INCH - POUND

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DETAIL SPECIFCATION

CONNECTORS, ELECTRIC, RAMP POWER. 480/277 VOLTS, 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 requirements for molded rubber male and female connectors for 480/277 volt ramp power (see 6.4.2, 6.4.4, and 6.4.9) for use in non-hazardous and hazardous (classified) locations.

1.2 Classification. Connectors are of the following series and types as specified (see 6.2).

1.2.1 Series. Connector series consist of the following.

a. Series 1 - A series 1 connector is for use in non-hazardous locations.
b. Series 2 - A series 2 connector is for use in hazardous (classified) locations which must interlock per Underwriter Laboratories Standard UL 1010.

1.2.2 Types. The types of connectors are defined as follows.

a. Type A – Type A connectors are series I (non-hazardous) connectors for 50/60 Hz, 600 VAC, 120 Amp service.
b. Type B – Type B connectors are series I (non-hazardous) connectors for 50/60 Hz, 600 VAC, 200 Amp service.
c. Type C – Type C connectors are series I (non-hazardous) connectors for 400 Hz, 600 VAC, 120 Amp service.
d. Type D – Type D connectors are series I (non-hazardous) connectors for 400 Hz, 600 VAC, 200 Amp service.
e. Type E – Type E connectors are series 2 (hazardous) connectors for 50/60 Hz, 600 VAC, 120 Amp service.
f. Type F – Type F connectors are series 2 (hazardous) connectors for 50/60 Hz, 600 VAC, 200 Amp service.
g. Type G – Type G connectors are series 2 (hazardous) connectors for 400 Hz, 600 VAC, 120 Amp service.
h. Type H – Type H connectors are series 2 (hazardous) connectors for 400 Hz, 600 VAC, 200 Amp service.

Comments, suggestions, or questions on this document should be addressed to Defense Supply Center, Columbus, ATTN: VAI, P.O. Box 3990 East Broad Street, Columbus, Ohio 43216-5000 or emailed to CircularConnectors@dscc.dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://www.dodssp.daps.mil.

AMSC N/A. FSC 5935

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in section 3, 4, or 5 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, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.1.1 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 listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

FEDERAL SPECIFICATIONS

MIL-DTL-5624	-	Turbine Fuel, Aviation, Grades JP-4, JP-5, and JP-5/JP-8ST
MIL-R-6855	-	Rubber, Synthetic, Sheets, Strips, Molded or Extruded Shapes
MIL-PRF-7808	-	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base

FEDERAL STANDARD

FED-STD-H28	-	Screw-Thread Standards for Federal Services

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-202	-	Test Method Standard, Electronic and Electrical Component Parts
MIL-STD-810	-	Environmental Engineering Considerations and Laboratory Tests
MIL-STD-889	-	Dissimilar Metals
MIL-STD-1285	-	Marking of Electrical and Electronic Parts
MIL-STD-2073-1	-	Standard Practice for Military Packaging

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-831	-	Test Reports, Preparation Of

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or http://www.dodssp.daps.mil or from the standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA, 19111-5094.)

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.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

ASME Y14.100	-	Engineering Drawing Practices
ASME Y14.24	-	Types and Applications of Engineering Drawings
ASME Y14.34M	-	Associated Lists
ASME Y14.35M	-	Revisions of Engineering Drawings and Associated Documents

(Copies of these documents are available online at http://www.asme.org or from ASME International, Three Park Avenue, MS 10E, New York, NY 10016-5990.)

ASTM INTERNATIONAL

ASTM B 16/B 16M	-	Rod, Brass, Free-cutting, Bar and Shapes for Use in Screw Machines
ASTM B 301/B301 M	-	Copper Rod, Bar, Wire, and Shapes, Free Cutting
ASTM B 700	-	Electrodeposited Coatings of Silver for Engineering Use
ASTM G 21	-	Determining Resistance of Synthetic Polymeric Materials to Fungi

(Copies of these documents are available online at http://www.astm.org or from ASTM International, P.O.Box C700, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

EIA-364-06	-	Contact Resistance Test Procedures for Electrical Connectors
EIA-364-21	-	Insulation Resistance Test Procedure for Electrical Connectors, Sockets, and Coaxial Contacts

(Copies of these documents are available online at http://www.eia.org or from the Electronic Industries Alliance, Technology Strategy & Standards Department, 2500 Wilson Boulevard, Arlington, VA 22201.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 10012-1	-	Equipment, Quality Assurance Requirements for Measuring – Part 1: Metrological Confirmation System for Measuring Equipment

(Copies of these documents are available online at http://www.iso.ch or from the International Organization for Standardization, RUE DE Varembe, Case postale 56, CH-1211 Geneva 20, Switzerland.)

NATIONAL CONFERENCE OF STANDARDS LABS (NCSL)

ANSI/NCSL Z540-1	-	Laboratories, Calibration, and Measuring and Test Equipment

(Copies of these documents are available online at http://www.ncsli.org or from the National Conference of Standards Laboratories, 2995 Wilderness Place Suite 107, Boulder, CO 80301-5404.)

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NCSL)

NEMA 250	-	Enclosures for Electrical Equipment

(Copies of these documents are available online at http://www.nema.org or from the National Electrical Manufacturer's Association, 1300 North 17th Street, Suite 1847, Rosslyn VA 22209.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 - National Electrical Code (NEC)

(Copies of these documents are available online at http://www.nfpa.org or from the National Fire Protection Association, 1 Battery March Park, Quincy, MA 02269-9101.)

UNDERWRITERS LABORATORIES INC.

UL 498 - Plugs and Receptacles, Attachment
UL 1010 - Receptacle-Plug Combinations for Use in Harazardous (Classified) Locations

(Copies of these documents are available online at http://www.ul.com or from the Underwriters Laboratories Inc., Publication Stock, 333 Pfingsten Road. Northbrook, IL 60062-2096.)

2.4 Order of precedence. 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 exception 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 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.4.

3.3 Materials. Connector materials shall be chosen so that under normal and anticipated conditions of usage or manufacture, the connector shall not attain a temperature at any time sufficient to:

a. Cause a risk of fire or explosion.
b. Cause damage to any material used in their construction.
c. Exceed a temperature rise of 63°F.

3.3.1 Non-fungus nutrient materials. Elastometric materials shall be non-fungus nutrient in accordance with ASTM G21.

3.3.1.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable 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.

3.3.2 Metals.

3.3.2.1 Corrosion-resistance. Metals shall be of the corrosion-resistant type or treated to resist corrosion due to fuels, salt spray, or atmospheric conditions likely to be met in storage or normal service.

3.3.2.2 Dissimilar metals. When dissimilar metals are used in intimate contact, suitable protection against galvanic corrosion shall be applied in accordance with MIL-STD-889, or equal.

3.3.3 Nonmetallic materials. Under normal and anticipated usage of the connector, nonmetallic materials are to be resistant to:

3.3.3.1 Series 1.

a. Mechanical damage.
b. Impact.
c. Moisture absorption.
d. Distortion and creep at all temperatures the connectors may be subjected to under all conditions of use.
e. Fungus.

3.3.3.2 Series 2. Series 2 connectors shall meet all of the requirements of series 1 connectors plus the following additional requirements:

a. Accumulation of static charges.
b. Repeated explosions.
c. Solvents as covered by the hazardous location group.
d. Combustibility.

