



DEFENSE LOGISTICS AGENCY

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

January 18, 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.

The subject Engineering Practice Study, dated 18 January 2018, is an effort to obtain feedback and to gauge the extent of interest in a proposed new military specification. Feedback is also sought from the military services, connector manufacturers, and user communities relating to the adequacy of the proposed requirements necessary for military applications. This proposed family of standardized circular connectors include requirements similar to MIL-DTL-38999, series III, but several requirements are modified to accommodate the physical differences in connector design. The proposed standardized document is for connectors that are lighter in weight than similarly sized MIL-DTL-38999 connectors. These connectors also have additional features that do not appear in the 38999 family of connectors, and new requirements are included to verify those features. For more information, see the rough draft of the basic specification, attached. Note: Other documents are also under development, including specification sheets for plugs, receptacles and accessories, as well as a military standard for insert arrangements.

This EPS is available for viewing or downloading from the DLA Land and Maritime website at the following address:

<http://www.landandmaritimeapps.dla.mil/Programs/MilSpec/initialdrafts.aspx>

Please submit your comments by email within 45 calendar days of the date of this letter to the following email address: Lisa.Hoffer@dlamail.

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. 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

18 January 2018

PRELIMINARY

**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

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

- I. OBJECTIVE: Solicit 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 proposed new standardized contacts: 1) Shorter length size 23 contact, and 2) New standardized size 20HD. 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.
Rough draft: In the rough draft, requirements that are still under review are identified with "TBD" (to be determined). Also, information of an explanatory nature is included in the draft in red italics and may have yellow highlighting. This information is for discussion purposes, only. Wording with red italics/yellow highlights is not currently intended for inclusion in the final document.
- III. METHODOLOGY: This EPS project is intended to generate additional information to be used in the preparation of the proposed new military specification and associated specification sheets. Request interested parties review the attached rough draft and provide comments to this office within 45 days from the date of this letter. If an interested party has no comments, but would like to be included on the coordination list for further communications specifically related to this project, then please provide feedback. All comments should be forwarded by email to Ms. Lisa Hoffer, lisa.hoffer@dla.mil, DLA Land and Maritime-VAI. Ms. Hoffer may also be contacted by phone at 614-692-7702.
- IV. RESULTS / CONCLUSIONS: Responses to this EPS will be coordinated with interested parties. The outcome of this EPS will be published to the DLA Land and Maritime website, and the coordinated responses will be used to aid in development of the proposed new military specification.

EPS ATTACHMENT
EPS PROJECT NUMBER 5935-2018-049, DATED 18 JANUARY 2018

INCH-POUND

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DRAFT

DETAIL SPECIFICATION

CONNECTORS, ELECTRICAL, CIRCULAR, MINIATURE, LIGHTWEIGHT, HIGH DENSITY,
QUICK DISCONNECT, TRI-START THREADED COUPLING, ENVIRONMENT RESISTANT WITH
REMOVABLE CRIMP CONTACTS, GENERAL SPECIFICATION FOR

This specification is approved for use by all Departments
and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements for environment resisting, EMI shielded connectors with a triple-start threaded coupling system. Mated connectors achieve full mating with one 360° turn. Plug connector includes ratcheting, anti-decoupling mechanism. Plugs and receptacles have keyed shells and removable, rear release crimp contacts. Shell style options include shells with integral backshells or shells with accessory threads. Contact mating end sizes include sizes 23, 20, 20HD, 16 and 12. Connectors support applications with service ratings up to 1800 Vac (rms) and are capable of operating within a temperature range of -65°C to +200°C, depending on class (see [table II](#)). Connectors are tested to withstand 37 g's random vibration and 300 g's shock. See [6.1](#) for intended use and applications.

1.2 Classification.

1.2.1 Classes. The connector classes, which indicate shell material and the electrically conductive surface finish, are identified with the letter designators listed below. See table I for additional information.

- F - Environment resisting – Aluminum with electroless nickel.
- T - Environment resisting - Aluminum with nickel fluorocarbon polymer.
- W - Environment resisting - Aluminum with cadmium and olive drab chromate.
- Z - Environment resisting - Aluminum with zinc-nickel, black chromate, non-reflective.
- G - Same as F, but space grade.
- K - Environment resisting - Non-magnetic stainless steel with passivate surface finish.
- L - Environment resisting – Non-magnetic stainless steel with electrodeposited nickel.

Comments, suggestions, or questions on this document should be addressed to DLA Land and Maritime, ATTN: VAI, P.O. Box 3990, Columbus OH 43218-3990 or emailed to CircularConnector@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

1.2.2 Connector types and styles. Connector types include plugs and receptacles. Each connector type is capable of being populated with rear-release male pin contacts or rear-release female socket contacts.

a. Connector type shall be as specified on the applicable specification sheet:

(1) Plug, Straight:

- Plug features permanently attached coupling ring with anti-decoupling, ratcheting mechanism, internal EMI grounding spring (also called spring fingers or EMI band). Coupling ring engages when turned in the clockwise direction and disengages in the counterclockwise direction. Shell style available with rear accessory threads or rear integral backshell.

(2) Receptacle, including jam-nut type and square flange type:

- Jam-nut receptacle is rear panel mounting, with rear accessory threads or rear integral backshell (see shell style). Jam nut receptacle includes mounting spanner nut or optional hex nut and external O-ring seal (see [figure 9](#) through [figure 11](#)).
- Square flange, front or rear panel mount, with rear accessory threads or rear integral backshell.

b. Shell style:

(1) Rear accessory threads:

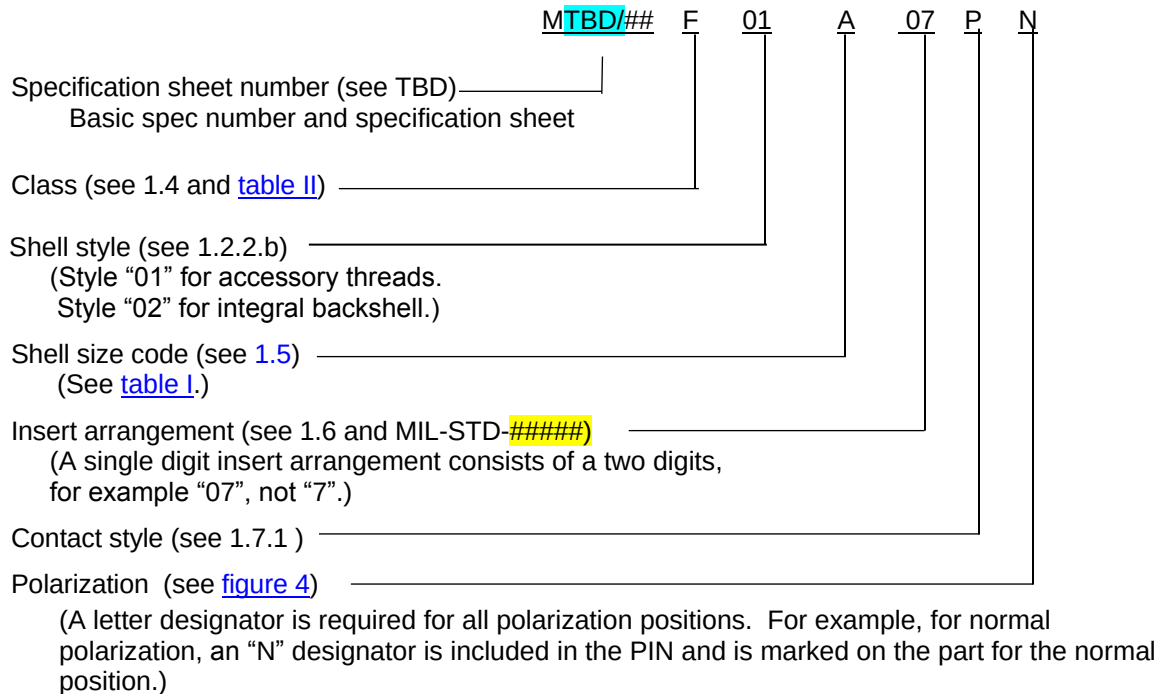
- Connector shells feature rear accessory threads to attach backshells and other accessories.

(2) Rear integral backshell:

- Connector shells feature integrated backshell, or banding platform, for direct termination of shield to shell.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

1.3 Military Part or Identifying Number (PIN). Unless otherwise specified in the specification sheet (see [3.1](#)), the connector PIN configuration for qualified products acquired to this specification is formatted as shown in the following example, and includes the letter “M”, the basic part number with the applicable specification sheet, followed by the applicable alphanumeric letter designators as formatted in the following example:



1.4 Class. For connector class, which includes shell materials and surface finishes, see [table II](#).

1.5 Shell size. Shell sizes are as specified on the applicable specification sheet.

1.6 Insert arrangement. Insert arrangements, or contact arrangement layouts, are specified in MIL-STD-#####.

TABLE I. Shell size code.

Shell size	Code letter	Shell size	Code letter	Shell size	Code letter
8	A	11	D	18	G
9	B	12	E	19	H
10	C	15	F	23	J

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

TABLE II. Classes – shell materials and finishes.

Class	Shell material	Finish (see 3.3.7.2)	Lower temperature limit	Upper temperature limit <u>2/</u>	Shell-to- shell conductivity	Salt spray (hours)
F	aluminum	nickel (electroless)	-65°C	+175°C	1.0	48
K	stainless steel	passivate	-65°C	+200°C	10.0	500
L	stainless steel	electrodeposited nickel	-65°C	+200°C	1.0	500
G <u>1/</u>	aluminum	nickel (electroless)	-65°C	+175°C	1.0	48
T	aluminum	nickel fluorocarbon polymer	-65°C	+175°C	2.5	500
W	aluminum	cadmium olive drab	-65°C	+175°C	2.5	500
Z	aluminum	zinc-nickel	-65°C	+175°C	2.5	500

1/ Class G: Same shell as F, but the class G insert includes outgassing requirements which are intended to make connectors more suitable for use in space applications.

2/ The upper temperature limit is the maximum internal hotspot temperature resulting from any combination of electrical load and ambient conditions.

1.7 Contacts. Contacts shall be removable with crimp terminations, as specified. Size 20, size 16 and size 12 contacts shall be qualified products in accordance with SAE-AS39029, as specified (see table III). Size 23 and size 20HD contacts shall be as specified herein. For contact rating, see table IV.

TABLE III. Crimp contact size and specification.

Type	Contact size				
	23	20HD	20	16	12
Pin	See figure 7	See figure 8	AS39029/122-672	AS39029/122-673	AS39029/122-674
Socket	See figure 7	See figure 8	AS39029/ TBD	AS39029/ TBD	AS39029/ TBD

TABLE IV. Crimp contact current rating.

Crimp contact size	Wire barrel size	Test current (amps) max (ambient temperature)	Millivolt (mV) drop max
23	23	5.0	73
20HD	20	7.5	55
20	20	7.5	55
16	16	13.0	49
12	12	23.0	42

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

1.7.1 Contact styles. The following contact letter designators are for use with connectors populated with contact arrangements herein:

- P - Pin contact, crimp termination.
- S - Socket contact, crimp termination.

1.7.2 Crimp removable contacts (styles P and S). The quantity of crimp contacts to be supplied with each connector unit package shall consist of a full complement of contacts as specified in the applicable specification sheet.

1.7.3 Connectors without contacts. If the user orders standardized contacts and connectors separately, but still intends to populate the connectors with the full complement of standard crimp removable contacts, as specified in MIL-STD-XXXX, then connectors may be ordered without standard contacts by adding the appropriate note on the contract order. However, the connector PIN and the marking requirements remain unchanged.

1.7.4 Figures and tables.

Figures:

- [Figure 1.](#) Receptacle intermateability dimensions.
- [Figure 2.](#) Plug intermateability dimensions.
- [Figure 3.](#) Interface design (pin contact raised seal barrier and socket contact cavity).
- [Figure 4.](#) Connector intermateability dimensions. Main key / keyway polarization.
- [Figure 5.](#) Connector accessory interface dimensions.
- [Figure 6.](#) Connector with integral backshell, rear interface dimensions.
- [Figure 7.](#) Size 23, pin and socket.
- [Figure 8.](#) Size 20HD contact, pin and socket.
- [Figure 9.](#) Spanner nut dimensions.
- [Figure 10.](#) Hex nut dimensions.
- [Figure 11.](#) O-ring dimensions.
- [Figure 12.](#) External bending moment test set-up.
- [Figure 13.](#) Pin contact stability test.
- [Figure 14.](#) Test system schematic for RFI leakage test.
- [Figure 15.](#) RFI leakage test fixture.
- [Figure 16.](#) Typical fixturing for high temperature exposure with contact loading.
- [Figure 17.](#) Contact retention system effectiveness (contact walk-out).
- [Figure 18.](#) Rear accessory thread torque test set-up.
- [Figure 19.](#) Test pin gauge, gauge location and gauge retention.
- [Figure 20.](#) Test gauge, pin, gauge location.
- [Figure 21.](#) Test gauge, socket, gauge location.
- [Figure 22.](#) Random vibration.
- [Figure 23.](#) Vibration test accessory load fixture.
- [Figure 24.](#) Depth of contact engagement for verification testing.
- [Figure 25.](#) External bending moment, accessories, test set-up.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

Tables:

Table I.	Shell size code.
Table II.	Classes – shell materials and finishes.
Table III.	Crimp contact size and specification.
Table IV.	Crimp contact current rating.
Table V.	Connector components, materials and finish codes.
Table VI.	Wire sealing diameter.
Table VII.	Maintenance aging.
Table VIII.	Contact engaging and separating forces.
Table IX.	Axial loads for contact retention.
Table X.	Pin contact stability.
Table XI.	Shell spring finger engagement and separation forces.
Table XII.	Accessory thread strength.
Table XIII.	Coupling and uncoupling torque.
Table XIV.	External bending moment (connector shell style “01”).
Table XV.	Test voltages, Vac (rms), 60 Hz.
Table XVI.	EMI shielding, frequencies.
Table XVII.	Test wire sizes.
Table XVIII.	Qualification and group C periodic tests.
Table XIX.	Group A inspection.
Table XX.	Group B inspection.
Table XXI.	Sampling plan.
Table XXII.	Contact retention.
Table XXIII.	Gunfire vibration.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see [6.2](#)).

FEDERAL STANDARD

FED-STD-H28	-	Screw-Thread Standards for Federal Services.
FED-STD-H28/2	-	Screw-Thread Standards for Federal Services Section 2 Unified Inch Screw Threads - UN and UNR Thread Forms.

(Copies of these documents are available online at <http://quicksearch.dla.mil>.)

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-S-7742	-	Screw Threads, Standard, Optimum Selected Series, General Specification for.
MIL-DTL-22520	-	General Specification for Crimping Tools, Wire Termination.
MIL-DTL-45204	-	Gold Plating, Electrodeposited.
MIL-A-46146	-	Adhesive Sealants, Silicone, RTV, Non-corrosive (for use with Sensitive Metals and Equipment).
MS27488	-	Plug, End Seal, Electrical Connector.

(See supplement 1 for list of specification sheets.)

(Copies of these documents are available online at <http://quicksearch.dla.mil>.)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-202-110	-	Method 110, Sand and Dust.
MIL-STD-790	-	Standard Practice for Established Reliability and High Reliability Qualified Products List (QPL) Systems for Electrical, Electronic, and Fiber Optic Parts.
MIL-STD-810	-	Test Method Standard for Environmental Engineering Considerations and Laboratory Tests.
MIL-STD-889	-	Dissimilar Metals.
MIL-STD-1285	-	Marking of Electrical and Electronic Parts.

(Copies of these documents are available online at <http://quicksearch.dla.mil>.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation or contract.

NATIONAL AERONAUTICAL SPACE ADMINISTRATION (NASA)

NASA Reference Publication 1124 – Outgassing Data for Selecting Spacecraft Materials.

(Copies of these documents are available online at <http://outgassing.nasa.gov>.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)

EIA/ECA-364-21	-	Insulation Resistance Test Procedure for Electrical Connectors, Sockets, and Coaxial Contacts.
EIA/ECA-364-26	-	Salt Spray Test Procedure for Electrical Connectors, Contacts and Sockets.
EIA/ECA-364-29	-	Contact Retention Test Procedure for Electrical Connectors.
EIA-359	-	EIA Standard Colors for Color Identification and Coding.
EIA-364	-	Electrical Connector/Socket Test Procedures including Environmental Classifications.
EIA-364-02	-	Air Leakage Test Procedure for Electrical Connectors.
EIA-364-06	-	Contact Resistance Test Procedure for Electrical Connectors.
EIA-364-10	-	Fluid Immersion Test Procedure for Electrical Connectors.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

EIA-364-14	- Ozone Exposure Test Procedure for Electrical Connectors.
EIA-364-20	- Withstanding Voltage Test Procedure for Electrical Connectors, Sockets and Coaxial Contacts.
EIA-364-23	- Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets.
EIA-364-24	- Maintenance Aging Test Procedure for Electrical Connectors.
EIA-364-27	- Mechanical Shock (Specified Pulse) Test Procedure for Electrical Connectors.
EIA-364-28	- Vibration Test Procedure for Electrical Connectors and Sockets.
EIA-364-29	- Contact Retention Test Procedure for Electrical Connectors.
EIA-364-31	- Humidity Test Procedure for Electrical Connectors and Sockets.
EIA-364-32	- Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors and Sockets.
EIA-364-35	- Insert Retention Test Procedure for Electrical Connectors.
EIA-364-42	- Impact Test Procedure for Electrical Connectors.
EIA-364-46	- Microsecond Discontinuity Test Procedures for Electrical Connectors, Contacts and Sockets.
EIA-364-54	- Magnetic Permeability Test Procedure for Electrical Connectors, Contacts, and Sockets.
EIA-364-66	- EMI Shielding Effectiveness Test Procedure for Electrical Connectors.
EIA-364-78	- Cavity-to-Cavity Leakage Bonding Integrity Test Procedure for Electrical Connectors.
EIA-364-79	- Insert Bond Strength Test Procedure for Electrical Connectors.
EIA-364-83	- Shell-To-Shell and Shell-To-Bulkhead Resistance Test Procedure for Electrical Connectors.
EIA-364-105	- Low Temperature Test Procedure for Electrical Connectors.
EIA-364-114	- Coupling and Uncoupling Force Test Procedure for Electrical Connectors, Sockets and Applicable Accessories.

(Copies of these documents are available online at <http://eciaonline.org>.)

ASME INTERNATIONAL

ASME Y14.5	- Dimensioning and Tolerancing.
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(Copies of these documents are available online at <http://www.asme.org>.)

ASTM INTERNATIONAL

ASTM B733	- Standard Specification for Autocatalytic (Electroless) Nickel Phosphorus Coatings on Metal.
ASTM B841	- Standard Specification for Electrodeposited Coatings of Zinc Nickel Alloy Deposits.

(Copies of these documents are available at <http://www.astm.org>.)

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

SAE INTERNATIONAL

SAE-AIR1351	-	Manufacturers' Identification of Aerospace Electrical and Electronic Wiring Devices and Accessories.
SAE-AMS2700	-	Passivation Treatments for Corrosion-Resistant Steel.
SAE-AMS-QQ-P-416	-	Plating, Cadmium (Electrodeposited).
SAE-AMS-QQ-N-290	-	Nickel Plating (Electrodeposited).
SAE-AMS2454	-	Plating, Electroless Nickel, Codeposited with Polytetrafluoroethylene (PTFE).
SAE-AS22759	-	Wire, Electrical, Fluoropolymer-Insulated, Copper or Copper Alloy.
SAE-AS22759/9	-	Wire, Electrical, Fluoropolymer-Insulated, Extruded TFE, Silver-Coated Copper Conductor, 100-Volt.
SAE-AS39029	-	Contacts, Electrical Connector, General Specification for.
SAE-AS39029/121	-	Contacts, Electrical Connector, Socket, Crimp Removable, Expanded Performance, Sizes 10, 12, 16, 20, 22 and 23 (for MIL-DTL-38999 Series III Connectors).
SAE-AS39029/122	-	Contacts, Electrical Connector, Pin, Crimp Removable, Expanded Performance, Sizes 10, 12, 16, 20, 22 and 23 (for MIL-DTL-38999 Series III Connectors).
SAE-AS81969/1	-	Installing and Removal Tools, Connector Electrical Contact, Type III, Class 2, Composition C.
SAE-AS81969/8	-	Installing and Removal Tools, Connector Electrical Contact, Type I & II, Class 2, Composition A.
SAE-AS81969/14	-	Installing & Removal Tools, Connector Electrical Contact, Type III, Class 2, Composition B.
SAE-EIA557	-	Statistical Process Control Systems.

(Copies of these documents are available at <http://www.sae.org>.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 Qualification. The connectors and accessories furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.3 and 6.5). Once product is qualified, if the manufacturer seeks to make design changes or process changes, or if the manufacturer seeks to use alternate / substitute materials, then the manufacturer shall be required to coordinate with and obtain approval from the qualifying activity.

3.2.1 Qualified Products List (QPL) system. The manufacturer shall establish and maintain a quality system that allows its parts that are covered by this specification to be listed on the QPL. Requirements for this system are specified in MIL-STD-790. In addition, the manufacturer shall implement and use SPC techniques in the manufacturing process for parts covered by this specification. The SPC program shall be developed and maintained in accordance with SAE-EIA557. The SPC program shall be documented and maintained as part of the overall reliability assurance program as specified in MIL-STD-790.

3.3 Materials.

3.3.1 Critical interface materials. Materials shall be as specified herein. When a definite material is not specified, a material shall be used which will enable the connector to meet the performance requirements of this specification.

3.3.1.1 Metals. Metals shall be corrosion-resistant or shall be plated or treated to resist corrosion, and as specified herein (see table V).

3.3.1.2 Dissimilar metals. When dissimilar metals are used in intimate contact with each other, protection against galvanic corrosion shall be provided. The use of dissimilar metals in contact, which tend toward active galvanic corrosion (particularly brass, copper, or steel used in contact with aluminum or aluminum alloy) is not acceptable. However, metal plating of dissimilar base metals to provide similar or suitable abutting surfaces is permitted. The use of dissimilar metals separated by a suitable insulating material is also permitted. Dissimilar metals and compatible couples are specified in MIL-STD-889.

3.3.1.3 Pure tin. The use of pure tin, as an underplate or final finish, is prohibited both internally and externally. Tin content of connectors, their components and solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum of 3 percent lead, by mass (see 6.x).

3.3.2 Components. Unless otherwise specified (see 3.1), materials for specific connector components shall be as specified in table V.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

TABLE V. Connector components, materials and finish codes.

Components	Materials and finishes
Shell housing (including coupling ring) and jam-nut (i.e., spanner nut and hex nut), base material	Impact extruded or machined aluminum alloy 6061 T6 (class F, G, T, W and Z) or stainless steel (class K and L). Finish as specified (see finish code details, para. 3.3.6)
Rigid dielectric of insert (i.e., insulator)	Glass-filled liquid crystal polymer (LCP) per ASTM D5138 or polyphenylene sulfide (PPS)
Interfacial seal, wire-sealing grommet and O-ring	Silicone/fluorosilicone or fluorosilicone blend elastomer (100% silicone note permitted)
EMI grounding spring (i.e., spring fingers)	Heat treated beryllium copper with nickel plating or corrosion resistant steel with plating as specified
Contact retention clip	Beryllium copper, heat treated
Filler compound	Room temperature vulcanizing (RTV) silicone in accordance with MIL-A-46146.
Adhesive	Epoxy film
Contacts (pins and sockets)	Qualified in accordance with QPL-39029 (contact sizes 12, 16, and 20) . Contact sizes 20HD and 23 shall be copper alloy in accordance with ASTM B-36, B-121, B16, B16M, B-124 or equivalent, plated with 50 microinches gold, and shall be as specified herein. Stainless steel socket hood finish shall be passivated per AMS-2700.

3.3.3 Recycled, recovered, or environmentally preferable, or biobased materials. Recycled, recovered, environmentally preferable, or biobased materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3.4 Hazardous materials. The use of environmentally preferable materials in the construction of these connectors is encouraged. See 6.9 for guidance.

3.3.5 Fungus resistance. Materials used in the construction of these connectors shall be fungus inert (see 4.5.43).

3.3.6 Magnetic permeability.

3.3.6.1 Magnetic permeability, mated connectors. The relative permeability of the wired, fully populated, and fully mated connector assembly shall be less than 2.0 μ (see 4.5.41).

3.3.6.2 Magnetic permeability, mated contacts (size 20HD and size 23, only). The relative permeability of the wired, fully populated, and fully mated contacts shall be less than 2.0 μ (see 4.5.41).

3.3.7 Plating and surface finishes.

3.3.7.1 Contacts, pins and sockets, plating. Size 23 and size 20HD crimp contacts specified herein shall be gold plated to a minimum thickness of .000050 inch (0.00127 mm) in accordance with MIL-DTL-45204 over a suitable underplate. Silver underplate shall not be used. Size 20, size 16 and size 12 crimp contacts shall be as specified in SAE-AS39029. Socket shall have a stainless steel hood, passivated in accordance with AMS-2700.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

3.3.7.2 Shells and accessory hardware. Unless otherwise specified, the finish on shells and accessory hardware shall be in accordance with the following requirements:

- G, F - Electrically conductive electroless nickel plating conforming to ASTM-B733, service category SC2 .0005 inches (0.013 mm) minimum thickness. Specified dimensions apply after plating. Use of a suitable underplate is permissible. Finish shall be capable of meeting salt spray (corrosion) testing in accordance with EIA/ECA-364-26 test condition B (48 hours).
- W - Olive drab cadmium plate in accordance with SAE-AMS-QQ-P-416 over a suitable underplate. Final finish shall be electrically conductive.
- T - Nickel with fluorocarbon polymer additives conforming to SAE-AMS2454 over a suitable underplate to withstand 500 hours of dynamic salt spray testing. Color shall be nonreflective.
- Z - Zinc nickel in accordance with ASTM-B841, type D (black), over a suitable underplate to withstand 500 hours of dynamic salt spray testing, with the following exception: Zinc may be alloyed with a maximum of 20% nickel, by mass. Color shall be nonreflective.
- K - Electrically conductive, non-magnetic, corrosion resistant steel, with passivate surface finish.
- L - Electrodeposited nickel in accordance with SAE-AMS-QQ-N-290, class 2, .0001 inch (0.003 mm) minimum thickness. Specified dimensions apply after plating.

3.3.7.3 Shell spring fingers (grounding springs). Shell spring fingers (also called grounding springs or EMI bands), shall be suitably protected to meet salt spray (corrosion) requirements and shall be galvanically compatible with connector shell. Gold-plated spring fingers shall not be used with cadmium plated shells.

3.4 Design and construction.

a. Connectors and accessories shall be configured to withstand normal handling incident to installation and maintenance in service. Connector intermateability control dimensions shall be as specified on figures 1 and 2. Connector accessory interface dimensions shall be as specified on [figure 5](#). All accessories designed to be used with MIL-DTL-xxxxx connectors shall conform to SAE-AS85049. Recommended panel cutout dimensions are shown in 6. **TBD** on figure **TBD**.

b. Size 23 and 20HD contacts (see [figures 7 and 8](#)): Contact accessory members, such as pressure members and retaining devices, shall be corrosion-resistant material or passivated, or shall be suitably treated to resist corrosion. Hoods shall be corrosion-resistant steel. The mating end of socket contacts shall be a closed-entry design with integral pressure members and ends shall be rounded or chamfered to direct and center the entry of the pin contact. The closed entry design shall exclude the entry of a pin 0.0005 inch larger than the allowable maximum pin diameter. Mechanical pressure members shall not be exposed, and shall assure contact pressure between mated pins and sockets and the pressure member shall be protected from probe damage, oversize pin and handling damage. The wire termination end of the contacts shall conform to SAE-AS39029.

3.4.1 Dimensioning. Unless otherwise specified, dimensioning and tolerancing shall be in accordance with ASME Y14.5. Unless otherwise specified, dimensions apply after plating. Metric dimensions are provided for information only. In this specification, a zero precedes the decimal point for metric values less than 1 mm.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

3.4.2 Interchangeability and intermateability. All connectors and accessories having the same military specification (MS) Part or Identifying Number (PIN) shall be completely interchangeable with each other with respect to installation (physical form and fit) and performance (function) as specified herein.

