



DEFENSE LOGISTICS AGENCY
DLA LAND AND MARITIME
POST OFFICE BOX 3990
COLUMBUS, OH 43218-3990

July 10, 2018

MEMORANDUM FOR MILITARY/INDUSTRY DISTRIBUTION

SUBJECT: Engineering Practice Study (EPS), Request for Comments on Proposal for new Military Specification documents for Miniature, Lightweight, Circular Connectors. Project Number 5935-2018-049.

This memorandum is a final report on the subject Engineering Practice Study. The EPS sought feedback and comments on the proposal to create a new military specification for lightweight miniature circular electrical connectors similar to MIL-DTL-38999 connectors. In addition, the proposed specification will include options for smaller shell sizes, smaller contact sizes with closer contact spacing, and option for connectors which include an integrated backshell. The EPS included a rough draft of the proposed military specification. Many of the comments and proposals received on the rough draft will be applied to the upcoming initial draft. Other proposals received during the coordination period will be held either for further discussion for the initial draft, or for inclusion in a possible "series II".

The final report of this document is available for viewing or downloading from our website at the following internet links: <https://landandmaritimeapps.dla.mil/programs/milspec/> or <https://landandmaritimeapps.dla.mil/programs/milspec/ListDocs.aspx?BasicDoc=5935EPStudies> . If you have any questions, please contact Mrs. Lisa Hoffer at the following phone numbers or email address: 614-692-7702, fax: 614-692-6939, e-mail: Lisa.Hoffer@dlamail.

Sincerely,

/ **SIGNED** /

ABDONASSER M. ABDOUNI
Chief
Interconnection Branch

Attachment:

1. Final Report, EPS, MIL-DTL-#####

cc:

DSCC.Standardization@dlamail

ENGINEERING PRACTICE STUDY

**SUBJECT: PREPARATION OF NEW MILITARY SPECIFICATION
DOCUMENTS FOR STANDARDIZED LIGHTWEIGHT CIRCULAR
CONNECTORS.**

STUDY PROJECT NUMBER 5935-2018-049

5 July 2018

FINAL REPORT – MIL-DTL-#####

**Study conducted by DLA Land and Maritime
Document Standardization Division (VA)
Interconnection Branch**

Prepared by:

Lisa Hoffer
Project Engineer (Circular Connectors)
DLA L&M-VAI

ENGINEERING PRACTICE STUDY – FINAL REPORT, MIL-DTL-#####

New military unique, standardized specification for lightweight, circular connectors:

- I. **OBJECTIVE:** The intent of this EPS was to obtain feedback from electrical connector manufacturers, military services, and other interested parties for use in the development of a military specification package for environment resistant, lightweight circular connectors.
- II. **BACKGROUND:** Design requirements for newer military platforms require smaller, lighter electrical components. The proposed circular connector styles in the attached draft military specification are very similar to MIL-DTL-38999 series III, triple-start connectors with rear release, removable contacts. Connectors specified by the draft document are expected to meet the majority of MIL-DTL-38999 performance requirements. Some requirements have been decreased from MIL-DTL-38999 requirements. Some new requirements have been added.

Differences between the subject draft specification and MIL-DTL-38999: Physical differences between connectors specified by the draft military specification and MIL-DTL-38999, series III, include lighter weight / thinner connector shell walls, shorter length connector shells, and different outside diameters of the connector shells. Two connector shell sizes are smaller than MIL-DTL-38999, shell size 9. The connector mating system includes 3 keys/keyways, rather than 5 keys/keyways found in MIL-DTL-38999 connectors. In addition, the electrical pin and socket contacts include a proposal for new standardized contacts: 1) Shorter length size 23 contacts, and 2) New standardized size 20HD contacts. Socket contact sizes 20, 16 and 12 are shorter in length than the standard MIL-DTL-38999 series III contacts. Currently, commercial versions of the draft mil spec connector use MIL-DTL-39029/57 and /58 size 20, 16 and 12 QPL'd contacts (these contacts are currently used in MIL-DTL-38999, series II). The new spec will use pin contacts in accordance with SAE-AS39029/122 (socket contacts spec is TBD). Connector rear accessories: In addition to a 38999 shell style that includes rear accessory threads, the proposed specification includes a connector style with an integral banding platform.

A rough draft of the proposed mil spec was attached to the EPS to provide interested parties with additional information about the proposed specification.

III. **SUMMARY OF COMMENTS:** The EPS project was published in January 2018 for review and comments. Teleconferences have been held to coordinate proposals received with prospective connector manufacturers and interested OEMs. Other technical comments are being retained for later discussion during an upcoming coordination meeting. Editorial comments received on the rough draft, such as comments pointing out spelling corrections and typographical errors, are being incorporated into the upcoming initial draft. Because the current proposed design is intended to be interchangeable and intermateable with commercial connectors in current use on military platforms, comments proposing major design changes that would prevent intermateability are currently beyond the scope of this project. These design proposals will be held for a possible "series II". Disposition of these comments/proposals are included in the attachment.

IV. **CONCLUSIONS:** The results of this EP Study are sufficient to support continued development of the proposed new military specification.

III. SUMMARY OF COMMENTS – Continued.

Comments received from the following interested parties:

1) Missile Defense Agency (MDA): DLA received numerous editorial comments from the MDA in the form of a “mark-up” to the rough draft. These editorial comments will be incorporated into the upcoming initial draft of the document. Further coordination with the MDA will be conducted if needed for any comments that are not accepted for incorporation into the initial draft. A copy of the MDA’s marked-up version of the rough draft will be provided to any interested party upon request.

2) Raytheon:

Note: DLA received comments in the form of a “mark-up” to the rough draft. Some comments are general in nature and do not include specific proposals. Raytheon’s comments are transcribed from the marked-up draft and included below. A teleconference with Raytheon, ITT Cannon, Amphenol, Omnetics and DLA was held on 7 June 2018 to develop a consensus and comment disposition. The disposition of comments follows:

Comment #1 (Raytheon). Missing from document: a. Figures for recommended panel cutouts for receptacles and b. Tables for recommended jam nut torque values.

Comment #1 DLA response: Propose to include panel cutouts and tables with recommended jam nut torque values in the “to be determined” section 6, “NOTES”. Figures with recommended panel cutouts and tables with recommended jam nut torque values are not a requirement for the connector products specified by the proposed military specification. For example, connector manufacturers will be required to meet external dimensions specified for jam-nut connectors, but an end item manufacturer is responsible for the panel cutout. However, this type of information will be provided in section 6..

Also missing: c. Max panel thickness to be specified on slash sheets.

DLA response: Concur, panel thicknesses to be specified on applicable slash sheets. Per discussion with connector manufacturers, the proposed max panel thickness is .100 inch.

Comment #2 (Raytheon). Why not add a hermetic class? Is there no current demand/usage for hermetics?