3.3.4 Connector body and shell material.

a. Series 1. The body and shell shall be fabricated of a synthetic rubber compound conforming to MIL-R-6855 type A, class 2, grade 60, black.
b. Series 2. The body and shell shall be fabricated of fluroelastometer, 60 durometer, red. (No specification assigned).

3.3.4.1. Two-segment integral external ring. The interlocking ring (series 2 connectors only) shall be a reinforced thermoplastic material (see 6.4.14.6).

3.3.5 Contacts.

3.3.5.1 Power contacts. Power contacts (see 6.4.12) and associated current-carrying parts shall be constructed of tellurium copper conforming to ASTM B301, alloy #145.

3.3.5.2 Control and grounding contacts. Control and ground contacts (sec 6.3.4 and 6.3.5) shall be constructed of free-turning brass conforming to ASTM B16/B 16M (copper alloy UNS No. C36000).

3.3.6 Grommets. Grommets shall be made of rubber material conforming to MIL-R-6855, type A, class 2, grade 60, black.

3.3.7 Dummy connectors. Dummy connectors shall be made of rubber material conforming to MIL-R-6855, type A, class 2, grade 60, black.

3.3.8 Set Screws. All setscrews shall be made of 300 series stainless steel. The screw threads shall conform to FED-STD-H28.

3.4 Design and construction. The connector shall be designed and constructed so parts will not work loose in service during normal and anticipated usage. It shall be built to withstand the strains, impacts, vibrations, solvents and weather conditions incident to shipping, storage, installation, and service. Connector type and grommet sizes shall be as specified (see 6.2).

3.4.1 Contacts. Contacts shall not be damaged by any twisting or forcing during the process of mating the connectors.

3.4.1.1 Grounding contacts. Connectors shall have a grounding circuit for inter-connection of the equipment grounding conductor. The male and female grounding contacts shall be arranged so electrical continuity is made to ground before continuity is established between any other contact pair when the connectors are being engaged. When being disengaged, ground contact pair continuity shall not be broken until continuity is broken between all other contact pairs. All dead metal parts of a connector that could become energized shall be conductively connected to the grounding conductor.

3.4.1.2 Control contacts. All connectors shall be provided with two contacts for use with control circuits. The control circuit contacts shall be arranged so electrical continuity is not made to the mating connector until all other contact pairs have been engaged. The control circuit contacts shall disengage before any other pair of mated contacts disengage.

3.4.2 Environment.

3.4.2.1 Series 1 connectors. Receptacle inserts shall be designed to be compatible with NEMA 1, 3R and 4 receptacles, contactor assemblies (see 6.4.1) and receptacle assemblies.

3.4.2.2 Series 2 connectors. All connectors shall meet the requirements for Class I, Division 1, Group D as defined in the National Electrical Code and the applicable portions of UL 1010 as defined herein. Receptacle inserts shall be designed to be compatible with NEMA 3R and 4 receptacles, contactor assemblies, and receptacle assemblies in addition to the NEMA 7D and UL 1010 requirements.

3.4.3 Maintainability. The connector shall be designed to allow connection to a cable within a 15 minute period and removal within a 10 minute period. This does not include the time required for cable selection and preparation, which is outside the scope of this specification.

3.5 Performance.

3.5.1 Thermal shock. There shall be no evidence of physical damage detrimental to the operation of the connector when tested in accordance with 4.6.2.

3.5.2 Moisture resistance. When tested as specified in 4.6.3 there shall be no visual evidence of damage. The connector must pass the dielectric withstanding voltage requirements of 3.5.6.

3.5.3 Salt fog. Unmated connectors shall show no exposure of basis material due to corrosion which will adversely affect performance when tested in accordance with 4.6.4. The temperature rise of the connectors shall not exceed the maximum temperature rise shown in table I by more than 10 percent.

3.5.4 Immersion. An unmated female connector shall meet the requirements of 3.5.10 when tested in accordance with 4.6.5.

3.5.5 Mechanical shock incident to service. The connector shall not crack or fracture when tested in accordance with 4.6.6. The contact resistance (see 4.6.18) and horizontal engaging and disengaging (see 4.6.11) test shall be repeated and the connector shall not show evidence of damage.

3.5.6 Dielectric withstanding voltage. When tested as specified (see 4.6.7) the connector shall not show any evidence of disruptive discharge or deterioration. Disruptive discharge is evidenced by flashover, sparkover, or breakdown.

3.5.7 Insulation resistance. When tested as specified (see 4.6.8) the insulation resistance of the connector shall not be less than 500 megohms at 500 volts dc.

3.5.8 Temperature rise. The temperature rise of the connector shall not exceed the values shown in table I when tested in accordance with 4.6.10. No current shall be conducted through the ground or neutral contacts.

TABLE I. Temperature limits.

Test current (amps)	Temperature rise °F (max)
7/32 diameter contacts - 25	63
1/2 diameter contacts for #1/0 cable - 120	63
1/2 diameter contacts for #4/0 cable - 200	63

3.5.9 Current overload. Mated connectors shall perform satisfactorily when tested In accordance with 4.6.9 and subjected to the current overload ratings specified in table II (see 4.6.9).

TABLE II. Current overload.

Contact size	1 hour	1/2 hour	3 minutes
1/2 diameter, #1/0	195 Amps	290 amps	520 amps
1/2 diameter, #4/0	300 Amps	450 Amps	800 amps

3.5.10 Horizontal engaging and disengaging forces. The forces required for engaging and disengaging male and female plugs shall be in accordance with table III when tested in accordance with 4.6.11.

3.5.11 Female connector power contact strength. The female power contacts shall not be damaged by nonaxial engagement and disengagement of the male connector. The horizontal engaging and disengaging forces shall not exceed the limits specified in 3.5.10 by more than 10 percent when tested in accordance with 4.6.12.

TABLE III. Engaging and disengaging forces.

Condition	Connector temperature (°F)		Engaging and disengaging force (pounds)
	Female	Male	
A	+75	+75	80 ± 25
B	+75	-40	100 ± 25
C	-40	+75	100 ± 25

3.5.12 Male and female connector contact mounting strength. The male and female connector contacts, when tested in accordance with 4.6.13, shall withstand the following torques in either direction without any angular displacement of the contact exceeding 5 degrees.

a. Power contacts - 14 ft-lb.
b. Control contacts - 3 ft-lb.

c. Ground contacts - 5 ft-lb.

3.5.13 Durability. The male and female connectors shall show no evidence of damage after 575 engaging and disengaging cycles. The contact resistance shall be as specified in table IV (see 4.6.14).

TABLE IV. Contact resistance.

Contact size	Test current (amps)	Voltage drop (mv)
1/2 diameter, #1/0	195	26
1/2 diameter, #4/0	300	40

3.5.14 Strain relief. When tested in accordance with 4.6.15, the connector shall withstand a straight pull of 100 pounds on each power, neutral, and grounding contact, and 50 pounds on each control contact.

3.5.15 Accelerated aging of elastomers. When tested in accordance with 4.6.16, the connector shall have no visible evidence of deterioration, including no cracking after flexing, and no softening or hardening more than 10 points on the Shore A Durometer scale.

3.5.16 No-load endurance. A male connector and female receptacle assembly shall be tested in accordance with 4.6.17. There shall not be evidence of mechanical or visible damage.

