	Hubbell Cord Connector	NPT threads	Hand tight + 1/4 turn
7185865-001	Coaxial BNC Bulkhead Connector	–	38
7186878-000	Fiber Optic Cable Assy, M28876 to TO	Jam nut on FO connector	83
7187108-000	Power Cord Plug Connector	External screws	6
		Wire terminal clamp screw	6
7187108-001	Power Cord Plug Connector	4-40 stud with nut	3
7187139-001	Hermetic Jam Nut Mount Connector	–	83
7187400-000	Coaxial RF Dummy Load	–	4
7190133-000	Hermetic Jam Nut Receptacle	–	105
7190658-007, -008	Rectangular Dual Row Connector	Mounting jackscrews	8 in-ozs
7191202-ALL	Adapter, EMI/RFI Metal Hood	Cover screw	Hand tight
7192099-000	Round Audio Connector	–	57
7193177-000	Coaxial SMA Fixed Attenuator	–	9
7193240-007	RJ45 Environmental Connector	–	105

L3Harris Part Number	Description	Item Being Tightened	Install
7193240-026	RJ45 Environmental Connector	Jam nut	55
		Secondary torque	40
7910018-000	SMA-SMA Bulkhead Feedthrough	Jam nut	16.5
7910059-ALL	Solderless Banana Plug	Wire terminal clamp screw	3.2
7910653-ALL	BNC Coaxial Connector	–	38
7190658-ALL	Rectangular Dual Row Connector	M1 screw	6 in-ozs
7912162-001	TRB Series Twinax/Triax Connector	–	38
7912162-006	TRB Series Twinax/Triax Connector	–	28
7918487-ALL	MDM Connector	Mounting jackscrews	2.3

** This value supercedes any vendor torque value presented. Analysis has been performed to verify this torque with the preapplied thread lock compound. The vendor states a maximum of 2.0 in-lbs.

3.10.14 Strain Relief Clamps

For connectors that include a strain relief clamp, each fastener on the clamp shall be tightened until the corresponding split lock washer is completely flattened, as shown in Figure 3. Complete washer compression is the indicator that the appropriate torque has been achieved. Another locking feature, such as thread locking compound allowable by IS-001 (or other locking feature as designated on the drawing/EBOM), should be used in the joint. Deformation of the cable bundle is allowed, excluding pinched wires, insulation, and/or sleeving in the clamp assembly.

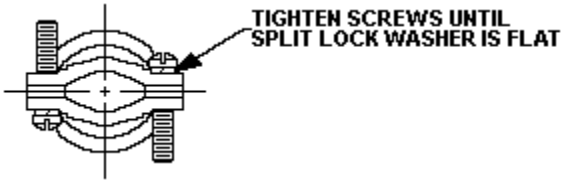

Figure 3: Diagram of a typical connector strain relief clamp

3.10.15 Style 2 Backshells with Reducers

Style 2 backshells are supplied with a reducer to attach the backshell to the connector; an example is shown in Figure 4. The smaller threads on the portion of the reducer that mates to the connector shall have the torque values provided in Table 34 applied. The larger threads on the portion of the reducer that mates to the backshell shall use the torque values for the larger thread size of the backshell interface, as shown in Table 46.

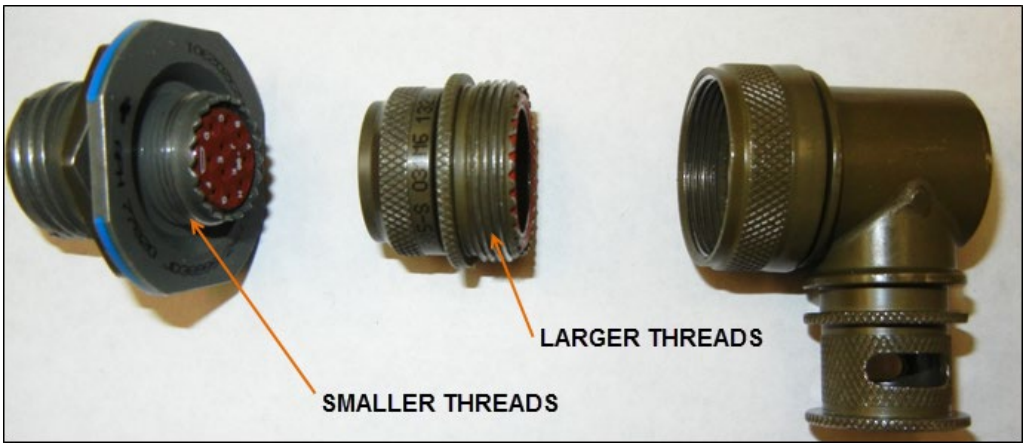

Figure 4: Style 2 Backshell and Reducer

Table 46: Torque values larger threads of Style 2 backshells (in-lbs with +/- 5 in-lbs tolerance).

Thread Size	Install
7/16-28	56
1/2-20	56
1/2-28	35
M12x1-6H	56
9/16-24	76
M15x1-6H	76
5/8-24	108
5/8-28	35
11/16-24	40
M18x1-6H	108
3/4-20	108
13/16-20	40
M22x1-6H	116
7/8-20	116
7/8-28	40
15/16-20	40
M25x1-6H	116
1-20	116
1-28	40
1 1/16-18	116
M28x1-6H	116
1 1/8-18	116
1 1/8-28	40
1 3/16-18	136
M31x1-6H	136
1 1/4-18	40
1 1/4-28	136
M34x1-6H	136
1 5/16-18	136
1 3/8-18	136
1 3/8-28	80
M37x1-6H	136
1 7/16-18	136
1 1/2-18	136
1 1/2-28	80
1 9/16-18	148
1 3/4-18	148
1 7/8-16	148
2-18	148
2 1/16-16	148
2 1/8-16	148
2 1/4-16	148
2 5/16-16	148
2 3/8-16	164
2 1/2-16	164
2 5/8-16	164
2 3/4-16	164

3-16	164
3 1/16-16	164

3.10.16 Backshells with AS Cable Clamp Assemblies

SAE AS50151 (MIL-DTL-5015) series connectors or other compatible connectors using accessories that include an AS85049/41 or AS85049/42 series cable clamp assembly shall have the connector mating portion of the backshell tightened to the torque values provided in Section 3.10, the clamp screws tightened per paragraph 3.10.14 and the cable clamp assembly threads tightened to the torque values provided in Table 47. Cable clamps that utilize elastomeric sealing grommets need adequate torque applied to assure proper cable sealing but not over tightened to the extent that the sealing grommet extrudes. EMI shielding terminated at conical metal ferrules shall be tightened to a minimum torque of 35 in-lbs.