3.5 Connector subcomponents and construction.

3.5.1 Contacts. Contacts shall be crimp removable, as specified.

3.5.1.1 Crimp removable contacts. Crimp removable contacts are intended to be used with all environment resisting classes of connectors. Crimp contacts shall be qualified products in accordance with SAE-AS39029, except for size 23 and 20HD, which shall be as specified herein. The quantity of crimp contacts to be supplied with each connector unit package shall consist of a full complement of contacts plus one spare contact for each contact size used in insert arrangements utilizing 26 contacts or less. For insert arrangements utilizing more than 26 contacts, 2 spare contacts of each contact size used in the arrangement shall be supplied.

3.5.2 Insert arrangement. Electrical connector inserts, or insulators, shall provide an insulating element to position and support the contacts within the connector.

3.5.2.1 Insert construction and insert retention. The entire insert, consisting of the rigid dielectric, fluorosilicone wire sealing/supporting grommet, and interfacial seals (when specified), shall be one integral assembly, configured to provide suitable sealing and support around the wires and cables. Inserts shall be positioned in the shell in accordance with figure 5, and shall be mechanically secured within the shell to ensure retention and to prevent rotation. The rigid dielectric shall be one molded piece or no more than two pieces bonded so as to form one integral piece. Interfacial seals, when specified, shall be bonded to the hard insert. The rigid dielectric shall be voidless to eliminate any air paths between contact cavities. The insert shall also be designed to permit the removal and replacement of individual crimp type pin or crimp type socket contacts into the rear, wired side of the connector insert contact cavities using SAE-AS81969 installing/removal tools. Positive locking of the contacts within the insert shall be accomplished with insert retention clips permanently installed within each contact cavity in the rigid dielectric insert. The insert shall meet the contact retention requirements of this specification.

3.5.2.2 Insert arrangement, contact location. The engaging end of the pin contact in assembled connectors shall be located within .024 inch (0.61 mm) diameter of true position and the engaging end of the socket contact in assembled connectors shall be located within .015 inch (0.38 mm) diameter of true position.

3.5.2.3 Contact alignment and float. Inserts for crimp socket contacts shall provide an overall side-play ("float") of the socket contacts of .0025 to .0075 inch (0.063 to 0.190 mm) from the true alignment position to facilitate alignment with mating pin contacts. The alignment of crimp pin contacts assembled into either plug or receptacle shall be in accordance with the applicable specification sheet when measured at the engaging end of the contacts.

3.5.2.4 Insert front interface. Mated connector pairs shall include environmental sealing features so that engaged connectors comply with the requirements specified herein. All pin contact inserts shall have resilient interfacial seals bonded to the front face of the connector insert. Chamfered socket "lead-in" entry holes and raised pin seal barriers, or pin "donut" rings, shall conform to the requirements on figures 1 through 3. The insert engaging faces shall be designed and constructed to eliminate air paths between the connector mating interfaces.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

3.5.2.5 Grommet-to-wire sealing. Environment resisting assemblies shall be designed to meet the environmental requirements of this specification. The grommet shall be permanently bonded to the hard insert. The grommet shall provide sealing for a full complement of wire or cable sizes and finished wire outside diameters. See [table VI](#) for minimum and maximum wire and cable outside diameters.

3.5.3 Grommet sealing plugs. Except when otherwise specified (see [3.1](#)), the grommets of environment resisting connectors shall be designed to accept sealing plugs/dummy contacts in accordance with MS27488. MS27488-22-2 (black) shall be used for size 23-22 and MS27488-20-2 (red) shall be used for both size 20 and 20HD. Grommet sealing plugs shall be used in lieu of wire in all unwired, unpopulated contact cavities. The quantity of sealing plugs to be enclosed in the unit pack shall be ten percent of the number of contacts, but not less than one, for each contact size. For indirect shipments, connectors may be specified without grommet sealing plugs (see [6.2](#)).

3.5.4 Connector shell. Connector shell bodies, including receptacle mounting flanges, shall be of a one-piece construction and shall be designed to retain their inserts in one position, both axially and with respect to rotation. A solid red stripe, uniform in color, shall be located on the connector shell to indicate the main, "master" key or keyway. The color of the red stripe shall be in accordance with EIA-359, and shall remain permanent after exposure to all tests specified in [table XVIII](#).

3.5.5 Cavity fill compound between shell and rear grommet. If the rear grommet design does not allow for intimate contact between it and the complete inner perimeter of the shell, any resulting cavity between the insert and the shell shall be filled with RTV silicone in accordance with MIL-A-46146. The silicone shall adhere to both the shell and the grommet.

3.5.6 Jam-nut mounting receptacles, mounting nuts and O-rings. Jam-nut mounting receptacles shall be provided with mounting nuts in accordance with [figure 9](#) (spanner nut) or [figure 10](#). (hex nut) as specified in accordance with MIL-DTL-[TBD/##](#) (see section 6 for application data). Jam nut mounting receptacles shall include an external fluorosilicone O-ring in accordance with [figure 11](#).

3.5.7 EMI grounding spring (plugs only) and minimum electrical engagement. All plugs shall include EMI grounding springs (also called spring fingers, EMI bands, grounding fingers or grounding straps). Grounding springs shall be designed to make electrical contact with the mating shell without interfering with mechanical coupling and engagement. The spring fingers shall be retained about the shell body periphery. Minimum engagement of coupling springs shall be .040 (1.02 mm) prior to contact engagement.

3.5.8 Screw threads (coupling threads and connector accessory threads). Coupling threads shall conform to FED-STD-H28 and MIL-S-7742 as applicable. Connector accessory threads shall be as specified in [figure 5](#). Threads shall be checked using ring or plug gauges. Slight out-of-roundness beyond the specified tolerances is acceptable if threads can accept the gauges without forcing.

3.5.8.1 Lubrication, internal threads. No lubricants shall be used on receptacle coupling areas, plug coupling areas, or on rear accessory threads. During connector manufacturing process, internal coupling threads of triple-start connectors may be coated with a lubricant that shall be non-flaking and galvanically compatible, and shall not migrate into other threaded areas.

3.6 Connector coupling and locking. Connector mating shall be accomplished with triple-start mating threads. Complete coupling shall be accomplished by rotating the coupling ring clock-wise until the coupling ring covers the red mating indicator band and the connector shells bottom against each other. Complete coupling and uncoupling shall be accomplished by rotating the coupling ring approximately 360°. Fully coupled connectors shall maintain shell-to-shell "bottoming", in which mechanical contact is

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

maintained between the receptacle and plug housing. Mated connectors shall not exhibit any shifts in resonance points during testing in accordance with 4.5.21.2. Mated connectors, when vibrated, shall not display any resonance at frequencies less than 300 Hz. An anti-decoupling device shall be provided to maintain complete coupling. A solid red indicator band, uniform in color, shall be located on the receptacle so as to be visible when unmated and to be fully covered when completely mated. The red band shall remain permanent after exposure to all tests specified in [table XVIII](#) herein. Counterpart connectors of any arrangement shall be capable of being fully coupled and uncoupled in a normal and accessible location without the use of tools.

3.6.1 Shell keying and polarization. Polarization of connectors shall be accomplished by matched integral key(s) and keyway(s) of counterpart plugs and receptacles. Polarization shall be accomplished prior to initial engagement of the plug coupling ring. During axial engagement, pins shall not touch sockets or the insert face until polarization has been achieved. The receptacle shall include three keyways which engage with corresponding keys in the plug. Connectors shall include a major, "master" key/keyway with a fixed location, which is wider than the two minor keys/keyways. The position of the insert shall be fixed relative to the master key. Different polarizations shall be obtained by altering the locations of the minor keys.

3.6.2 Alternate keying/polarization positions. Alternate rotation positions shall be as specified in [figure 4](#). For alternate polarization positions, the master key always stays fixed, while the position of the two minor keys/keyways rotate in relation to the master key.

3.6.3 Pin-to-pin mating prevention. Connectors shall be designed such that electrical or physical pin-to-pin contact is not possible if a plug with pin contacts is inadvertently mated with a receptacle with pin contacts.

3.7 Contact installation/removal method, and installing / removal tools. Crimp contact installation and removal shall be accomplished from the rear, wired side of the connector. SAE-AS81969/1, SAE-AS81969/8 and SAE-AS81969/14 tools shall be used to install and lock pin and socket contacts in place, and release and remove pin and socket contacts from their respective contact cavities. One SAE-AS81969/14 (contact sizes 12, 16, 20 and 20HD), or one SAE-AS81969/1 (contact size 23 only) installing/removal tool for each contact size, as applicable, shall be enclosed in the unit package. For indirect shipments, connectors may be specified without installation and removal tools ([see 6.2](#)).

TABLE VI. Wire sealing diameter 1/

Contact mating end size	Wire size (AWG)	Finished maximum outside wire diameter (OD)	
		Inch min	Inch max
23	28, 26, 24, 22	.030	.054
20HD	24, 22, 20	.040	.083
20	24, 22, 20	.040	.083
16	18, 16	.065	.109
12	14, 12	.097	.142

1/ Dimensions are in inches. Metric equivalents are given for information only.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

3.8 Dust caps. Protective plastic dust caps shall be furnished in place on the mating end of each connector for shipment in the unit package for protection during shipping and storage. For plugs with spring fingers, dust caps shall be assembled externally over the mating end of the coupling ring.

3.9 Mechanical requirements.

3.9.1 Maintenance aging. After being tested as specified in [4.5.2](#), crimp contact installing and removal forces shall not exceed the requirements specified in [table VII](#). Contact retention (see [4.5.5](#)), shall be performed on contacts subjected to the maintenance aging conditioning test.

TABLE VII. Maintenance aging – installing and removal forces.

Contact mating end size	Installing and removal forces (maximum)	
	Pounds	Newtons
23	10	44
20 and 20HD	20	89
16	20	89
12	30	133

3.9.2 Durability.

3.9.2.1 Durability, connector mating and unmating. When tested as specified in [4.5.3](#), counterpart connectors populated with the specified complement of contacts, shall withstand 500 cycles of mating and unmating without mechanical or electrical degradation. Connectors shall meet all subsequent test requirements.

3.9.2.2 Durability, contact mating and unmating (contact sizes 23 and 20HD only). When tested as specified in [4.5.3](#), counterpart contacts shall show no evidence of defects detrimental to the mechanical or electrical performance when subjected to 500 mating cycles.

3.9.3 Contact engagement and separating forces, size 23 and 20HD only (see [4.5.44](#)). Size 23 and 20HD crimp contacts shall be tested in accordance with the contact engagement and separation test procedure as specified in SAE-AS39029. Contact engagement and separation forces shall be as specified in [table VIII](#).

Table VIII – Contact engaging and separating forces

Contact mating end size	Separation and engagement force initial (before conditioning) (ounces)			Separation and engagement force after conditioning (ounces)		
	Separation force minimum	Maximum average engagement force	Maximum engagement force	Separation force minimum	Maximum average engagement force	Maximum engagement force
23	0.5	6.8	8	0.4	8.1	10
20HD	0.7	9.5	12	0.6	11.4	14

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

3.9.4 Contact retention. When tested as specified in 4.5.5, crimp contacts shall be retained in their inserts at the axial loads specified in [table IX](#) without damage to the contacts or insert. The axial displacement of contacts with respect to the shell shall not exceed .012 inch (0.30 mm) while under load. The axial displacement of contacts with respect to the shell shall not exceed .012 inch (0.30 mm) within one minute after the load has been removed.

TABLE IX. Axial loads for contact retention.

Crimp contact mating end size	Axial load minimum (pounds) +10% /- 0 lb	Axial load minimum (Newtons) +10% /-0 N
23	10	44
20HD	10	44
20	15	67
16	25	110
12	25	110

3.9.5 Gauge location. The axial location of pin and socket contacts shall be measured as specified in 4.5.6 using test gages simulating contacts at minimum material conditions in accordance with figures 19 through 21, as applicable. Gauge location measurements shall fall within the range specified on [figures 1 and 2](#).

3.9.6 Gauge retention. Test gauges in accordance with 4.5.7, as applicable, shall be retained in the pin and socket cavities of crimp contact connectors when axial loads specified in table IX are applied. The axial displacement of the test gauges while under load shall not exceed 0.012 inch (0.38 mm).

3.9.7 Installing and removal tool abuse. When tested as specified in 4.5.8, there shall be no damage to the crimp contacts, the connector insert, or the contact retaining mechanism. The connectors shall meet the requirements of subsequent testing.

3.9.8 Resistance to probe damage (contacts sizes 23 and 20HD, socket contacts only). Contacts may be installed in the connector. When tested as specified in 4.5.10, socket contacts shall withstand the bending moment and depth of the test probe insertion without evidence of damage that would interfere with the mechanical or electrical performance of subsequent connector testing.

3.9.9 Pin contact stability. When tested as specified in 4.5.9, the total displacement of a reference point on the contact tip end shall not exceed the amount shown in [table X](#).

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

TABLE X. Pin contact stability.

Crimp contact size (mating end)	Wire barrel size	Total displacement		Force	
		Inch	mm	Pounds (lbf)	Newtons (N)
23	22	.025	0.64	.25	1.1
20HD	20	.054	1.37	.55	2.4
20	20	.054	1.37	.55	2.4
16	16	.075	1.91	1.1	4.9
12	12	.075	1.91	1.1	4.9

3.9.10 Contact retention system effectiveness (contact walk-out). When tested as specified in [4.5.11](#), contacts shall not become dislodged from their normal position.

3.9.11 Plating porosity (size 20HD and size 23 only). When tested as specified in [4.5.12](#), there shall be no bubbling during the observation period when gold-finished contacts are examined for plating porosity.

3.9.12 Plating thickness (size 20HD and size 23 only, not applicable to socket accessory members or socket hoods). When measured as specified in [4.5.13](#), the plating thickness of external plated surface diameters, except for corners, shall be in accordance with the overall finish requirements for type D, specified in SAE-AS39029. All other surfaces shall be plated to a thickness to assure specified performance of the contact.

3.9.13 Surface roughness (size 20HD and size 23 only). The roughness height shall be as defined in ASME B46.1. When measured as specified in [4.5.14](#), the roughness height of pin mating surfaces indicated (see [figure 7](#) and [figure 8](#)), shall be 32 micro-inches or less after plating. Other surfaces shall be 63 micro-inches or less after plating.

3.9.14 Contact strength (size 20HD and size 23 only). After being subjected to mechanical loading specified in [4.5.15](#), pin contacts shall exhibit a permanent set no greater than 0.005 inch.

3.9.15 Axial concentricity (size 20HD and size 23 only). When measured as specified in [4.5.16](#), unless otherwise specified (see 3.1), all diameters shall be concentric to each other within the limits specified in 3.9.15.1 and 3.9.15.2.

3.9.15.1 Axial concentricity, unwired. The total indicator reading (TIR) shall not exceed .006 for contact mating end sizes 12 and 16 and shall not exceed .005 for contact mating end sizes 20, 20HD and 23.

3.9.15.2 Axial concentricity, wired. The total indicator reading (TIR) shall not exceed .012 for contact mating end sizes 12 and 16 and shall not exceed .011 for contact mating end sizes 20, 20HD and 23.

3.9.16 Crimpability / crimp tensile strength. When tested in accordance with [4.5.17](#), contacts shall conform to the crimp termination and crimp tensile strength requirements specified in SAE-AS39029.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

3.9.17 Shell spring finger engagement and separation forces. When tested as specified in [4.5.18](#), the minimum force required to engage and separate plugs with spring fingers for mating receptacles shall be within the values specified in [table XI](#).

TABLE XI. Shell spring finger engagement and separation forces.

Shell size	Axial force	
	Maximum lbs (N)	Minimum lbs (N)
8	25 (111)	.5 (2.2)
9	25	.5 (2.2)
10	25	.5 (2.2)
11	30 (133)	.5 (2.2)
12	30	.5 (2.2)
15	35 (156)	.5 (2.2)
18	35	.5 (2.2)
19	35	.5 (2.2)
23	35	.5 (2.2)

3.9.18 Accessory thread strength. When tested as specified in [4.5.19](#), the accessory threads and portion of the connector that accepts cable clamps and "J" adapters shall be capable of withstanding the torque listed in [table XII](#).

TABLE XII. Accessory thread strength.

Shell size	Accessory thread torque (inch-pounds)	Accessory thread torque (Newton-meters)
8	100 +/- 10	11.3 +/- 1.1
9	100 +/- 10	11.3 +/- 1.1
10	100 +/- 10	11.3 +/- 1.1
11	100 +/- 10	11.3 +/- 1.1
12	150 +/- 15	17.0 +/- 1.7
15	150 +/- 15	17.0 +/- 1.7
18	200 +/- 20	22.6 +/- 2.3
19	200 +/- 20	22.6 +/- 2.3
23	250 +/- 25	28.3 +/- 2.3

3.9.19 Insert retention. When tested as specified in [4.5.20](#), and subjected a specified maximum pressure in both directions, inserts shall not be dislocated from their original positions, and there shall be no evidence of cracking, breaking or separation from the shell, or loosening of parts.

3.9.20 Vibration (sine, random, and gunfire).

3.9.20.1 Vibration, mated connectors (sine, random, and gunfire). When tested as specified in [4.5.21](#), there shall be no electrical discontinuities greater than 1 microsecond. There shall be no physical disengagement or backing off of the coupling mechanism between wired, mated connectors, and there shall be no evidence of cracking, breaking or loosening of parts.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

3.9.20.2 Vibration, accessories (sine, random, and gunfire). When tested as specified in 4.5.21, connector accessories shall not be damaged, nor shall there be any loosening of parts during vibration. The coupling torque shall be within +20 / -10 in-lbs of the initial value after vibration. Connector accessories that provide termination features for individual or overall EMI/RFI shielding shall be measure for electrical conductivity before and after vibration for initial qualification only.

3.9.21 Shock (specified pulse). When tested as specified in 4.5.22, wired, mated connectors shall not be damaged and there shall be no interruption of electrical continuity greater than 1 microsecond. There shall be no physical disengagement or backing off of the coupling mechanism between wired, mated connectors, and there shall be no evidence of cracking, breaking or loosening of parts.

3.9.22 Impact (drop) (qualification only). When connectors are tested as specified in 4.5.23, there shall be no breaking or cracking of inserts, bending of pins, nor any other damage which prevents the connectors from being mated or renders them unfit to continue further testing. Any chipping of the inserts which affects its polarization or retention in the shell shall be considered a failure.

3.9.23 Cavity leakage bonding integrity. When tested as specified in 4.5.44, there shall be no air leakage between contact cavities.

3.9.24 Insert bond strength. When tested as specified in 4.5.53, there shall be no visible separation or cracks at the bond joint while an axial load is applied.

3.9.25 Coupling and uncoupling torque. When tested as specified in 4.5.51, the coupling torque for mating and the uncoupling torque for unmating of counterpart plugs and receptacles shall meet the requirements in table XIII.

DATA HIGHLIGHTED BELOW INCLUDED FOR DISCUSSION PURPOSES - DATA ON LEFT LISTS REQUIREMENTS FROM 38999 - Data on right in red font is data from commercial catalogs for similar connectors. It is for comparison and discussion only and is not currently intended for inclusion in publication of the initial draft..

TABLE XIII. Coupling and uncoupling torque.

Shell size	Disenga gement	Eng and Disenga gement	Disenga gement	Eng and Disenga gement
	In-lbs		N-m	
	Min	Max	Min	Max
8	2	8	0.2	0.9
9	2	8	0.2	0.9
10	2	12	0.2	1.4
11	2	12	0.2	1.4
12	2	16	0.2	1.8
15	3	20	0.3	2.3
18	5	28	0.6	3.2
19	3	28	0.3	3.2
23	5	36	0.6	4.1

AMPHENOL 2M805 In-lbs		Glenair 805 series In-lbs	
Min	Max	Min	Max
35	40	18	22
		20	24
40	50	22	26
		24	28
50	60	26	30
		32	36
		38	42
		40	44
		48	52

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

3.9.26 External bending moment. When connectors with accessory threads (shell style “-01”) and accessories with saddle bars are tested as specified in [4.5.40](#), using the applicable bending moment shown in [table XIV](#), connectors and accessories shall show no evidence of damage detrimental to their normal operation, nor shall there be any interruption of connector electrical continuity.

TABLE XIV. External bending moment (connector shell style “01” and accessories, only).

Shell size	Bending moment (connector shell style “01”) 2 inch lever In-lbs (N-m) (± 5 in-lb)	Bending moment (accessories with saddle bars) In-lbs (N-m) (± 5 in-lb)
8	55 (6.2 N-m)	50
9	61 (6.9 N-m)	50
10	115 (13.0 N-m)	75
11	134 (15.14 N-m)	75
12	154 (17.40 N-m)	75
15	199 (22.48 N-m)	100
18	245 (27.68 N-m)	125
19	270 (30.50 N-m)	125
23	328 (37.04 N-m)	150

3.10 Electrical requirements.

3.10.1 Insulation resistance (IR).

3.10.1.1 IR at ambient temperature. When tested as specified in [4.5.24.1](#), the insulation resistance between any pair of contacts and between any contact and the shell shall be 5000 megohms, minimum.

3.10.1.2 IR at ambient temperature, after humidity. Insulation resistance after humidity shall be 100 megohms minimum.

3.10.1.3 IR at ambient temperature, after altitude immersion. Insulation resistance after altitude immersion shall be 1000 megohms minimum.

3.10.1.4 IR at elevated temperature. When tested as specified in [4.5.24.2](#), at the maximum operating temperature of 150°C, the insulation resistance between any pair of contacts and between any contact and the shell shall be 1000 megohms minimum.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

3.10.2 Dielectric withstanding voltage (DWV) at sea level and at altitude. When tested as specified in [4.5.25](#), connectors shall be capable of withstanding the applicable voltages specified in table XV with no evidence of flashover or breakdown. The leakage current shall be 2 milliamperes maximum. See MIL-STD-XXXX for applicable service ratings for each insert arrangement. Note: The service rating is the test voltage. See section 6 for suggested operating voltages at sea level.

TABLE XV. Test voltages, Vac (rms), 60 Hz.

Altitude	Service rating A		Service rating B		Service rating C		Service rating D	
	Mated	Unmated	Mated	Unmated	Mated	Unmated	Mated	Unmated
Sea level	1800	1800	1800	1800	1000	1000	750	750
40,000 ft	1000	TBD	400		400	TBD	400	TBD
70,000 ft	TBD	TBD			TBD	TBD	TBD	TBD
	16 (13 Amps) & 12 (23 Amps)		20		20HD (7.5 Amps)		23 (5 Amps)	

**Additional discussion/review needed for contact test voltages at 40,000 feet:
Size 23 and size 20HD contacts – 400 Vrms / 60 Hz; Size 16 and 12 - 1000 Vrms / 60 Hz.**

3.10.3 Electrical engagement. When tested as specified in [4.5.15](#), the wired, mated connectors shall provide an electrical engagement of .050 inch (0.86 mm) minimum.

3.10.4 Shell-to-shell conductivity.

3.10.4.1 Shell-to-shell conductivity, initial. When tested as specified in [4.5.27](#), the maximum measured voltage drop across a mated pair of connectors shall be 2.0 mV maximum.

3.10.4.2 Shell-to-shell conductivity, after conditioning. After conditioning (salt spray and / or mating force testing), the voltage drop may increase 100 percent, maximum. Test probes shall not puncture or otherwise damage connector finish.

3.10.5 EMI shielding

3.10.5.1 EMI shielding, low frequencies, 100 to 1,000 MHz. When tested as specified in [4.5.28](#), the EMI shielding capabilities of mated shells with EMI grounding springs shall not be less than that specified in [table XVI](#) at the specified frequencies.

3.10.5.2 EMI shielding, high frequencies, 1,000 to 10,000 MHz. When tested as specified in [4.5.28](#), the EMI shielding capabilities of mated shell with EMI spring fingers shall not be less than that specified in [table XVI](#) using the mode-stirred technique.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

TABLE XVI. EMI shielding, frequencies.

EMI shielding, low frequencies		EMI shielding, high frequencies	
Frequency MHz	dB minimum (leakage attenuation)	Frequency GHz	dB minimum (leakage attenuation)
100	75	1	85
200	70	3	69
300	65	5	66
400	63	19	65
800	58	-	-
1000	55	-	-

3.10.6. Contact resistance. When tested as specified in [4.5.29](#), connectors in the mated condition shall meet the contact resistance requirements specified in SAE-AS39029.

3.10.6.1 Contact resistance (size 23 and 20HD contacts, only). When contacts are tested as specified in 4.5.29, the contact voltage drop shall meet the contact resistance requirements specified in SAE-AS39029.

3.10.7 Low level contact resistance. When tested as specified in [4.5.30](#), connectors in mated condition shall meet the LLRC requirements specified in SAE-AS39029.

3.10.7.1 Low level contact resistance (size 23 and 20HD contacts, only). When tested as specified in [4.5.30](#), contacts installed in connectors in mated condition shall meet the LLRC requirements specified in SAE-AS39029.

3.10.8 Backshell shield braid-to-shell conductivity. When tested as specified in [4.5.52](#), probes shall not puncture or otherwise damage the connector finish. In addition, the maximum measured initial potential drop across mated assemblies shall be as follows.

- (1) Classes T, W, and Z: 5.0 millivolts.
- (2) Classes F, G and L: 3.5 millivolts.
- (3) Class K: 15.0 millivolts.

After conditioning (see 6.4), the maximum measured braid shield braid-to-shell conductivity values may increase up to 100 percent.

3.11 Environmental requirements.

3.11.1 Thermal shock (temperature cycling). When mated connectors are subjected to testing as specified in [4.5.31](#), there shall be no blistering, peeling, separation of plating or other damage detrimental to the operation of connectors, and connectors shall meet the requirements of all subsequent testing.

3.11.2 Salt spray (corrosion).

3.11.2.1 Salt spray (corrosion) unmated connectors and unmated contacts. When tested as specified in [4.5.32](#), unmated connectors and mated contacts shall show no corrosion sites or defects such as lifting of plated coating or exposure of base metal under three power (3X) magnification which adversely affects performance when evaluated in accordance with EIA/ECA-364-26.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

3.11.3 Fluid immersion. After being tested as specified in [4.5.33](#), connectors shall show no visible damage from immersion in fluids, shall meet the mating and unmating forces requirements, dielectric withstanding voltage requirements, and shall meet the requirements of all subsequent testing.

3.11.4 Humidity. When tested as specified in [4.5.35](#), wired, mated connectors shall maintain an insulation resistance of 100 megohms or greater at 25°C. Connectors shall show no deterioration which adversely impacts performance during subsequent testing

3.11.5 High temperature exposure with contact loading (contacts installed in connectors). When tested for 1,000 hours as specified in [4.5.36](#), the contacts shall maintain their specified locations as shown on figures 1, 2, 3 and 4, and there shall be no electrical discontinuity in excess of 1 microsecond.

3.11.6 Ozone exposure. When connectors are tested as specified in [4.5.37](#), there shall be no evidence of cracking of dielectric material or other damage that will adversely affect the subsequent performance of the connectors in the applicable test sequence.

3.11.7 Sand and dust. When tested as specified in [4.5.39](#), connectors shall pass succeeding tests in the qualification table. When tested as specified in [4.5.51](#), uncoupling and recoupling torque shall not exceed the values specified in [table XIII](#) by more than 25 percent.

3.11.8 Ice resistance. When tested as specified in [4.5.38](#), connectors shall pass succeeding tests in the qualification table. When tested as specified in [4.5.51](#), uncoupling and recoupling torque shall not exceed the values specified in [table XIII](#) by more than 25 percent.

3.11.9 Thermal vacuum outgassing. Applicable to class G and initial qualification only. When tested as specified in [4.5.48](#), all nonmetallic materials used in the finished connector shall not release greater than 1.0 percent total mass loss (TML) and 0.1 percent total collected volatile condensable material (CVCM).

3.11.10 Resistance to indirect lightning strike. When tested as specified in [4.5.49](#), wired and mated connectors shall meet braid shield braid-to-shell conductivity as specified in [4.5.52](#), coupling and uncoupling torque as specified in [4.5.51](#), insulation resistance at ambient temperature as specified in [4.5.24.1](#), and dielectric withstanding voltage at sea level as specified in [4.5.25](#). Connectors shall show no damage or degradation in the finish or base material that would affect subsequent use. Damage or hardening of elastomeric sealing members affecting sealing shall be considered a failure.