Comment #2 DLA response: Scope of project is currently limited to connectors with crimp removable contacts. Once the upcoming initial draft is finalized, proposals for hermetically sealed connectors may be considered, provided that there are military applications that require hermetically sealed connectors.

Comment #3 (Raytheon). Table I, shell size code. Shell sizes 13, 17 and 21 omitted from the table.

Comment #3 DLA response: Agree / concur: Since there are current military applications for insert arrangements 13-31 and 21-100, sizes 13 and 21 will be added to the table in the upcoming initial draft of the spec. Size 17 will not be added, since no commercial version of the tri-start type micro circular connector is being produced by prospective connector manufacturers.

III. SUMMARY OF COMMENTS – Continued.

2) Raytheon – Continued:

Comment #4 (Raytheon). Glenair operating temp range -65C to +175C (table II, page 4). Glenair has a mod code to get 200C epoxy for insert bonding. Table IV, Crimp contact specs – Showing 39029/121 in Applicable Documents

Comment #4. DLA response: Discussed temperature ranges with Amphenol, ITT and Raytheon during teleconference on 7 June 2018. The current designs have been developed to meet the temperature range specified in the rough draft version of the proposed specification.

In the upcoming initial draft, propose adding two new classes with electroless nickel on aluminum, similar to class F and class G, but with a higher upper temperature limit of 200°C.

Contact issue: The reference to 39029/121 (socket contact) will be deleted from Applicable Documents for the upcoming initial draft.

Comment #5 (Raytheon). page 5, figures 14 and 15 titles, which reference the term “RFI”. Change “RFI leakage” to “EMI shielding”.

Comment #5. DLA response: Modification: Use term “EMI/RFI”, or “EMI/RFI shielding”, as applicable, anywhere the acronym “RFI” appears.

Comment #6 (Raytheon). page 11, table V and editorial comments on paragraph 3.3.7.1. As long as silicone is cured, why not allow it as on 38999 and other specs? Why not use the same level of detail as used in 38999 (i.e., don’t specify alloy, insert material, etc. Performance spec.

Comment #6. DLA response: Discussed issue during teleconference on 7 June. Agreed to use the term fluorosilicone rather than silicone. Rationale: Silicone is known to swell and expand in the presence of the types of fluids, as well as the fumes, of the jet fuels

Comment #7, page 13 (Raytheon). Two editorial issues. To first sentence, 3.4.2, add word “contacts”, following the words “All connectors”, and to 3.5.1.1, Crimp removable contacts, correct typo (change “inn” to “in”).

Comment #7 DLA response: Concur. Correction to be included in initial draft.

Comment #8, page 14 (Raytheon). Paragraph 3.5.2.5, Grommet-to-wire sealing. Are box mount type connectors included in the spec? If yes, then box mount receptacles do not have wire sealing grommets.

Comment #8 DLA response: Currently, the addition of box mount receptacles to the proposed family of documents is beyond the scope of this project, however, box mounts could be added following publication of the final drafts of the initial group of documents if there are military applications that require standardized box mount connectors.

III. SUMMARY OF COMMENTS – Continued.

2) Raytheon – Continued.

Comment #9, page 16 Raytheon). General note – need to review all paragraph number references in requirements and test method paragraphs and tables.

Comment #9 DLA response: A more thorough review of these types of editorial issues will be conducted prior to the release of an initial draft. The intent of the rough draft was to publicize this standardization further for the purpose of ensuring that design elements needed for current military applications were included in the upcoming initial draft, and for the preparation of a list of all interested parties.

Comment #10, page 23 (Raytheon). Paragraph 3.11.2.1, Salt spray (corrosion): Reference AIR4789 for determining failures? No corrosion sites is difficult to meet. Minor pitting should be allowed provided no adverse affects in performance, such as mating torque and shell conductivity. Also, Zinc nickel shows white corrosion product after 48 hours salt spray. White corrosion product worse after 500 hours salt spray.

Comment #10 DLA response: Discussed with two connector manufacturers, ITT and Amphenol. Issue is under review.

DLA concerns: No military department has officially adopted AIR4789 for use in DoD specs and standards.

Note on ZnNi white “corrosion”: ZnNi is prone to surface discoloration that may appear to be corrosion, but which doesn’t impact performance. Propose adding a user advisory on this issue in section 6 on this issue.

Comment #11, page 31 (Raytheon). Table XVIII. Qualification and group C periodic tests. Paragraph 3.4.2, Interchangeability and intermateability should be performed during qualification for all suppliers.

Comment #11 DLA response: Discussed issue during teleconference and consensus is that if contact figures are appropriately enhanced to specify additional intermateability dimensions, then additional intermateability testing between products produced by different manufacturers is not necessary..

Comment #12, page 48 (Raytheon). Paragraph 4.5.25.2, DWV at altitude: Drop subparagraph e, since referencing hermetic and box mount.

Comment #12 DLA response: Concur. Currently, no hermetically sealed or box mount connectors are included in the draft.

Comment #13, page 53 (Raytheon). Paragraph 4.5.48, Resistance to lightning strike: Can suppliers meet this requirement? There is some question as to whether the small shell size will ever meet this requirement. Subparagraph f states “The peak current, I_{pk}, shall be 10,000 amperes. Is 10,000 amps the right value. It seems low. An application note for composite airframes may be needed, since the connector will be the most conductive path, and the smaller shell sizes will not take larger currents.

Comment #13 DLA response: Amphenol has conducted some testing and will provide additional data on this concern. ITT has not yet conducted tests but is developing a test plan for lightning strike. Topic may need to be revisited following publication of the upcoming initial draft.

III. SUMMARY OF COMMENTS – Continued.

2) Raytheon – Continued.

Comment #14, page 56 (Raytheon). Figure 1, Receptacle intermateability dimensions. “A” should be labeled as “Detail A”, not “A”. Same comment for the labels provided on other figures for the drawing details.

Comment #14 DLA response: Editorial issue. Concur.

Comment #15, page 62 (Raytheon). Figure 2, Plug intermateability control dimensions. Add note: “NOTE: SHELL SIZES 8 THRU 13”.

Comment #15 DLA response: Additional review and discussion with manufacturers required..

Comment #16, page 66 (Raytheon). Figure 3, Interface design. Detail drawing should be part of the same figure number as where they are first identified.

Comment #16 DLA response: Concur.

Comment #17, page 70 (Raytheon).

a) Figure 5, Connector accessory interface dimension. Jam nut threads are not specified anywhere.

a) DLA response: Mating threads will be located on jam nut receptacle slash sheet.

b) Comment #17, page 70, Figure 5, Already have a detail A on page 66.

b) DLA response: There is a detail A referenced for Figure 3. There is another detail A referenced for Figure 5. Having two figures with a detail A in the same mil spec has historically been acceptable practice. MIL-STD-961, the standard for mil specs, does not prohibit the practice.