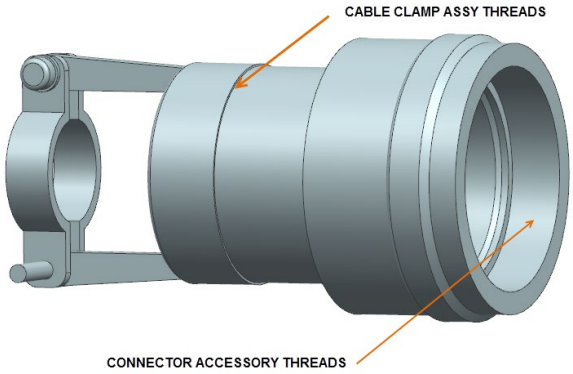

Figure 5: Backshell with AS cable clamp assembly

Table 47: Torque Values for Cable Clamp Assemblies (in-lbs with +/-5 in-lbs tolerance).

AS Clamp Size	AS85049/41 Dash No.	AS85049/42 Dash No.	Thread Size, Class 2B	Install
3	-3A		.500-20 UNEF	35
4	-4A	-4D	.625-24 UNEF	35
6	-6A	-6D	.750-20 UNEF	45
8	-8A	-8D	.875-20 UNEF	45
10	-10A	-10D	1.00-20 UNEF	45
12	-12A	-12D	1.1875-18 UNEF	50
16	-16A	-16D	1.4375-18 UNEF	50
20	-20A	-20D	1.750-18 UNS	50
24	-24A	-24D	2.00-18 UNS	90

28	-28A	-28D	2.250-16 UN	90
32	-32A	-32D	2.50-16 UN	90
40	-40A		3.00-15 UN	90

3.10.17 Virginia Panel Corporation® Connectors

The connector components from Virginia Panel Corporation® shall be tightened to the applicable torque values listed in the Tables below. The non-service related fasteners require additional locking provisions per Section 3.7, if not provided on the engineering drawing/EBOM. The part numbers contained herein are examples; these torque values may be used on the equivalent vendor components that are contained within other part number(s).

3.10.17.1 iCon ITA Connector and Components

The iCon ITA connector and related components are illustrated in Figure 6 through Figure 11, with the applicable torque values indicated in Table 48.

Table 48: iCon ITA Connector and Component Torque Values (in-lbs with +/- 0.2 in-lbs tolerance)

L3Harris Part Number	Item Being Tightened	Install
P/O 1000146630	Keying Pin Fastener	2.0
P/O 1000156702	Terminal Block Fastener	1.5
P/O 1000156726	Ground Lug Fastener	6.0
P/O 1000156726	Captive Screw on Housing Assembly	3.5
P/O 1000156726	Slotted Shoulder Screw on Locking Mechanism	6.0
P/O 1000156726	Bundle Clamp Fastener	Seated