3.11.11 Altitude immersion. When tested as specified in [4.5.45](#), the insulation resistance of the mated pair shall be 1,000 Megohms minimum. Insulation resistance after humidity shall be 100 megohms minimum. Connector insert interfaces and contact mating ends shall show no evidence of moisture.

3.11.12 Altitude-low temperature. When tested as specified in [4.5.46](#), the connectors shall meet the requirements of dielectric withstanding voltage at sea level specified in [4.5.25](#), and insulation resistance at ambient temperature specified in [4.5.24.1](#).

3.11.13 Retention system fluid immersion. When tested as specified [4.5.34](#), insert assemblies shall meet requirements of contact retention as specified in [3.9.4](#). Effects of the fluids on resilient sealing members shall not be a consideration of this test.

3.11.14 Electrolytic erosion. When tested as specified in [4.5.49](#), pin contacts shall show no exposure of base metal due to electrolytic erosion. Corrosion deposits shall not be considered as defects.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

3.12 Marking.

3.12.1 Connector shell marking. Connectors and accessories shall be legibly and permanently marked on the shell or coupling ring with the PIN, date code, manufacturer's identification marking, and also with the assembly plant identification, when applicable (see 1.3 and 3.1). In addition, the part shall be marked with the "JAN" or "J" certification (see 3.12.4). The manufacturer and assembly plants may be identified by the use of Commercial or Government Entity Number (CAGE code), name, trademark, symbol, or identification letters, and shall be as specified in SAE-AIR1351. The manufacturer's name, if used, may be abbreviated. If the connectors are assembled by a qualified assembly plant, then the identification marking shall also include the assembly plant's identification marking. The trademark shall be as specified in SAE-AIR1351 or shall be that which has been provided to the qualifying activity. Stamping shall be in accordance with MIL-STD-1285 where space permits, in the location specified (see 3.1). Metal stamping shall be accomplished before plating. Marking shall be nonfading and shall remain legible following completion of all inspections.

3.12.2 Insert marking. Contact locations shall be identified as specified on MIL-STD-#####. Raised or depressed characters shall not be used on insert mating faces for any markings of crimp contact connectors, but are permitted on the rear face of the grommet. Supplier's identification is permitted on face of insert. Contact cavity designators specified by MIL-STD-##### shall be marked on the front insert face and rear grommet face, except where space limitations make this impracticable. Location of contact identifying characters shall be in close proximity to the contact cavities, but need not be placed exactly where specified in the standard. The preferred color of the contact identifying character is white. When the background is a color against which white is difficult to distinguish, a color shall be chosen for which the identifying character can be easily distinguished.

3.12.3 Contact marking (size 20HD and size 23 only). Size 20HD and size 23 contacts shall be permanently and legibly marked with the supplier's symbol or trademark and one color band on the wire barrel (see figures 7 and 8). Colors for color bands shall be in accordance with EIA RS-359. The supplier shall list the symbol or trademark in accordance with AIR1351. All markings shall remain legible after all tests. Flaking of the color band in the crimp indenter area is acceptable providing the color of the bands is still identifiable.

3.12.5 JAN brand. The United States Government has adopted and is exercising legitimate control over the certification marks "JAN" and "J", respectively, to indicate that items so marked or identified are manufactured to, and meet all the requirements of specifications. Accordingly, items acquired to, and meeting all of the criteria specified herein and in applicable specifications shall bear the certification mark "JAN" except that items too small to bear the certification mark "JAN" shall bear the letter "J". The "JAN" or "J" shall be placed immediately before the part number except that if such location would place a hardship on the manufacturer in connection with such marking, the "JAN" or "J" may be located on the first line above or below the part number. Items furnished under contracts or orders which either permit or require deviation from the conditions or requirements specified herein or in applicable specifications shall not bear "JAN" or "J". In the event an item fails to meet the conditions or requirements of this specification or in applicable specification sheets, the manufacturer shall remove completely military part number and the "JAN" or the "J" from the sample tested and also from all items represented by the sample. The "JAN" or "J" certification mark shall not be used on products acquired to contractor drawings or specifications. The United States Government has obtained Certificate of Registration Number 504,860 for the certification mark "JAN" and Registration Number 1,586,261 for the certification mark "J".

Note: The "JAN" or "J" is not part of the PIN but indicates a certification.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

3.13 Workmanship. Connectors and accessories shall meet all design dimensions and interchangeability requirements of this specification. Loose contacts, poor molding fabrication, loose materials, defective bonding, damaged or improperly assembled contact, peeling, or chipping of plating or finish, galling of mating parts and post molding warpage will be considered adequate basis for rejection of items of quality inferior for the purpose intended. The connector shall be fabricated in a manner such that the criteria for appearance, fit and adherence to specified tolerances are observed. Particular attention shall be given to neatness and thoroughness of marking parts, plating, welding, soldering, riveting, staking, and bonding. The visual examination under three power (3X) magnification shall include examination of each retention cavity for molding discrepancies, retention features, and excessive adhesive. The connectors shall be free from crazing, cracks, voids, pimples, chips, blisters, pinholes, sharp cutting edges, nicks, burrs, and other defects that will adversely affect life, serviceability, or appearance. Contacts shall be processed in such a manner as to be uniform in quality. Contacts shall be free from foreign material and burrs or sharp corners that might damage the connector or affect mating of the contacts.

4. VERIFICATION

4.1 Classification of inspection. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.3).
- b. Conformance inspection (see 4.4).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the "General Requirements" of EIA-364.

4.2.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection shall be established and maintained by the manufacturer. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with NCSL Z540.3 or ISO 10012-1.

4.2.1.1 QPL system, manufacturing facilities and value-added distributors. The manufacturer shall establish and maintain a system to meet the requirements of MIL-STD-790 and the requirements herein (see 3.2.1). Evidence of such compliance shall be verified by the qualifying activity as a prerequisite for qualification and retention of qualification. Manufacturer changes to process control inspections, quality conformance inspections, manufacturing control drawings (except editorial changes) or manufacturing locations (except within the same facility) without express approval by the qualifying activity may result in loss of qualification for that product. Value-added distributors, or assembly plants that assemble QPL connectors, shall be approved by the qualifying activity and listed on the applicable Qualified Products List. Assemblies produced at the assembly plant shall be subjected to inspection to ensure that the assembly process conforms with that established at the qualified manufacturing plant. Quality control requirements, including Government inspection surveillance, shall be the same as required for the qualified connector manufacturer.

4.2.1.2 Assembly plants. The qualified connector manufacturer shall certify that the value-added distributor's assembly plant is approved for the distribution of the manufacturer's parts. Assembly plants shall use only piece parts (i.e. subcomponents such as connector shells and inserts) produced by the qualified manufacturer, and the assembly plant shall assemble the manufacturer's product in accordance with the manufacturer's assembly procedures.. No incoming inspection or testing other than visual examination is required of certified piece parts obtained from the qualified manufacturer, except when there is cause for rejection. Assemblies produced at the assembly plant shall be subjected to inspection to assure that the assembly process conforms with that established at the qualified manufacturing plant.

4.3 Qualification inspection. The qualifying activity (see 6.5) maintains the associated QPL, and requests for qualification are reviewed and authorized by the qualifying activity prior to the start of qualification testing. Qualification inspection shall be performed at a laboratory acceptable to the qualifying activity (see 6.3) on sample units produced with equipment and procedures normally used in production. Qualification approval may be granted upon successful completion of the inspections and tests of 4.3.3 conducted on samples of 4.3.1; such approval to include classes, finishes, connector shell configurations, and insert arrangements other than those actually tested, providing that the capability to manufacture these parts is demonstrated by providing exhibit samples or equivalent listing.

4.3.1 Qualification samples. Samples of each class for which qualification is desired shall be tested in the sequence specified in [table XVIII](#), as applicable. Each connector subjected to qualification testing shall be provided with a counterpart connector for those tests requiring mating assemblies. Manufacturers not producing mating connectors shall submit data substantiating that tests were performed with new, qualified counterpart connectors. Samples for connectors, accessories, and contacts (sizes 20HD and 23 only) shall be as follows:

a. **Groups 1 and 2: For all classes and each shell size**, a minimum of two mating pairs of straight plugs and wall mounting receptacles, and two mating pairs of straight plugs and jam-nut receptacles shall be provided for qualification testing. The mated pairs, representing each shell size, shell material, and shell finish, shall consist of the following types:

Note: For limited qualification of service rating types, the manufacturer shall coordinate with the qualifying activity to determine the sample quantities required to fully represent that manufacturer's qualified product. A minimum of nine mated pairs shall be supplied for limited qualification of service rating types.

b. **Group 3: For all classes, mated pairs consisting of** straight plugs with spring fingers and counterpart wall mounting receptacles in small, medium, and large shell sizes with applicable EMI backshells shall be provided for qualification testing. Counterpart receptacles may be shells only, less inserts.

c. **Group 4: For dielectric testing / resistance to ozone and fluids**, ten mated pairs, including straight plugs and wall mounting receptacles, in a medium shell size, in any insert arrangement, shall be provided for qualification testing.

d. **Group 5: For retention system fluid resistance testing**, ten mated pairs, (one pair for each fluid type), straight plugs and wall mounting receptacles, in any representative shell size, finish, shell type, and insert arrangement, shall be provided for qualification testing.

e. **Group 6: For retention system testing**, sufficient mated pairs, including a straight plug and wall mounting receptacles in representative shell sizes, to provide a minimum of 21 contact cavities of each applicable contact size, shall be provided for qualification testing.

f. **Group 7: For environmental/corrosion testing**, including shock and temperature cycling, one mating pair for each class and shell size, including a straight plug and receptacle, which are supplied with environmental backshells in accordance with **SAE-AS85049 category 2B**, shall be provided for qualification testing. Connectors shall be supplied in maximum density contact arrangements with pin contacts installed in the receptacles.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

g. **Group 8: For ice and dust resistance**, one mating pair in each shell size, including a plug and receptacle, shall be provided in each class for which qualification is desired. Each arrangement in a given shell size shall be the most dense contact arrangement for that particular service rating.

h. **Group 9: For insert bonding, cavity leakage and outgassing**, two bonded insert grommet assemblies and two bonded insert interface seal assemblies which have not been assembled into the connector shell shall be provided. The assemblies shall be of the size and contact arrangement for which qualification is to be conducted (Sample size required for thermal vacuum outgassing test shall be as specified in ASTM E595).

i. **Group 10: For resistance to lightning strike testing**, three mating pairs of series III straight plugs and receptacles in shell sizes 9, 15, and 21 (nine mating pairs total) in each class for which qualification is desired shall be tested. Each mating pair of connectors shall be provided with an SAE-AS85049 braidsock strain relief as specified in EIA/ECA-364-75. (Note: An SAE-AS85049/103 strain relief is recommended).

j. **Group 11 (contacts only)**: For contact sizes 20HD and 23 only, 10 uninstalled contacts in each contact size shall be provided.

k. **Group 12 (contacts only)**: For connectors with contact sizes 20HD and 23 only, sufficient mated connector pairs in the most dense contact arrangement representing each service rating and which shall provide a minimum quantity of 65 socket contacts for each contact size, shall be provided for qualification testing.

l. **Group 13 (accessories only)**: One accessory (backshell) of each shell size for which qualification is desired shall be tested.

4.3.1.1 Sample size (limited qualification). Manufacturers that do not intend to qualify all nine shell sizes in all series or all contact sizes shall provide the following test samples instead of those specified in 4.3.1a and 4.3.1b: Four mating pairs of each shell for each series or contact size to be qualified. The maximum number of connectors that will be tested is thirty-six. Future qualification of additional shell or contact sizes will require qualification as determined by the qualifying activity.

4.3.2 Preparation of samples. For contact sizes 12, 16, 20, and 23, crimp terminations shall be accomplished using tools conforming to SAE-AS22520, class 1. The wire or cable shall be stripped so that as a minimum, the stripped length shall reach the bottom of the crimp barrel. When the conductor is installed so that the end touches the bottom of the crimp barrel, no more than .031 inch (0.79 mm) of the stripped conductor shall be exposed beyond the end of the barrel. Test samples shall be coupled to the maximum torque value specified in [table XIII](#). An alternate sample preparation may be used with the approval of the qualifying activity.

a. **For groups 1 and 2**, samples provided under 4.3.1a shall be wired with wire having a smooth extruded outer jacket of waterproof construction. Two samples of each shell size shall utilize maximum diameter wire and the remaining samples shall utilize minimum diameter wire. See table XVII for examples of wires that can be used to accomplish the required minimum and maximum diameter. Two cavities of each sample provided shall contain unwired contacts and sealing plugs in accordance with MS27488. Connectors with less than four contacts of a given contact size will not have sealing plugs installed for that contact size.

b. **For group 3**, samples provided under 4.3.1e and 4.3.1k (spring finger testing) shall be wired with nominal gauge wire, except size 23 contacts shall be wired with 24 gauge wire. Examples of wire that may be used are SAE-AS22759/9 or MIL-W-81381/7.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

c. **For group 4 (dielectric)**, samples provided under 4.3.1i, one each shell size shall be wired with nominal gauge wire. Examples of wires that can be used are SAE-AS22759/9 or MIL-W-81381/7.

d. **For group 5 (retention systmr fluid immersion)**, samples provided under 4.3.1j shall be wired with wire of suitable gauge. Examples of wires that can be used are MIL-DTL-25038/3. To facilitate wiring, the glass braid may be stripped back so that it is flush with the back of the grommet.

e. **For group 6 (retention system)**, receptacles provided under 4.3.1n shall be wired with wire of nominal gauge, except size 23 contacts shall be wired with 24 gauge wire. Examples of wires that can be used are SAE-AS22759/9 or MIL-W-81381/7. Connector plugs shall have contact locations populated with unwired contacts.

f. For group 7 (environmental/corrosion), one mating pair in each shell size range shall be supplied with accessory. Connectors shall be supplied in maximum density contact arrangements with pin contacts installed in the receptacles.

g. For group 8 (ice/dust), one mating pair shall be supplied in each shell size and each service rating. Connectors shall be supplied in maximum density contact arrangements for each connector service rating.

h. For group 9 (insert bonding /outgassing), two bonded insert grommet assemblies and two bonded insert interface seal assemblies, which have not been assembled into connector shells, shall be tested. The assemblies shall be supplied for each size and contact arrangement for which qualification is to be conducted, except the sample size required for thermal vacuum outgassing shall be as specified in ASTM-E595.

i. For group 10 (lightning strike), three mating pairs of straight plugs and receptacles in shell sizes 8, 12, and 23, for nine mating pairs total. Sample pairs are required for each class for which qualification is to be conducted. Each mating pair of connectors shall be provided with a SAE-AS85049 braidsock strain relief as specified in EIA/ECA-364-75.

j and k . For group 11 (contact plating system – uninstalled contacts) and group 12 (contact performance – connectors with contacts installed), contact sizes 23 and 20HD only. Test samples of contacts of each size shall be selected at random in the quantities specified in SAE-AS39029 for random sample quantities.

l. group 13 - Each accessory sample shall be assembled to a counterpart connector plug and counterpart flange mount receptacle. The backshell shall be assembled to 10 feet of the applicable cable as specified in table XVII or to 7 feet of the applicable conduit and 10 feet of the applicable cable specified in table XVII as applicable.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

TABLE XVII. Test wire sizes. 1/

Contact size (mating end)	Wire barrel size	Example of wire to accomplish maximum diameter	Example of wire to accomplish minimum diameter
23	-22	M22759/9 or /20 -24 M22759/10 or /21 -24	M22759/18, /19, /32, /33 -26 M22759/44, /45, /46 -26
20HD and 20	-20	M22759/7 -20 M22759/8 -20	M22759/18, /19, /32, /33 -22 M22759/44, /45, /46 -22 M22759/11, /12, /13, /14 -24 M22759/22, /23
16	-16	M22759/3, /4, -16 /7, or /8	M22759/18, /19, /32, -16 M22759/44, /45
12	-12	M22759/7 -12 M22759/8 -12	M81381/7 or /8 -12 M81381/11 or /12

4.3.3 Qualification tests.

- a. Samples provided under 4.3.1a shall be divided into two similar groups. One group shall be subjected to the tests of [group 1, table XVIII](#), in the sequence specified. The other group shall be subjected to the tests of [group 2, table XVIII](#), in the sequence specified.
- b. Samples provided under 4.3.1b shall be divided into two similar groups. One group shall be subjected to the tests of [group 1, table XVIII](#), in the sequence specified. The other group shall be subjected to the tests of [group 3, table XVIII](#), in the sequence specified.
- c. Samples provided under 4.3.1c shall be subjected to the test of [group 4, table XVIII](#), in the sequence specified (except for receptacles for shell spring finger forces, 4.3.1d and 4.3.3d).
- d. Samples provided under 4.3.1d shall **be subjected to the tests of group 5,, [table XVIII](#)**, in the sequence specified.
- e. Samples provided under 4.3.1e shall be subjected to the tests of [group 6, table XVIII](#), in the sequence specified.
- f. Samples provided under 4.3.1f shall be subjected to the tests of [group 7, table XVIII](#), in the sequence specified.
- g. Samples provided under 4.3.1g shall be subjected to the tests of [group 8, table XVIII](#), in the sequence specified.
- h. Samples provided under 4.3.1h shall be subjected to the tests of [group 9, table XVIII](#), in the sequence specified.
- i. Samples provided under 4.3.1i shall be subjected to the tests of [group 10, table XVIII I](#), in the sequence specified.
- j. Samples provided under 4.3.1j shall be subjected to the tests of [group 11, table XVIII](#), in the sequence specified.
- k. Samples provided under 4.3.1k shall be subjected to the tests of [group 12, table XVIII](#), in the sequence specified.
- l. Samples provided under 4.3.1l shall be subjected to the tests of group 13, table XVIII, in the sequence specified.

4.3.3.1 Failures. One or more failures shall be cause for refusal to grant qualification.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

TABLE XVIII. Qualification and group C periodic tests.

Inspection	Requirement paragraph	Test paragraph
<u>Group 1</u> (all classes and finishes)		
Visual and mechanical examination	3.1 , 3.3 , 3.4 , 3.5 , 3.12 and 3.13	4.5.1
Magnetic permeability	3.3.6.1	4.5.41
Maintenance aging	3.9.1	4.5.2
Thermal shock (temperature cycling)	3.11.1	4.5.31
Coupling and uncoupling torque	3.9.25	4.5.50
Durability	3.9.2.1	4.5.8.1
Attitude immersion <u>1</u> /	3.11.11	4.5.45
Insulation resistance at ambient temperature	3.10.1.1	4.5.24.1
Dielectric withstanding voltage at sea level	3.10.2	4.5.25.1
Insert retention	3.9.19	4.5.20
Shell-to-shell conductivity, initial	3.10.4.1	4.5.25
Salt spray (corrosion) (standard test applicable classes F and G only)	3.11.2.1	4.5.32
Coupling and uncoupling torque	3.9.25	4.5.51
Shell-to-shell conductivity, after conditioning	3.10.4.2	4.5.25
Contact resistance	3.10.6	4.5.29
Electrical engagement	3.10.3	4.5.15
External bending moment	3.9.26	4.5.40.1
Post test examination	3.12 and 3.13	4.5.53

See footnotes at end of table.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

TABLE XVIII. Qualification and group C periodic tests - Continued.

Inspection		
<u>Group 2</u> (all classes)	Requirement paragraph	Test paragraph
Visual and mechanical examination	3.1 , 3.3 , 3.4 , 3.5 , 3.12 and 3.13	4.5.1
Gauge location	3.9.5	4.5.6
Gauge retention	3.9.6	4.5.7
Maintenance aging	3.9.1	4.5.2
Contact retention	3.9.4	4.5.5
Altitude-low temperature	3.11.12	4.5.46
Insulation resistance at ambient temperature	3.10.1.1	4.5.24.1
Dielectric withstanding voltage at sea level	3.10.2	4.5.25.1
Thermal shock (temperature cycling)	3.11.1	4.5.31
Coupling and uncoupling torque	3.9.25	4.5.50
Insulation resistance at elevated temperature	3.10.1.4	4.5.24.4
Dielectric withstanding voltage at sea level	3.10.2	4.5.25.1
Dielectric withstanding voltage at altitude <u>1</u> /	3.10.2	4.5.25.2
Durability	3.9.2.1	4.5.3.1
Accessory thread strength	3.9.18	4.5.19
Contact resistance	3.10.6	4.5.29
Vibration <u>4</u> /	3.9.20	4.5.21
Contact resistance	3.10.6	4.5.29
Shock <u>4</u> /	3.9.21	4.5.21
Shell-to-shell conductivity	3.10.4.2	4.5.27
High temperature exposure with contact loading <u>1</u> /	3.11.5	4.5.36
Humidity	3.11.4	4.5.36
Insulation resistance at ambient temperature	3.10.1.1	4.5.24.1
Dielectric withstanding voltage at sea level	3.10.2	4.5.25.1
Contact retention	3.9.4	4.5.5
Post test examination	3.12 and 3.13	4.5.53

See footnotes at end of table.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

TABLE XVIII. Qualification and group C periodic tests - Continued.

Inspection	Requirement paragraph	Test paragraph
<u>Group 3</u> (shells with spring fingers)		
Visual and mechanical examination	3.1 , 3.3 , 3.4 , 3.5 , 3.12 and 3.13	4.5.1
Durability	3.9.2	4.5.3
Shell spring finger forces	3.9.17	4.5.18
Shell-to-shell conductivity	3.10.4.1	4.5.25
EMI shielding	3.10.5	4.5.28
Post test examination	3.12 and 3.13	4.5.54
<u>Group 4</u> (dielectric)		
Visual and mechanical examination	3.1 , 3.3 , 3.4 , 3.5 , 3.12 and 3.13	4.5.1
Ozone exposure	3.11.6	4.5.37
Insulation resistance at ambient temperature	3.10.1.1	4.5.24.1
Dielectric withstanding voltage at sea level	3.10.2	4.5.25
Fluid immersion <u>1</u> /	3.11.3	4.5.33
Dielectric withstanding voltage at sea level	3.10.2	4.5.25
Coupling and uncoupling torque	3.9.25	4.5.50
Post test examination	3.12 and 3.13	4.5.53
<u>Group 5</u> (retention system / fluid immersion)		
Visual and mechanical examination	3.1 , 3.3 , 3.4 , 3.5 , 3.12 and 3.13	4.5.1
Retention system fluid immersion	3.11.14	4.5.34
Contact retention	3.9.4	4.5.5
Post test examination	3.12 and 3.13	4.5.53

See footnotes at end of table.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

TABLE XVIII. Qualification and group C periodic tests - Continued.

Inspection	Requirement paragraph	Test paragraph
<u>Group 6</u> (<u>retention system</u>)		
Visual and mechanical examination	3.1 , 3.3 , 3.4 , 3.5 , 3.12 and 3.13	4.5.1
Pin contact stability	3.9.9	4.5.9
Contact retention system effectiveness (contact walk-out)	3.9.10	4.5.11
Installing/removal tool abuse	3.9.7	4.5.8
High temperature exposure with contact loading	3.11.5	4.5.36
Insert retention	3.9.19	4.5.20
Post test examination	3.12 and 3.13	4.5.53
<u>Group 7</u> (<u>environmental with dynamic salt spray</u>)		
Visual and mechanical examination	3.1 , 3.3 , 3.4 , 3.5 , 3.12 and 3.13	4.5.1
Impact (drop) (qualification only)	3.9.21	4.5.23
Dielectric withstanding voltage at sea level	3.10.2	4.5.25.1
Electrolytic erosion	3.11.15	4.5.47
Shell-to-shell conductivity, initial	3.10.4.1	4.5.25
Thermal shock (temperature cycling)	3.11.1	4.5.31
Salt spray (corrosion) (dynamic salt spray test applicable to classes K, L, T, W, and Z)	3.11.2.1	4.5.13.2
Coupling and uncoupling torque	3.9.25	4.5.50
Shell-to-shell conductivity, after conditioning	3.10.4.2	4.5.25
Post test examination	3.12 and 3.13	4.5.53

See footnotes at end of table.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

TABLE XVIII. Qualification and group C periodic tests - Continued.

Inspection	Requirement paragraph	Test paragraph
<u>Group 8</u> (ice and sand resistance)		
Visual and mechanical examination	3.1 , 3.3 , 3.4 , 3.5 , 3.12 and 3.13	4.5.1
Ice resistance	3.11.8	4.5.38
Sand and dust	3.11.7	4.5.39
Post test examination	3.12 and 3.13	4.5.53
<u>Group 9</u> (insert strength and outgassing)		
Visual and mechanical examination	3.1 , 3.3 , 3.4 , 3.5 , 3.12 and 3.13	4.5.1
Cavity leakage <u>2/</u>	3.9.23	4.5.44
Insert bond strength <u>2/</u>	3.9.24	4.5.52
Thermal vacuum outgassing (class G only) <u>1/ 2/</u>	3.11.9	4.5.47
Post test examination	3.12 and 3.13	4.5.53
<u>Group 10 1/ 3/</u> (lightning strike)		
Visual and mechanical examination	3.1 , 3.3 , 3.4 , 3.5 , 3.12 and 3.13	4.5.1
Coupling and uncoupling torque	3.9.25	4.5.50
Backshell shield braid-to-shell conductivity	3.10.8	4.5.51
Resistance to indirect lightning strike	3.11.10	4.5.48
Backshell shield braid-to-shell conductivity	3.10.8	4.5.51
Coupling and uncoupling torque	3.9.25	4.5.50
Insulation resistance at ambient temperature	3.10.1.1	4.5.10.1
Dielectric withstanding voltage at sea level	3.10.2	4.5.11.1
Post test examination	3.12 and 3.13	4.5.53

See footnotes at end of table.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

TABLE XVIII. Qualification and group C periodic tests - Continued.

Inspection	Requirement paragraph	Test paragraph
<u>Group 11</u> (individual contacts, material/plating, sizes 20HD and 23 only)		
Visual and mechanical examination	3.1 , 3.3 , 3.4 , 3.5 , 3.12 and 3.13	4.5.1
Plating porosity	3.9.11	4.5.12
Plating thickness	3.9.12	4.5.13
Surface roughness	3.9.13	4.5.14
Contact strength	3.9.14	4.5.15
Axial concentricity (unwired and wired)	3.9.15	4.5.16
Post test examination	3.12 and 3.13	4.5.53
<u>Group 12</u> (individual contacts, sizes 20HD and 23 only)		
Visual and mechanical examination	3.1 , 3.3 , 3.4 , 3.5 , 3.12 and 3.13	4.5.1
High temperature exposure	3.11.5	4.5.38.2
Low signal level contact resistance	3.10.7	4.5.30
Contact resistance	3.10.6.1	4.5.29
Resistance to probe damage	3.9.8	4.5.10
Contact engagement and separating forces	3.9.3	4.5.43
Contact resistance	3.10.6.1	4.5.14.2
Durability	3.9.2.2	4.5.3.2
Salt spray (corrosion)	3.11.2	4.5.32
Low signal level contact resistance	3.10.7.1	4.5.30
Contact resistance	3.10.6	4.5.14.2
Crimpability / crimp tensile strength	3.9.16	4.5.17
Contact engagement and separating force	3.9.3	4.5.43
Post test examination	3.12 and 3.13	4.5.53

See footnotes at end of table.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

TABLE XVIII. Qualification and group C periodic tests - Continued.

Inspection	Requirement paragraph	Test paragraph
<u>Group 13</u> <u>(accessories only)</u>		
Visual and mechanical examination	3.1 , 3.3 , 3.4 , 3.5 , 3.12 and 3.13	4.5.1
Magnetic permeability	3.3.6	4.5.41
Shell conductivity	3.10.4.2	4.5.25
Vibration	3.9.20	4.5.21
Shock	3.9.21	4.5.21
Salt spray (corrosion)	3.11.2	4.5.32
Shell conductivity	3.10.4.2	4.5.27
External bending moment	3.9.26	4.5.40.2
Post test examination	3.12 and 3.13	4.5.53

- 1/ Unless otherwise specified, initial qualification only (for exceptions, see 4.4.2.1.2).
- 2/ Additional parts may be used.
- 3/ If the supplier's plating system changes (e.g., change to method of plating, or change in plating thicknesses of underplates and finishes), then the manufacturer shall notify the qualifying activity and submit a requalification test plan for approval.
- 4/ Vibration and shock testing are required for all classes during initial qualification. For periodic requalification, random vibration testing at elevated temperature (see 4.5.23.2.3) is required.