Comment #18, page 72 (Raytheon). Figure 6, Connector with integral backshell, rear interface dimensions. Add polysulfide and alternate finish options similar to what is in AS85049 banding platforms.

Comment #18 DLA response: Per feedback from Amphenol and ITT, the proposed change would require changes to the current standard commercial items. It may be acceptable for the connector shells with accessory threads. More discussion needed.

Comment #19, page 73 (Raytheon). Figure 7, Size 23 contact, pin and socket. Contact dimensioning incomplete.

Comment #19 DLA response: ITT and Amphenol to review and modify as needed prior to publication of official initial draft.

Comment #20, page 74 (Raytheon). Figure 8, Size 20HD contact, pin and socket. Contact dimensioning incomplete.

Comment #20 DLA response: ITT and Amphenol to review and modify as needed prior to publication of official initial draft.

Comment #21, page 75 (Raytheon). Figure 9, Spanner nut dimensions. Shell sizes not specified, multiple thread pitches for a given thread size. Not sure if the thread pitch is a product of different manufacturers, i.e., Glenair vs Amphenol vs ITT.

Comment #21 DLA response: See Glenair comments with mark-up of applicable sizes. Amphenol and ITT to review and provide additional feedback.

III. SUMMARY OF COMMENTS – Continued.

2) Raytheon – Continued.

Comment #22, page 76 (Raytheon). Figure 10, Hex nut dimensions. Shell sizes not specified, multiple thread pitches for a given thread size. .3125 thread missing.

Comment #22 DLA response: Per discussion with ITT and Amphenol. Once spanner nut sizes and threads are established, then ensure hex nut sizes / threads match spanner nut sizes / threads.

Comment #23, page 80 (Raytheon). Figures 14 and 15, Change “RF Leakage” to “EMI shielding” in both the figures themselves and in the figure titles.

Comment #23 DLA response: See earlier comment on same issue. Change terminology to “EMI/RFI Leakage”.

Comment #24, page 92 (Raytheon). Figure 23, Vibration test accessory load fixture. Doesn’t map to D38999 sizes.

Comment #24 DLA response: Discussed with ITT and Amphenol. Weighted backshell is not applicable to the integral banded platform type connector shell. Agree that this vibration test is applicable to connector shells with accessory threads. Values may need to be adjusted, since the proposed mil spec connector shells have thinner shell walls than comparably sized MIL-DTL-38999 connector shells. More discussion needed.

III. SUMMARY OF COMMENTS – Continued.3) Glenair:

Note: DLA received several comments from Glenair. A teleconference with Glenair, ITT Cannon and Amphenol, as well as NGC and Raytheon representatives, was held on 24 April 2018 to discuss Glenair's proposals further. The disposition of comments follows:

Comment #25 (Glenair). Page 15 and fig 4 on pages 68-69..

1. Para 3.6.3 Pin to pin mating prevention. To meet this critical requirement, Glenair recommends the following change to Figure 4. Main key / keyway polarization:

- Different master key/keyway widths are required on pin-type and socket-type connectors in order to prevent pin-to-pin mating as required by paragraph 3.6.3 of the subject specification. This method is used in construction of MIL-DTL-38999 series IV connectors.
- Additionally a tolerance change from: $\pm.001$ to: $\pm.003$ is also required to increase the manufacturability of the connectors. This tolerance reflects the master key/keyway of MIL-DTL-38999.

The following master key/keyway configuration is proposed to remedy this requirement:

	Pin-Type Connector	Socket-Type Connector
Plug, key width	$.125 \pm .003$	$.095 \pm .003$
Receptacle, keyway width	$.105 \pm .003$	$.135 \pm .003$

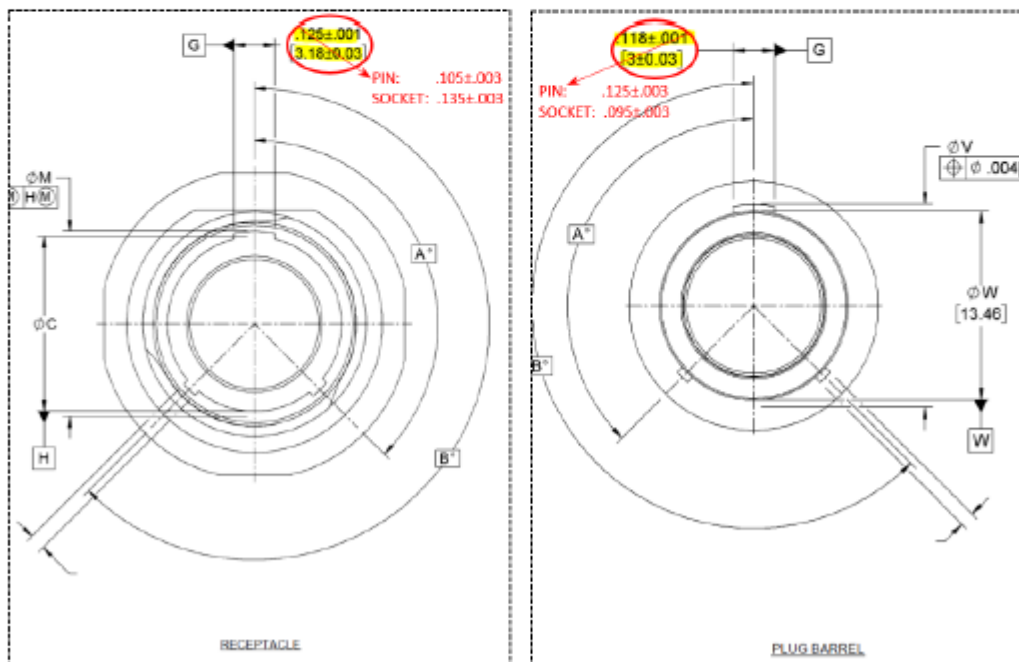


Figure 1, Receptacle and Plug Master Key/Keyway Configuration (image taken from pages 68 & 69)

Comment #25 DLA response: Discussed proposal during teleconference on 24 April 2018 –Proposed changes would result in major design changes. Military applications require the design defined in the rough draft. Consensus is to defer proposal for possible “series 2” to the proposed mil spec.