Figure 6: iCon ITA Connector Frame and Keying Pin

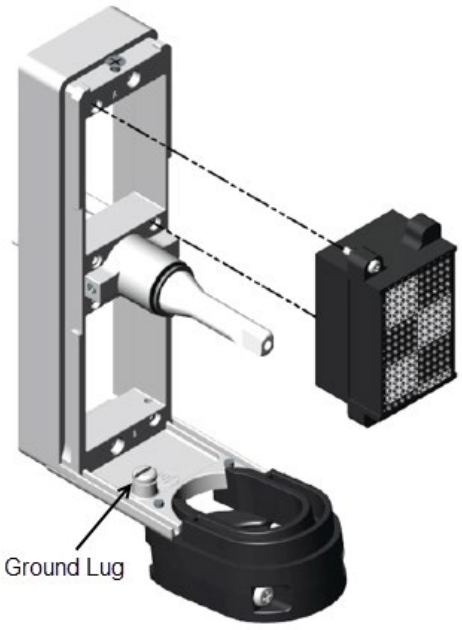

Figure 7: iCon ITA Connector Frame, Terminal Block and Ground Lug

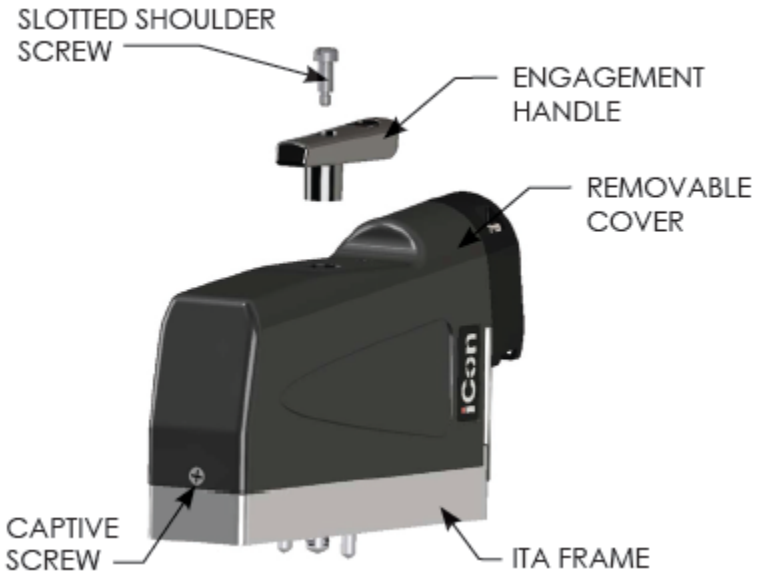

Figure 8: iCon ITA Connector Housing Assembly, Frame and Locking Mechanism

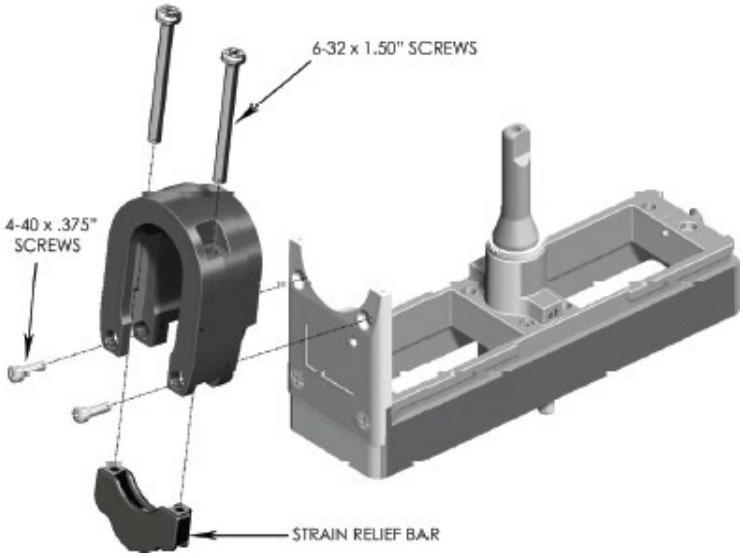

Figure 9: iCon ITA Connector Frame and Bundle Clamp

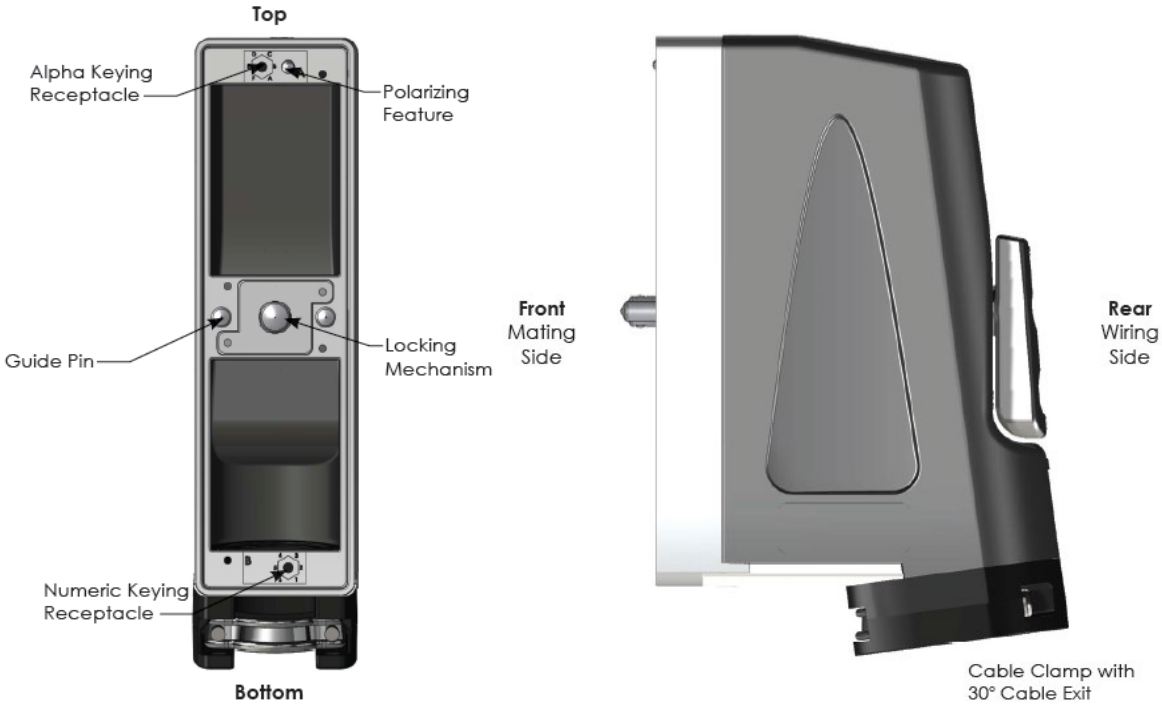

Figure 10: iCon ITA Connector Frame and Connector Housing

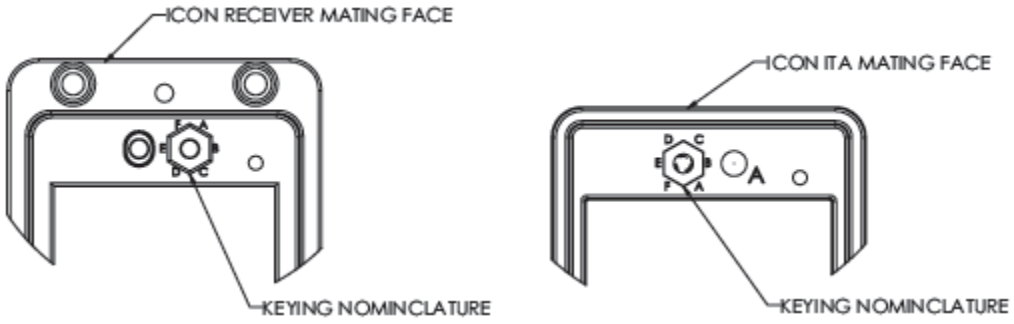

Figure 11: iCon ITA Connector Frame Keying Detail

3.10.17.2 i1 ITA Connector and Components

The i1 ITA connector and related components are illustrated in Figure 12 through Figure 15, with the applicable torque values indicated in Table 49.