4.3.4 Retention of qualification. To retain qualification, the qualified manufacturer shall periodically forward reports to the Qualifying Activity (see 6.3) as follows:

- a. At 24 month intervals, unless otherwise specified by the Qualifying Activity, the qualified manufacturer shall forward a report with a summary of the results of groups A and B testing (see 4.4.4.1 and 4.4.1.2). The results of tests of all reworked lots shall be identified and accounted for.
- b. At 24 month intervals, unless otherwise specified by the Qualifying Activity, the qualified manufacturer shall submit requalification, group C test reports (see 4.4.2.1), including the number and mode of failures. The summary shall include results of all qualification verification inspection testing performed during that period.

Reports shall include certification that the qualified source continues to produce qualified product under the same conditions as originally qualified (i.e., same processes, materials, design, construction, etc., including manufacturing locations), unless such changes have been authorized by the Qualifying Activity.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

Note: The qualified source shall immediately notify the Qualifying Activity at any time during the reporting period when inspection data indicates failure of the qualified product to meet the requirements of the specification. If the summary of test results indicates nonconformance with the specification requirements, and corrective action acceptable to the Qualifying Activity has not been taken, then action may be taken to remove failing product from the QPL. In addition, failure to submit the report within thirty days after the end of each reporting period may result in loss of qualification for that product. In the event that no production occurred during the reporting period, the qualified manufacturer shall submit a report certifying that the company still has the capability and facilities required to produce the qualified product. If there has been no production during two consecutive reporting periods, the Qualifying Activity, at their discretion, may require the manufacturer submit a representative product of each type, class, etc., to retention testing in accordance with qualification inspection requirements.

4.4 Conformance inspection.

4.4.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspections. The documentation requirements of the applicable military or industry test procedures do not apply.

4.4.1.1 Group A inspection. Group A inspection shall consist of the inspections specified in [table XVIII](#).

4.4.1.1.1 Visual examination (group A inspection). Each connector and accessory shall be visually examined for completeness, workmanship, and identification requirements. For those assemblies that require a gasket, the condition of the gasket shall be visually examined. Gaskets which are missing, twisted, buckled, kinked, or damaged in any way shall be cause for rejection. Each connector shall be visually inspected for the presence of filler compound in the cavity between the wire termination end of the insert and the shell.

4.4.1.1.2 Critical examination (group A inspection). The following dimensions and features shown on the pertinent military standard are considered critical.

- a. Mating diameter H shall be as specified on figures 1 and 2 (max shell inside dia. on plugs, min shell outside dia. min on receptacles).
- b. Key or keyway positions.
- c. Registration of grommet and insert markings (hole pattern between the grommet and the front face of the insert).
- d. Red band dimension in accordance with applicable receptacle specification sheet.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

TABLE XIX. Group A inspection. 1/

Inspection	Requirement paragraph	Test paragraph
Visual inspection <u>2/ 3/</u>	3.1 , 3.3 , 3.4 , 3.5 , 3.12 and 3.13	4.5.1
Critical examination <u>2/ 3/</u>	3.1	4.4.1.1.2
Insulation resistance at ambient temperature <u>2/ 3/ 4/</u>	3.10.1.1	4.5.24.1
Dielectric withstanding voltage at sea level <u>2/ 3/ 4/</u>	3.10.2	4.5.11.1

1/ Contacts shipped with connectors shall be qualified: Contact sizes 20, 16 and 12 shall be qualified in accordance with SAE-AS39029. Contact sizes 23 and 20HD shall be qualified by the connector manufacturer.

2/ 100 percent inspection.

3/ The contractor may use in-process controls for this requirement.

4/ Test 100 percent of contacts. Points of measurement and application of voltage shall be between circuits consisting of each contact and its closest adjacent contact and between connector shell and closest contacts adjacent to the shell. Multiple circuits may be tested concurrently.

4.4.1.2 Group B inspection. Group B inspection shall consist of the inspections specified in [table XIX](#) in the order shown and shall be made on sample units which have been subjected to and have passed the group A inspection.

TABLE XX. Group B inspection.

Inspection	Requirement paragraph	Test paragraph	Number of samples
Contact engaging and separating forces (connectors with size 23 and size 20HD sockets only) <u>1/</u>	3.9.3	4.5.43	As specified in table XX
Shell spring finger forces (plugs with spring fingers only) <u>1/ 2/ 3/</u>	3.9.17	4.5.18	

1/ The contractor may use in-process controls for this requirement.

2/ No failures permitted.

3/ Test 5 pieces.

4.4.1.2.1 Sampling plan (group B inspection). A sample size shall be randomly selected as specified in [table XX](#), except sampling for shell spring finger forces shall be as specified [table XIX](#), footnote 3/. If one or more defects are found, then the lot shall be rescreened and defects removed. A new sample as specified in [table XX](#) shall then be randomly selected. If one or more defects are found in the second sample, then the lot shall not be supplied to this specification.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

TABLE XXI. Sampling plan.

Lot size	Sample size
1 to 13	100 percent
14 to 150	13 units
151 to 280	20 units
281 to 500	29 units
501 to 1,200	34 units
1,201 to 3,200	42 units

4.4.1.2.2 Lot definition (group B inspection). The production lot, as defined in MIL-STD-790, is further specified as follows:

- a. A production lot consists of all connectors covered under one military specification or standard, manufactured from the specified raw materials, processed under the same specification and procedures, produced by the same type of equipment, and submitted for inspection at one time. Each production lot of assembled connectors shall be a group identified by a common manufacturing record through all significant assembly operations.
- b. Common manufacturing records and traceability shall begin with machining and molding and shall include connector assembly. Traceability of connectors to specific physical/chemical test reports of incoming raw material is not required.

4.4.1.2.3 Disposition of sample units. Sample units which have completely passed group B inspection may be delivered on the contract or purchase order if the lot is accepted and the sample units are still within specified tolerances.

4.4.2 Periodic inspection. Periodic inspection shall consist of group C inspection. Except where the results of this inspection show noncompliance with the applicable requirements (see 4.4.2.1.5), delivery of products which have passed groups A and B inspections shall not be delayed pending the results of this periodic inspection.

4.4.2.1 Group C inspection (periodic tests). Periodic tests shall be performed on a 24-month basis. Random vibration at temperature shall be performed during 24-month periodic testing, beginning with the first 24-month periodic test. Following the initial 24-month testing period, vibration testing shall only be required during every alternate 24-month time period (i.e., random vibration shall be required during the first group C inspection after initial qualification, and then it shall be required every 48 months thereafter, unless otherwise required by the qualifying activity). Samples submitted to periodic tests shall have passed groups A and B inspections.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

4.4.2.1.2 Twenty-four month periodic tests. Every 24 months, mated connector pair sample units shall be selected, configured and tested as specified below (Note: At the discretion of the qualifying activity, an alternate test sequence may be performed):

- a. Groups 1 and 2 (all classes and finishes), test sample quantity and configuration: For each series qualified, two mating plugs and receptacles from each shell size range and having each service rating represented shall be provided. The three shell size ranges are small (sizes 8 through 10), medium (sizes 11 through 15), and large (sizes 18 through 23). One mating pair from each shell size range shall be fully wired with the applicable wire listed in [table XVI](#) maximum diameter and subjected to the applicable tests in [table XVII, group 1](#). The remaining samples shall be fully wired with the applicable wire listed in [table XVI](#) minimum diameter and subjected to the applicable tests in [table XVI, group 2](#). Random vibration at temperature (see 4.5.21.2,) shall be included in group 2 during every alternate 24-month periodic testing time period.
- b. Group 9 (all series), test sample quantity and configuration: Two bonded insert grommet subassemblies and two bonded insert interfacial seal subassemblies with the highest density insert arrangement for each shell size (small, medium and large, see [4.4.2.1.2 a](#)) shall be provided. One set of each type of insert assembly shall be installed in the connector shell. Assemblies shall be subjected to the tests in [table XVII, group 9](#), with the exception of thermal vacuum outgassing. The set of inserts assembled into shells shall be subjected to cavity-to-cavity leakage bonding integrity as specified in group 9. The set of inserts provided without shells shall be subjected to insert bond strength as specified in group 9.
- c. High temperature: One mating pair of connectors, of any representative shell size and insert arrangement for each contact size qualified, shall be subjected to high temperature exposure with contact loading in accordance with [4.5.37](#), except that the time period shall be 250 hours.

4.4.2.1.3 Failures. If one or more sample units fail to pass group C inspection, the sample shall be considered to have failed and corrective action shall be taken in accordance with [4.4.2.1.5](#).

4.4.2.1.4 Disposition of sample units. Sample units which have been subjected to group C inspection shall not be delivered on the contract or purchase order.

4.4.2.1.5 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall take corrective action on the materials or processes or both, as warranted, and on all units of product which are to be corrected and which were manufactured with essentially the same materials and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action acceptable to the qualifying activity has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspections, or the inspection which the original sample failed, at the option of the qualifying activity). Groups A and B inspections may be reinstituted; however, final acceptance shall be withheld until the group C reinspection has shown that corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the qualifying activity.

4.4.3 Failures of groups A, B or C. Lots which fail groups A, B or C and also either fail retesting or are not submitted for retesting, shall not be shipped, and the PIN and "JAN" marking shall be removed within 30 days from product produced to these lots (see [3.12.1](#) and [3.12.4](#)).

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

4.5 Methods of inspection.

4.5.1 Visual and mechanical examination.

4.5.1.1 Connectors, accessories and piece parts. The connectors, accessories and piece parts covered by this specification shall be visually and mechanically examined to ensure conformance with the specification and the applicable military standards (see 3.1, 3.3, 3.4, 3.4.2, 3.12 and 3.13). The contractor may use in-process controls to satisfy these requirements.

4.5.1.2 Contacts (size 23 and size 20HD only). The contacts shall be visually examined for mechanical defects (see 3.1, 3.3, 3.4, 3.12 and 3.13). The contacts shall be inspected through a device having approximately three power (3X) magnification. The contractor may use in-process controls to satisfy these requirements.

4.5.1.3 Test methods. The following identified tests and methods assure connector integrity within typical operating conditions and applications. Alternate commercial industry standard test methods are allowed when determined to provide equivalent results; however when an alternate method is proposed, the manufacturer shall submit details of the alternate method to the qualifying activity for their review and approval prior to the performance of the test. The test methods described herein are proven methods and shall be the referee methods in the event of a dispute.

4.5.2 Maintenance aging. See 3.9.1. Connectors shall be tested in accordance with test procedure EIA-364-24. The following details shall apply:

- a. Installing/removal tools shall be in accordance with SAE-AS81969/1, SAE-AS81969/8, SAE-AS81969/14.
- b. A minimum of twenty (20) percent, but not less than three contacts of each connector shall be tested.
- c. Fifty (50) percent of maintenance aging shall be performed with SAE-AS81969/8 tools and fifty percent with SAE-AS81969/14 tools, except for connectors with size 23 contacts, which shall use fifty percent SAE-AS81969/8 tools and fifty percent SAE-AS81969/1 tools.
- d. Contact installing and removal force measurements may be made with the appropriate installing and removal tips adapted to measure installing and removal forces on the initial and final cycle of maintenance aging.
- e. No lubricant shall be used during this test.

4.5.3 Durability.

4.5.3.1 Durability, connectors. The wired, assembled plugs and receptacles shall be mated and unmated 500 cycles, at a rate of 300 cycles per hour, maximum. The mating and unmating shall be accomplished so that the plug and receptacle are completely separated during each cycle.

4.5.3.2 Durability, contacts (sizes 23 and 20HD only). Contacts shall be installed in connectors and shall be subjected to 500 cycles of mating and unmating at a rate of 300 cycles per hour, maximum. The depth of engagement shall not be less than 70% of the minimum bore depth (see figure 24). The connector coupling devices may be removed for this test.

4.5.4 Contact engagement and separating force. Applicable to size 20HD and size 23 socket contacts, see 3.9.3. Sockets shall be mounted in a suitable fixture for applying gradually increasing loads for engagement and separation in accordance with EIA-364-37 using test pins as specified in AS31971. The test pins shall be inserted into the socket contacts to a minimum of .7L as illustrated on figure 24. A maximum diameter test pin shall be inserted and removed from each socket contact and the separation force shall be measured during removal.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

4.5.5 Contact retention. See [3.9.4](#). Unless otherwise specified, contacts shall be tested to procedures I and II.

4.5.5.1 Procedure I, axial displacement from front to rear. Contact retention shall be tested in accordance with test procedure EIA/ECA-364-29. The following details and exceptions shall apply:

- a. Number of samples - The test shall be performed on 20 percent of the contact complement; but not less than three contacts in each connector half.
- b. Applied axial load - Preload to 3 pounds maximum, (13.6 Newtons). Apply load as specified in [table XXII](#).
- c. Special requirements - Where the test sequence required maintenance aging prior to contact retention, the contacts which were subjected to maintenance aging shall also be selected for contact retention.
- d. Axial direction - The applicable forces shall be applied along the longitudinal axis of individual contacts in the direction tending to displace the contacts to the rear.
- e. Only the contacts to be tested need be installed in the connector.

Discussion only: Specified forces for contact retention are proposed based on similar commercial connector series. Other similar commercial connectors, Glenair 805 series, catalog test data shows size 23 at 6 lbs, size 20HD at 9 lbs, size 20, 16 and 12: same as 38999

TABLE XXII. Contact retention.

Contact size (mating end)	Wire barrel size	Pounds minimum	Newtons minimum
		Load $\pm$ 10 percent	
23	-22	10	44
20HD	-20	15	67
20	-20	15	67
16	-16	25	111
12	-12	25	111

4.5.5.2 Procedure II, axial displacement from rear to front. Contact retention shall be tested in accordance with test procedure EIA/ECA-364-29. The following details and exceptions shall apply:

- a. [4.5.10.1a](#) through [4.5.10.1c](#) apply.
- b. Axial direction - Same as [4.5.20.1.d](#), except the direction shall tend to displace the contacts to the front.
- c. Only the contacts to be tested need be installed in the connector.

4.5.6 Gauge location. See [3.9.5](#). Applicable test gauges, specified on [figure 20](#), [figure 21](#) and [figure 22](#), shall be installed in three randomly selected cavities in each connector, with the accessory rear hardware removed. With each test gauge fully seated back against its contact retention device, the axial location of the front end of each gauge shall be measured relative to the reference point specified on [figures 1 through 4](#), as applicable. The test shall be repeated on pin assemblies using gauges specified on [figure 20](#) and seating them forward in the contact cavity.

4.5.7 Gauge retention. See [3.9.6](#). Applicable test gauges, [figure 20](#), [figure 21](#) and [figure 22](#), shall be installed in three randomly selected cavities in each connector, with the accessory rear hardware removed. The axial load specified in [table IX](#) shall be applied to individual test gauges in both directions. The load shall be applied at a rate of approximately 1 pound per second until the specified load has been reached. Gauge displacement shall be measured with respect to the connector shell after an initial load of 2 pounds has been applied to assure that all slack has been taken up.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

4.5.8 Installing and removal tool abuse and removal tool rotation. See [3.9.7](#). Applicable at initial qualification only,

4.5.8.1 Installing and removal tool abuse. Five contact cavities in each connector shall be subjected to the following removal tool rotation test. Different contact cavities shall be used for each test. Tools in accordance with SAE-AS81969/14 (except size 23) or SAE-AS81969/1 (size 23 only), as applicable, shall be utilized to perform this test. Should a tool become damaged during any of the testing, it shall be replaced. Failure of a tool shall not constitute a test failure.

4.5.8.2 Removal tool rotation. The tool shall be inserted as if to remove a contact, and a total of 3 pounds axial load shall be applied. With the force applied, the tool shall be rotated 180° and then removed also removing the contact. The contact shall be reinserted. The steps shall be repeated three times on each of five contacts selected.

4.5.9 Pin contact stability. See [3.9.9](#). The unmated connectors shall have 10 percent of their pin contacts subjected to this test. Gauge pins conforming dimensionally to the requirements on [figure 20](#), [figure 21](#) and [figure 22](#), shall be used. The connector shall be held in a holding device. The forces specified in [table X](#) shall be applied to the exposed rod as shown on [figure 14](#). The load shall be applied gradually at a rate not exceeding 1 inch (25.4 mm) per minute. The total pin tip displacement shall be measured as shown on [figure 14](#).

4.5.10 Resistance to probe damage (contact sizes 23 and 20HD socket contacts only). See [3.9.8](#). Resistance to probe damage shall be performed as specified in SAE-AS39029, except contacts may be installed in connector.

4.5.11 Contact retention system effectiveness (contact walk-out). See [3.9.10](#). Two contacts in each plug and receptacle shall be tested. The contacts shall be crimped to stranded steel cable of an appropriate size and installed in the connector. The unmated connector shall be mounted in a test fixture as shown on [figure 18](#). A 3 pound load shall be applied to the cable. One 360° rotation of the fixture with the connector mounted shall constitute one cycle. The connector shall be subjected to 100 cycles at a rate of 10 to 20 cycles per minute.

4.5.12 Plating porosity (sizes 23 and 20HD individual contacts only). See [3.9.11](#). Overall gold finished contacts shall be placed in containers and covered with nitric acid (specific gravity 1.316 at 15.6 °C) at 25 ° ± 3 °C so that all contacts may be observed during the test. The contacts shall be observed for 30 seconds for plating porosity.

4.5.13 Plating thickness (sizes 23 and 20HD individual contacts only). See [3.9.12](#). Overall plating thickness shall be measured in accordance with MIL-DTL-45204, as applicable, for the finish to be measured. Measurements shall be made on the external surfaces of the contact body at the locations shown on figures 7 and 8.

4.5.14 Surface roughness (sizes 23 and 20HD individual contacts only). See [3.9.13](#). Surface roughness after plating for pin mating surfaces (32 micro-inches or less) and other surfaces (64 micro-inches or less) shall be measured as specified in SAE-AS39029.

4.5.15 Contact strength (sizes 23 and 20HD individual pin contacts only). See [3.9.14](#). Contact strength shall be measured as specified in SAE-AS39029.

4.5.16 Axial concentricity (sizes 23 and 20HD individual contacts only) unwired and wired. See [3.9.15](#). Axial concentricity of unwired and wired contacts shall be measured as specified in SAE-AS39029.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

4.5.17 Crimpability / crimp tensile strength. See [3.9.16](#). Wired contacts shall be subjected to crimpability /crimp tensile strength testing as specified in SAE-AS39029 and EIA-364-08. Unless otherwise specified, crimping tools shall be in accordance with MIL-DTL-22520 and SAE-AS22520.

4.5.18 Shell spring finger eng/sep forces. See [3.9.17](#). Plugs shall be completely mated and unmated 10 times with counterpart receptacles less coupling pins (if applicable) and inserts. On the mating of the first cycle, the forces necessary to engage the connectors shall be within the values specified in [table XI](#). On the unmating of the last cycle, the forces necessary to separate the connectors shall be within the value specified in [table XI](#). When measuring the engagement and separation forces, the axial loads shall be applied at a displacement rate of 0.5 inches per minute.

4.5.19 Accessory thread strength. See [3.9.18](#). The mated connector shall be mounted as in normal service to a rigid panel. The torque wrench shall be attached as shown on [figure 19](#). After mating the plug and receptacle connectors, a torque shall be applied to the accessory end of the plug at a rate of approximately 10 pounds-inches per second until the required torque is achieved. The applied load shall be held for 1 minute, then the load shall be released. The test shall then be repeated on the accessory end of the receptacle.

4.5.20 Insert retention. See [3.9.19](#). Unmated connectors shall be tested in accordance with test procedure EIA-364-35 with the following details and exceptions (Note: Connectors may be wired.):

a. Force to be applied:

- Shell sizes 8 thru 15 - 100 ± 5 pounds per square inch with 25 pounds minimum force.
- Shell size 18 - 100 ± 5 pounds per square inch with 40 pounds minimum force.
- Shell size 19 thru 23 - 100 ± 5 pounds per square inch with 50 pounds minimum force.

4.5.21 Vibration (sine, random and gunfire vibration). See [3.9.20](#). Wired and mated connectors shall be subjected to the applicable test(s) specified. Connectors shall be mounted on the vibration table by normal means. All contacts shall carry a test current of 100 milliamperes maximum and shall be continuously monitored for discontinuities throughout the test. A detector capable of detecting any discontinuities in excess of 1 microsecond shall be used. All plugs shall have an accessory load fixture specified on figure 20 attached during vibration. Backshell accessories shall meet coupling nut torque requirements specified in SAE-AS85049 for category 4C, light duty type accessories.

4.5.21.1 Sine vibration. Connector samples shall be subjected to a simple harmonic motion from 10 to 2,000 Hz in each of three mutually perpendicular axes. The level of vibration shall be a velocity of 254 mm/sec from 10-50 Hz; 1.5 mm double amplitude from 50-140 Hz, and 60 G from 140-2,000 Hz. The entire frequency range from 10-2,000 Hz and back shall be traversed in 20 minutes. The vibration shall be applied for a duration of 12 hours in each of the three mutually perpendicular axes for a total of 36 hours. Each axis of vibration shall be accomplished by vibrating for 4 hours at ambient room temperature, 4 hours at $-55^{\circ}\text{C} \pm 5^{\circ}\text{C}$, and 4 hours at $+175^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for classes T, W and Z, and $200^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for classes F, K, L and G.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

4.5.21.2 Random vibration. Connectors shall be subjected to the test specified in test procedure EIA-364-28. The following details shall apply:

- a. Test condition VI - Letter "J". All classes shall be tested at elevated temperature and testing shall include verification of metal-to-metal shell bottoming (see 3.6). The verification of plug to receptacle metal-to-metal shell bottoming (or composite-to-composite shell bottoming) shall be accomplished by demonstrating that the connector meets a minimum rigidity requirement of 300 Hz (i.e. no resonances at frequencies less than 300 Hz). Two accelerometers, one for the perpendicular axis and one for the longitudinal axis (see figure 23), shall be placed on the backshell of the plug connector in the location as specified on figure 23 (dimension LL). Additionally, an input or control accelerometer shall be placed on a non-resonant point of the fixture to control the input vibration. If the accelerometers on the backshell indicate a resonance at a frequency below 300 Hz during any part of the vibration test procedures, the connector shall be considered to have failed (see 3.6). Verification of resonance shall be accomplished by monitoring the accelerometers placed on the backshell assembly. Prior to the random vibration test, a 2 g sinusoidal resonance search shall be performed to verify system response. During the random vibration test, the accelerometers data shall be recorded at 1 hour intervals. Following the random vibration test, the sinusoidal resonance search shall be performed again to verify any change in system resonance. In the case of the sinusoidal tests, resonance shall be defined as a response greater than twice the input vibration level. In the case of the random vibration test, resonance shall be defined as a response greater than four times the input vibration level ($1g^2$ vs $4g^2$). Note: Lightweight accelerometers and mounting features shall be selected so that the total mass of the backshell/cable assembly shall be as specified on figure 23. Vibration testing shall be conducted at the following temperatures: Classes T, W and Z at $+175^{\circ}\text{C} \pm 5^{\circ}$. Classes F, K, L and G: $200^{\circ}\text{C} \pm 5^{\circ}\text{C}$. Duration shall be 8 hours in the longitudinal direction and 8 hours in a perpendicular direction for a total of 16 hours for all classes.

4.5.21.3 Random vibration. Connectors shall be tested in accordance with test procedure EIA-364-28. The following details shall apply:

- a. Test condition V - Using the vibration envelope shown on [figure 22](#).
- b. Vibration to be conducted at ambient temperature.
- c. Duration shall be 8 hours in the longitudinal direction and 8 hours in a perpendicular direction for a total of 16 hours.
- d. The test accessory specified on figure 23 is not required.

4.5.21.4 Gunfire vibration. Wired and mated connector assemblies shall be subjected to a functional test in accordance with MIL-STD-810, method 519.5, except that T_1 shall be at 20 Hz and 2 kHz instead of 30 Hz and 2 kHz, at the levels defined in [table XIII](#), which are applied for 26.5 minutes in each of the 3 axes.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

TABLE XXIII. Gunfire vibration.

$T_1 (g^2/Hz) = 0.037$
$T_2 (g^2/Hz) = 0.765$
$T_3 (g^2/Hz) = 2.518$
Overall gms = 37.18
$F_1 (Hz) = 28.3$
$F_2 (Hz) = 56.6$
$F_3 (Hz) = 84.9$
$F_4 (Hz) = 113.2$
$P_1 (g^2/Hz) = 2.312$
$P_2 (g^2/Hz) = 2.440$
$P_3 (g^2/Hz) = 2.784$
$P_4 (g^2/Hz) = 3.833$

4.5.22 Shock (specified pulse). See [3.9.21](#). Wired and mated connectors shall be subjected to the applicable test specified. Connectors shall be mounted by normal means and held together by normal coupling means. All contacts shall be wired in a series circuit with 100 milliamperes maximum current flow through the series circuit during shock. Connectors shall be monitored for any discontinuities. A detector capable of detecting all discontinuities of 1.0 microsecond or longer shall be used.

4.5.22.1 Standard shock (all series). Connectors shall be tested in accordance with test procedure EIA-364-27. The following details shall apply:

- a. The pulse shall be an approximate half sine wave of $300 G \pm 15$ percent magnitude with a duration of 3 ± 1 milliseconds.
- b. The wire bundle shall be clamped to fixed points at least 8 inches (203.2 mm) from the rear of the connector.

4.5.23 Impact (drop) (qualification only). See [3.9.22](#). Connector plugs with straight strain relief clamps shall be tested in accordance with EIA-364-42. The following details apply:

- a. Drop height: 6 feet (1.8 m).
- b. Number of drops: 8 drops total.
- c. Impact surface: Concrete floor or plate, which shall be 4 in (0.1 m) min thickness.
- d. Plugs shall have no protective covers installed.
- e. The test fixture in accordance with EIA-364-42 shall be indexed at 36° intervals, and each drop shall originate from a different index position.

4.5.24 Insulation resistance (IR).

4.5.24.1 IR at ambient temperature. See [3.10.1](#). Unmated connectors shall be tested in accordance with test procedure EIA/ECA-364-21. The following details and exceptions apply:

- a. For lot acceptance testing, where it is undesirable to install actual contacts in connectors, simulated contacts and special techniques may be used in performing this test.
- b. The tolerance on the applied voltage shall be ± 10 percent.
- c. Connectors shall be mated when testing after altitude immersion, humidity and altitude-low temperature.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

4.5.24.2 IR at elevated temperature. See [3.10.1.4](#). Unmated connectors shall be tested in accordance with test procedure EIA/ECA-364-21. The following details and exceptions shall apply:

- a. The tolerance on the applied voltage shall be ± 10 percent.
- b. Applicable elevated temperature for 30 minutes: Classes T, W and Z at $+175^{\circ}\text{C} \pm 5^{\circ}$. Classes F, K, L and G: $200^{\circ}\text{C} \pm 5^{\circ}\text{C}$.
- c. Measurements shall be made while the connectors are still in the chamber at the specified temperature.

4.5.25 Dielectric withstanding voltage at sea level and altitude. See [3.10.2](#).

4.5.25.1 Dielectric withstanding voltage at sea level. Wired, unmated connectors shall be tested in accordance with test procedure EIA-364-20, method A. Connectors shall be mated when testing after altitude immersion, humidity, and altitude-low temperature. The following details and exceptions apply:

- a. The magnitude of the test voltage shall be as specified in table XV. (see [MIL-STD-#####](#) for service rating of insert arrangement).
- b. Fifty (50) percent of the contacts available shall be tested, but in no case shall less than six dielectric withstanding voltage readings be taken. If the number of contacts is three or less, all contacts shall be tested. The test voltage shall be applied between each wired contact, and each adjacent contact, and the shell.
- c. The test voltage shall be maintained at the specified value for 2 seconds minimum.
- d. For conformance inspection (see 4.4), simulated contacts and special techniques may be used in performing this test.