3.6 Part numbering of Interchangeable parts. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable. The item identification and part number requirements of ASME Y14.100, Y14.24, Y14.34M and Y14.35M shall govern the manufacturer's part number and changes thereto.

3.7 Dimensions. The dimensions of the connectors shall be as specified on the applicable specification sheet.

3.8 Weight. The maximum weight of the connector shall not exceed the following:

a. Male - 12 pounds.
b. Female - 12 pounds.

3.9 Color.

3.9.1 Series 1 connectors. The color of the connector body and shell shall be black (see 3.3.4.a).

3.9.2 Series 2 connectors. The color of the connector body and shell shall be red (see 3.3.4.b)

3.10 Finishes and protective coatings (metal parts). All metal contacts shall be silver-plated in accordance with ASTM B 700, grades B or C, .0002/.0004 inch coverage.

3.11 Contact identification. Contacts shall be permanently identified by molded markings on both the mating and cable ends of the inserts (see 6.3.7). The markings shall be as shown on the applicable specification sheet.

3.12 Identification of product.

3.12.1 Series 1. Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-1285.

3.12.2 Series 2. Equipment, assemblies, and connectors shall be marked for identification in accordance with MIL-STD-1285, and the following additional requirements in accordance with UL 1010.

a. Designation of the hazardous (classified) location for which the connector is rated: Class, division and group.
b. Electrical ratings: Volts, amps and Hz.
c. Ambient temperature rating: -67°F to +130°F.
d. Raintight.
e. Maximum operating temperature: 194°F (90°C).
f. For use with (identify equipment/system to be used with).

3.12.2.1 Marking location. The above markings shall be molded into the surface of the connector, or stamped on a permanently attached name plate or name tag. The instruction bulletin shall contain the statement: For supply connectors, use cable rated for at least 194°F (90°C).

3.13 Series 2 receptacle assembly requirements. A male or female insert must be assembled into a hazardous (classified) location receptacle assembly (see 6.4.13 and 6.4.14.1). The receptacle assembly must be designed to have power supplied through an electrically interlocked circuit and the control contacts protected by an intrinsically safe circuit.

3.13.1 Rotatable collar for explosion proof receptacles. The receptacle assembly shall incorporate a rotatable collar as a safety feature to introduce a delayed action into the insertion and withdrawal process of the plug. The time required to actuate this feature is an added measure of safety to allow the electrical interlock circuit of the receptacle assembly to react.

a. The series 2 plugs per this specification, for use in hazardous (classified) locations, shall include a two-segment integral external ring intended to interface with the internal Z -shaped slots of the rotatable collar of the receptacle housing. This collar is to rotate approximately 45 degrees, aligning the internal two-step Z-shaped slots of the collar with the segmented ring of the plug.
b. The insertion process for the plug requires it to be initially inserted into the receptacle, engaging the grounding contacts. The receptacle housing collar is rotated in the clockwise direction to align its internal Z-shaped slots with the external segments of the integral ring of the plug, allowing the plug to then be fully inserted, engaging the power and control contacts.
c. The disengagement sequence occurs in reverse order.

3.13.2 Performance requirements. This receptacle assembly must conform to the requirements of UL 1010 as specified herein (see 4.6.16, 4.6.17, and 4.6.21).

3.14 Dummy connectors. Unless otherwise specified (see 6.2), dummy connectors conforming to applicable specification sheet shall not be provided to protect the male and female contacts from adverse environmental conditions when the connector is not engaged with a service receptacle.

3.15 Workmanship. The connector, including all parts and accessories, 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 and assemblies, and removal of foreign material during and after final assembly. The connector shall be free from crazing, cracks, voids, pimples, chips, blisters, pinholes, sharp cutting edges, burrs, and other defects that adversely affect life, serviceability or appearance.

4. VERIFICATION

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

a. First article inspection (see 4.4).
b. Quality conformance inspection (see 4.5).

4.2 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 contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with ISO 10012-1, ANSI/NCSL Z540-1, or comparable standards.

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in 4.3.1 and 4.3.2.

4.3.1 Atmospheric conditions.

a. Temperature	77° ± 4°F.
b. Relative humidity	45 to 85 percent.
c. Barometric pressure	30 Inches Hg ± 5 percent.

4.3.2 Apparatus. Special apparatus shall be devised to verify mating capability if male or female connectors are inspected separately.

4.4 First article inspection. First article inspection shall he performed by the contractor after award of contract and prior to production at a location acceptable to the Government. First article inspection shall be performed on sample units which have been produced with equipment and procedures normally used in production. First article approval is valid only on the contract under which it is granted, unless extended by the Government to other contracts.

4.4.1 Sample size. Sample size shall be seven sets of male and female connectors as shown in figure 1. Connectors of the same part number with its mating connector shall be subjected to first article inspection.

4.4.2 Inspection routine. The sample shall be subjected to the inspections specified in table V. All sample units, series 1 and series 2, shall be subjected to the inspection of group I. The series 2 sample units shall then be subjected to the inspection of group II. When the specimen is to be used for more than one test, the order of testing shall be accomplished in a manner as not to affect the latter testing results.

4.4.3 Order of Inspection. The connectors shall be tested serially in the order shown on figure 1. The contractor has the option of using new, untested connectors for each of the inspections instead of the serial testing shown on figure 1. If this option is selected, each of the inspections required by table V can be performed in parallel.

4.4.4 Failures. One or more failures shall be cause for refusal to grant first article approval. Failure criteria for specimens shall be as specified in the applicable method paragraph or requirement paragraph.

4.4.5 Identification of first article inspection samples. The samples shall be identified with the manufacturer's part number and any additional information required by acquisition documents.

4.4.6 Test report. After the first article inspection is complete, three complete copies of a test report, acceptable to the procuring activity, shall be provided. (See MIL-HDBK-831 for guidance on test report preparation.)

4.4.6.1 Reliability and maintainability information. The following information shall be included as an attachment accompanying the first article inspection report (same quantity and quality of copies) or shall be included as part of that report:

a. All failures, maintenance, and other events recorded shall be identified by accumulated operating cycles in the test procedure as appropriate. Test conditions during the failures or irregular operations identified shall be recorded.
b. Description of the engineering reasoning and of any test conducted to determine assignable causes for all failures and irregular operations identified.
c. Description of the engineering reasoning verifying corrections made or to be made on production items, or proposed to be made, that substantiate the predicted effectiveness of those corrections.
d. Test activity or contractor comments on item features or requirements that, if modified, should improve the item.
e. Test activity or contractor comments on field conditions on procedures to be avoided or cultivated to increase the reliability and useful life of the item.
f. Estimates (± 5 percent of actual experienced) of man-hours required for each maintenance and servicing action during the tests. A brief description of the qualifications and experience of the personnel involved shall be included, and shall be adequate to allow comparison to the personnel anticipated in similar fieldwork.

TABLE V. First article inspection.