Table 49: I1 ITA Connector and Component Torque Values (in-lbs with +/- 0.2 in-lbs tolerance)

L3Harris Part Number	Item Being Tightened	Install
P/O 1000146630	Keying Pin Fastener	2.0
P/O 1000156702	Terminal Block Fastener	1.5
P/O 1000156720	Ground Lug Fastener	6.0
P/O 1000156720	Housing Assembly Fastener	3.5
P/O 1000156720	Bundle Clamp Fastener	Seated

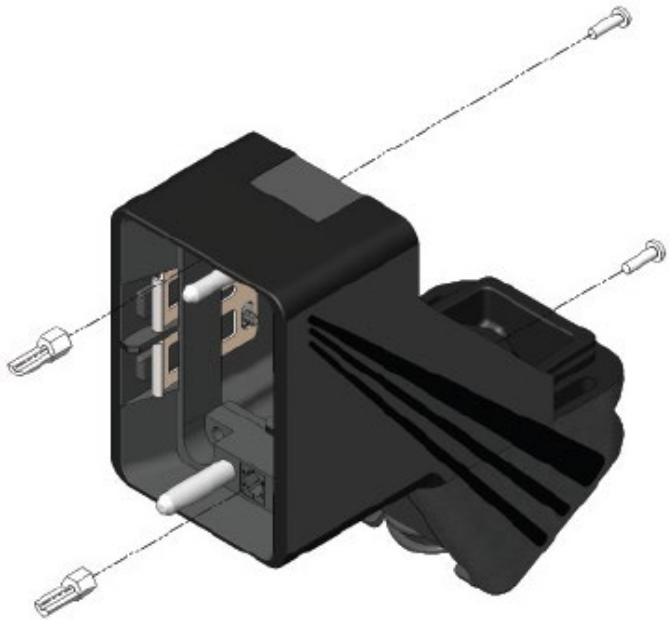

Figure 12: i1 ITA Connector Frame and Keying Pins

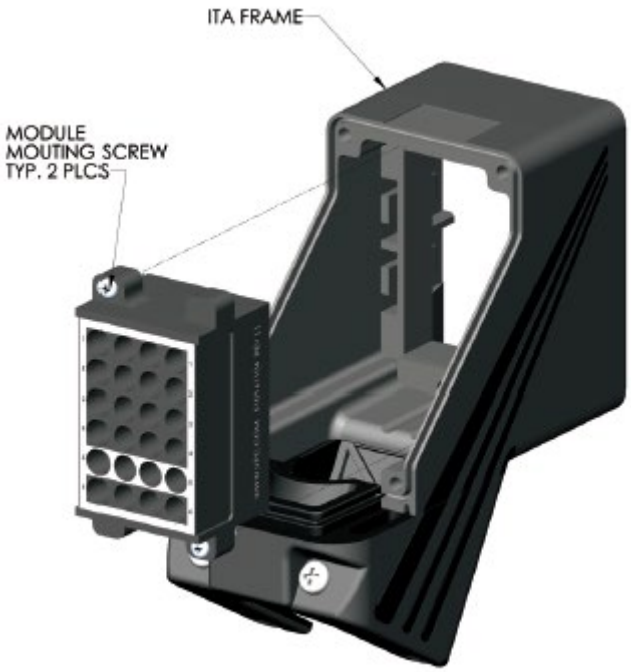

Figure 13: i1 ITA Connector Frame and Terminal Block

Figure 14: i1 ITA Connector Frame and Ground Screw

Figure 15: i1 ITA Connector Frame and Bundle Clamp

3.10.17.3 iCon ITA Receiver and Components

The iCon ITA receiver and related components are illustrated in Figure 16 through Figure 19, with the applicable torque values indicated in Table 50.

Table 50: iCon ITA Reciever and Component Torque Values (in-lbs with +/- 0.2 in-lbs tolerance)

L3Harris Part Number	Item Being Tightened	Install
P/O 1000146630	Keying Pin Fastener	2.0
P/O 1000156702	Terminal Block Fastener	1.5
P/O 1000147373	Panel Mount Fastener	2.0
P/O 1000146622	Strain Relief Fastener	3.5