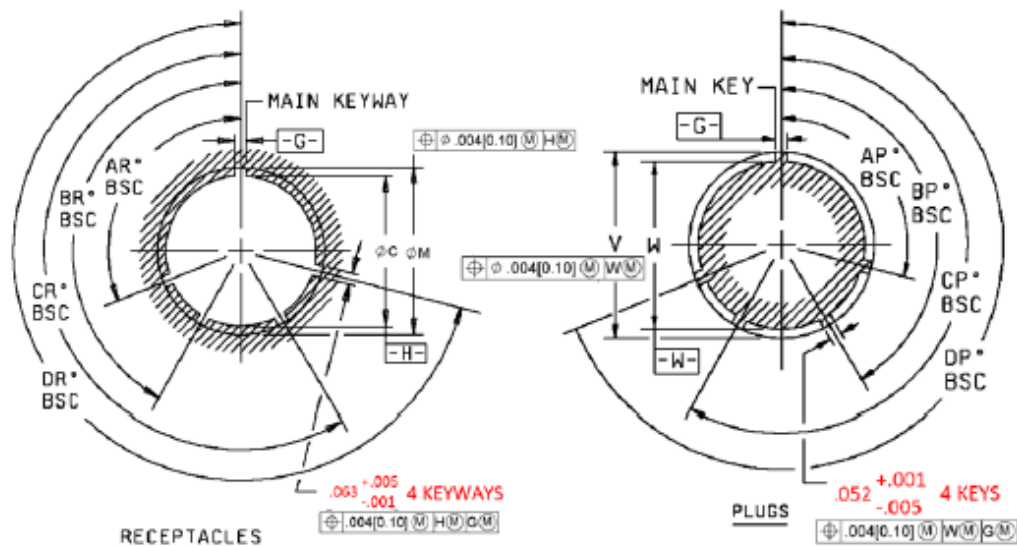
III. SUMMARY OF COMMENTS – Continued.3. Glenair – Continued.

Comment #26 (Glenair).

2. **Minor key/keyway configuration.** In blind mating conditions, the 3 key / keyway construction of the proposed connector can allow the plug connectors to “rock” side to side in the region where not supported by polarization keying (3 O’clock and 9 O’clock regions). This condition can lead into cross threading of plug connector’s coupling thread and the receptacle connector thread:

- In order to mitigate the risk of cross threading, remove possible rocking during mating, and improve overall mateability, an additional two minor key/keyways must be added.
- This 5 key/keyway configuration reflects MIL-DTL-38999 series 3.

The following key/keyway configuration is proposed to remedy this risk:



Key and keyway arrangement identification letter	Minor key/keyway rotations			
	AR° or AP° BSC	BR° or BP° BSC	CR° or CP° BSC	DR° or DP° BSC
N	105	140	215	265
A	102	132	248	320
B	80	118	230	312
C	35	140	205	275
D	64	155	234	304
E	91	131	197	240

Figure 2, Receptacle and Plug Minor Key/Keyway Configuration

Comment #26 DLA response: The proposal was discussed during teleconference on 24 April 2018 (also see comment #1). Proposed changes would result in major product design changes. The proposed design would not be interchangeable in current applications. Military applications require the design defined in the rough draft. Consensus is to defer proposal for possible “series 2” to the proposed mil spec.

III. SUMMARY OF COMMENTS – Continued.3. Glenair. – Continued.

Comment #27 (Glenair).

3. Coupling Thread configuration (BB & DD thread per figure 2, pages 65 and 68):

- a. The subject specification references MIL-DTL-38999 for performance requirements/characteristics. Smaller shell sizes of MIL-DTL-38999 series 3, specifically sizes 9 and 11, have been known to decouple during exposure to high levels of vibration. This problem is an effect of the insufficient thread ramp angle of the triple start thread on these smaller diameter connectors. In light of the subject specification detailing miniaturized MIL-DTL-38999 connectors, this problem will be present with the mating thread in smaller sizes (.750 thread size and smaller) as currently detailed.
- In order to mitigate the risk of de-coupling during vibration, a double-start 60° modified stub ACME thread should be used instead. The suggested double start thread improves the ramp angle and reduces the possibility of decoupling during vibration. This style of thread is used in MIL-DTL-28876 and MIL-DTL-28840 effectively, where no other anti-decoupling features are used.
 - The double-start thread will improve the thread ramp angle while maintaining a 1-full turn [360°] to mate coupling, changing no other dimensional or performance characteristic of the candidate connector as depicted here.
 - An alternative solution is to decrease the thread lead below 0.3, while maintaining the triple thread start of the current configuration. This would improve the thread ramp angle, however it increases the full-mate turning angle to above 360° (as can be achieved with the current configuration).

The following Double-start Mating Thread configuration is proposed to remedy this risk:

Receptacle BB-Thread (DOUBLE 60° ACME Stub Modified Screw-Thread)									
Shell size	Designation a Class 2A thread (TS-2A)			External b Threading Class 2A					
	Thread size (in)	Apparent pitch (in)	Lead	Major Diameter		Minor Diameter		Pitch Diameter	
				Max	Min	Max	Min	Max	Min
8	0.5000	0.15	0.3	TBD	---	---	---	---	---
9	0.5625			TBD	---	---	---	---	---
10	0.6250			TBD	---	---	---	---	---
11	0.6875			TBD	---	---	---	---	---
12	0.7500			TBD	---	---	---	---	---
15	0.9375			TBD	---	---	---	---	---
18	1.1250			TBD	---	---	---	---	---
19	1.1875			TBD	---	---	---	---	---
23	1.4375			TBD	---	---	---	---	---
Plug Coupling Nut - CC-Thread (DOUBLE 60° ACME Stub Modified Screw-Thread)									
Shell size	Designation a Class 2B thread (TS-2B)			Internal Threading Class 2B					
	Thread size (in)	Apparent pitch (in)	Lead	Major Diameter		Minor Diameter		Pitch Diameter	
				Max	Min	Max	Min	Max	Min
8	0.5000	0.15	0.3	TBD	---	---	---	---	---
9	0.5625			TBD	---	---	---	---	---
10	0.6250			TBD	---	---	---	---	---
11	0.6875			TBD	---	---	---	---	---
12	0.7500			TBD	---	---	---	---	---
15	0.9375			TBD	---	---	---	---	---
18	1.1250			TBD	---	---	---	---	---
19	1.1875			TBD	---	---	---	---	---
23	1.4375			TBD	---	---	---	---	---

Figure 3. Receptacle and Plug Mating Threads Configuration

III. SUMMARY OF COMMENTS – **Continued.**

3. Glenair. – **Continued.**

Comment #27 DLA response: Discussed proposal during teleconference on 24 April 2018 (also see comment #1). Defer proposal for possible series II. If users require a different design that could potentially prove to better able to meet more stringent environmental requirements, such as higher vibration requirements, the proposed design may possibly meet these needs.

Comment #28 (Glenair). Shell-to-shell conductivity - Table II, page 4 vs 3.10.4.1 (2 mV)

Comment #28 DLA response: Concur. Change para 3.10.4.1, Shell-to-shell conductivity, initial, to reference conductivity values in Table II. Instead of listing 2.0 mV maximum, 3.10.4.1 shall state "voltage drop across a mated pair of connectors shall be as specified in Table II".