4.5.25.2 Dielectric withstanding voltage at altitude. Mated connectors and unmated connector halves with pin contacts shall be tested in accordance with test procedure EIA-364-20, method A, with the following details and exceptions:

- a. The magnitude of the test voltage shall be as specified in table XV.
- b. Fifty (50) percent of the contacts available shall be tested, but in no case shall less than six dielectric withstanding voltage readings be taken. If the number of contacts is three or less, all contacts shall be tested. The test voltage shall be applied between each wired contact and each adjacent contact and the shell.
- c. The test voltage shall be maintained at the specified value for 2 seconds minimum.
- d. The leads of all test circuits shall be brought out through the walls of the chamber. There shall be no wire splices inside the chamber. The wire ends of all leads shall be unsealed.
- e. Only the engaging faces of hermetically sealed and box mounting receptacle connectors shall be subjected to the high altitude. The rear face shall be suitably protected.
- f. The chamber shall be evacuated to each of the specified altitude pressure equivalents listed below.

<u>Altitude</u>	<u>Equivalent pressure</u>
40,000 feet	141 torr
70,000 feet	34 torr

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

4.5.26 Electrical engagement. See [3.10.3](#). Counterpart plugs and receptacles shall be wired to provide a complete series circuit through all contacts of the mated connector. A suitable power source and indicator shall be provided such that the earliest point at which the circuit is completed, during normal connector mating, can be established. Connector halves shall be slowly mated by the normal mating means until first indication of a completed circuit is observed. Means shall be provided to assure that electrical contact is made between the pin and the spring of the socket contact, rather than the hood of the socket contact. The mating operation shall be held at this point and the overall connector length shall be measured from solid reference points on the connector halves. The mating operation shall then be continued until the connector halves are in the completely mated position. A second overall length measurement shall then be taken from the same reference points. The difference of these two measurements shall be not less than specified in [3.10.3](#). Both the outer shield and inner conductor circuits shall be included in the test of shielded contacts.

4.5.27 Shell-to-shell conductivity, before and after conditioning. See [3.10.4](#). Mated connectors shall be tested in accordance with test procedure EIA-364-83.

4.5.28 EMI shielding. Applicable to all classes. See [3.10.5](#).

4.5.28.1 EMI shielding, low frequencies. Applicable frequency range is 100 to 1,000 MHz only. The EMI shielding effectiveness of mated connectors with EMI backshells (backshells may be soldered to the connector) shall be measured in a triaxial radio frequency leakage fixture as shown on [figure 16](#), and test system schematic shown on [figure 15](#). The EMI leakage from the conductor inside the connector in the same inner coaxial line into the outer coaxial line shall be measured at the frequencies specified in [table XV](#) within a frequency accuracy of ± 5 percent. The level of detected signal power shall be specified by a tunable radio frequency field intensity meter isolated from the test circuit by a 3 to 10 dB pad. Care shall be taken to ensure that the signal is a result of EMI leakage from within the mated connector and not due to a faulty termination inside the fixture. All terminations inside the fixture, whether to the EMI backshells or between internal conductors, shall have a leakage at least 10 dB less than the test requirements. The signal source shall be set to the desired frequency. The signal shall be fed through a 3 to 10 dB isolation pad to a parallel circuit consisting of a coaxial switch (DPDT) so connected that the signal can be manually or electronically fed alternately to the fixture and to a variable 100 dB reference attenuator. The attenuator shall be adjustable in 1 dB steps and calibrated to ± 3 dB.

- a. The inserts may be removed from the connectors under test or the contacts removed and a hole drilled through the inserts to accommodate a center conductor of suitable geometry to provide a good 50-ohms impedance match with the inside diameter of the mated connector shells and EMI backshells. Tapered transition may be used to provide a means of changing diameters without introducing significant discontinuities in the line. The maximum voltage standing wave ratio (VSWR) in the inner coaxial line shall be 1.5. The outer shell of the test fixture shall be so constructed as to provide a good 50-ohms impedance match with the outside diameter of the mated connector shells, coupling ring, and EMI backshells. The maximum VSWR of the outer coaxial line shall be 1.5.
- b. A sliding circumferential short shall be positioned behind the connector on the signal input end of the fixture to provide for tuning the outer coaxial line for maximum output at each test frequency. The allowable travel of this short shall be greater than $1/2$ wave length at the lowest test frequency of 1.5 meters minimum for 100 MHz. The inner coaxial line shall be terminated in a fixed 50-ohms load impedance behind the connector at the output end of the fixture.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

- c. The connectors used to couple together the various elements of the test system shall be of a low-leakage type which have a nominal impedance of 50 ohms, a VSWR of less than 1.5, and a minimum leakage attenuation of 100 dB. The output impedance of the signal source and the input impedance of the detector shall be nominally 50 ohms with a maximum VSWR of 1.5. The input and output VSWR of the standard attenuator shall be less than 1.5 in the 20 to 100 dB range.
- d. The relative signal level in the variable attenuator shall be equaled to the signal level through the leakage fixture by adjusting the attenuator. The signal loss in the fixture can then be read from the setting on the variable attenuator.

4.5.28.2 EMI shielding, high frequencies. Applicable frequency range is 1,000 to 10,000 MHz only. The EMI shielding effectiveness of mated connectors with EMI backshells shall be measured using the mode-stirred technique in accordance with test procedure EIA-364-66.

4.5.29 Contact resistance. See [3.10.6](#). Mated connectors shall be tested in accordance with the contact resistance requirements of SAE-AS39029. The following details shall apply: Contact resistance testing shall be performed at ambient temperature. 10% of contacts shall be tested in accordance with SAE-AS39029 except the millivolt drop shall be measured at the end of the test article wire bundles and recorded. Of the 10%, 1/3 of the contacts shall be selected from the center of the insert arrangement, 1/3 of the contacts shall be selected from those located nearest to the connector shell, and the remaining 1/3 shall be selected from random locations. After vibration testing, a second millivolt drop measurement shall be conducted at the same location at the end of the wire bundles. The differential between the first millivolt drop measurement and the second millivolt drop measurement shall not be greater than 100 milliohms. If the insert arrangement includes 11 contacts or more, then circuits for the contacts selected for contact resistance testing prior to and following vibration testing are not required to be monitored for discontinuities during vibration testing,

4.5.30 Low level contact resistance. See [3.10.7](#). When tested in accordance with ECIA/EIA-364-23, with the pin contact engaged to a depth of .7L as illustrated on figure 24. wired, mated connectors shall meet the LLCR requirements specified in SAE-AS39029.

4.5.31 Thermal shock (temperature cycling). See [3.11.1](#). Mated connectors shall be tested in accordance with test procedure EIA-364-32, test method A, test condition V, test duration A, except that the duration of steps 2 and 4 shall be 2 minutes.

4.5.32 Salt spray (corrosion). See [3.11.2](#).

4.5.32.1 Salt spray (corrosion), standard test. Applicable to connectors (classes F and G, only) and to individual contact samples with contact mating end size 20HD and 23. Unmated connectors and unmated contacts shall be tested in accordance with test procedure EIA/ECA-364-26. The following details and exceptions shall apply:

- a. Test condition B (48 hours).
- b. The samples shall not be mounted but shall be suspended from the top of the chamber using waxed twine or string, glass rods, or glass cord.
- c. Wire ends must be protected to prevent salt migration.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

4.5.32.2 Salt spray (corrosion), dynamic test. Applicable to classes K, L, T, W and Z. The wired, assembled plugs and receptacles shall be mated and unmated 50 cycles at a rate of 300 cycles per hour maximum. The mating and unmating shall be accomplished so that the plug and receptacle are completely separated during each cycle. The connectors shall then be subjected to the salt spray test in accordance with test procedure EIA/ECA-364-26. The following details and exceptions apply:

- a. The connectors shall be tested for 452 hours mated followed by 48 hours unmated.
- b. The connectors shall not be mounted but shall be suspended from the top of the chamber using waxed twine or string, glass rods, or glass cord.
- c. Wire ends shall be protected to prevent salt migration.

After salt spray exposure, the remaining number of durability cycles specified in 4.5.8 shall be completed.

4.5.33 Fluid immersion. Applicable to initial qualification only, see 3.11.3. Connector samples shall be tested in accordance with test procedure EIA-364-10 (one sample per fluid). Following the fluid immersion cycles, the connectors shall be tested for coupling torque in accordance with 4.5.7 and dielectric withstanding voltage at sea level in accordance with 4.5.11.1 within 3 hours.

4.5.34 Retention system fluid immersion. See 3.11.13. Unmated connectors with contacts removed shall be immersed in the fluids in accordance with test procedure EIA-364-10 (one sample per fluid) for 2 hours at room temperature. After removal, excess fluid shall drain from the connectors for 4 hours and the contacts reinstalled. Following the test, the connectors shall be subjected to contact retention as specified in 4.5.5.

4.5.35 Humidity. See 3.11.4. Wired, mated connectors shall be tested in accordance with test procedure EIA-364-31. The following details and exceptions shall apply:

- a. Test method IV, test duration B (10 24-hr cycles, 240 hrs total), including "cold shock" sub-cycle (step 7a).
- b. The mated connectors shall be mounted in a vertical position.
- c. For qualification testing, insulation resistance readings shall be made on a minimum of 50 percent of the circuits. Outer circuits shall be measured to the connector shell.

4.5.36 High temperature exposure with contact loading. See 3.11.5. Connectors with removable contacts shall have one mating pair of contacts removed from an untested contact cavity and replaced with contacts crimped or otherwise attached to steel cable or steel-cored copper wire (copper-weld, or equivalent) of an appropriate size. The axial location of these contacts shall be measured for conformance to the applicable dimensions on figures 1 through 4, as applicable, with a load of approximately 2 pounds applied to seat the contact back against the retention device. The connector shall then be mounted in a fixture equivalent as shown on figure 17. A weight equal to 50 percent of the axial load specified in table IX for the applicable contact size shall be suspended freely from each steel wire.

A current of 100 milliamperes maximum shall be applied to the test contacts and a suitable instrument shall be used to monitor the circuit for discontinuities in excess of 1 microsecond. The mounted connector shall then be exposed to 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. After the connectors return to ambient temperature, they shall be unmated and the contact locations shall be remeasured with approximately 2 pounds axial load applied to seat the contact back against the retention device.

4.5.37 Ozone exposure. See 3.11.6. Wired, mated connectors shall be tested in accordance with test procedure EIA-364-14.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

4.5.38 Ice resistance. See [3.11.8](#). Mated connectors shall be immersed in tap water for 1 minute and then placed in an ambience of -65°C $+0^{\circ}\text{C}/-5^{\circ}\text{C}$ for 1 hour. A minimum of three such cycles shall be performed until the connector surfaces are completely iced over. Immediately after removal from the last cycle, the frozen connectors shall be uncoupled and then recoupled. The connectors shall be uncoupled and recoupled a second time with the uncoupling and coupling torque measured in accordance with [4.5.7](#). The uncoupling and coupling torque shall not be measured on the first uncoupling and recoupling.

4.5.39 Sand and dust. See [3.11.7](#). Mated connectors shall be tested in accordance with MIL-STD-202-110.

4.5.40 External bending moment. See [3.9.26](#).

4.5.40.1 External bending moment, connectors. The receptacle connector shall be mounted as in normal service to a rigid panel. Before mating the plug connector to the receptacle, an adapter or test torque arm shall be attached as shown on [figure 13](#). After mating the plug and receptacle connectors, the distance "L" from the point of load application "P" to the mounting panel shall be determined. The load to be applied at point "P" shall then be determined as the bending moment specified in [table XIV](#) divided by the lever arm "L". This load shall be applied at a rate of approximately 10 pounds per second until the required load is achieved. The applied load shall be held for 1 minute, then the load shall be released. Continuity of the contacts shall be monitored during the test. The test circuit used to monitor the circuit shall be capable of detecting a discontinuity in excess of 1 microsecond.

4.5.40.2 External bending moment, accessories. The connector accessory shall be mounted as in normal service to a rigid panel as shown on figure 25. The distance "L" from the point of load application "P" to the mounting panel shall be determined. The load to be applied to point "P" shall then be determined as the bending moment listed in Table XIV divided by the lever arm "L". This load shall be applied at a rate of approximately 10 pounds per second until the required load is achieved. The applied load shall be held for 1 minute and then released. For straight accessories, the load shall be applied as shown on figure 25 to two axes, 90 degrees apart, at different times.

4.5.41 Magnetic permeability. See [3.3.6](#). Connectors (all classes) and contacts (contact sizes 23 and 20HD, only) shall be tested in accordance with test procedure EIA-364-54.

4.5.42 Fungus resistance. See [3.3.5](#). Certification to method 508 of MIL-STD-810 is required.

4.5.43 Contact engaging and separating forces (applicable to connectors with size 23 and size 20HD sockets contacts, only). See [3.9.3](#). Contact engagement and separating force shall be measured as specified in SAE-AS39029.

4.5.44 Cavity leakage. See [3.9.23](#). Unmated connectors shall be tested in accordance with test procedure EIA-364-78.

4.5.45 Altitude immersion. See [3.11.11](#). Mated connectors shall be tested in accordance with test procedure EIA-364-03. The following details shall apply:

- a All wire ends shall be located within the chamber and exposed to the chamber atmosphere but not submerged or sealed.
- b. At the end of the third cycle, while the connectors are still submerged in the solution, the insulation resistance at ambient temperature shall be measured as specified in [4.5.24.1](#), and the dielectric withstanding voltage test shall be performed as specified in [4.5.25.1](#).

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

4.5.46 Altitude-low temperature. See [3.11.12](#). Wired, mated, assembled connectors shall be tested in accordance with test procedure EIA-364-105. The following details and exceptions apply:

- a. No wire ends or splices inside the chamber.
- b. Chamber pressure shall be reduced to simulate an altitude of 100,000 feet. The chamber internal temperature shall be reduced to -65 °C, +0 °C, -4 °C. Temperature shall be maintained until the mated pair stabilizes.
- c. Insulation resistance test to be performed at 100,000 feet at -65 °C, +0 °C, -4 °C, and shall be in accordance with 4.5.10.1.
- d. Dielectric withstanding voltage test to be performed after return to ambient conditions and shall be in accordance with 4.5.11.1.

4.5.47 Thermal vacuum outgassing. Applicable to space grade class G, only, and for initial qualification only, see [3.11.9](#). All materials used in the finished connector shall be tested in accordance with ASTM E595. Samples to be tested shall have been processed in the same manner as that used in production of the qualification lot.

4.5.48 Resistance to indirect lightning strike. see [3.11.10](#). Mated connectors as specified in test procedure EIA/ECA-364-75 shall be tested in accordance with test procedure EIA/ECA-364-75 with the following details and exceptions:

- a. Test sequence shall be as specified in table XVII, group 10.
- b. Each specimen shall be subjected to three current pulses in each polarity (a total of six pulses). After each current pulse, the connectors shall be unscrewed ½ turn counter-clockwise without removing or unmating in order to break any weld points that may have occurred. Connectors shall then be re-tightened ½ turn, back to the fully mated position.
- c. Visual examination shall be conducted under three-five power (3-5X) magnification in accordance with test procedure EIA/ECA-364-75.
- d. Coupling torque shall be in accordance with 4.5.50.
- e. Shell-to-shell conductivity testing shall be in accordance with 4.5.27.
- f. The peak current, I_{pk}, shall be 10,000 amperes.
- g. Insulation resistance at ambient temperature shall be in accordance with 4.5.24, followed by dielectric withstanding voltage at sea level in accordance with 4.5.25.
- h. The waveform for indirect lightning strike effects, as specified on figure 32, shall be utilized. Indirect lightning strike test setup, as specified on figure 33, shall be utilized.

4.5.49 Electrolytic erosion. See [3.11.14](#). The wired receptacle half of the connector containing the pin contacts shall be firmly mounted in a vertical position with pins facing up. A salt-water solution (5 percent salt by weight) shall be poured onto the pin interface until the solution level just reaches the pin tips. The solution shall remain in the connector for a minimum of 30 seconds and then poured out, lightly shaking excesses from the connector. The counterpart plug shall immediately be mated with the receptacle. One cell pattern, with all contacts adjacent to a central contact at a positive polarity and the center contact at a negative polarity, shall be set up at a location giving the most uniform distribution of contacts adjacent to the center contact. A potential of 60 volts dc shall be applied between the contacts adjacent to the center contact. The contacts shall be energized for 40 hours. Following this, with the voltage disconnected, the connectors shall be unmated and the pin contacts removed. The contacts shall exhibit no erosion to base metal when examined under three power (3X) magnification.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

4.5.50 Coupling and uncoupling torque. See [3.9.25](#). Mated connectors shall be tested in accordance with test procedure EIA-364-114, except mated pairs shall be fully coupled within 5 seconds minimum, and shall be fully uncoupled within 5 seconds minimum. For qualification testing, mated connectors shall be coupled and uncoupled; the axial mating force (series IV) and the torque which must be applied to facilitate full coupling and uncoupling shall be measured and recorded. The following detail applies:

- a. Full coupling: Full coupling is achieved when the red band is covered by the plug coupling ring.

4.5.51 Backshell shield braid-to-shell conductivity. See [3.10.8](#). Mated connectors shall be tested in accordance with test procedure EIA-364-83, except that measurement shall be made between the plug backshell's shield braid and either the accessory threads or mounting flange of the receptacle (see figure 31 for test setup). A backshell in accordance with SAE-AS85049 shall be utilized.

4.5.52 Insert bond strength. See [3.9.24](#). The connector's bonded insert assembly shall be tested in accordance with test procedure EIA-364-79.

4.5.53 Post test examination. The tested connectors and contacts shall be examined for compliance with [3.12](#) and [3.13](#) to determine the effects of previous testing. Any evidence of cracking, loosening of parts, carbon tracking, excess wear, or missing parts shall be recorded.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see [6.2](#)). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. This electrical connector is military unique. A full commercial substitute is not available. It is a miniature, high density, threaded, environment resisting, high shock, high vibration, high corrosion resistant connector that utilizes crimp removable electrical contacts. It is capable of operating at temperatures up to 200°C. It is designed to withstand up to 500 hours of salt spray. Where weight is a critical consideration for military applications, this circular electrical connector may be preferred over other military circular connector specifications. Depending on the insert arrangement and shell size, the mated connector pair may be up to 20-30 % lighter than a similar triple-start MIL-DTL-38999 mated pair. The various classes and types of connectors are intended for general weapon system applications in which a quick disconnect coupling system is required for blind mating areas. When installed with appropriate connector accessories, some classes of this connector family are suitable for high vibration environments, as well as severe wind and moisture problem (SWAMP) areas.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

6.1.1 Application guidance.

a. Intermateability/interchangeability: See 3.4.2. Performance (function) may vary when different finishes or shell material are mated together.

b. When evaluating connectors for use in new design, including new systems and support equipment, users are advised to carefully evaluate the following connector characteristics:

6.1.2 Application notes.

a. **TBD**

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of the specification.
- b. Title, number, and date of the applicable MS standard and the complete PIN.
- c. For indirect shipment, these connectors may be furnished without contacts, grommet sealing plugs or insertion and removal tools (see 3.4.1, 3.4.1.2.3, 3.4.1.4.3, and 3.4.5.7).
- d. Special finish.
- e. Shielded contacts.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Product List QPL No. **TBD** whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from the qualifying activity, Defense Supply Center Columbus, DLA Land and Maritime-VQ, 3990 East Broad Street, Columbus, Ohio 43218-3990. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://assist.dla.mil>.

6.3.1 Qualifying Activity program information and points of contact. Additional information is available on the DLA L&M website at <https://landandmaritimeapps.dla.mil/programs/QMLQPL/default.aspx>.

6.3.2 Copies of "Provisions Governing Qualification SD-6". Copies of "Provisions Governing Qualification SD-6" are available on the DLA Document Services' website at <https://assist.dla.mil>.

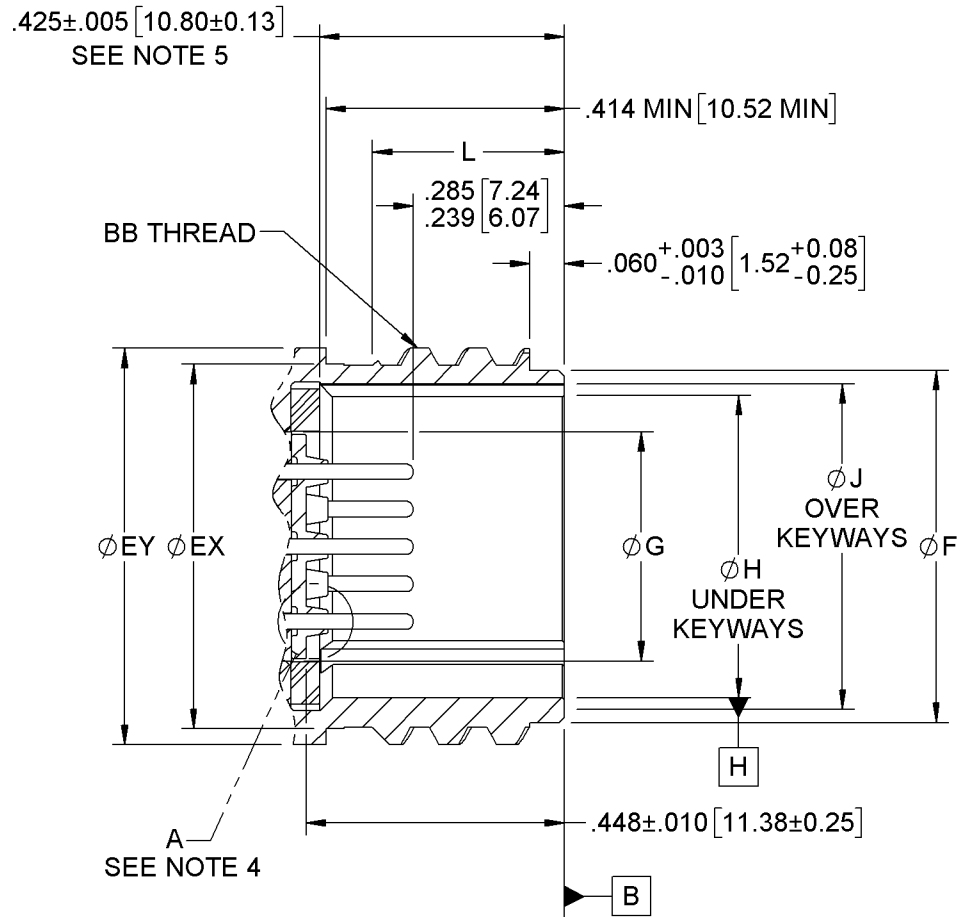
6.3.3 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification.

6.3.4 Subject term (keyword) listing.

Beryllium	Copper	Metal	Plug	Silver
Cadmium	Lead	Nickel	Receptacle	Space grade

6.3.5 Tin whisker growth. The use of alloys with tin content greater than 97 percent, by mass, may exhibit tin whisker growth problems after manufacture. Tin whiskers may occur anytime from a day to years after manufacture and can develop under typical operating conditions, on products that use such materials. Conformal coatings applied over top of a whisker-prone surface will not prevent the formation of tin whiskers. Alloys of 3 percent lead, by mass, have shown to inhibit the growth of tin whiskers. For additional information on this matter, refer to ASTM-B545 (Standard Specification for Electrodeposited Coatings of Tin) (see 3.3.1.3).

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

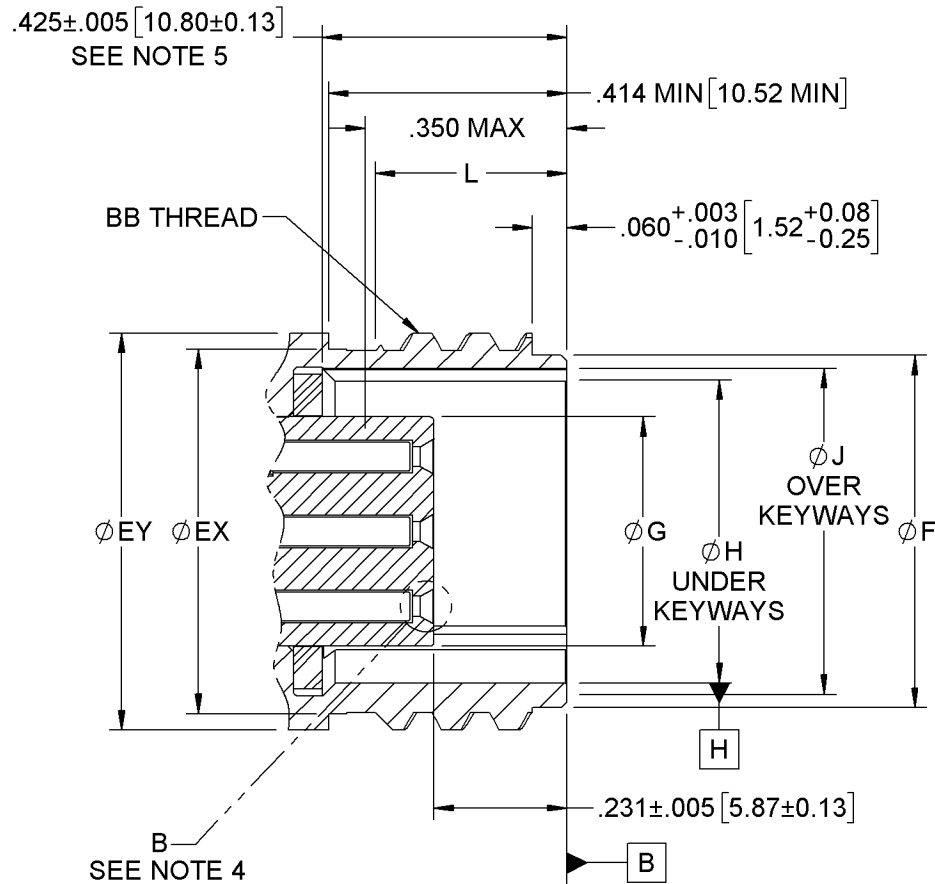


RECEPTACLE PIN INSERT

FOR DETAIL A – SEE FIGURE 3

FIGURE 1. Receptacle intermateability dimensions.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049



RECEPTACLE SOCKET INSERT

DETAIL B – SEE FIGURE 3 –

FIGURE 1. Receptacle intermateability dimensions - Continued.

The distance between the front face of the shell and the point where the right end of a gauge with a diameter equal to the nominal diameter of a male contact comes into contact with the elastic part of the female contact.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

Shell size	A dia max	C dia max	D dia max	F dia max dia $\pm .003$ Recpt Thd Lead-in	H dia $\pm .002$ Between keyways Recpt shell ID	J dia $\pm .002$ Recpt shell ID keyways	EX dia $\pm .002$ rcpt thd clean- out	EY dia $\pm .002$ rcpt shell	U dia max	T dia max	V dia max
8	0.407	0.330	0.223	0.403	0.328	0.375	0.445	0.490	0.057	0.035	0.060
9	0.498	0.408	0.292	0.494	0.408	0.450	0.516	0.554			
10	0.557	0.479	0.340	0.553	0.475	0.510	0.572	0.622			
11	0.615	0.530	0.395	0.611	0.525	0.565	0.632	0.688			
12	0.679	0.602	0.470	0.675	0.598	0.648	0.685	0.745			
15	0.797	0.692	0.547	0.793	0.690	0.732	0.878	0.931			
18	0.972	0.847	0.710	0.968	0.845	0.900	1.046	1.110			
19	0.993	0.917	0.763	0.989	0.918	0.958	1.151	1.168			
23	1.252	1.162	0.998	1.248	1.163	1.215	1.375	1.445			

FIGURE 1. Receptacle intermateability dimensions – Continued.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

Receptacle BB-Thread (Triple 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	0.1	0.3	0.499	0.491	0.443	0.436	0.473	0.469
9	0.5625			0.561	0.553	0.505	0.498	0.535	0.531
10	0.6250			0.624	0.616	0.568	0.561	0.598	0.594
11	0.6875			0.686	0.678	0.630	0.623	0.660	0.656
12	0.7500			0.749	0.741	0.693	0.686	0.723	0.719
15	0.9375			0.936	0.928	0.880	0.875	0.910	0.906
18	1.1250			1.123	1.111	1.051	1.044	1.089	1.085
19	1.1875			1.186	1.174	1.114	1.107	1.152	1.148
23	1.4375			1.436	1.434	1.364	1.357	1.402	1.398
a Threads are modified 60° stub configuration									
b Gauges for plated threads: Maximum gauging limits of class 2A threads which are plated, are increased by the allowance .0015. Unplated threads, for example class Y, may be checked with standard after plate gauges.									