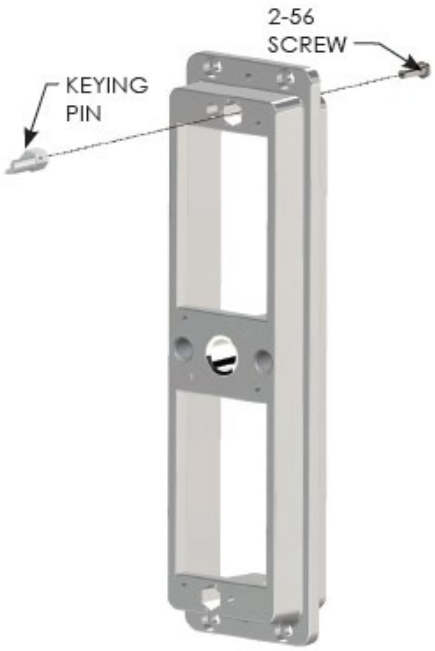

Figure 16: iCon ITA Receiver Frame and Keying Pin

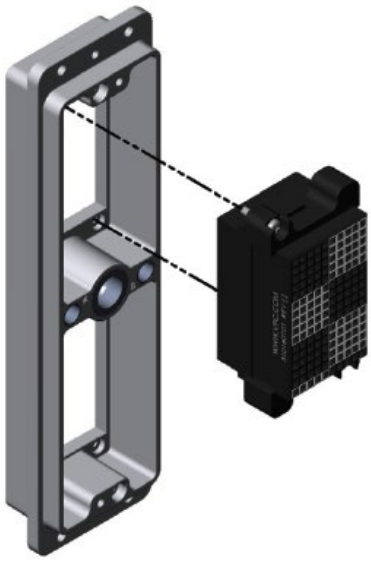

Figure 17: iCon ITA Receiver Frame and Terminal Block

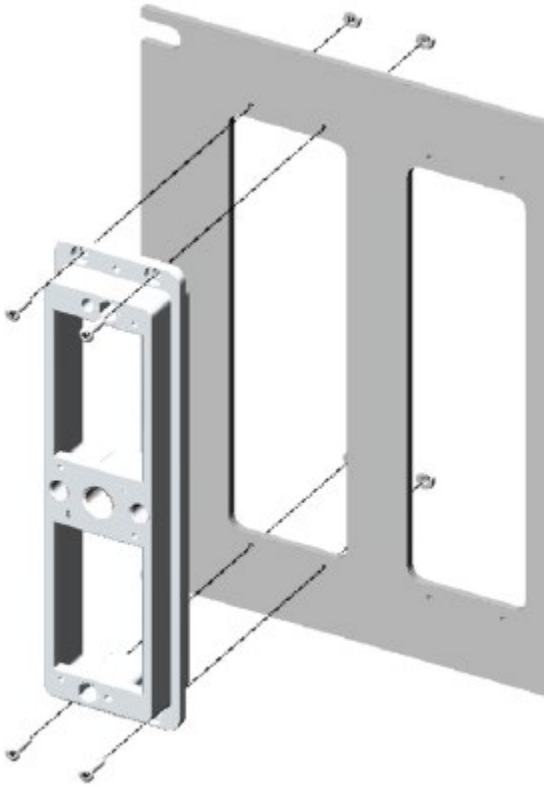

Figure 18: iCon ITA Reciever Frame and Panel Mount Hardware

Figure 19: iCon ITA Receiver Frame and Strain Relief

4 N/A

5 N/A

6 NOTES

6.1 ABBREVIATIONS

AC	Alternating Current
ANSI	American National Standards Institute
ASTM	ASTM International (formerly the American Society for Testing and Materials)
BNC	Bayonet Neill-Concelman (RF Connector)
BSPT	British Standard Taper Pipe Thread
CCA	Circuit Card Assembly

CIP	Cure-In-Place
CRES	Corrosion-Resistant Steel
CSW	L3Harris Technologies, Inc. - Communication Systems-West
D-sub	D-Subminiature (Connector)
DC	Direct Current
DIA or Dia	Diameter
EBOM	Engineering Bill of Material
ECR	Enterprise Change Request (also called: Engineering Change Request)
e.g.	For Example (from the Latin phrase *Exempli Gratia*)
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EMP	Electromagnetic Pulse
F.F.F.T.	Flats from Finger Tight
F.F.W.R.	Flats from Wrench Resistance
FIP	Form-In-Place
ft-lbs	Foot-Pounds
i.e.	In Other Words (from the Latin phrase *Id Est*)
in-lbs	Inch-Pounds
in-ozs	Inch-Ounces
ISO	International Standards Organization
JIC	Joint Industry Council
JIS	Japanese Industrial Standard
K	K (RF Connector) or Subminiature Type K (RF Connector)
ksi	Kilo-Pounds per Square Inch (1 ksi = 10^3 psi)
L3Harris	L3Harris Technologies, Inc. - Communication Systems-West
LED	Light-Emitting Diode
Max	Maximum
MDM	Microminiature D (Connector)
MIL	Military
mm	Millimeters
MPa	Megapascals
MPE	Manufacturing Process Engineer

N	Neill (RF connector)
N/A	Not Applicable
N·m	Newton-Meters
N·mm	Newton-Millimeters
No.	Number
NPSM	American National Straight Pipe Thread for Mechanical Joints
NPT	National Pipe Thread Tapered
NPTF	American National Taper Pipe Thread for Dryseal Pressure-Tight Joints
O.D.	Outer Diameter
ORFS	O-Ring Face Seal
OS	Omni-Spectra (RF Connector)
OSM	Omni-Spectra Miniature (RF Connector)
OSMM	Omni-Spectra Microminiature (RF Connector)
OSP	Omni-Spectra Push-On (RF Connector)
OSSM	Omni-Spectra Subminiature (RF Connector)
OSSP	Omni-Spectra Subminiature Push-On (RF Connector)
OST	Omni-Spectra Threaded (RF Connector)
PCB	Printed Circuit Board
P/N or p/n	Part Number
PR	Problem Report
psi	Pounds per Square Inch
PTFE	Polytetrafluoroethylene
RF	Radio Frequency
RFI	Radio Frequency Interference
SAE	Society of Automotive Engineers
SMA	Subminiature Type A (RF Connector)
SMC	Subminiature Type C (RF Connector)
Spec	Specification
SPF	Standard Process File
SS	Stainless Steel
SSMA	Sub-SMA (RF Connector)
St-St	Stainless Steel

T.F.F.T.	Turns from Finger Tight
TNC	Threaded Neill-Concelman (RF Connector)
UN	Unified Inch Screw Thread
UNC	Unified Inch Screw Thread, Coarse-Thread Series
UNEF	Unified Inch Screw Thread, Extra-Fine-Thread Series
UNF	Unified Inch Screw Thread, Fine-Thread Series
UNS	Unified Inch Screw Thread, Special-Thread Series

6.2 DEFINITIONS

The following definitions apply to words and phrases used in the body of this specification.

Word / Phrase	Definition
Adhesive Locking Feature	Fastening system design which uses chemical compounds added at the time of assembly (e.g. anaerobic adhesive, epoxies, or urethanes).
Applied Torque	The torque transmitted to the fastener by the installation tool.
Assembly Sequence	A method indicating sequence of assembling fasteners in a prescribed pattern. (Also called: installation sequence, tightening sequence.)
Assembly Torque	This shall be the design torque applied at final assembly. It shall include the net effect of the following: 1. The torque required to overcome kinetic friction between mating bearing faces and between mating threads (i.e. free-running torque), 2. The torque required to overcome the self-locking feature (i.e. prevailing torque), if any, and 3. The torque required to apply the desired axial load to a fastener assembly. The assembly torque shall be measured only in the tightening direction. (Also called: installation torque, tightening torque.)
Bolt	An externally threaded fastener. The term is used interchangeably with “screw” in this specification. Traditionally, however, the term “bolt” is used to describe the fastener that will accept a nut on the opposite side of a thru hole assembly.
Fastener	A threaded device that joins two or more parts and transfers load between them.
Finger Tight	Tightened by fingers as far as possible without the use of tools. This term is typically used in conjunction with threaded pipe/hose fittings and adapters, but may be used on other items.