Comment #29 (Glenair). Upper temperature limits in table II, page 4, contradicts temperature maximums shown in other places throughout the specification, including the following: 4.5.21.1 Sine vibration, 4.5.21.2 Random Vibration, 4.5.24.2 IR at elevated temperature, 4.5.36 High temperature exposure with contact loading, 6.1 Intended use. Reduce the temperature limits of these paragraphs to match the content of table II.

Comment #29 DLA position –

First, for reference:

TABLE II temp limits: Class F, G, T, W and Z: -65 deg C- +175 deg C. Class K and L - -65 to 200 deg C.

Temp limits - body of document: 4.5.21.1. Sine Vibration 4 hours at -55°C ± 5°C, and 4 hours at +175°C ± 5°C for classes T, W and Z, and 200°C ± 5°C for classes F, K, L and G. 4.5.21.2 Random vibe limits - Classes T, W and Z at +175°C ± 5°. Classes F, K, L and G: 200°C ± 5°C. 4.5.24.2. Classes T, W and Z at +175°C ± 5°. Classes F, K, L and G: 200°C ± 5°C. 4.5.36 High temp exp with contact loading 175°C + 3°C/- 0°C for classes T, W and Z, and 200°C + 3°C/- 0°C for classes F, K, L and G for 1,000 hours minimum

Concur – In 4.5.21.1 – change -55 to -65. In 4.5.21.1, 4.5.21.2, 4.5.24.2, and 4.5.36: Only classes K and L should be required to be tested at 200 deg C. The max temperature for classes F, G, T, W and Z should be 175 deg C.

Comment #30 (Glenair). The material requirements of table V, page 11, should match the material requirements of MIL-DTL-38999 for the shell housing: "Shell and coupling ring – Impact extruded or machined aluminum alloy".

Comment #30

DLA response: Concur.

Comment #31(Glenair). The material requirements of table V, page 11, should match the material requirements of MIL-DTL-38999 for the shell housing: "Shell and coupling ring – Impact extruded or machined aluminum alloy".

Comment #31

DLA response: Concur.

Comment #32 (Glenair). Paragraph 3.9.22 requires Impact testing, which is only applicable to Class J & M (Composite) in MIL-DTL-38999, and this requirement needs removal.

Comment #32

DLA response: Concur.

III. SUMMARY OF COMMENTS – Continued.

3. Glenair. – Continued.

Comment #33 (Glenair). Maintenance Aging + Altitude Immersion: Test group 1 requires Maintenance Aging prior to Altitude Immersion. As an advisory note, the high density and small diameters of the holes in the insulators and grommet seal can be susceptible to damage resulting from use of removal tool as required in maintenance aging. Glenair recommends that the Maintenance Aging be removed as a pre-conditioning testing prior to Altitude immersion.

Comment #33 DLA response: Issue was discussed during previously referenced 24 April 2018 teleconference. Consensus among connector manufacturers is that the test technician needs to be more careful when conducting maintenance aging testing on connectors with relatively higher density inserts and relatively closer contact spacing. Consensus is that some maintenance aging should be performed prior to altitude immersion. No consensus has been developed on whether or not fewer than the current 10 maintenance aging cycles should be required for the proposed mil spec.

Comment #34 (Glenair). Glenair recommends the following changes to dimensional details on page 56 thru 77.

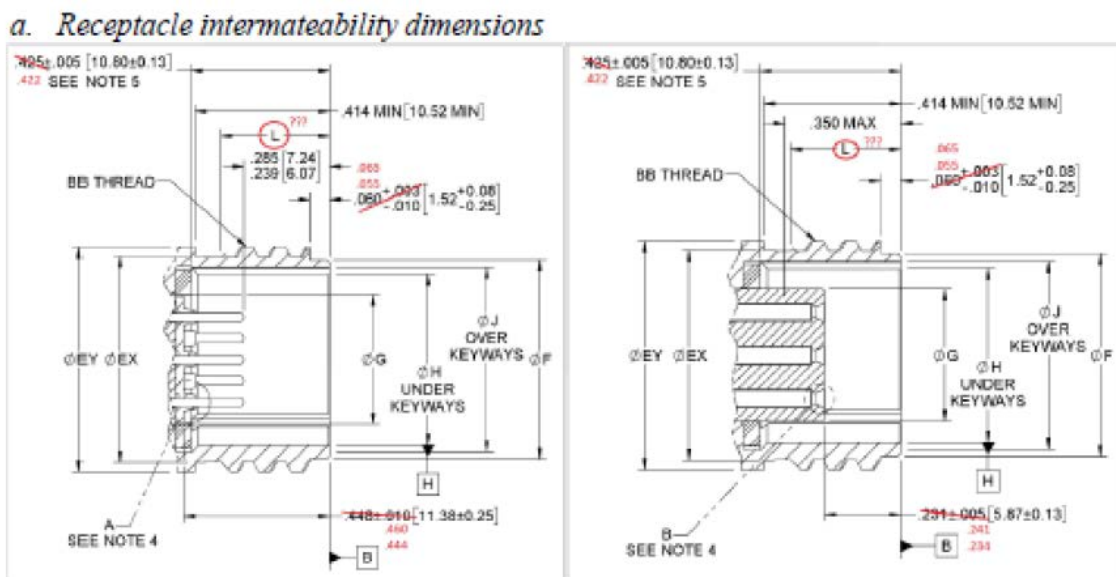


Figure 4, Receptacle intermateability dimensions (from 8935-2018-049 pages 56 & 57, figure 1)

Comment #34 DLA response for RECEPTACLE INTERMATEABILITY (FIGURE 1 in rough draft). Proposal suitable for a “series 2” which is currently beyond the scope of this project. See previous comment #1.

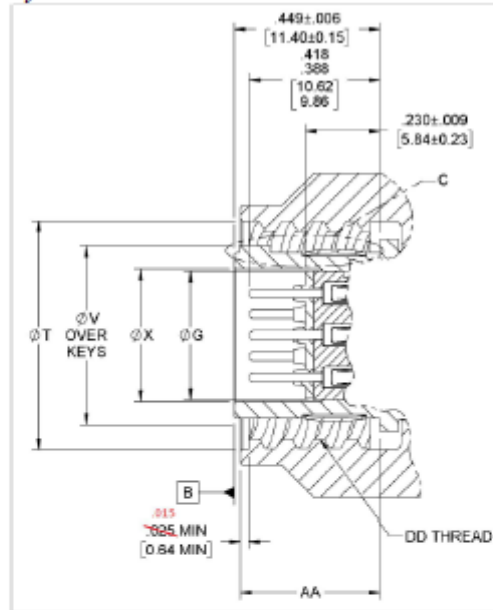
III. SUMMARY OF COMMENTS – **Continued.**3. Glenair.Comment #35 (Glenair). – **Continued.***b. Plug intermateability dimensions*

Figure 6, Plug intermateability dimensions (from 8935-2018-049 page 60, figure 2)

Shell size	W dia + .001 between keys	W' dia max between keys	T dia coupling nut entrance dia	V dia +.000 / -.010 plug shell dia between keys	X dia min plug shell ID	G dia ± .0015	DD thd max major OD	AA ensure Red Band coverage	U dia max	T dia max	V dia max
8	0.311	0.317	0.512 ± .008	0.311	0.231	.222 ~~-0.2225~~ .219	0.502				

Figure 7, Plug intermateability dimensions (from 8935-2018-049 pages 64, table)

Comment #35 DLA response for PLUG INTERMATEABILITY (FIGURE 2 in rough draft). Proposal suitable for a “series 2” which is currently beyond the scope of this project. See previous comment #1.