Inspection	Requirement paragraph	Test paragraph
Group I		
Examination	---	4.6.1
Thermal shock	3.5.1	4.6.2
Moisture resistance	3.5.2	4.6.3
Salt fog	3.5.3	4.6.4
Immersion	3.5.4	4.6.5
Mechanical shock	3.5.5	4.6.6
Dielectric withstanding voltage	3.5.6	4.6.7
Insulation resistance	3.5.7	4.6.8
Current overload	3.5.9	4.6.9
Temperature rise	3.5.8	4.6.10
Horizontal engaging and disengaging	3.5.10	4.6.11
Female connector power contact strength	3.5.11	4.6.12
Contact mounting strength	3.5.12	4.6.13
Durability	3.5.13	4.6.14
Strain relief	3.5.14	4.5.15
Group II		
Accelerated aging of elastomers	3.5.15	4.6.16
No-load endurance	3.5.16	4.6.17
Receptacle assembly (UL 1010)	3.13.2	4.6.21

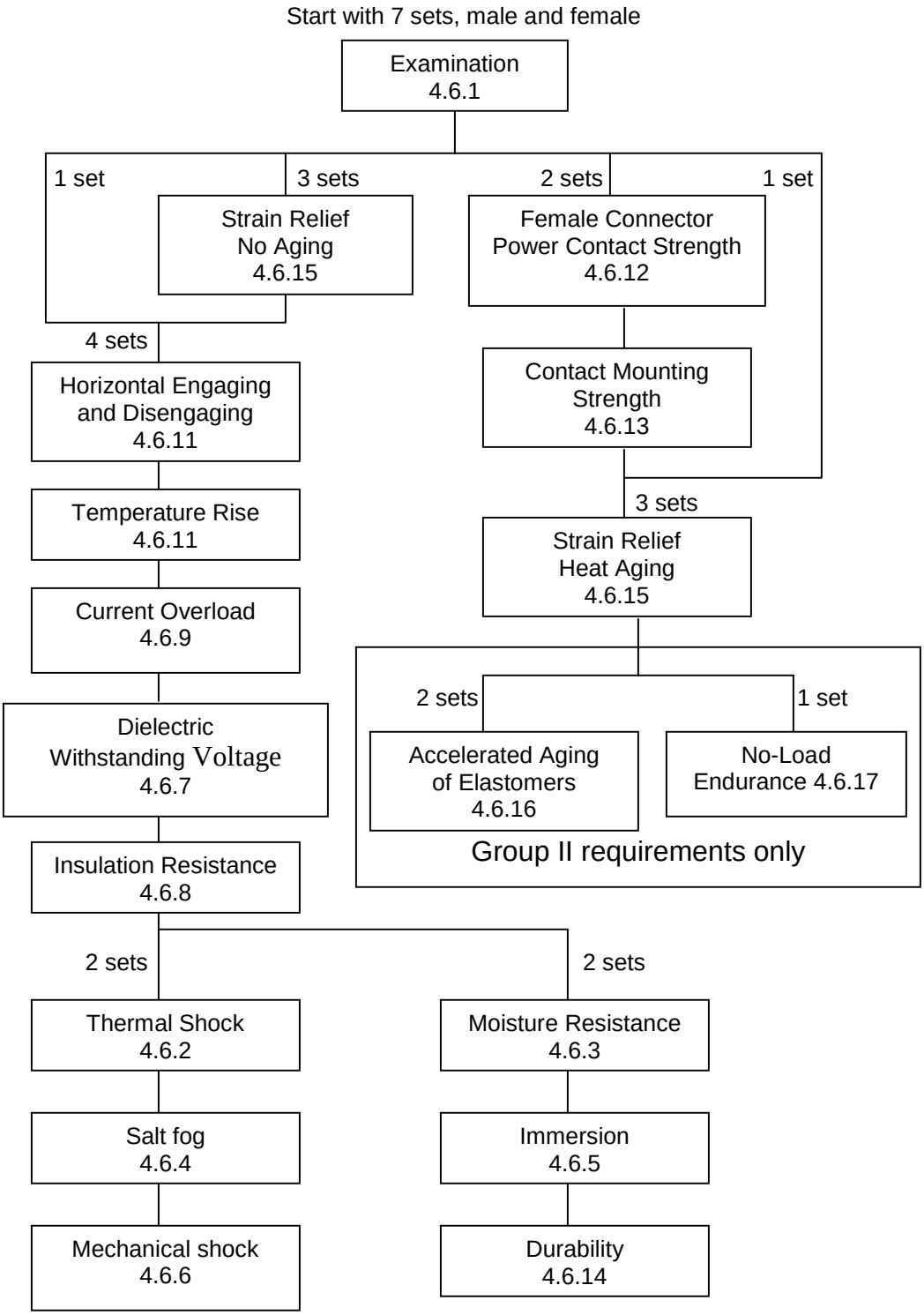


FIGURE 1. Order of first article inspection testing for connectors.

4.5 Conformance inspection.

4.5.1 Inspection lot. An inspection lot shall consist of all the connectors and associated fittings comprised of identical piece parts produced under essentially the same conditions and offered for inspection at one time.

4.5.1.1 Group A inspections. Group A Inspection shall consist of the inspections specified in table VI, and shall be made on the same set of sample units in the order shown.

TABLE VI. Group. A inspection.

Inspection	Requirement paragraph	Method paragraph
Visual and mechanical examination		
Material	3.3	4.7.1
Finish	3.10	4.7.1
Dissimilar metals	3.3.2.2	4.7.1
Design and construction	3.4	4.7.1
Marking	3.12	4.7.1
Workmanship	3.15	4.7.1
Dielectric withstanding voltage	3.5.6	4.7.2

4.5.1.2 Group B inspection. Group B inspection shall consist of the inspections specified in table VII in the order shown, and shall be made on sample units which have been subjected to and passed the group A inspection. Connectors having identical piece parts may be combined for lot purposes and shall be in proportion to the quantity of each part-numbered connector produced.

TABLE VII. Group B inspection.

Inspection	Requirement paragraph	Method paragraph
Force to disengage	3.5.10	4.7.3

4.5.2 Sampling plan. A sample of parts shall be randomly selected in accordance with table VIII. If one or more defects are found, the lot shall be rescreened and defects removed. After screening and removal of defects, a new sample of parts shall be randomly selected in accordance with table VIII. If one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification.

4.5.3 Disposition of sample units. Sample units which have passed all the group B inspections may be delivered on the contract or purchase order if the lot is accepted. Any connector or connector part deformed or otherwise damaged during testing shall not be delivered on the contract or order.

4.6 First article inspection methods.

4.6.1 Examination of product.

4.6.1.1 Visual examination. All connectors shall be visually examined for workmanship, cleaning, identification and operational marking, and evenness of finish.

TABLE VIII. Sampling plan. 1/

Lot size	Sample size
2 to 8	all
9 to 150	13
151 to 280	20
281 to 500	29
501 to 1,200	34

Lot size	Sample size
1,201 to 3,200	42
3,201 to 1,0000	50
10,001 to 35,000	60
35,001 to 150,000	74
150,001 to 500,000	90
500,001 and over	102

1/ The acceptance number in all cases is zero.

4.6.1.2 Dimensional examination. One complete male and female connector shall be examined for dimensional conformance to the applicable specification sheet. All dimensions on the specification sheet will be verified.

4.6.2 Thermal shock. The thermal shock test shall be in accordance with MIL-STD-202, method 107, and the following requirements, exceptions, and clarifications.

4.6.2.1 Sample size. Two completely assembled male and two completely assembled mating female connectors.

4.6.2.2 Sample preparation. A male and female connector shall be mated.

4.6.2.3 Test procedure.

a. The test type shall be air and the test condition shall be A.
b. The exposure time in air at the temperature extremes shall be 4 hours.