NOTES:

- Dimensions are in inches.
- Metric (mm) equivalents are given for general information only.
- A point at which a gauge pin, having the same basic diameter as the mating contact and a square face, touches socket contact spring.
- Details "A" (socket entry) and "B" (pin barrier) on figure 3 apply to both plugs and receptacles.
- "A" initial contact with static seal.
- Insert front surface shall be flat within 0.13 mm TIR.
- Diameters "H" and "G" shall be concentric within 0.13 mm TIR at MMC.
- Thread approach modified to eliminate cross-threading.
- Red band location is critical. Dimensional verification of red band location is performed in Group A Inspection.
- Gauges for plated threads: Maximum gauging limits of class 2A threads which are plated, are increased by the allowance. Unplated threads, for example class K, may be checked with standard after plate gauges.
- When the receptacle is mated to the plug, the radius or chamfer shall neither damage the plug's EMI band nor impede EMI sealing.
- For shell size code used for part numbering, see [table I](#).

FIGURE 1. Receptacle intermateability dimensions – Continued.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

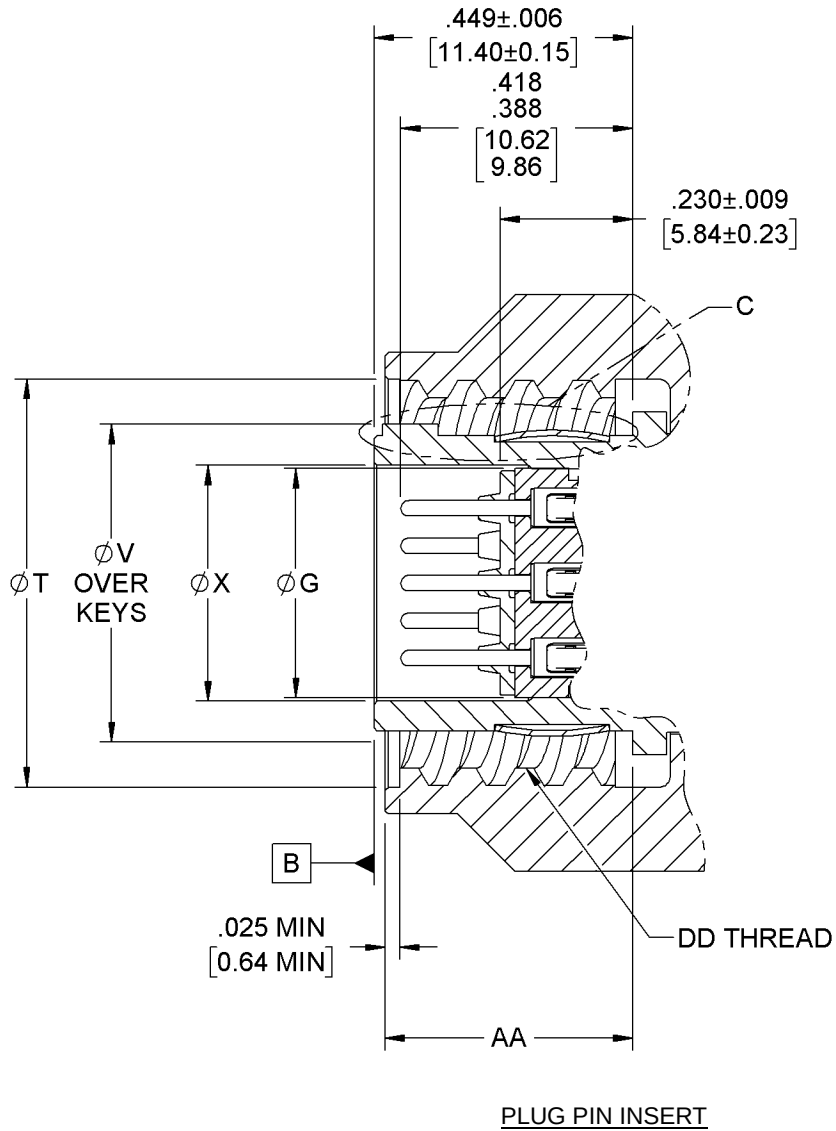


FIGURE 2. Plug intermateability control dimensions.

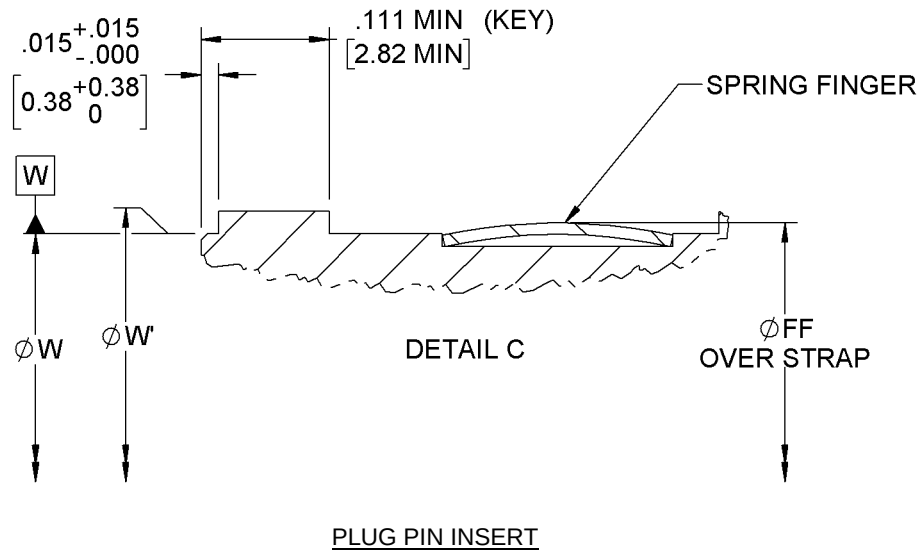
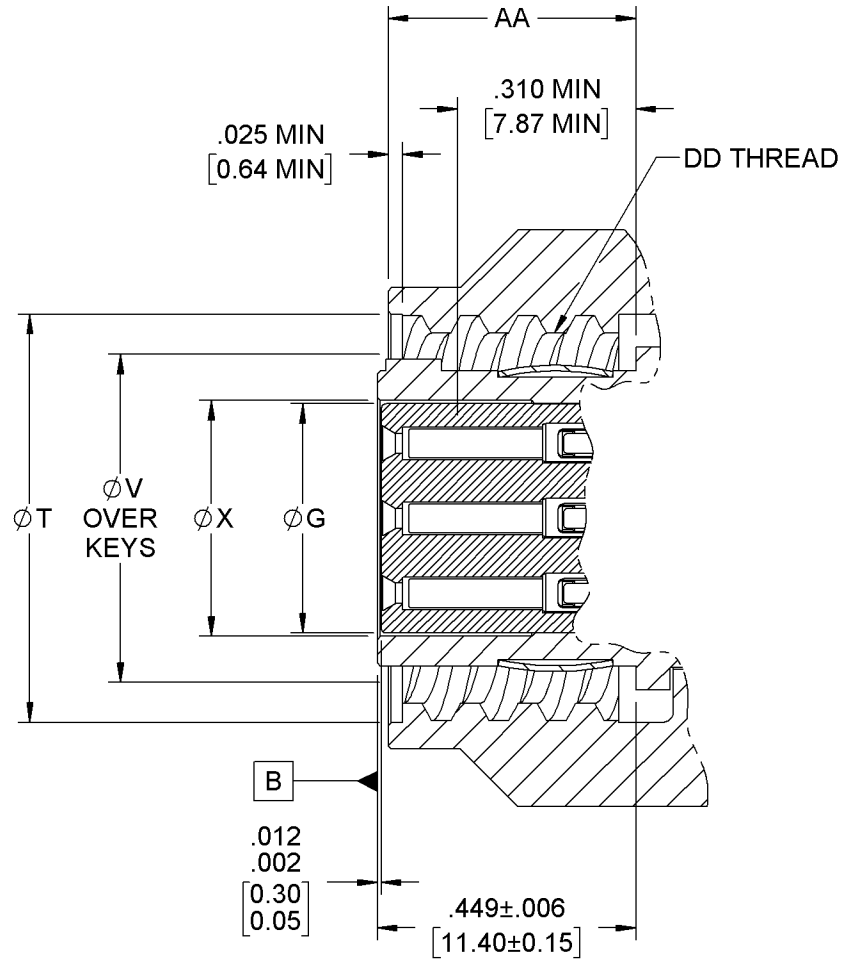


FIGURE 2. Plug intermateability control dimensions - Continued.



PLUG SOCKET INSERT

FIGURE 2. Plug intermateability control dimensions – Continued.

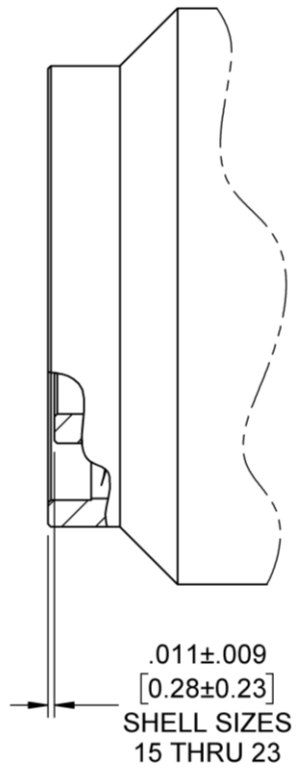


FIGURE 2. Plug intermateability control dimensions – Continued.

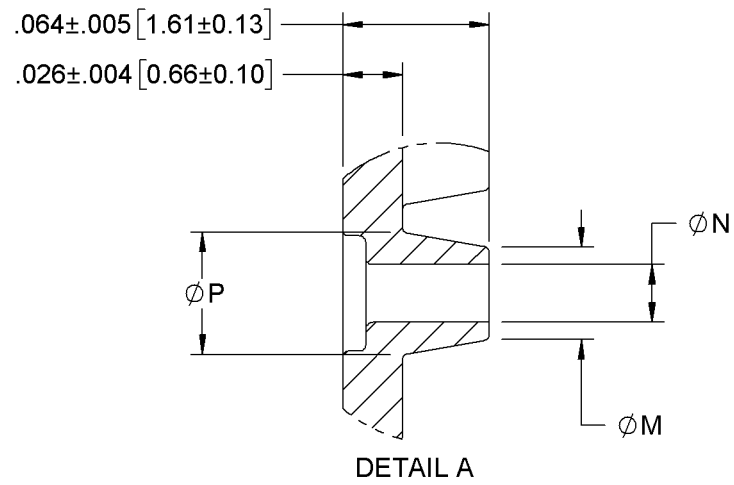
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 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

Shell size	W dia $\pm .001$ 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 $\pm .0015$	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 $\pm .008$	0.311	0.231	0.2225	0.502	.426 $\pm .011$	0.057	0.035	0.060
9	0.390	0.396	0.574 $\pm .008$	0.390	0.306	0.2945	0.565				
10	0.458	0.464	0.637 $\pm .008$	0.458	0.354	0.3415	0.627				
11	0.512	0.518	0.698 $\pm .008$	0.512	0.409	0.3975	0.690				
12	0.633	0.592	0.762 $\pm .008$	0.586	0.483	0.4725	0.752				
15	0.718	0.682	0.949 $\pm .008$	0.676	0.561	0.5495	0.940	.466 $\pm .011$			
18	0.881	0.8365	1.139 $\pm .010$	0.831	0.722	0.7105	1.127				
19	0.951	0.8885	1.201 $\pm .010$	0.883	0.783	0.7715	1.189				
23	1.198	1.1155	1.451 $\pm .010$	1.110	1.010	0.9985	1.439				

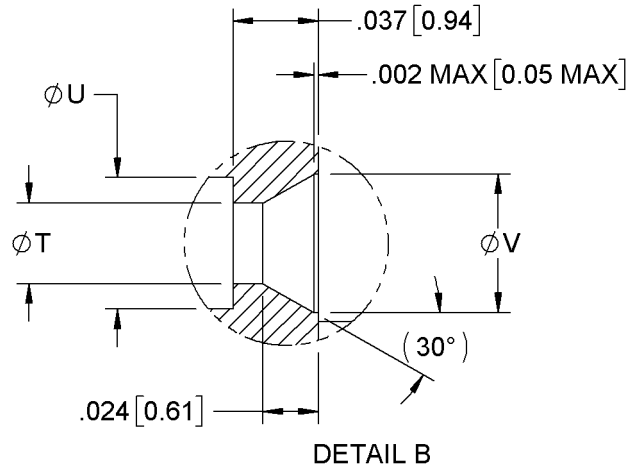
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 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

Plug Coupling Nut - CC-Thread (Triple 60° ACME Stub Modified Screw-Thread)									
Shell size	Designation ^a Class 2B thread (TS-2B)			Internal Threading Class 2B					
	Thread size (inch)	Apparent pitch (inch)	Actual pitch (inch)	Major Diameter		Minor Diameter		Pitch Diameter	
				Max	Min	Max	Min	Max	Min
8	.5000	.100	.300	.520 (13.21)	.504 (12.80)	.464 (11.79)	.454 (11.53)	.480 (12.19)	.474 (12.18)
9	.5625			.583 (14.80)	.567 (14.40)	.527 (13.54)	.517 (13.13)	.543 (13.79)	.537 (13.64)
10	.6250			.645 (16.38)	.629 (15.98)	.589 (14.96)	.579 (14.71)	.605 (15.37)	.599 (15.21)
11	.6875			.708	.692	.652	.642	.668	.662
12	.7500			.770	.754	.714	.704	.730	.724
15	.9375			.958	.942	.902	.892	.918	.912
18	1.1250			1.149	1.129	1.077	1.065	1.097	1.091
19	1.1875			1.212	1.192	1.139	1.127	1.160	1.154
23	1.4375			1.462	1.442	1.390	1.378	1.410	1.404
^a Threads are modified 60° stub configuration									

FIGURE 2. Plug intermateability control dimensions – Continued.



PIN CONTACT RAISED SEAL BARRIER



SOCKET CONTACT CAVITY

FIGURE 3. Interface design.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

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	.035 (0.89) .033 (0.84)	.058 (1.47) .055 (1.40)	.060 (1.52) .056 (1.42)	.042 (1.06) .038 (0.97)	.025 (0.64) .022 (0.56)	.048 (1.22) .044 (1.12)
20HD	.052 (1.32) .050 (1.27)	0.086 (2.18) 0.083 (2.11)	.087 (2.21) .085 (2.16)	.082 (2.08) .078 (1.98)	.038 (0.95) .035 (0.89)	.098 (2.49) .094 (2.39)
20	.052 (1.32) .050 (1.27)	0.086 (2.18) 0.083 (2.11)	.087 (2.21) .085 (2.16)	.082 (2.08) .078 (1.98)	.038 (0.95) .035 (0.89)	.098 (2.49) .094 (2.39)
16	.074 (1.88) .071 (1.80)	.121 (3.07) .118 (3.00)	.114 (2.89) .110 (2.79)	.098 (2.49) .095 (2.41)	.060 (1.52) .057 (1.45)	.119 (3.02) .114 (2.90)
12	.106 (2.69) .104 (2.64)	.169 (4.29) .166 (4.22)	.142 (3.61) .140 (3.56)	.136 (3.45) .132 (3.35)	.093 (2.36) .090 (2.29)	.153 (3.89) .149 (3.78)

NOTES:

1. Dimensions are in inches.
2. Millimeter equivalents (in parentheses) are given for information only.

FIGURE 3. Interface design - Continued.

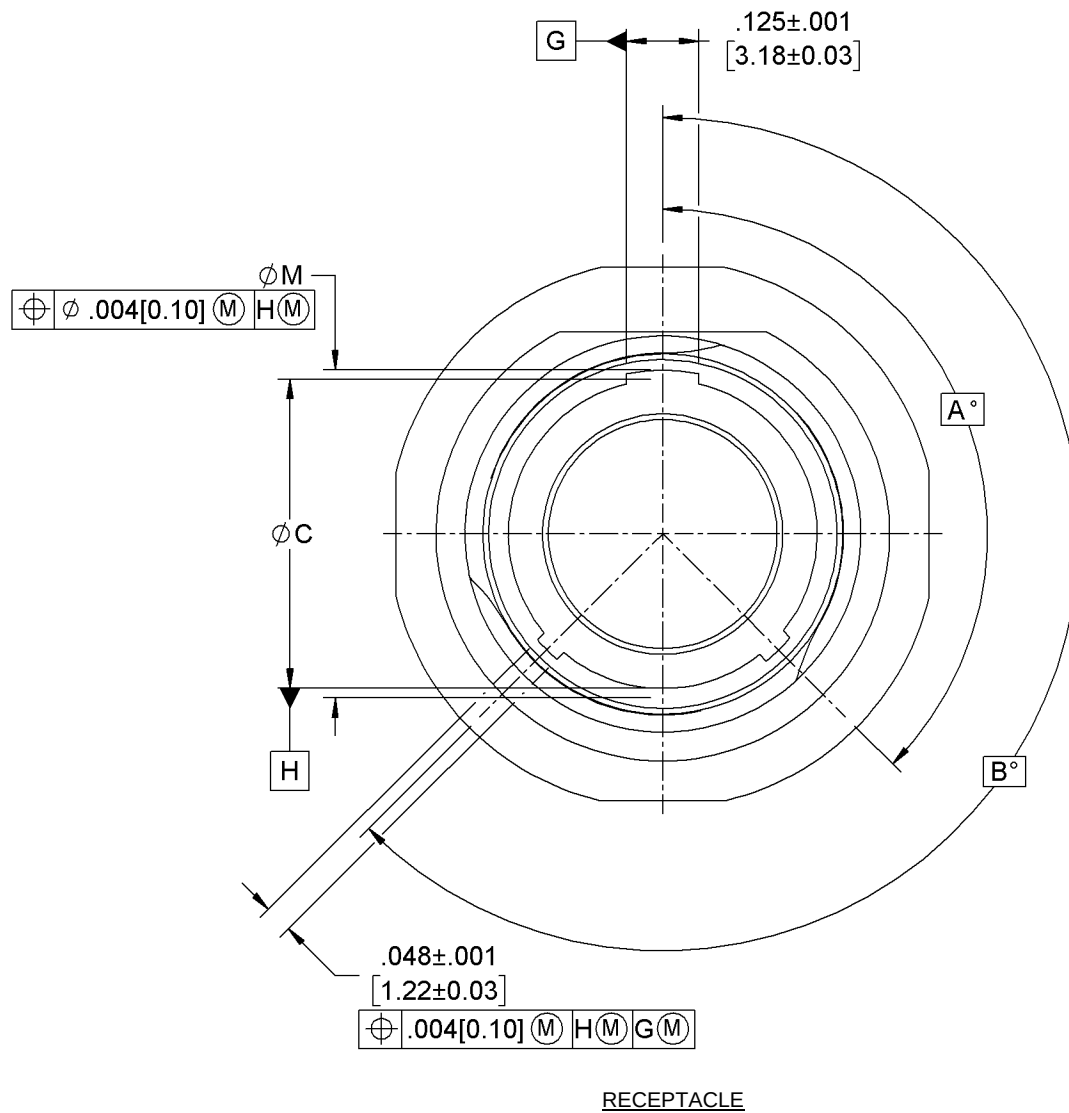
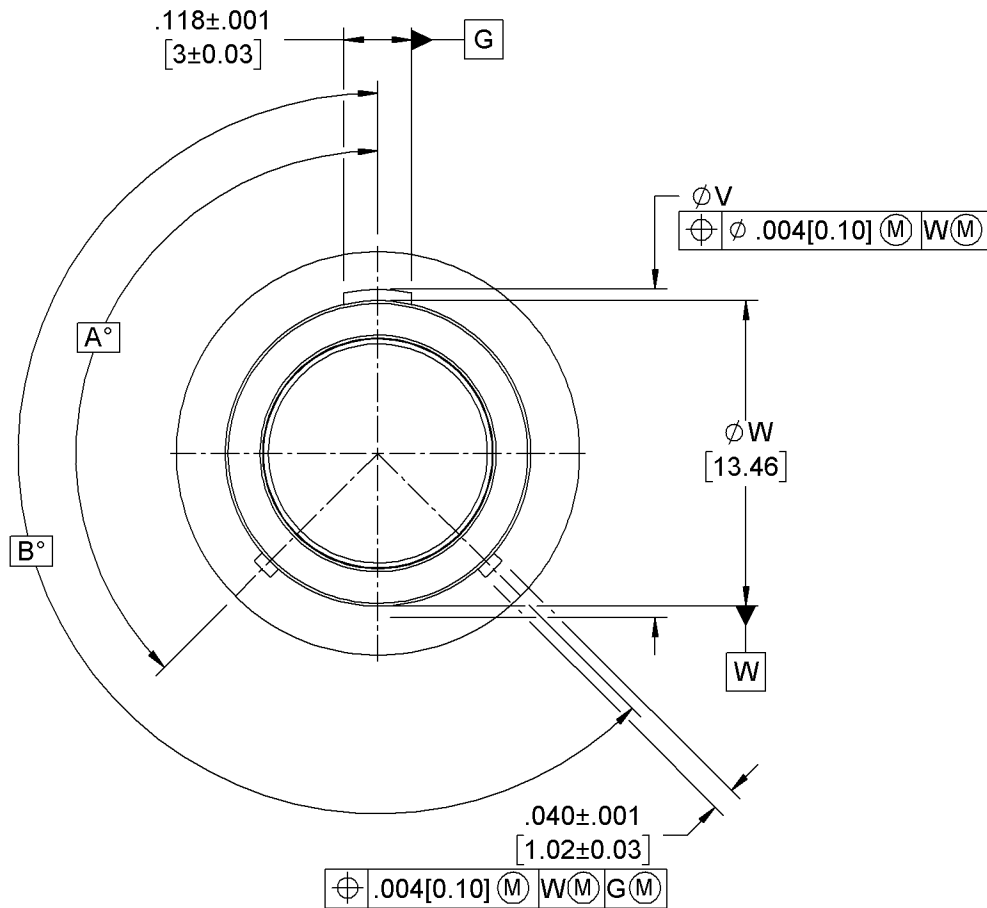


FIGURE 4. Connector intermateability dimensions. Main key / keyway polarization.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049



PLUG BARREL

Polarization	A (degrees)	B (degrees)
N (normal /standard)	150	210
B	75	210
C	95	230
D	140	275

NOTES:

1. Dimensions are in inches. Millimeter equivalents are given for information only.
2. All angles are BSC.
3. The insert arrangement does not rotate with main key/keyway.
4. For alternate rotations B through E, the main key stays fixed, and the minor keys rotate.

FIGURE 4. Connector intermateability dimensions. Main key / keyway polarization – Continued.

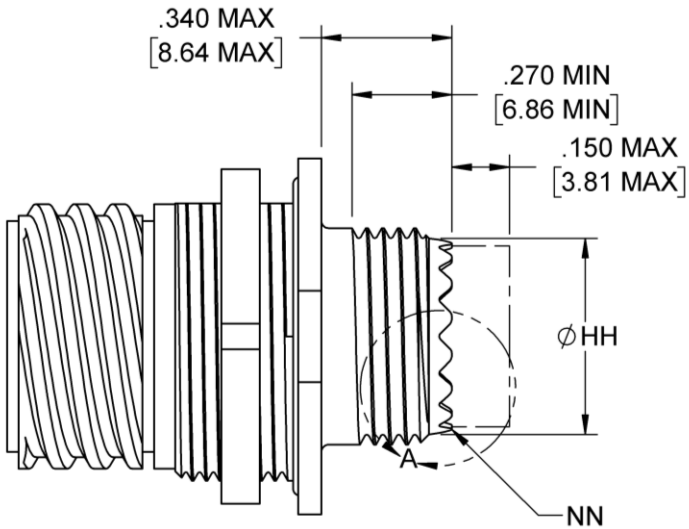


FIGURE 5. Connector accessory interface dimensions.

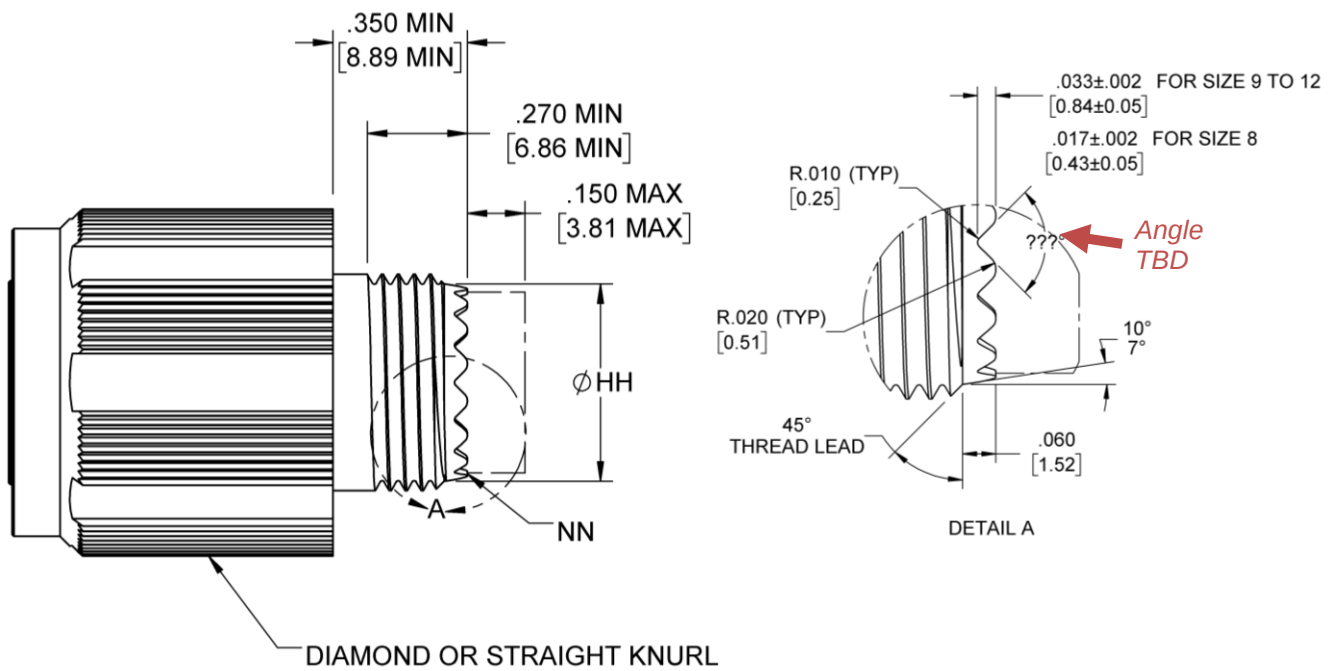


FIGURE 5. Connector accessory interface dimensions - Continued.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

Shell size	Shell size code	Ø HH	NN No of Teeth	Accessory Threads (Inch)
8	A	.324 (8.23)	20	.3750-32 UNEF-2A
9	B	.392 (9.96)	12	.4375-28 UNEF-2A
10	C	.453 (11.51)	13	.5000-28 UNEF-2A
11	D	0.513	16	.5625-24 UNEF-2A
12	E	0.565	17	.6250-24 UNEF-2A
15	F	0.695	23	.7500-20 UNEF-2A
18	G	0.873	28	.9375-20 UNEF-2A
19	H	0.873	28	.9375-20 UNEF-2A
23	J	1.128	35	1.1875-18 UNEF-2A

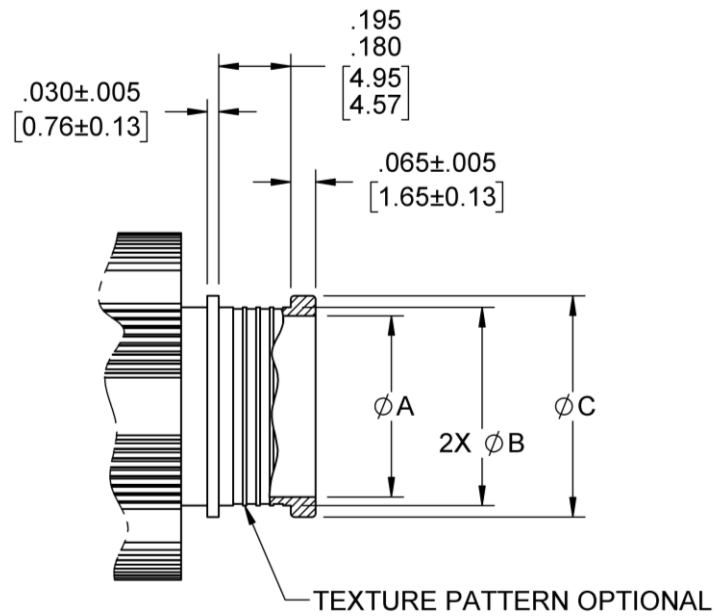
The axis of a tooth shall be in the medial plane of the main key or keyway.
 Alignment tolerance of axis ± 1 .