III. SUMMARY OF COMMENTS – Continued.3. Glenair – Continued.

Comment #36 (Glenair) - Continued.

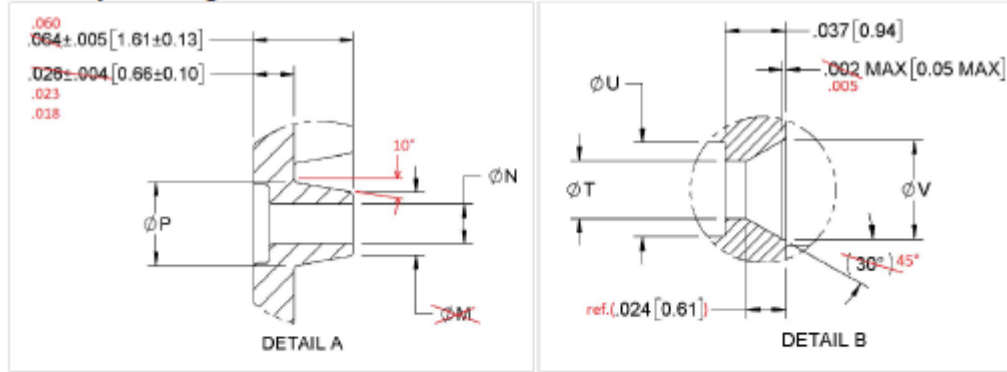
c. Interface Design

Figure 8, Interface design (from 8935-2018-049 page 66, figure 3)

CONTACT SIZE	Interface design - socket contact cavity (Detail B - socket entry)			Interface design - pin contact cavity (Detail A - pin barrier)		
	T dia	U dia	V dia	M dia	N dia	P dia
23	.033 035 (0.89) 033 (0.84) 031	.055 058 (1.47) 055 (1.40) 053	.056 060 (1.52) 056 (1.42) 052	.042 (1.06) 038 (0.97)	.026 025 (0.64) 022 (0.56) 024	.057 048 (1.22) 044 (1.12) 051
20HD	.057 052 (1.32) 050 (1.27) 049	0.086 (2.18) 0.083 (2.11)	0.087 (2.21) 0.085 (2.16) 0.082	0.082 (2.08) 0.078 (1.98)	0.038 (0.95) 0.035 (0.89)	0.082 0.088 (2.49) 0.094 (2.39) 0.076
20	.057 052 (1.32) 050 (1.27) 049	0.086 (2.18) 0.083 (2.11)	0.086 (2.21) 0.085 (2.16) 0.082	0.082 (2.08) 0.078 (1.98)	0.038 (0.95) 0.035 (0.89)	0.082 0.088 (2.49) 0.094 (2.39) 0.076
16	.074 (1.88) 071 (1.80)	.121 (3.07) 118 (3.00)	.112 (2.89) 114 (2.89) 110 (2.79) 108	.098 (2.49) 095 (2.41)	.062 060 (1.52) 057 (1.45) 061	.117 119 (3.02) 114 (2.90) 111
12	.105 106 (2.69) 104 (2.64) 102	.165 169 (4.29) 166 (4.22) 163	.144 142 (3.61) 140 (3.56)	.136 (3.45) 132 (3.35)	.093 (2.36) 090 (2.29)	.149 153 (3.89) 149 (3.78) 145

Figure 9, Interface design (from 8935-2018-049 pages 67, table)

Comment #36 DLA response for PIN CONTACT RAISED SEAL BARRIER / INTERFACE and SOCKET CONTACT CAVITY INTERFACE (FIGURE 3 in rough draft). Proposal suitable for a "series 2" which is currently beyond the scope of this project. See previous comment #1.

III. SUMMARY OF COMMENTS – Continued.3. Glenair. – Continued.

Comment #35 (Glenair) – Continued

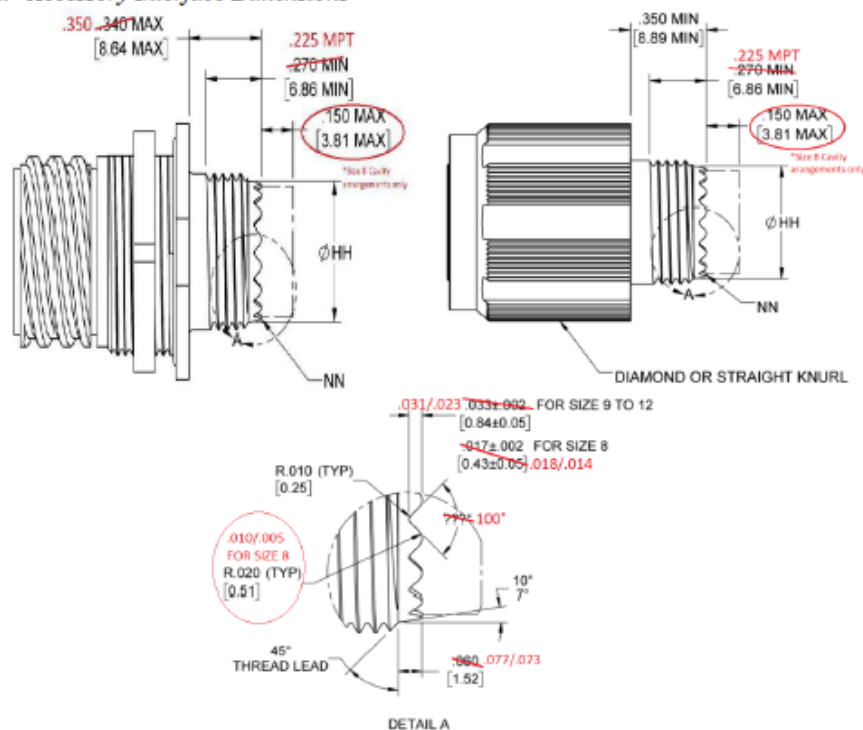
d. Accessory Interface Dimensions

Figure 10, Accessory Interface Dimensions (from 8935-2018-049 page 70, figure 5)