4.6.2.4 Acceptance criteria. A visual examination shall be made prior to the first cycle and after the last cycle for evidence of physical damage detrimental to the connectors.

4.6.3 Moisture resistance. The moisture resistance test shall be in accordance with MIL-STD-202, method 106, and the following requirements and clarifications.

4.6.3.1 Sample size. Two completely assembled male and two completely assembled mating female connectors.

4.6.3.2 Test procedure.

a. The samples shall be conditioned at 122°F for 24 hours prior to starting this test. The humidity shall be uncontrolled during this conditioning period.
b. A male and female connector shall be mated to simulate the normal operating condition.
c. The vibration test portion of the test is not required.
d. Prior to the first cycle, a dielectric withstanding voltage test shall be performed in accordance with 4.6.7.
e. No polarization voltage shall be applied during the test.
f. The dielectric withstanding voltage test required at high humidity shall be performed on unmated connectors. Excess water shall be wiped off the exterior of the mated assembly prior to disengaging the connectors.
g. For safety, electrically insulated rubber gloves or other suitable protection shall be worn by the person performing the dielectric withstanding voltage test at high humidity.

4.6.3.3 Acceptance criteria. A dielectric withstanding voltage test shall be performed at high humidity after the final cycle. The dielectric withstanding voltage test shall be performed in accordance with 4.6.7.

4.6.4 Salt fog. The salt fog test shall be in accordance with MIL-STD-810, method 509, procedure I, and the following requirements and clarifications.

4.6.4.1 Sample size. Two completely assembled male and two completely assembled mating female connectors. The connectors shall be tested unmated.

4.6.4.2 Test procedure.

a. The salt fog exposure shall he a minimum of 48 hours, followed by a 48 hour drying period.
b. Cyclic testing is not required.
c. The salt concentration shall be 5 percent.
d. The salt fog test shall be considered a destructive test. As such, samples used for the salt fog test shall not be used for subsequent tests, except they may be used for the mechanical shock test (see 4.6.6) at the option of the manufacturer.

4.6.4.3 Acceptance criteria. At the end of the drying period, the samples shall be tested for contact resistance in accordance with 4.6.17. The voltage drop shall not exceed the maximum value shown in table IV by more than 10 percent.

4.6.5 Immersion. An unmated female connector shall be immersed in each of the following fluids as indicated.

4.6.5.1 Sample size. Two completely assembled female connectors.

4.6.5.2 Test procedure.

a. The connector shall he immersed in each of the specified fluids for a period of 20 hours in each fluid.
b. The fluids to be used are aircraft lubricating oil conforming to MIL-PRF-7808 and grade JP-4 turbine fuel conforming to MIL-DTL-5624.
c. Upon completion of the required immersion, the connector shall be wiped free of fluids with a dry cloth.
d. Do not use solvents to soak or clean the contacts after immersion and prior to the engaging and disengaging test.

4.6.5.3 Acceptance criteria. The sample must pass the engagement and disengagement tests specified in 4.6.11 for condition A values shown in table III.

4.6.6 Mechanical shock. An unmated male and female connector shall be dropped to a hard, level concrete surface. The concrete shall be a 4 inches thick.

4.6.6.1 Sample size. Two completely assembled male and two completely assembled mating female connectors.

4.6.6.2 Sample preparation. The connector shall be attached to an insulated cable or cables 10 feet in length. The conductor size shall be the minimum allowable conductor size shown in the appendix for the connector type (A, B, C, D, E, F, G, H) being tested.

4.6.6.3 Test procedure.

a. A rope shall he secured to the cable 24 ± 2 inches from the face of the connector.
b. The rope shall be used to raise the cable until the connector face is a minimum of 6 feet from the concrete surface. The end of the conductors opposite the connector end shall remain in contact with the concrete surface.
c. The rope shall he released allowing the connector to free fall to the concrete.
d. This sequence shall be repeated 15 times.

4.6.6.4 Acceptance criteria.

a. The connector shall not crack or fracture as a result of this test.
b. The connectors shall pass the contact resistance test in accordance with 4.6.17.
c. The connectors shall meet the horizontal engaging and disengaging forces test specified in 4.6.11 for condition A values shown in table III.

4.6.7 Dielectric withstanding voltage test. Unmated connectors shall be tested in accordance with MIL-STD-202, Method 301 and the following requirements.

4.6.7.1 Sample size. Four completely assembled male and four completely assembled mating female connecters.

4.6.7.2 Test procedure.

a. Testing shall be conducted at the ambient conditions specified in 4.3.1 unless otherwise specified.
b. The test voltage shall be 2500 volts AC.
c. The test voltage shall be applied between all pairs of contacts, and between all contacts and metal non-current carrying parts of the connector.
d. The test voltage shall be raised from zero to the specified value as uniformly as possible, at a rate of approximately 500 volts AC per second. The test voltage shall be gradually reduced to avoid voltage surges.

4.6.7.3 Acceptance criteria. During and after the application of the test voltage the connector will be examined for evidence of disruptive discharge or deterioration. Disruptive discharge is evidenced by flashover, sparkover, or breakdown.

4.6.8 Insulation resistance. Unmated connectors shall be tested in accordance with EIA-364-21 and the following.

4.6.8.1 Sample size. Four completely assembled male and four completely assembled mating female connectors.

4.6.8.2 Sample preparation. No cleaning or special conditioning is required.

4.6.8.3 Test procedure.

a. The minimum insulation resistance shall be 500 megohms.
b. Electrification time of 2 minutes shall be allowed.
c. Insulation resistance readings shall be taken between all pairs of contacts, and between all contacts and metal non-current carrying parts of the connector.

4.6.8.4 Acceptance criteria. Insulation resistance shall meet the requirements of 3.5.7.

4.6.9 Current overload.

4.6.9.1 Sample size. Four completely assembled male and four completely assembled mating female connectors.

4.6.9.2 Sample preparation. Each connector shall be assembled and wired in accordance with the appendix and applicable specification sheet for the connector being tested.

4.6.9.3 Test procedure.

4.6.9.3.1 120 Amp connectors. A continuous current of 195 amps for 1 hour, 290 amps for 1/2 hour, and 520 amps for 3 minutes shall be passed simultaneously through all contacts in a mated pair of connectors, except the grounding and control contacts. The test current frequency shall be the rated frequency for the connector being tested.

4.6.9.3.2 200 Amp connectors. A continuous current of 300 amps for 1 hour, 450 amps for 1/2 hour, and 800 amps for 3 minutes shall be passed simultaneously through all contacts in a mated pair of connectors except the grounding and control contacts. The test current frequency shall be the rated frequency for the connector being tested.

4.6.9.4. Acceptance criteria. After the test, the connectors shall be visually inspected for damage.

4.6.10 Temperature rise. A normal temperature test in accordance with UL 1010, section 30, with the following exceptions and clarifications, shall be performed on an assembled connector.

4.6.10.1 Sample size. Four completely assembled male and four completely assembled mating female connectors.

4.6.10.2 Sample preparation. Each connector shall be assembled and wired in accordance with the appendix and applicable specification sheet for the connector being tested.