NOTES:

1. Dimensions are in inches.
2. Millimeter (mm) equivalents are given in parentheses for information only.
3. Threads are to be inspected with a TBD.
4. Grommet may taper to shell inner diameter.
5. The centerline of specified projection must be located on vertical centerline within 2° of -G- (see figure 4, key/keyway polarization).

FIGURE 5. Connector accessory interface dimensions – Continued.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049



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	.455
10	C	.421	.472	.532
11	D	.471	.515	.575
12	E	.547	.583	.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 6. Connector with integral backshell, interface dimensions.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

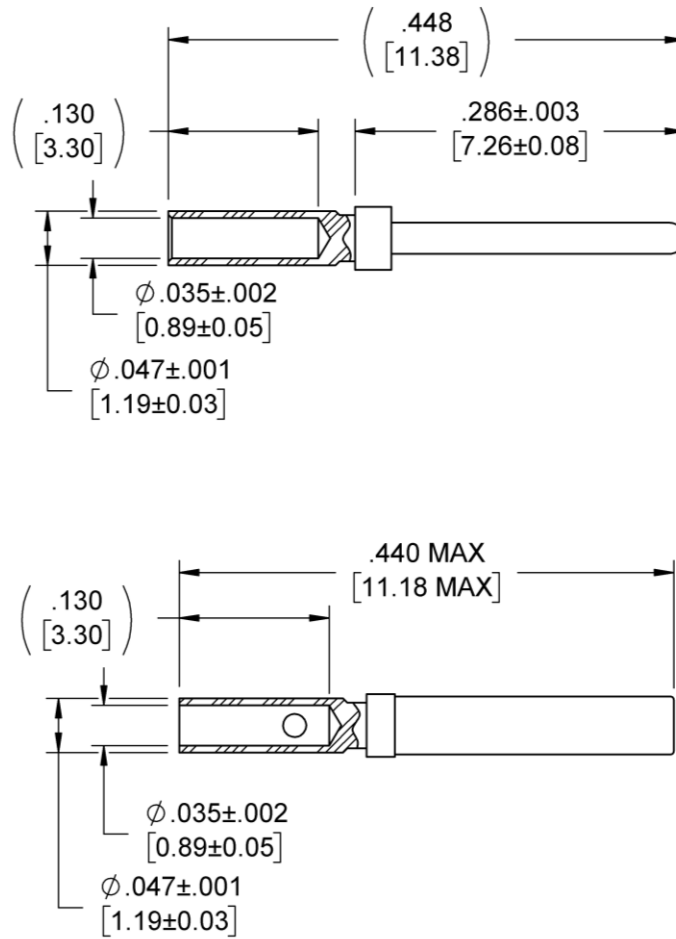


FIGURE 7. Size 23 contact, pin and socket.

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 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

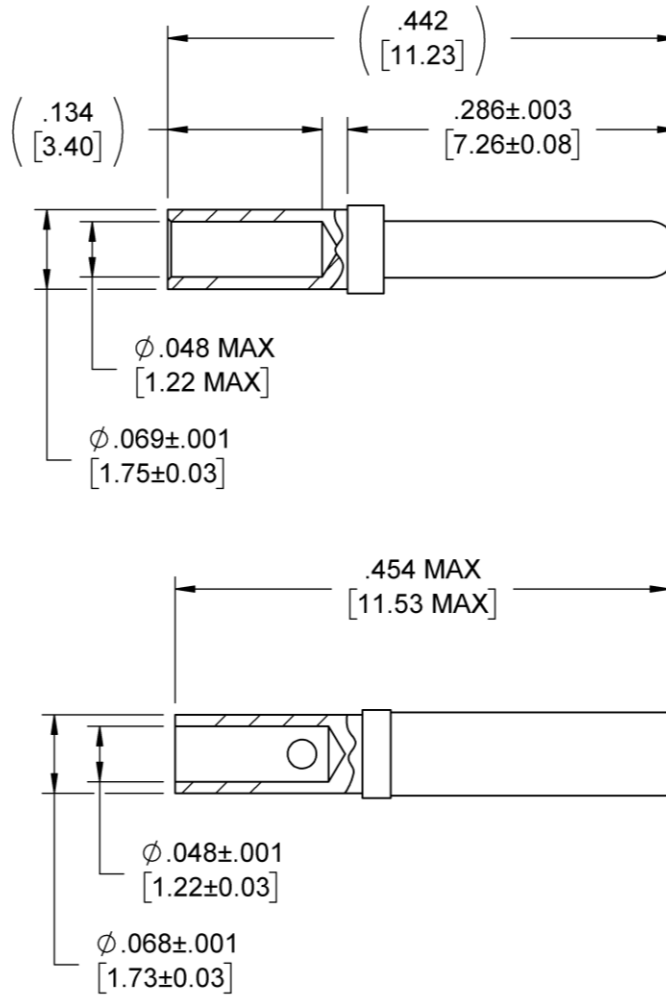


FIGURE 8. Size 20HD contact, pin and socket.

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 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

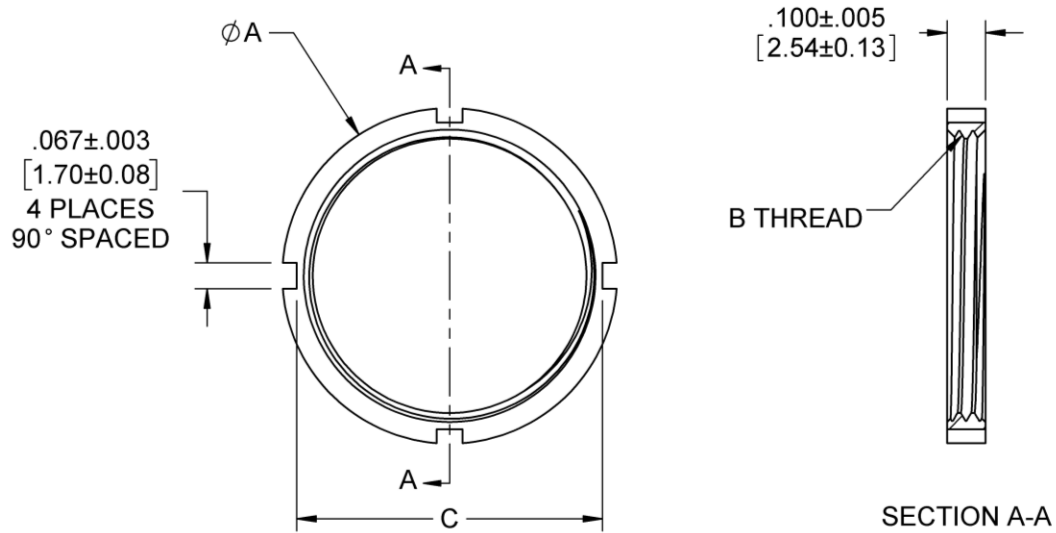
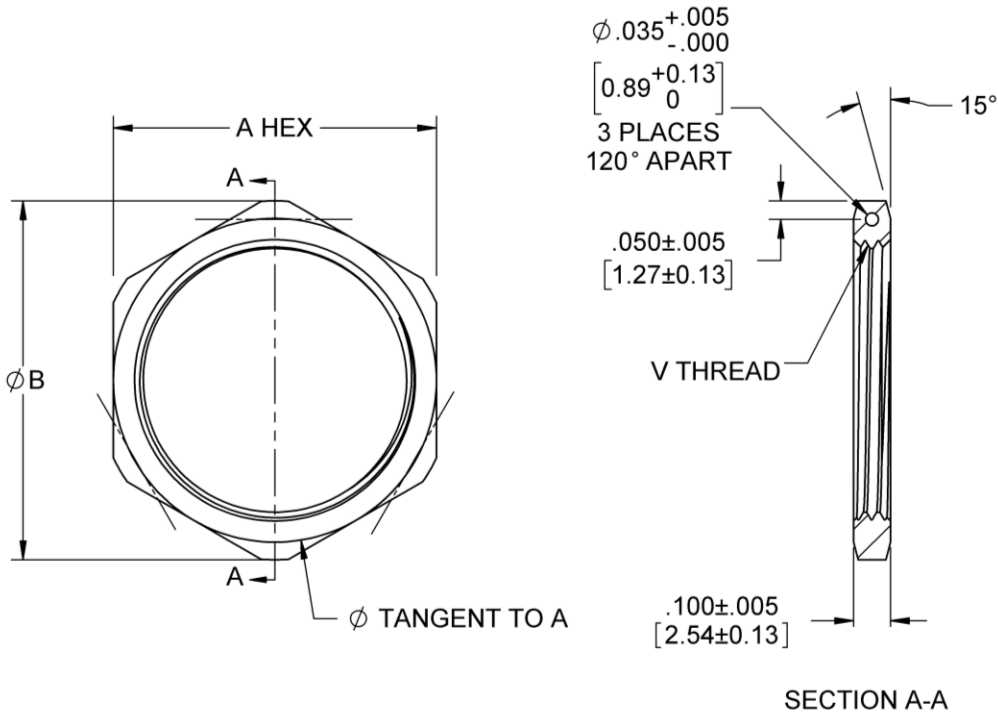


FIGURE 9. Spanner nut dimensions.

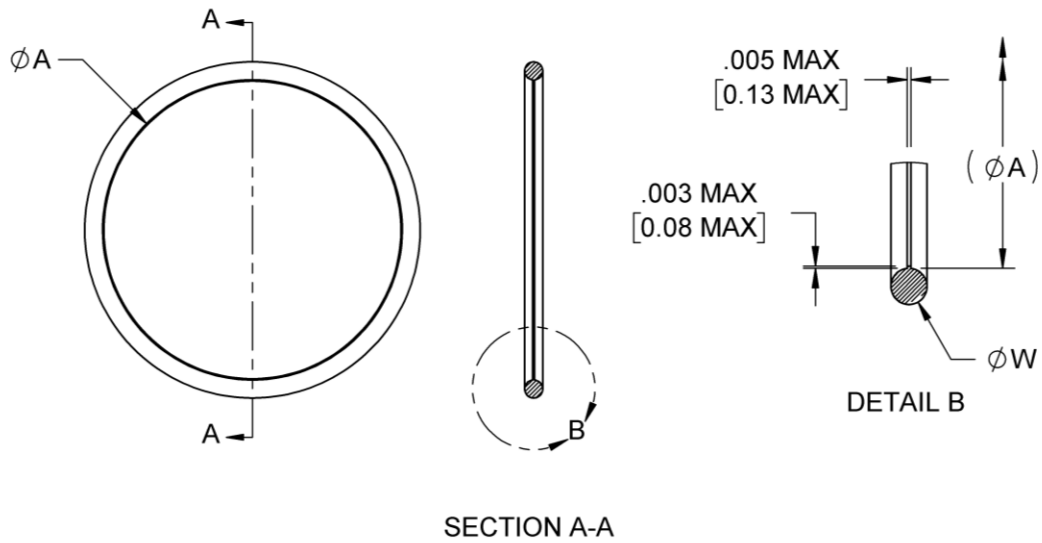
MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049



A +.010 -.000	ØB REF	V THREAD UN-28
.500	.547	.3750-28
.500	.547	.3750-31 UNEF
.563	.620	.4375-28 UNEF
.563	.620	.4375-32
.625	.700	.5000-32
.688	.755	.5625-32
.688	.755	.5625-28
.750	.830	.6250-28
.813	.898	.6875-28
.875	.970	.7500-28
.938	1.030	.8125-28
1.000	1.078	.8750-28
1.125	1.200	1.0000-28
1.188	1.264	1.0625-20
1.250	1.325	1.1250-28
1.313	1.415	1.1875-28
1.375	1.490	1.2500-28
1.500	1.625	1.3750-28
1.625	1.750	1.5000-28

FIGURE 10. Hex nut dimensions.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049



Shell size	A dia max ID	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 11. O-ring dimensions.

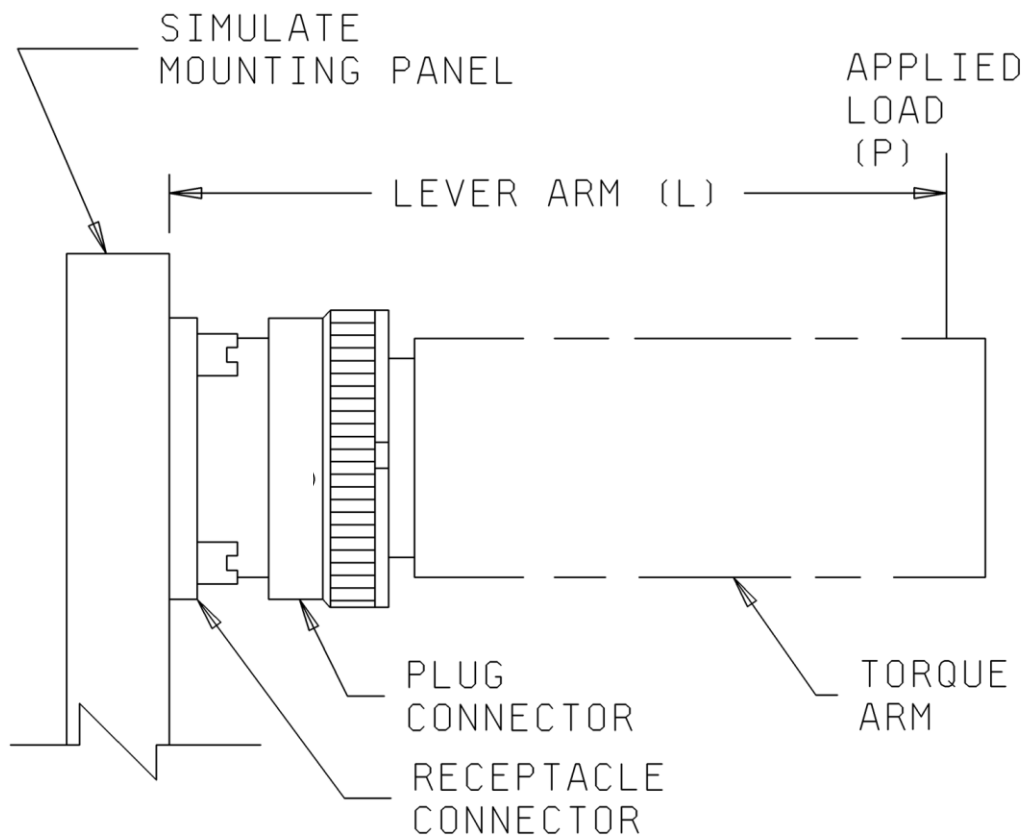
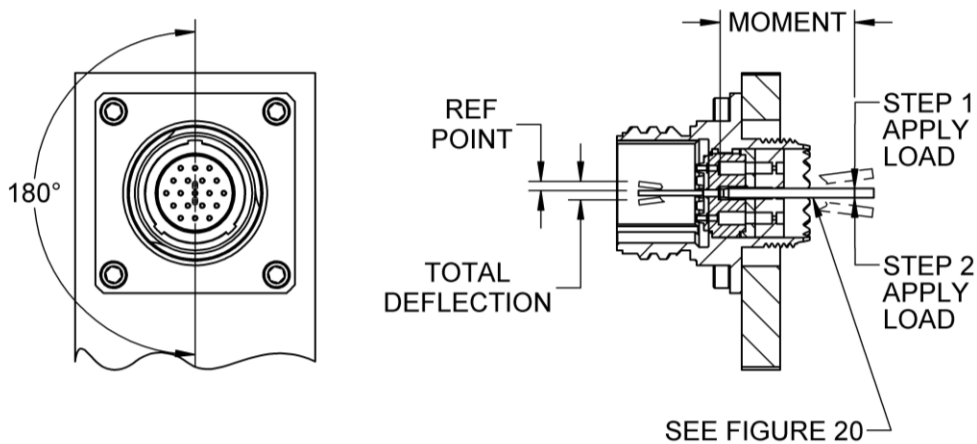


FIGURE 12. External bending moment test setup.



Step 1 – Apply load to determine reference point.
Step 2 – Apply load in opposite direction (180°) and measure total deflection.

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for information only.

FIGURE 13. Pin contact stability test.

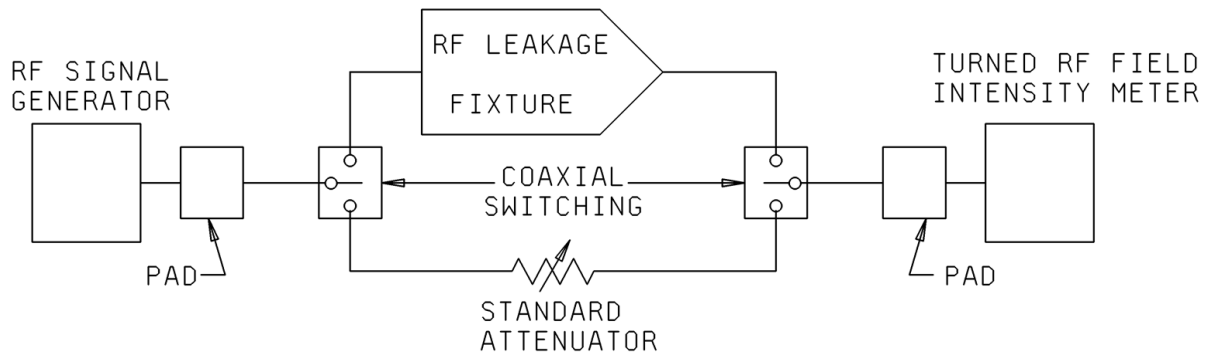


FIGURE 14. Test system schematic for RFI leakage test.

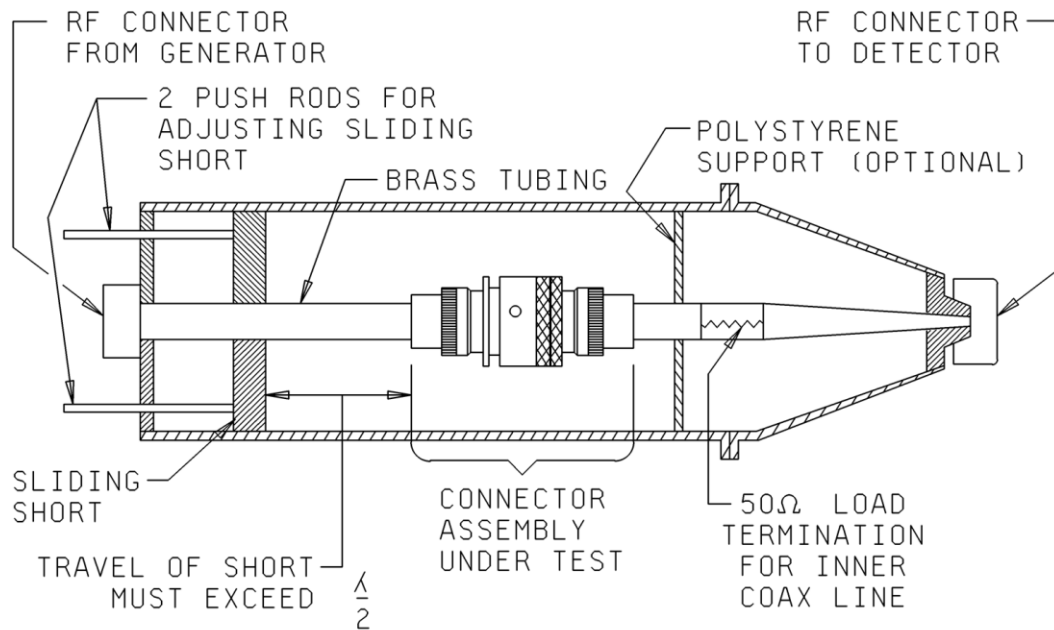


FIGURE 15. RFI leakage test fixture.

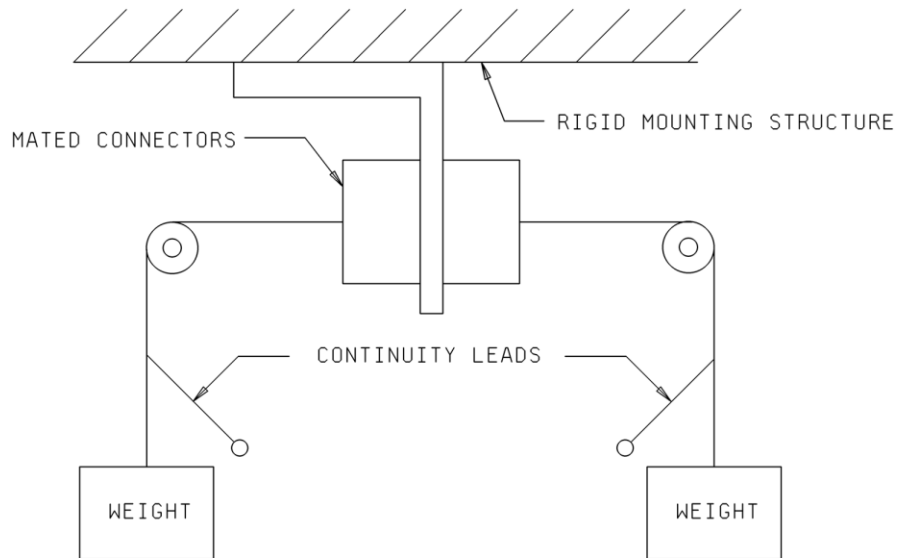
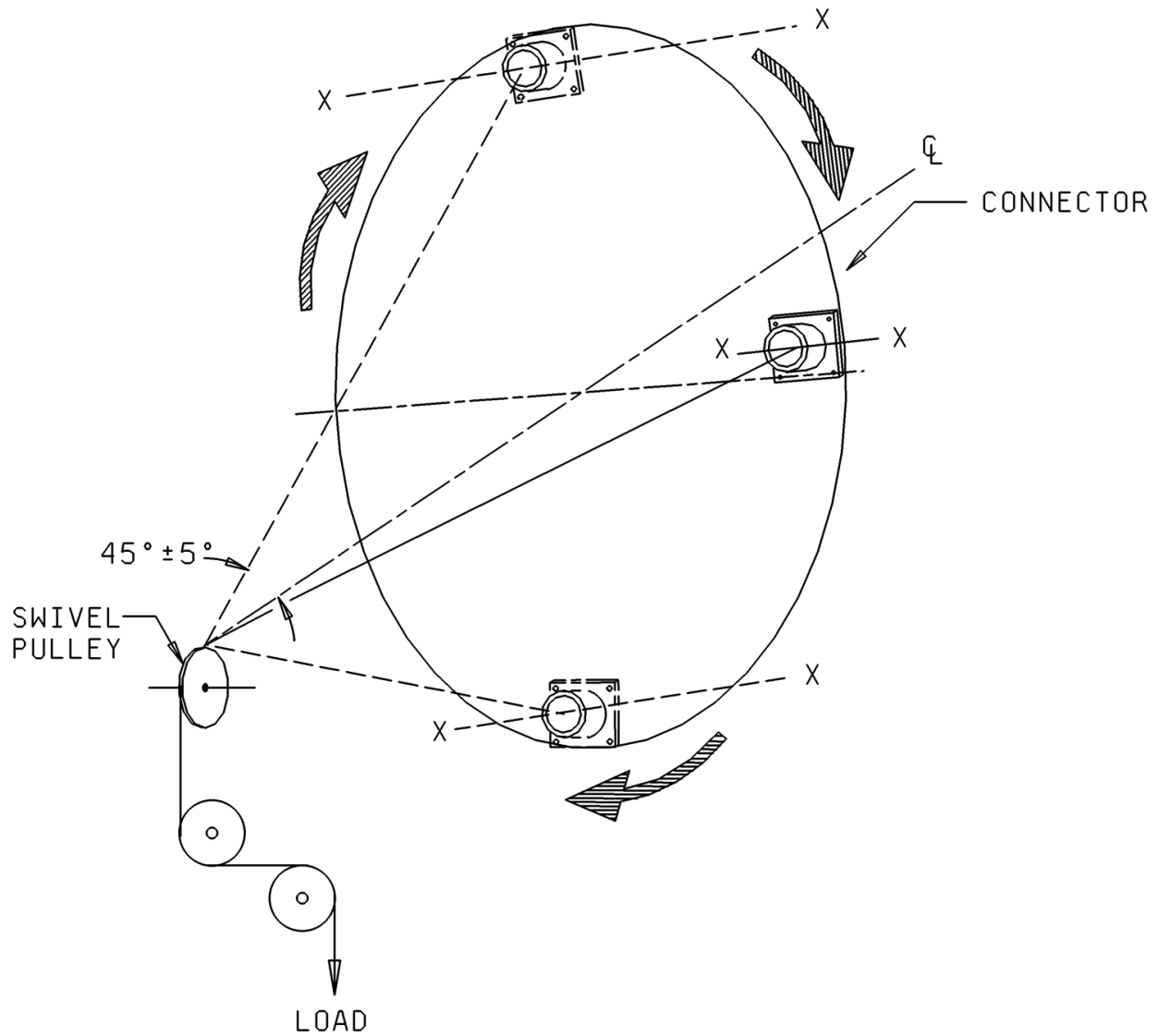


FIGURE 16. Typical fixturing for high temperature exposure with contact loading (orientation optional).



NOTE: Connector axis (ref X-X) to remain constant during rotation.

FIGURE 17. Contact retention system effectiveness (contact walk-out).