Shell size	Shell size code	Ø HH	NN No of Teeth	Accessory Threads (Inch)
8	A	.332 ~~.324~~ (8.23) ~~.330~~	20	.3750-32 UNEF-2A
9	B	.389 ~~.392~~ (9.96) ~~.387~~	12	.4375-28 UNEF-2A
10	C	.452 ~~.453~~ (11.51) ~~.450~~	13	.5000-28 UNEF-2A
11	D	.507 ~~0.513~~ .505	16	.5625-24 UNEF-2A
12	E	.569 ~~0.565~~ .567	17	.6250-24 UNEF-2A
15	F	.685 ~~0.695~~ .683	23	.7500-20 UNEF-2A
18	G	.872 ~~0.873~~ .870	28	.9375-20 UNEF-2A
19	H	.872 ~~0.873~~ .870	28	.9375-20 UNEF-2A
23	J	1.115 ~~1.128~~ 1.113	35 ~~36~~	1.1875-18 UNEF-2A

Figure 11, Accessory Interface Dimensions (from 8935-2018-049 pages 71, table)

Comment #35 DLA response for REAR ACCESSORY INTERFACE (FIGURE 5 in rough draft). During preparation of the upcoming initial draft, proposed changes to be discussed further with prospective QPL connector manufacturers in order to develop consensus. . Also, sizes 13 and 21 will be added to the table (see comment #3).

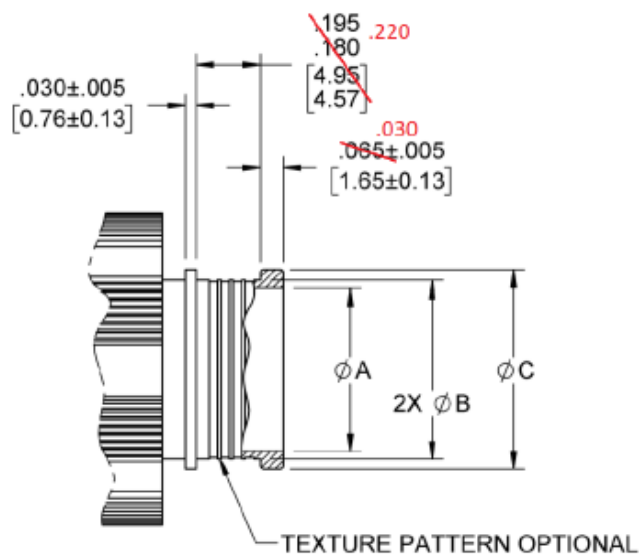
III. SUMMARY OF COMMENTS – **Continued.**3. Glenair. – **Continued.**Comment #36 (Glenair) – **Continued***e. Integral Backshell Interface Dimensions*

Figure 12, Integral Backshell Interface Dimensions (from 8935-2018-049 page 72, figure 6)

Shell size	Shell size code	A dia (ID shell – back end)	B dia (OD shell back edge)	C dia (rear shoulder)
8	A	.274	.315	.375
9	B	.354	.395	~~.445~~ .455
10	C	~~.421~~ .415	.472	.532
11	D	.471	~~.519~~ .515	~~.558~~ .575
12	E	.547	.583	~~.622~~ .640
15	F	.626	.685	.745
18	G	.788	.881	.940
19	H	.834	.881	.940
23	J	1.083	1.132	1.182

Figure 13, Integral Backshell Interface Dimensions (from 8935-2018-049 pages 72, table)

Comment #36 DLA response for CONNECTOR – INTEGRAL BACKSHELL INTERFACE (FIGURE 6 in rough draft). During preparation of the upcoming initial draft, proposed changes to be discussed further with prospective QPL connector manufacturers in order to develop consensus. . Also, sizes 13 and 21 will be added to the table (see comment #3).

III. SUMMARY OF COMMENTS – **Continued.**

3. Glenair. – **Continued.**

Comment #37 (Glenair) – **Continued**

g. Size 20HD Contact, Pin and Socket

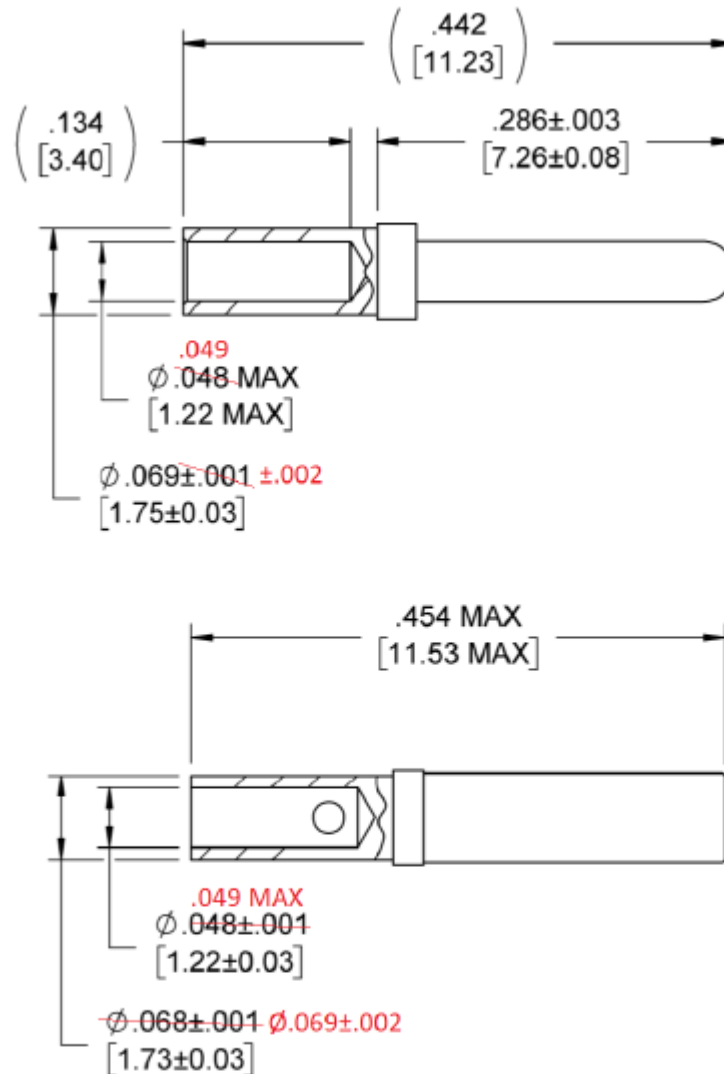


Figure 15, Size 20HD Contact, Pin and Socket (from 8935-2018-049 page 74, figure 8)

Comment #37 DLA response for proposed changes, Size 20HD Pin and Socket contacts (FIGURE 8 in rough draft). During preparation of the upcoming initial draft, proposed changes to be discussed further with prospective QPL connector manufacturers in order to develop consensus.