4.6.10.3 Test procedure.

a. A continuous current, as specified in table I, shall be passed simultaneously through all mated contacts, except the grounding contact, for a minimum of 4 hours or until the temperature of the connector is constant.
b. The test current shall be applied after the first mating action of the connectors under test.
c. The temperature rise shall not exceed the values listed in table I.
d. The thermocouples are to be attached to the rear of each current carrying contact where the conductor enters the contact.
e. A male and female connector can be mated and tested simultaneously. Thermocouples shall be attached to the male and female connectors.

4.6.10.4 Acceptance criteria. The temperature rise on each current carrying contact shall not exceed the values shown in table I.

4.6.11 Horizontal engaging and disengaging forces.

4.6.11.1 Sample size. Four completely assembled male and four completely assembled mating female connectors.

4.6.11.2 Test procedure.

a. Engage and disengage the sample connector pairs twice before making the test.
b. Engage the connector pair measuring the force required for full engagement.
c. Disengage the connector pair measuring the withdrawal force.

4.6.11.3 Acceptance criteria. The engagement and disengagement forces shall conform to the values in table Ill.

4.6.12 Female connector power contact strength.

4.6.12.1 Sample size. Two female connector inserts.

4.6.12.2 Sample preparation. A contact extension device shall be provided for attachment to the cable end of the female contacts. This extension shall allow for a weight to hang behind the front face of the female connector to yield the moment specified in 4.6.12.3.b.

4.6.12.3 Test procedure.

a. The female contacts shall be tested by hanging a weight on the rear of the specially constructed contact extension device (see 4.6.12.2) with a male contact inserted to a depth of 2.250 ± 0.062 inch from the face of the female connector.
b. The weight shall hang free at a distance that will yield a moment of 12 ± 1/2 ft-lb. The moment shall be calculated using a point located at the tip of the inserted male contact as the fulcrum.

4.6.12.4 Acceptance criteria. At the completion of the contact strength test, the horizontal engaging and disengaging forces test specified in 4.6.11 shall be repeated. The engaging forces shown in table III, condition A, shall not be reduced by more than 10 percent.

4.6.13 Male and female contact mounting strength. Torque shall be applied to each contact to assure the contacts are adequately bonded to the connector insert and will not be damaged during normal service.

4.6.13.1 Sample size. Two male and female connector inserts.

4.6.13.2 Test equipment.

a. Metallic rods (shape optional) shall be procured, one for each contact size being tested. The rods shall have some means to permit the rod to be coupled to a torque wrench (square end, hex stock, socket welded to end, etc.). A flat area may be machined on the rod to provide a seat for the set screws. The circumscribed diameter of the rods shall approximate the conductor diameter of the maximum cable size specified for the contact being tested.
b. Torque wrenches permitting each test range to be read in the upper half of the scale shall be used. For greater ease, the wrench should be capable of reading torque in both clockwise and counter-clockwise directions. Torque wrench accuracy shall be ± 2 percent of the measured value.
c. A clamping or holding fixture for the connector shall be used. This fixture must hold the connector securely when the test torque is applied to the contacts. The clamping or mounting scheme shall not damage the connector or bias the test results. Slight rotation of the connector during the test is permissible if it does not influence the test results.

4.6.13.3 Test procedure.

a. The metallic rod shall be inserted into the contact being tested and secured in the contact with the setscrews used to secure the conductor in the contact.
b. A torque wrench shall be connected to the metallic rod.
c. A clockwise and counterclockwise torque in accordance with 3.5.7 shall be applied to each contact and held for a period of one minute.
d. The torque shall be released and the connector allowed to relax for two minutes

4.6.13.4 Acceptance criteria. After relaxing for the two minute period specified in 4.6.13.3.d, the contact shall be examined for any evidence of damage to the contact and connector insert. Particular attention should be given to the interface (bond) between the rubber and contact for evidence of damage or tearing of the bond between the contact and the rubber. The contact shall meet the angular displacement requirement of 3.5.12.

4.6.14 Durability.

4.6.14.1 Sample size. One completely assembled male and mating female connector.

4.6.14.2 Sample Preparation. A male connector shall be rigidly clasped and mounted in a horizontal attitude to accept a counterpart female connector. The female connector shall be positioned in a test rig to allow engagement with the male connector. The connector shall be dry.

4.6.14.3 Test procedure.

a. The connectors shall be alternately engaged and disengaged for 575 cycles under standard atmospheric conditions (see 4.3.1), simulating one engagement and disengagement per day for approximately 3 years.
b. One engagement and disengagement of a connector constitutes one cycle.
c. The durability test shall be considered a destructive test. As such, samples used for the durability test shall not be used for subsequent tests, except they may be used for the strain relief test (see 4.6.10) at the option of the contractor.
d. The cable required for the contact resistance tests (see 4.6.18) may be left attached to the connectors during the durability test.

4.6.14.4 Acceptance criteria. The contact resistance (see 4.6.18) shall be measured at the end of every 100 cycles and at the end of the test by passing current through each power contact as specified in table IV. A voltage drop in excess of the values shown in table IV shall be cause for rejection.

4.6.15 Strain relief test. The strain relief test shall be conducted in accordance with UL 498, section 78, with the following exceptions and clarifications.

4.6.15.1 Sample size. The sample shall consist of two sets of six connectors. Each set shall contain three male and three female connectors.

4.6.15.2 Sample preparation.

a. Each connector in the sample shall be assembled with individual conductors wired to each contact. The conductor size shall be the minimum allowable conductor size shown in the appendix for the connector type (A, B, C, D, E, F, G, H) being tested.
b. A test fixture shall be devised to hold the male and female connectors during the strain relief test. The apparatus shall not squeeze or clamp the connector in a manner that would bias test results.
c. The connectors will be divided into two sets (see 4.6.15.1).

4.6.15.3 Test procedure.

a. Assemble the connector to the test fixture (see 4.6.15.2).
b. The pull force and direction shall be as specified in 3.5.14.

4.6.15.4 Acceptance criteria.

a. The connector and contacts shall not exhibit evidence of any damage that could increase the risk of fire or electrical shock.
b. The conductor shall remain attached to the contact.

4.6.16 Accelerated aging of elastomers test. The accelerated aging test shall be conducted in accordance with UL 1010, section 43 for elastomeric materials of rubber composition with the following exceptions and clarifications.

4.6.16.1 Sample size. Two completely assembled male and two completely assembled female connectors.

4.6.16.2 Test procedure. As described in UL 1010.

4.6.16.3 Acceptance criteria. The acceptance criteria shall be as stated in 3.5.15.2.

4.6.17 No-load endurance test. The no-load endurance test shall be conducted in accordance with UL 1010, section 33 with the following exceptions and clarifications.

4.6.17.1 Sample size. One male connector and one matching female receptacle assembly, with the female insert assembled to a hazardous (classified) housing.

4.6.17.2 Test procedure. As described in UL 1010.

4.6.17.3 Acceptance criteria. There shall be no mechanical or visible damage to any of the parts, including the interlocking mechanism.

4.6.18 Contact resistance test. A connector shall be tested for contact resistance in accordance with EIA-364-06 and the following requirements, exceptions, and clarifications.

4.6.18.1 Sample size. Since this test is used as an acceptance criteria for other tests, the sample size will be as required by the test being performed.