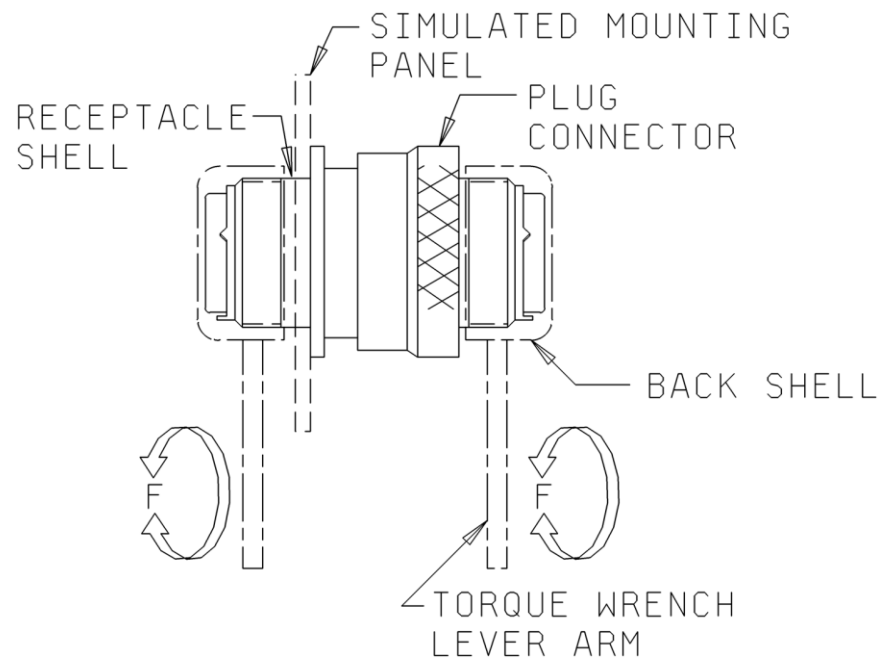
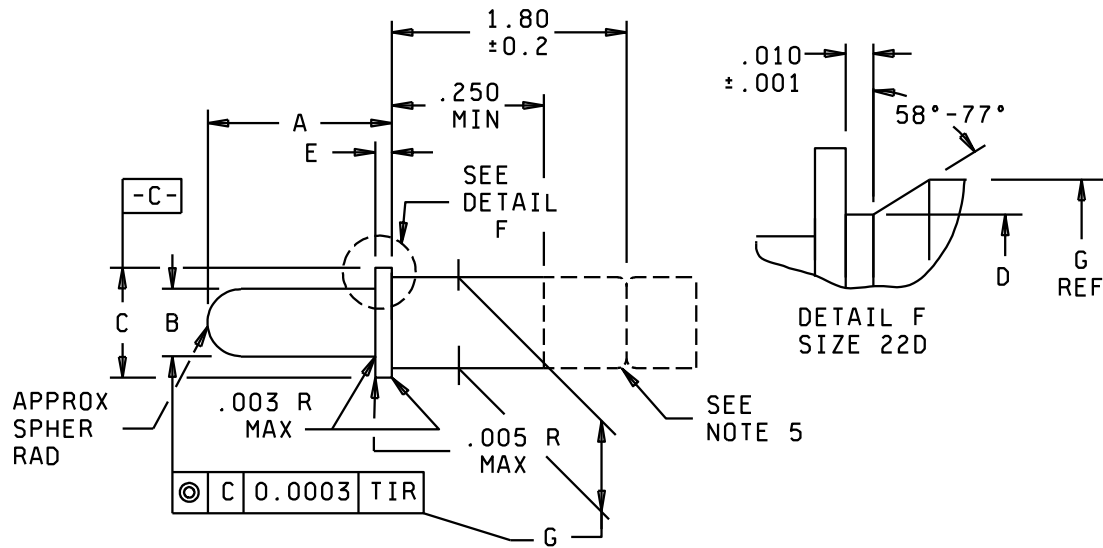
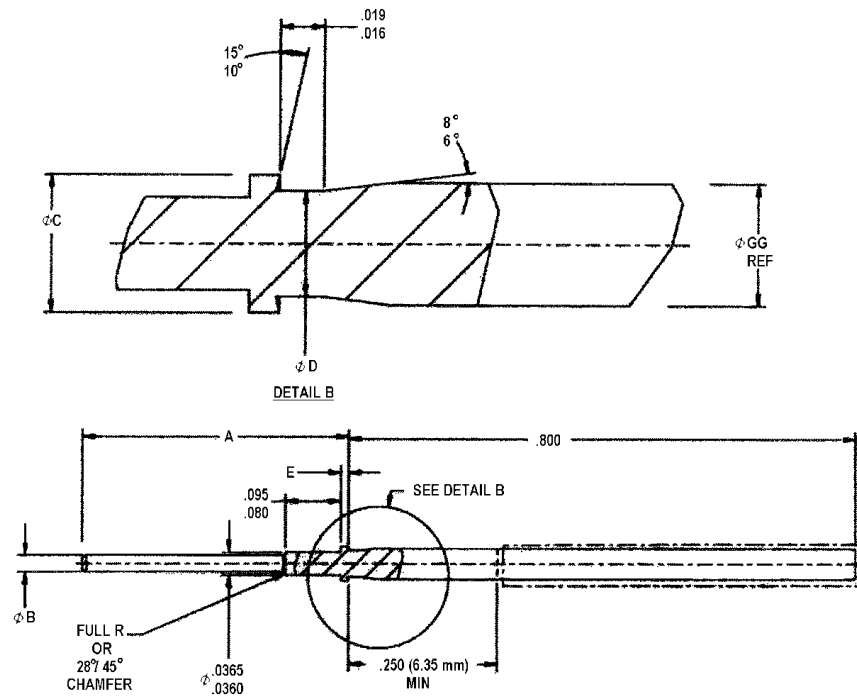


FIGURE 18. Rear accessory thread torque test setup.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049



SIZES 12 THROUGH 20 and 20HD



SIZE 23

FIGURE 19. Test pin gauge, gauge location and gauge retention.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

Contact size	A +.0005 -.0000	B dia +.0002 -.0000	C dia +.0002 -.0000	D dia +.0000 -.0002	E +.0000 -.0002	G dia +.0000 -.0002
23	.4200	.0265	.0540	.0415	.0120	.0480
20 and 20HD	"	.0390	.0910	---	"	.0700
16	"	.0615	.1270	---	"	.1030
12	"	.0930	.1790	---	"	.1510

Inches	mm	Inches	mm	Inches	mm
.0002	0.005	.0390	0.991	.1270	3.226
.0003	0.008	.0410	1.041	.1510	3.835
.0005	0.013	.0480	1.219	.1790	4.547
.001	0.03	.0600	1.524	.2130	5.41
.003	0.08	.0615	1.562	.2170	5.51
.005	0.13	.0700	1.778	.2380	6.05
.010	0.25	.0910	2.311	.250	6.35
.02	0.5	.0930	2.362	.2760	7.01
.0295	0.749	.1030	2.616	.2950	7.493
.0330	0.838	.1240	3.15	1.80	45.7

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Material: Hardened tool steel.
4. Finish: 32 microinches polished.
5. Design of rear extension is optional, but must have a groove provided as specified.

FIGURE 19. Test pin gauge, gauge location and gauge retention - Continued.

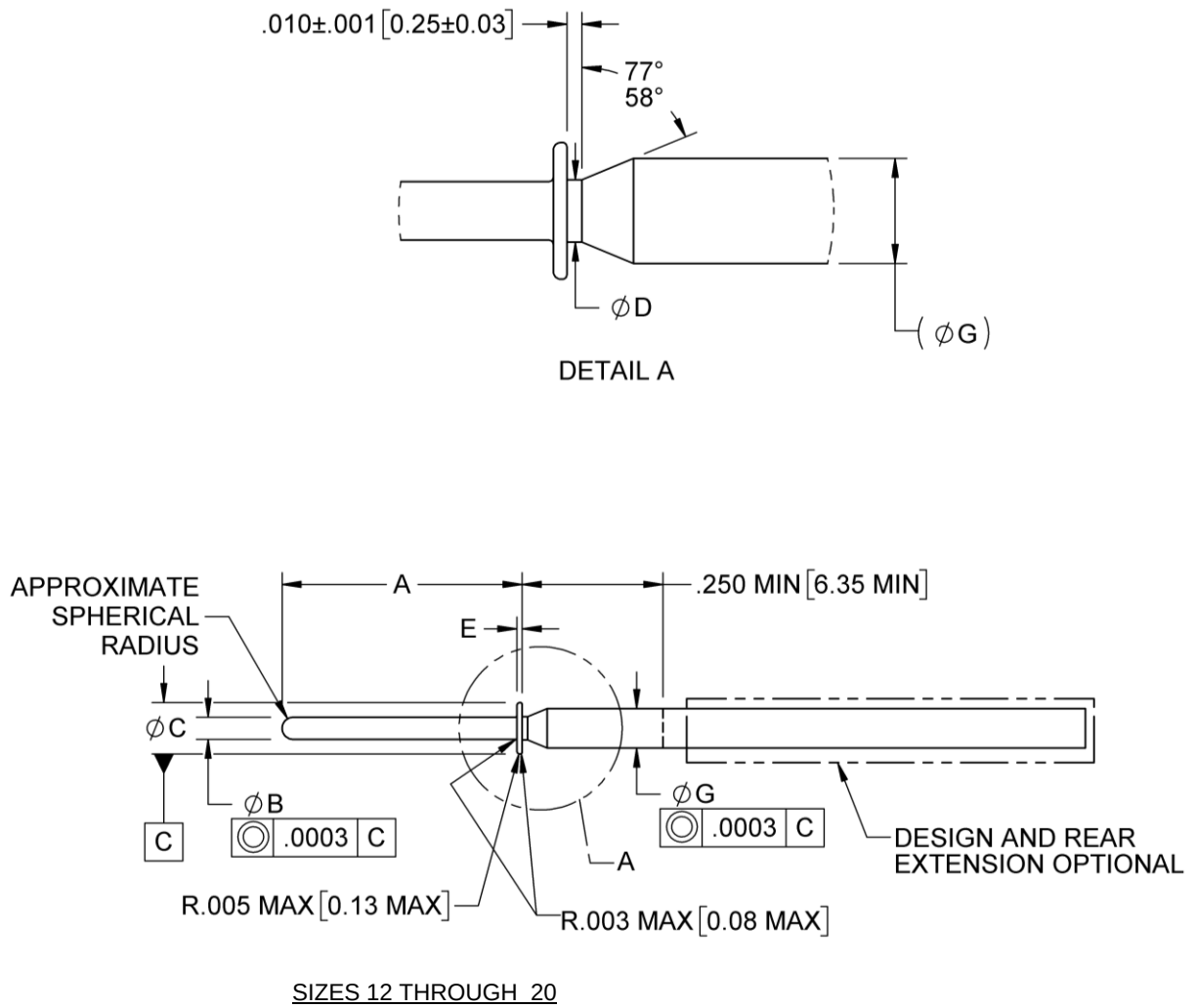


FIGURE 20. Test gauge, pin, gauge location- Continued.

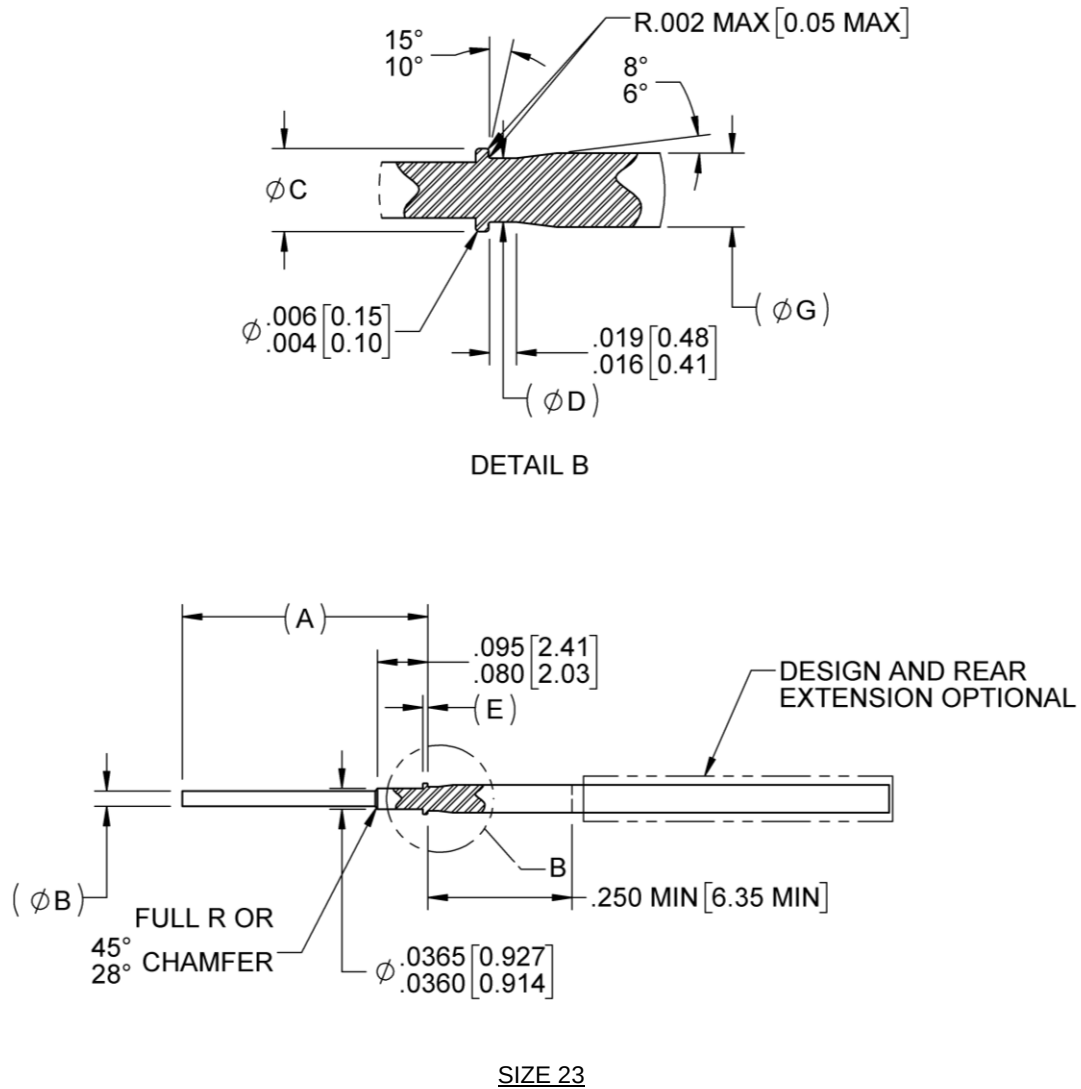


FIGURE 20. Test gauge, pin, gauge location

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

Contact size	A +.0005 -.0000	B dia +.0002 -.0000	C dia +.0002 -.0000	D dia +.0000 -.0002	E +.0000 -.0002	G dia +.0000 -.0002
23	.4260	.0265	.0540	.0415	.0090	.0480
20 and 20HD	"	.0390	.0910	---	"	.0700
16	"	.0615	.1270	---	"	.1030
12	"	.0930	.1790	---	"	.1510

Inches	mm	Inches	mm	Inches	mm
.0002	0.005	.0410	1.041	.1510	3.835
.0003	0.008	.0480	1.219	.1790	4.547
.0005	0.013	.0600	1.524	.2130	5.41
.001	0.03	.0615	1.562	.2170	5.51
.003	0.08	.0700	1.778	.2380	6.05
.005	0.13	.0910	2.311	.250	6.35
.010	0.25	.0930	2.362	.2760	7.01
.0290	0.737	.1030	2.616	.3000	7.620
.0295	0.749	.1240	3.15	.3110	7.899
.0390	0.991	.1270	3.226		

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Material: Hardened tool steel.
4. Finish: 32 microinches polished.

FIGURE 20. Test gauge, pin, gauge location- Continued.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

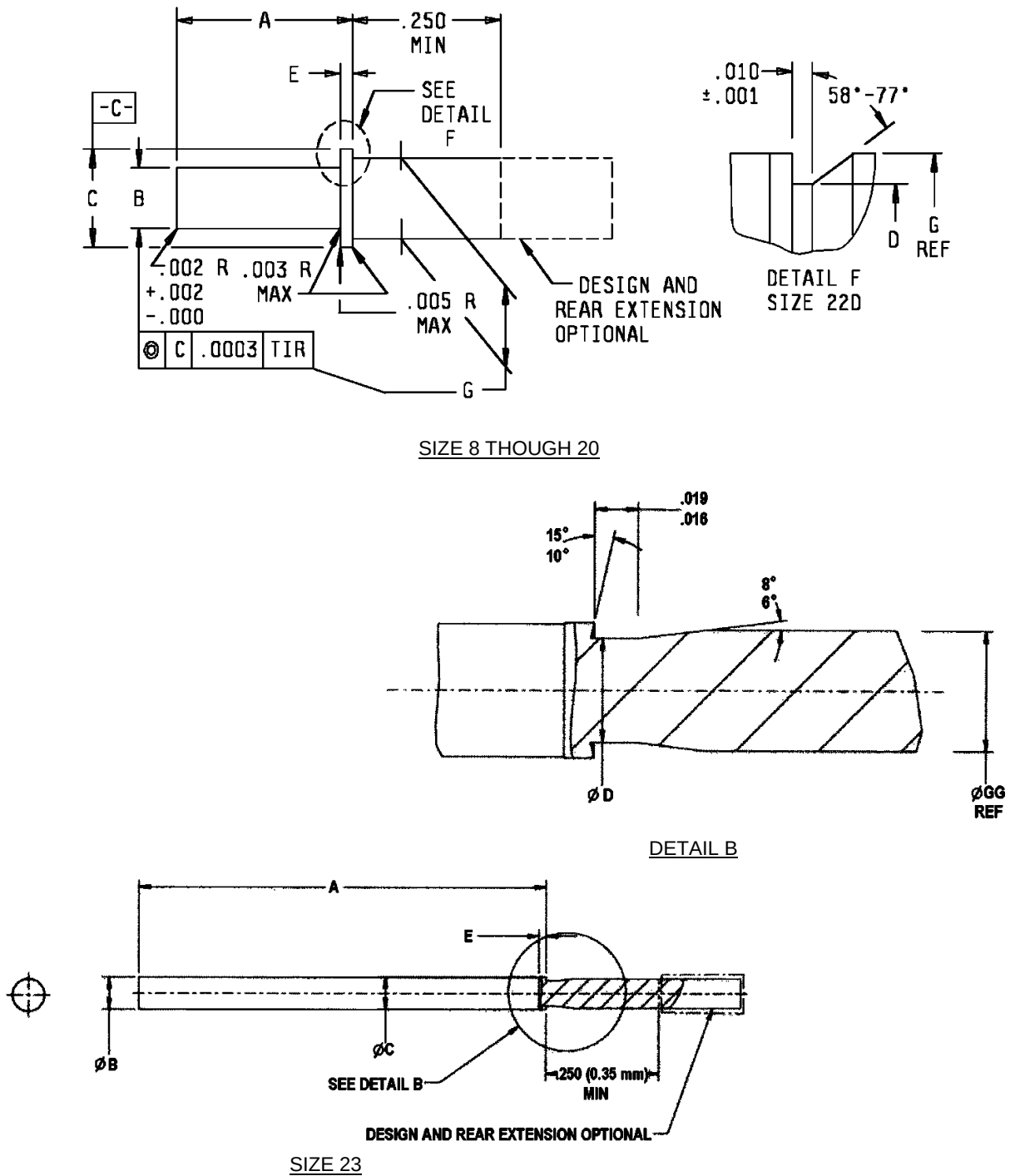


FIGURE 21. Test gauge, socket, gauge location.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049

Contact size	A +.0005 -.0000	B dia +.0002 -.0000	C dia +.0002 -.0000	D dia +.0000 -.0002	E +.0000 -.0002	G dia +.0000 -.0002
23	.6780	.0540	.0540	.0415	.0120	.0480
20 and 20HD	"	.0770	.0910	---	.0330	.0700
16	"	.1120	.1270	---	"	.1030
12	"	.1600	.1790	---	"	.1510

Inches	mm	Inches	mm	Inches	mm
.0002	0.005	.0480	1.219	.1790	4.547
.0003	0.008	.0600	1.524	.2130	5.41
.0005	0.013	.0700	1.778	.2190	5.56
.001	0.03	.0770	1.956	.2380	6.05
.002	0.05	.0910	2.311	.250	6.35
.003	0.08	.1030	2.616	.2760	7.01
.005	0.13	.1120	2.845	.2870	7.29
.010	0.25	.1270	3.226	.5850	14.859
.0330	0.838	.1510	3.835	.5900	14.99
.0410	1.041	.1600	4.064		

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Material: Hardened tool steel.
4. Finish: 32 microinches polished.
5. Dimension A conforms to point of spring engagement (C and Y, figures 1, 3, and 4).

FIGURE 21. Test gauge, socket, gauge location - Continued.

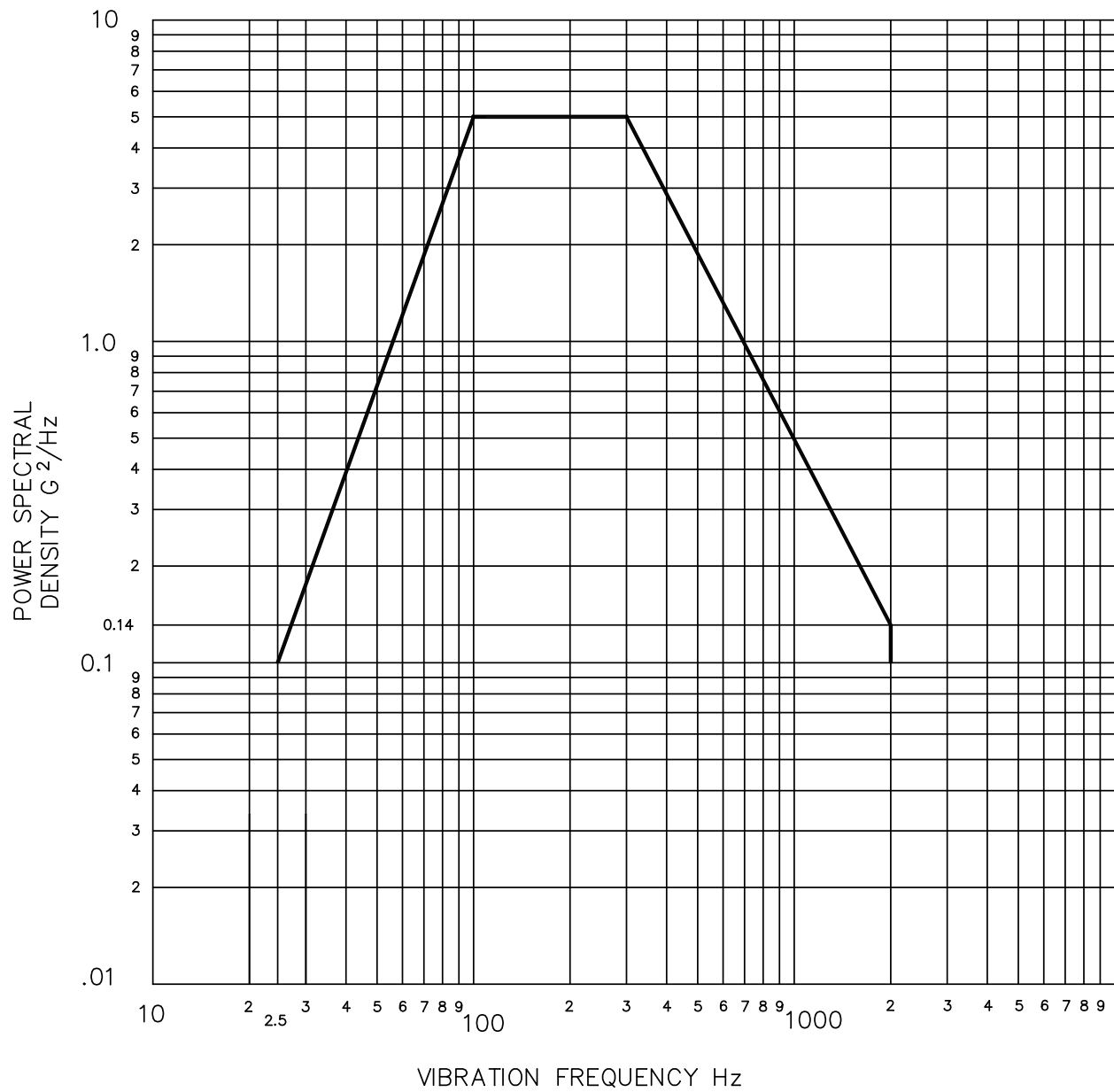
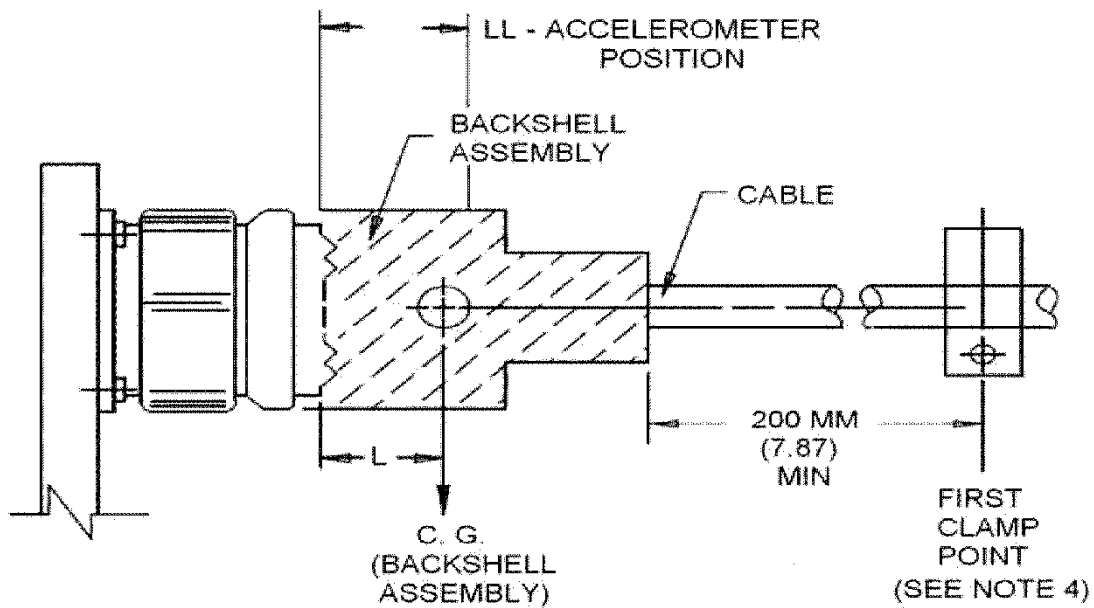


FIGURE 22. Random vibration.

MIL-DTL-#####
 EPS ATTACHMENT DATED 18 JANUARY 2018
 EPS PROJECT NUMBER 5935-2018-049



Shell size	L (mm) root to C.G. + 10% - 0%	Weight (kg) backshell assembly + 10% - 0%	LL (mm) ± 1
8	15.24	.05	10.2
9	17.78	.06	10.2
10	19.05	.07	17.8
11	19.05	.09	25.4
12	19.05	.11	25.4
15	22.86	.18	30.5
18	22.86	.22	30.5
19	23.37	.25	35.6
23	23.37	.31	35.6

NOTES:

1. Dimensions are in millimeters.
2. Shape of test accessory is optional.
3. The test accessory may include a strain relief clamp.
4. Clamp point to be located on vibration table, and cable weight between rear of grommet and tie down clamp point to be considered a portion of the backshell assembly weight.

FIGURE 23. Vibration test accessory load fixture.

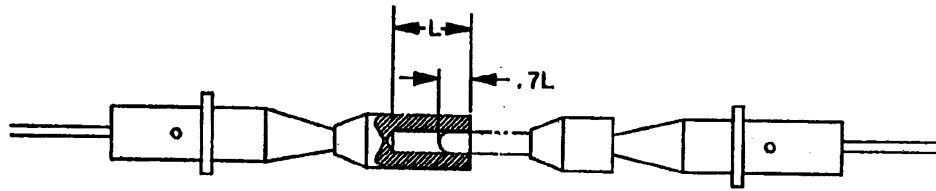


FIGURE 24. Depth of contact engagement for verification testing.

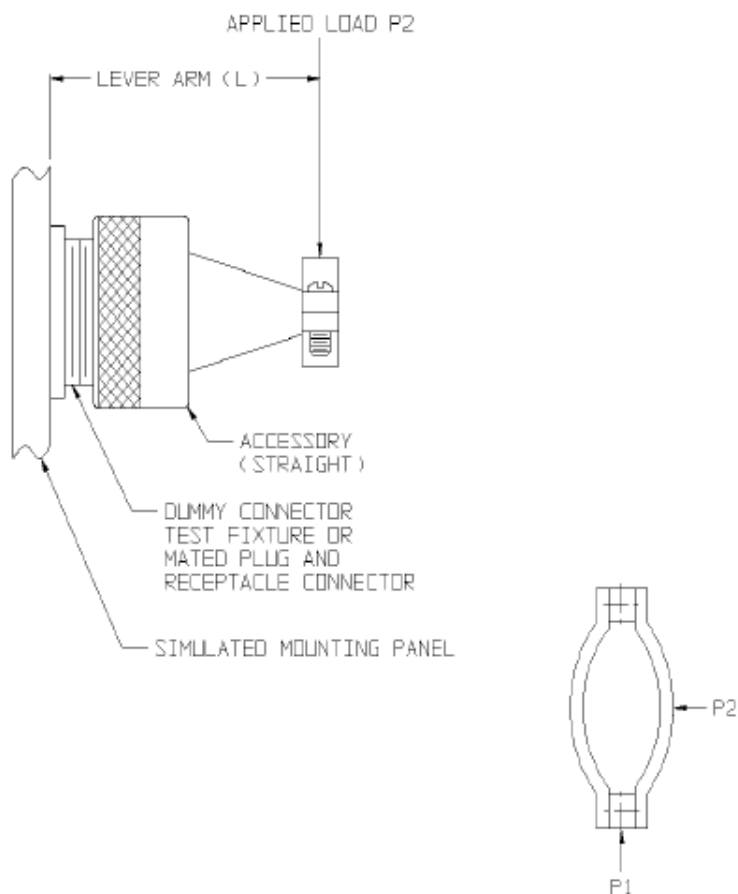


FIGURE 25. External bending moment, accessories, test setup.

MIL-DTL-#####
EPS ATTACHMENT DATED 18 JANUARY 2018
EPS PROJECT NUMBER 5935-2018-049

CONCLUDING MATERIAL

Custodians:

Army - CR
Navy - AS
Air Force - 85
DLA - CC

Preparing activity:

DLA - CC

(Project 5935-2018-049)

Review activities:

Army - AR, AV
Navy - EC, SH, TD
Air Force - 99

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.