Word / Phrase	Definition
Free-Running Torque	This shall be the torque required to overcome kinetic friction between mating threads. This torque can be measured in either a loosening or tightening direction. Free-running torque shall not include any component of torque required to overcome a locking feature or axial load in a fastener assembly. Free-running torque is not applicable when a locking feature is present in the joint. (Also called no load torque.)
Hand Tight	Tightened by hand until snug, with or without the use of tools.
Inspection Stick	A plastic inspection tool about 7 inches long with one flat end and one sharp, pointed end. (Also called: "diddle" stick.)
Legacy Design	Any design for which the formal documentation (i.e. engineering drawings) were released prior to May 3, 2011. This is the release date of Revision B of this specification, which first included supplementary locking feature (or "secondary retention") requirements for threaded joints.
Locking Feature	A device, chemical substance, or other physical characteristic added by design to one or more elements of a threaded fastening system to resist vibration-induced loosening or to provide retention against complete disengagement of the fastening elements. (Also called locking element, locking device, or secondary retention device.) Common locking features can be grouped into the following four categories: 1. Prevailing torque locking features 2. Adhesive locking features 3. Preload-dependent locking features 4. Mechanical locking features
Mechanical Hard-Stop	A feature incorporated into a gasketed joint design that functions to consistently control the amount of gasket compression that occurs when the joint is fully tightened. This feature provides a hard surface to clamp against and prevents the gasket from being in the main load path of the joint preload.
Mechanical Locking Feature	Fastening system design employing non-friction elements usually involving a "hard stop" (e.g. cotter pins or safety wire).
Positive Direction	The direction of rotation that tightens the threaded joint. This is generally in the clockwise direction when looking at the top of the fastener head, since right-handed threads are the most common type.
Preload	Preload is the tension on the fastener that causes a clamping force to hold bolted joint together when the fastener is seated and tightened, prior to external in-service loading is applied to the joint. This tension force on the bolt is approximately equal to the joint clamping force when the joint is not subject to any external loads.

Word / Phrase	Definition
Preload-Dependent Locking Feature	Free-spinning fastening system design in which the locking mechanism is dependent on the presence of preload (e.g. Spiralock® threads or Belleville washers).
Prevailing Torque Locking Feature	Fastening system design that relies on friction to resist fastener rotation independent of preload (e.g. deformed thread or locking patch). The locking feature is designed to retain the fastener(s) in the junction in the event of loss of preload. These features do not protect junctions from all forms of preload loss that may occur.
Prevailing Torque	The torque required to overcome kinetic friction in the mating threads plus the torque required to overcome the locking feature when 100% of the locking feature is engaged and the fastener is unseated. The phrase "running torque" shall be understood as the average locking torque when it is not prefixed by the words "maximum" or "minimum." Running torque shall not contain any torque component for axial load in the fastener assembly. The running torque can be measured in either a loosening or a tightening direction while the fastener is in motion. (Also called: running torque, self-locking torque, run-in torque, or run-down torque.)
Screw	An externally threaded fastener. The term is used interchangeably with "bolt" in this specification. Traditionally, however, the term "screw" is used to describe a fastener in situations where a nut is not used on the opposing side, or the thread type will not accept a nut.
Seated	A fastener shall be considered seated when its bearing surface contacts the material being joined, and any additional applied torque (seating torque) will produce a residual axial stress in either the male (bolt) or female (nut) component.
Self-Locking	An attribute of a fastener or fastener assembly having an integral locking feature to impede relative rotation of mating components.
Snug	The condition where the threaded hardware has been tightened to the point where the joint is being compressed and "feels" tight to the operator installing the hardware. At a minimum, there is no perceptible play between the mated hardware threads; at a maximum, the threads have not fully yielded.
Thru Hole Application	A joint design in which both sides of the stackup must be accessed in order to apply an installation torque (e.g. torquing the nut on one side of a stackup while holding the screw with a driver on the other side). This is different than a blind hole into which a screw can be threaded and tightened without having to hold the mating part that includes the female threads.
Torque	Torque is the force or turning moment tending to produce rotation. It is expressed in terms of applied load and the length of the moment arm applying it, usually in units of inch-ounces (in-ozs), inch-pounds (in-lbs), foot-pounds (ft-lbs), Newton-meters (N·m), or Newton-millimeters (N·mm).

Word / Phrase	Definition
Unseated	A fastener shall be considered unseated when the application of removal torque disengages the bearing surface of the fastener from the material being joined, reducing the axial stress to zero.

APPENDIX A - FASTENER P/N CROSS-REFERENCE TABLE

Table 47 can be used to find the applicable document sections and torque values that apply to a given MIL or L3Harris fastener part number. Attention must be paid to material codes that may be embedded in the full fastener part number. When different material options exist for a single base part number, multiple rows have been added to the table. "N/A" is used to indicate part number options that are not currently covered by this specification. Note that correction factors may apply to values pulled from the torque tables in this specification, per Section 3.5.2.1.

Table 51: Fastener part number / torque table cross-reference [see Section 3.9.18].