4.6.18.2 Sample preparation.

a. Individual contacts shall be mated to the connector being tested.
b. The individual contacts shall have a minimum of 3 feet of single conductor cable attached for heat dissipation. The conductor size shall be the minimum allowable conductor size shown in the appendix for the connector type (A, B, C, D, E, F, G. H) being tested.
c. The test samples shall not be cleaned by any means prior to the test, nor shall any lubricants or other coatings be applied.
d. A minimum of 3 feet of single conductor cable shall be attached to each of the contacts for heat dissipation.
e. The DPDT reversing switch shown in EIA-364-06 is not required.

4.6.18.3 Test procedure.

a. Reverse current readings are not required.
b. One voltmeter probe shall be connected to the sample at the rear of the connector contact at the point where the conductor enters the contact. The probe shall be in contact with the connector contact. The other voltmeter probe shall be connected to the individual contact at the point where the conductor enters the contact.

4.6.18.4 Acceptance criteria. The voltage drop shall not exceed the values shown in table IV.

4.6.19 Reliability demonstration and test. Satisfactory completion of all tests specified herein demonstrates compliance with the quantitative reliability requirements of this specification.

4.6.20 Maintainability verification. Verification of the maintainability requirements as specified in 3.4.3 shall be demonstrated during three operations of assembly and disassembly.

4.6.21 Additional first article qualification tests (series 2 connectors). Following successful completion of first article tests required in paragraphs 4.6.1 through 4.6.17, there shall be further tests with the connector insert (type E, F, G, H) mounted in a receptacle assembly (see 6.4.14.1).

4.6.21.1 Tests required per UL 1010 for series 2 connectors,

a. Overload test.
b. Normal temperature rise.
c. Exposed surface temperature rise.
d. Full load endurance test.
e. Test for arc-sustaining in the presence of explosive atmospheres.
f. Overload test in the presence of explosive atmospheres.
g. Explosion test.
h. Hydrostatic pressure test.
i. Dust penetration test.
j. Test for secureness of conduit hubs.
k. Rain test.
l. Water tightness test.

4.7 Quality conformance inspection methods.

4.7.1 Examination of product.

4.7.1.1 Visual examination. Connectors shall be visually examined for workmanship, cleaning, identification and operational marking, and for evenness of finish.

4.7.1.2 Dimensional examination. Mating dimensions shall be inspected by mating the connector with its applicable mating gauges or other suitable means acceptable to the Government.

4.7.2 Dielectric withstanding voltage test. Unmated connectors shall be tested in accordance with MIL-STD-202, Method 301 and the following:

a. Testing shall be conducted at the ambient conditions specified in 4.3.1, unless otherwise specified.
b. The test voltage shall be 2500 volts AC
c. The test voltage shall be applied between all pairs of contacts, and between all contacts and metal non-current carrying parts of the connector.
d. At the option of the manufacturer, the test voltage may be applied and removed instantaneously.
e. At the option of the manufacturer, the test duration may be reduced to one second.
f. The test shall be performed on 100 percent of the connectors.
g. During and after the application of the test voltage, the connector will be examined for evidence of disruptive discharge or deterioration. Disruptive discharge is evidenced by flashover, sparkover, or breakdown.

4.7.3 Horizontal disengaging forces. Engage and disengage the sample connector pairs twice before making the following test. Engage the plugs, then measure withdrawal force for conformance to table III, using the forces for condition A.

4.8 Inspection of preparation for delivery. Sample items and packs shall be selected and inspected in accordance with MIL-STD-2073-1, and shall conform to the requirements of Section 5 of this specification.

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 activity within the Military Service or Defense Agency, or within the Military Service 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. The male and female connectors and receptacles covered by this specification are intended for use with ground support and base facility equipment (ramp or wall-mounted outlets) requiring 480/277 VAC. The series 1 connectors and receptacles are for use in non-hazardous locations. The series 2 connectors and receptacles are for use in hazardous (classified) locations. This specification is not intended to include specifications for explosionproof receptacle housings. The series 2 connectors specified herein can be used in enclosures approved for use in hazardous (classified) locations. The receptacle housings for the series 2 receptacle inserts, when used in hazardous (classified) locations, must include a rotatable collar with spring door.

6.1.1 Description. All series are designed to assure proper orientation of the mating halves prior to electrical circuit closure. All series are designed to assure the grounding contacts (see 6.4.5) are engaged first and disengaged last when the connectors are mated (see 6.4.10) and unmated. The control contacts (see 6.4.3) are designed to assure the control circuit is not completed until the power contacts (see 6.4.12) are mated. The control contacts will disengage prior to the power contacts, assuring the connector is not used to interrupt the load current.

6.1.2 Intermatabilty.

a. Plugs and receptacles with different electrical ratings are not interchangeable with each other.
b. A receptacle will not accommodate a plug other than one specifically designed for use with the combination with the following exceptions:

    1. Male plugs for use in hazardous (classified) locations (see 6.4.6) will mate with non-hazardous (see 6.4.11) female receptacles if the electrical ratings of the plug and receptacle are the same.
    2. Plugs for use in non-hazardous locations will not mate with hazardous (classified) receptacles even if the electrical rating of the plug and receptacle are the same.
    3. Male plugs procured under earlier revisions of this specification will mate with type A female receptacles. However, the male plug does not have provisions to engage the grounding circuit provided in the type A receptacle, and the make-first, break-last feature is therefore not present.

6.2 Acquisition requirements. Acquisition requirements must specify the following:

a. Title, number, and date of this specification.
b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1 and 2.2).
c. Nomenclature, MS, and dash number of connectors.
d. When first article inspection is required (see 3.2).
e. When dummy connectors are required (see 3.14).
f. Refer to Section 5 of this specification for packaging requirements. This includes any special shipment marking or preservation requirements.

6.3 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a first article sample, a first production item, or a standard production item from the contractor's current inventory (see 3.2), and the number of items to be tested as specified in 4.4. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitation for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.4 Definitions. For the purpose of this specification, the following definitions apply:

6.4.1 Contactor assembly. A wall-mountable enclosure which houses a magnetic contactor, control circuit transformer (48 or 24 VAC secondary for 50/60 Hz and 400 Hz) with a fuse or circuit breaker on the primary side and a control circuit relay. The explosion proof enclosure also includes a shunt-trip circuit.

6.4.2 Connector. Connector is defined as a male or female plug, receptacle or receptacle insert.

6.4.3 Control contacts. Control contacts are defined as pins and sockets on the intermating control circuit current-carrying part of the connector.

6.4.4 Female connector. Female connector is defined as the connector which has socket contacts.

6.4.5 Grounding contact. The grounding contact is the pin and socket on the intermating earth grounding circuit of the connector.

6.4.6 Hazardous (classified) location. A location meeting the requirements of NEC article 500 because explosion or fire hazards potentially exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or filings. The hazardous classifications used in this specification are for design criteria of electrical fixtures and fixed equipment and do not establish the operational environment for the ground support equipment.

6.4.7 Insert. An insert is the insulated part (body) of the connector in which the contacts are arranged.

6.4.8 Intrinsically safe circuit. A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions per ANSI/UL 913. The circuit must meet the FM Class 3610 approval standard.

6.4.9 Male connector. Male connector is defined as the portion of the mated connector assembly with pin contacts.

6.4.10 Mated connector. The term mated connector refers to a male and female connector in the engaged position.

6.4.11 Nonhazardous location. Any location not meeting the requirements for hazardous (classified) locations as defined in the NEC article 500.

6.4.12 Power contacts. Power contacts are defined as pins and sockets on the intermating power current-carrying part of the connector.