III. SUMMARY OF COMMENTS – Continued.

3. Glenair. – Continued.

Comment #38 (Glenair) – Continued

f. Size 23 Contact, Pin and Socket

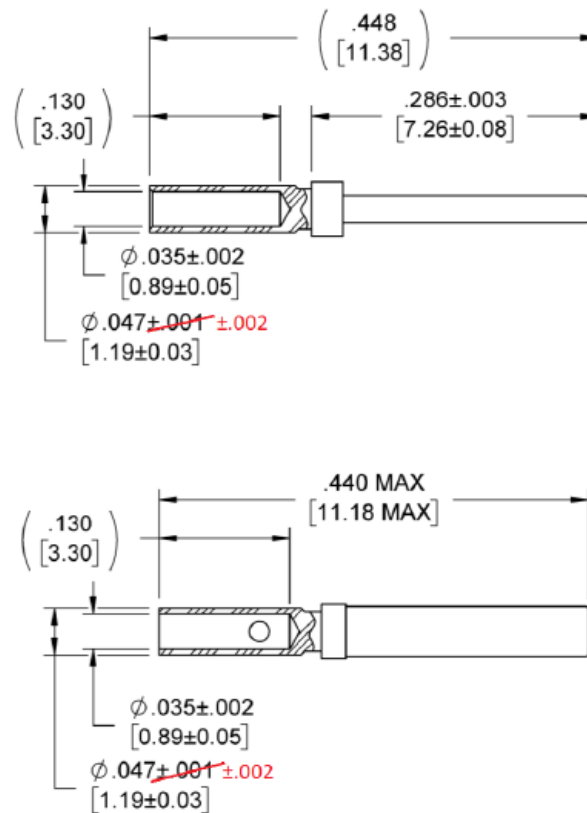


Figure 14, Size 23 Contact, Pin and Socket (from 8935-2018-049 page 73, figure 7)

Comment #38 DLA response for proposed changes, Size 23 Pin and Socket contacts (FIGURE 7 in rough draft). During preparation of the upcoming initial draft, proposed changes to be discussed further with prospective QPL connector manufacturers in order to develop consensus.

III. SUMMARY OF COMMENTS – Continued.3. Glenair. – Continued.

Comment #39 (Glenair) – Continued

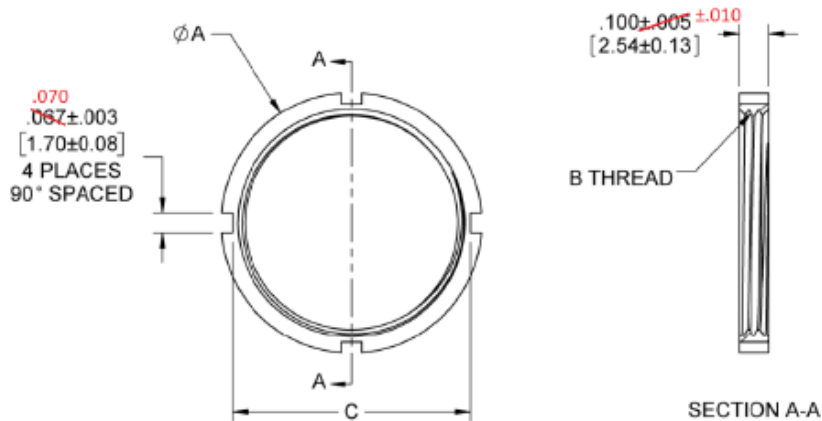
h. *Spanner Nut Dimensions*

Figure 16, Spanner Nut Dimensions (from 8935-2018-049 page 75, figure 9)

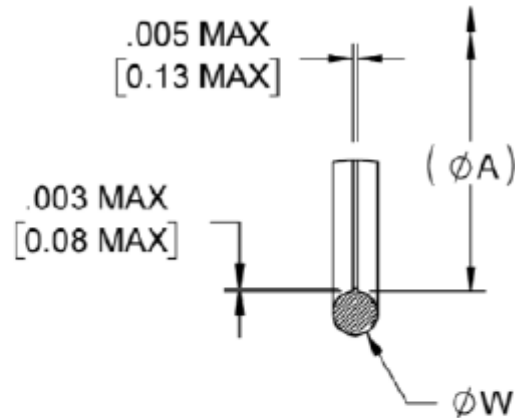
$\text{ØA} \pm .010$	B THREAD UN-28	C
~~.497~~	~~.3750-28~~	~~.422~~
~~.497~~	~~.3750-31 UNEF~~	~~.422~~
~~.562~~	~~.4375-28 UNEF~~	~~.472~~
~~.562~~	~~.4375-32~~	~~.472~~
~~.622~~	~~Shell .5600-32~~	~~.547~~
~~.665~~	~~Size: .5625-32~~	~~.612~~
.685	8 .5625-28	.605 .612
~~.747~~	~~.6250-28~~	~~.672~~
.813	9 & 10 .6875-28	.732
.872	11 .7500-28	.797
.935	12 .8125-28	.862
~~.997~~	~~.8750-28~~	~~.922~~
1.123	15 1.0000-28	1.047
~~1.187~~	~~1.0625-20~~	~~1.122~~
~~1.247~~	~~1.1250-20~~	~~1.172~~
1.322	18 1.1875-28	1.232 1.247
1.372	19 1.2500-28	1.297
~~1.497~~	~~1.3750-28~~	~~1.422~~
1.622	23 1.5000-28	1.547
~~.437~~	~~.3125-48 UNS~~	~~.375~~
~~.427~~	~~.3125-28~~	~~.354~~

Figure 17, Spanner Nut Dimensions (from 8935-2018-049 pages 75, table)

Comment #39 DLA response for proposed changes, Spanner Nut (FIGURE 9 in rough draft). During preparation of the upcoming initial draft, proposed changes to be discussed further with prospective QPL connector manufacturers in order to develop consensus. Also, sizes 13 and 21 will be added to the table (see comment #3).

III. SUMMARY OF COMMENTS – Continued.3. Glenair. – Continued.

Comment #40 (Glenair) – Continued

i. *O-ring Dimensions*

DETAIL B

~~ØW~~

Shell size	A dia max ID ~~±.005~~	B dia max OD cross-section
8	.578 (14.68)	.040 (1.02)
9	.709 (18.01)	.045 (1.14)
10	.709 (18.01)	.045 (1.14)
11	.780 (19.81)	.047 (1.19)
12	.894 (22.71)	.047 (1.19)
15	1.024 (26.01)	.047 (1.19)
18	1.201 (30.51)	.047 (1.19)
19	1.257 (31.93)	.047 (1.19)
23	1.530 (38.86)	.047 (1.19)

Figure 18, O-ring Dimensions (from 8935-2018-049 page 77, figure 11 & table)

Comment #40 DLA response for proposed changes, O-Ring (FIGURE 11 in rough draft). Concur, in upcoming initial draft, add +/- .005 tolerance to A dia and change "B dia" in 3rd column heading to "W dia" to harmonize with figure 11. Also, sizes 13 and 21 will be added to the table (see comment #3).