Base P/N (L3Harris or MIL)	P/N Option or Dash Number (If Applicable)	Applicable Torque Info		
		Document Section(s)	Table Number	Column Number
AN3 thru AN20	"-" before dash number	3.9.2	Table 4	I
	"C" before dash number	3.9.2	Table 3	I
	"DD" before dash number	3.9.2	Table 5	II
AN565	"C" code in part number	3.9.5	Table 12	I
	Absence of "C" code in part number	3.9.5	Table 12	II
AS85049	/17, /49	3.10.13	Table 45	N/A
	/41, /42	3.10.16	Table 47	N/A
M24308/25	"P" after dash number	3.9.2	Table 3	I
	No letter code or all other letter codes	3.9.2	Table 4	I
M24308/26	–	3.10.12	Table 45	N/A
M83513/05	-07, -17	3.9.2	Table 3	I
	All other dash numbers	3.9.2	N/A	N/A
M8805/99	-026,-011	3.9.16.2	Table 26	N/A
M8805/101	-3XXX, -6XXX	3.9.16.2	Table 26	N/A
MS16995	–	3.9.2	Table 3	I
MS16996	–	3.9.2	Table 3	I
MS18212	–	3.9.2	Table 5	III
MS24628	–	3.9.10	Table 17	–
MS24630	–	3.9.10	Table 17	–
MS24671	–	3.9.2	Table 3	I
MS24693	"A" before dash number	3.9.2	Table 5	II
	"B", "BB", CB", or "NB" before dash number	3.9.2	Table 5	I
	"C" before dash number or "B" after dash number	3.9.2	Table 3	I
	"N" before dash number	3.9.2	N/A	N/A
	"S" before dash number	3.9.2	Table 4	I

Base P/N (L3Harris or MIL)	P/N Option or Dash Number (If Applicable)	Applicable Torque Info		
		Document Section(s)	Table Number	Column Number
	"U" before dash number	3.9.2	N/A	N/A
MS25082	No letter code in dash number	3.9.2	Table 4	I
	"C" in dash number	3.9.2	Table 3	I
	"B" or "S" in dash number	3.9.2	Table 5	I
MS27040	–	3.9.2	Table 4	I
MS3186	See torque tables for applicable circular MIL connectors	3.10.4	Table 34	N/A
MS3213	–	3.9.6	Table 13	I
MS35214	–	3.9.2	Table 5	I
MS35250	–	3.9.2	Table 3	I
MS35307	–	3.9.2	Table 3	I
MS35308	–	3.9.2	Table 3	I
MS35649	-23, -43, -63, -83, -103, -202, -222, -242, -262, -282, -2252, -2312, -2382	3.9.2	Table 4	I
	-204, -224, -244, -264, -284, -2254, -2314, -2384	3.9.2	Table 3	I
	-205, -225, -245, -265, -286, -2255, -2315, -2385	3.9.2	Table 5	I
	-206, -226, -246, -266, 287, -2256, -2316, -2386	3.9.2	N/A	N/A
MS35650	Dash number ends in "2" or "3"	3.9.2	Table 4	I
	Dash number ends in "4"	3.9.2	Table 3	I
	Dash number ends in "5"	3.9.2	Table 5	I
MS35690	-424, -427, -604, -607, -624, -627	3.9.2	Table 4	I
	-413, -613, -633	3.9.2	Table 5	I
	All other dash numbers	3.9.2	N/A	N/A
MS35691	-1, -2, -5, -6, -9, -10, 13, -14, -17, -18, -21, -22, -25, -26, -29, -30, -33, -34, -37, -38, -41, -42, -45, -46, -49, -50, -53, -54, -57, -58, -61, -62, -65, -66, -69, -70, -73, -74, -77, -78, -406, -426, -506, -526, -606, -626, -706, -726, -806, -826, -1006, -1026, -1206, -1226	3.9.2	Table 4	I
	-3, -7, -11, -15, -19, -23, -27, -31, -35, -39, -43, -47, -51, -55, -59, -63, -67, -71, -75, -79	3.9.2	Table 3	I
	-4, -8, -12, -16, -20, -24, -28, -32, -36, -40, -44, -48, -52, -56, -60, -64, -68, -72, -76, -80	3.9.2	Table 5	I
	All other dash numbers	3.9.2	N/A	N/A
MS51021	-1 thru -96	3.9.5	Table 12	I
	-101 thru -142	3.9.5	N/A	N/A
MS51023	-1 thru -96	3.9.5	Table 12	I

Base P/N (L3Harris or MIL)	P/N Option or Dash Number (If Applicable)	Applicable Torque Info		
		Document Section(s)	Table Number	Column Number
	-101 thru -158	3.9.5	N/A	N/A
MS51861	–	3.9.10	Table 17	–
MS51957	–	3.9.2	Table 3	I
MS51958	–	3.9.2	Table 3	I
MS51959	–	3.9.2	Table 3	I
MS51960	–	3.9.2	Table 3	I
MS51971	–	3.9.2	Table 3	I
MS51972	–	3.9.2	Table 3	I
NAS1003 thru 1020	–	3.9.2	Table 3	III
NAS1096	–	3.9.2	Table 4	II
NAS1102	“-” before dash number (default)	3.9.2	Table 4	II
	“E” before dash number	3.9.2	Table 3	III
	“V” before dash number	3.9.2	N/A	N/A
NAS1351	“-” before dash number, no “LE”, “LL”, “LN”, or “LB”	3.9.2	Table 4	II
	“C” before dash number, no “LE”, “LL”, “LN”, or “LB”	3.9.2	Table 3	I
	“N” before dash number, no “LE”, “LL”, “LN”, or “LB”	3.9.2	Table 3	III
	“LE”, “LL”, “LN”, or “LB” (self-locking)	3.9.2	N/A	N/A
NAS1352	“-” before dash number, no “LE”, “LL”, “LN”, or “LB”	3.9.2	Table 4	II
	“C” before dash number, no “LE”, “LL”, “LN”, or “LB”	3.9.2	Table 3	I
	“N” before dash number, no “LE”, “LL”, “LN”, or “LB”	3.9.2	Table 3	III
	“LE”, “LL”, “LN”, or “LB” (self-locking)	3.9.2	N/A	N/A
NAS1454	“-” before first dash number	3.9.7	N/A	N/A
	“B” before first dash number	3.9.7	N/A	N/A
	“C” before first dash number	3.9.7	Table 14	–
NAS1635	“LE”, “LL”, “LN”, or “LR” before second dash number	3.9.2	N/A	N/A
	Free-running screw (none of the above codes in p/n)	3.9.2	Table 3	I
NAS1801	–	3.9.2	Table 4	II
NAS1802	–	3.9.2	Table 3	III
NAS1829	“-” before first dash number (default)	3.9.2	Table 4	II
	“A” or “AC” before first dash number	3.9.2	Table 5	II
	“B” or “BT” before first dash number	3.9.2	Table 5	I
	“C” before first dash number	3.9.2	Table 3	I
	“H” before first dash number	3.9.2	Table 5	III

Base P/N (L3Harris or MIL)	P/N Option or Dash Number (If Applicable)	Applicable Torque Info		
		Document Section(s)	Table Number	Column Number
NAS600 thru 606	–	3.9.2	Table 4	II
NAS623	–	3.9.2	Table 4	II
NAS662	"-" before first dash number (default)	3.9.2	Table 4	II
	"C" before first dash number	3.9.2	Table 3	I
	"B" before first dash number	3.9.2	Table 5	I
NAS6703 thru 6720	"L" after basic number (self-locking)	3.9.2	N/A	N/A
	Free-running screw (none of the above codes in p/n)	3.9.2	Table 3	III
NAS671	No letter code in part number	3.9.2	Table 4	I
	"B" before dash number	3.9.2	Table 5	I
	"C" before dash number	3.9.2	Table 3	I
NAS7500 thru 7516	"L" after basic number (self-locking)	3.9.2	N/A	N/A
	Free-running screw (none of the above codes in p/n)	3.9.2	Table 3	III
NAS8100 thru 8106	"L" after basic number (self-locking)	3.9.2	N/A	N/A
	Free-running screw (none of the above codes in p/n)	3.9.2	Table 3	III
2842546	–	3.9.3	Table 6	I
2842549	–	3.9.3	Table 6	I
2842556	–	3.9.3	Table 6	I
40006187	–	3.9.2	Table 3	I
40006772	–	3.9.2	Table 3	I
40006977	–	3.9.3	Table 6	I
40007214	–	3.9.3	Table 6	I
40007538	–	3.9.3	Table 6	I
40007702	–	3.9.2	Table 3	I
40008502	–	3.9.3	Table 6	I
40008693	–	3.9.6	Table 13	I
40008842	–	3.9.2	Table 3	I
40009044	–	3.10.13	Table 45	N/A
40009157	–	3.9.2	Table 3	I
40009477	-000, -002 through -008	3.9.2	Table 3	I
	-001	3.9.2	N/A	N/A
40009939	–	3.9.6	Table 13	I
40010320	–	3.9.6	Table 13	I
40010838	–	3.9.2	Table 3	I

Base P/N (L3Harris or MIL)	P/N Option or Dash Number (If Applicable)	Applicable Torque Info		
		Document Section(s)	Table Number	Column Number
40010919	–	3.9.6	Table 13	I
40011069	–	3.9.2	Table 4	II
40011322	–	3.9.2	Table 3	I
40011644	–	3.9.2	Table 3	I
40011736	–	3.9.6	Table 13	I
40011803	–	3.9.2	Table 3	I
40015234	-000	3.9.11	Table 18	N/A
45001052	–	3.9.6	Table 13	I
45001099	-000 through -005, -009 through -011	3.9.2	Table 3	I
	-006 through -008	3.9.2	Table 4	II
7181020	–	3.9.7	Table 14	–
7181716	–	3.9.2	Table 3	I
7183372	–	3.9.3	Table 6	I
7183797	-000, -002, -003, -005 through -012	3.9.2	Table 3	I
	-001, -004	3.9.2	Table 3	III
7184022	–	3.9.2	Table 3	I
7184123	–	3.9.2	Table 3	I
7184486	–	3.9.3	Table 6	I
7184571	–	3.9.3	Table 6	I
7185304	–	3.9.7	Table 14	–
7185305	–	3.9.7	Table 14	–
7185316	-000	3.10.13	Table 45	–
7185629	–	3.9.2	Table 3	I
7186694	-000 through -011, -013 through -016, -018, -020 through -025	3.9.2	Table 3	I
	-012	3.9.2	Table 3	II
	-017	3.9.2	N/A	N/A
	-019	3.9.2	Table 3	III
7186748	–	3.9.2	Table 5	I
7186755	–	3.9.2	Table 3	I
7186786	–	3.9.2	Table 5	III
7190746	–	3.9.2	Table 5	II
7190798	–	3.9.10	Table 17	–
7191005	–	3.9.10	Table 17	–

Base P/N (L3Harris or MIL)	P/N Option or Dash Number (If Applicable)	Applicable Torque Info		
		Document Section(s)	Table Number	Column Number
7191061	–	3.9.2	Table 3	I
7191251	–	3.9.10	Table 17	–
7191586	–	3.9.2	Table 5	III
7192016	–	3.9.10	Table 17	–
7192044	–	3.9.10	Table 17	–
7192359	–	3.9.3	Table 6	I
7192672	–	3.9.2	Table 3	I
7192770	–	3.9.5	Table 12	I
7192808	-000	3.9.2	Table 4	II
	-001 through -027	3.9.2	Table 3	I
7192875	–	3.9.3	Table 6	I
7916096	–	3.9.2	Table 3	I
7918585	–	3.9.2	Table 3	I
1000189524	–	3.9.16.4	Table 28	N/A
1000188602	–	3.9.16.4	Table 28	N/A
1000188647	–	3.9.16.4	Table 28	N/A
1000383575	–	3.9.11	Table 18	N/A
1000429590	–	3.9.17	Table 31	N/A
1000437750	–	3.9.11	Table 18	N/A