6.4.13 Receptacle assembly. Enclosure identical to the contactor assembly except the receptacle assembly includes the receptacle.

6.4.14 Definitions unique to series 2 connectors and receptacles. The following definitions are unique to the series 2 hazardous (classified) connectors and receptacles. The definitions referencing the National Electrical Code are quoted from NEC article 500.

6.4.14.1 Hazardous (classified) locations. The hazardous (classified) location receptacle assembly, including the female receptacle insert (see 6.4.7), is a factory-assembled, wall-mounted unit conforming to NEMA 7D and 3R requirements, and UL Standard 1010. Verification of conformance to these requirements is performed by a qualified third-party testing facility. The receptacle assembly includes a shunt-trip circuit breaker, magnetic contactor and an electrically protected control circuit that includes an intrinsically safe circuit (see 6.4.8) to allow remote control of the contactor. The shunt-trip circuit breaker is electrically interlocked with the magnetic contactor to break the power circuit to the receptacle if the contactor fails to open. The electrical rating of all components is consistent with the ampacity of the receptacle assembly. The plug and receptacle assembly incorporate a delay mechanical interlock to assure the power circuits are de-energized prior to disengaging the power contacts.

6.4.14.2 Class I. Class 1 locations are those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. (see NEC article 500-5).

6.4.14.3 Division 1. A Division 1 location is a location: (1) in which ignitable concentrations of flammable gases or vapors can exist under normal operating conditions; or (2) in which ignitable concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage: or (3) in which breakdown or faulty operation of equipment or processes might release ignitable concentrations of flammable gases or vapors, and might also cause simultaneous failure of electrical equipment. (See NEC article 500-5 (a)).

6.4.14.4 Group D. Group D defines an atmosphere containing any of the following gases.

Acetone	Ethanol	Methyl Ethyl Ketone	2-Propanol
Acrylonitrile	Ethyl Acetate	Methyl Isobutyl Ketone	Propylene
Ammonia	Ethylene Dichloride	2-Methyl-1-Propanol	Styrene
Benzene	Gasoline	2-Methyl- 2-Propanol	Toluene
Butane	Heptane	Naphtha (Petroleum)	Vinyl Acetate
1-Butanol	Hexane	Octane	Vinyl Chloride
2-Butanol	Isoamyl Alcohol	Pentane	Xylene
n-Butly Acetate	Isoprene	1-Pentanol	
Cyclopropane	Methane	Propane	
Ethane	Methanol	1-Propanol	

6.4.14.5 Rotatable collar. The external component of the explosionproof receptacle housing that also includes a spring loaded cover.

6.4.14.6 Two-segment integral external ring. The molded-in component of the series 2 insert with pin contacts. This interfaces with the internal slots of the rotatable collar of the explosionproof receptacle housing.

6.5 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. Table IX lists the Environmental Protection Agency (EPA) top seventeen hazardous materials targeted for major usage reduction. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see section 3).

TABLE IX. EPA top seventeen hazardous materials.

Benzene	Dichloromethane	Tetrachloroethylene
Cadmium and Compounds	Lead and Compounds	Toluene
Carbon Tetrachloride	Mercury and Compounds	1,1,1 - Trichoroethane
Chloroform	Methyl Ethyl Ketone	Trichloroethylene
Chromium and Compounds	Methyl Isobutyl Ketone	Xylenes
Cyanide and Compounds	Nickel and Compounds	

6.6 Subject term (key word) listing.

Female receptacle
Hazardous
Male receptacle
Non-hazardous
Ramp outlet
Wall-mounted outlet

6.7 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

INSERT ARRANGEMENTS

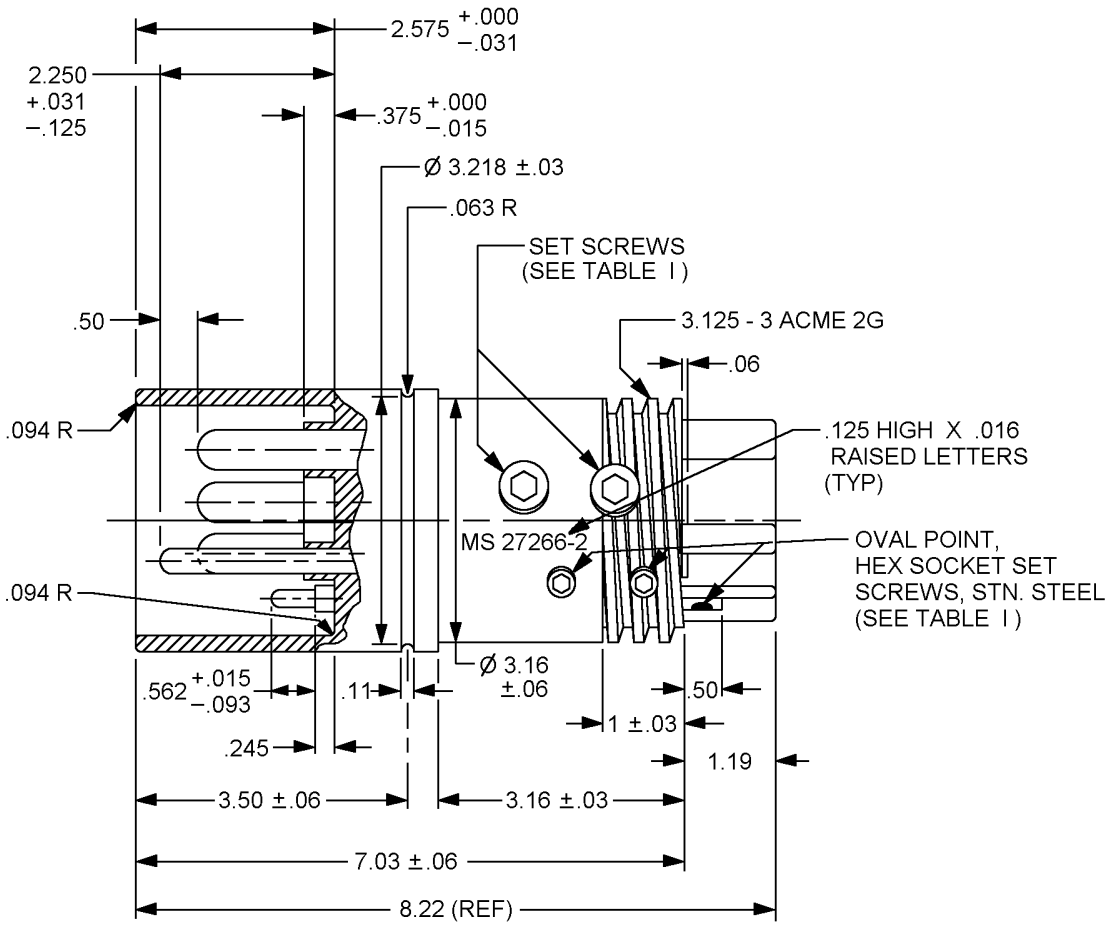
A.1 SCOPE

A.1.1 Scope. This appendix describes the insert arrangements available for connectors contained in MIL-DTL-38159. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance only (see table A-I and figures A-2 through A-21).

A.2 APPLICABLE DOCUMENTS This section is not applicable to this appendix.

TABLE A-I. Conductor and set screw sizes.

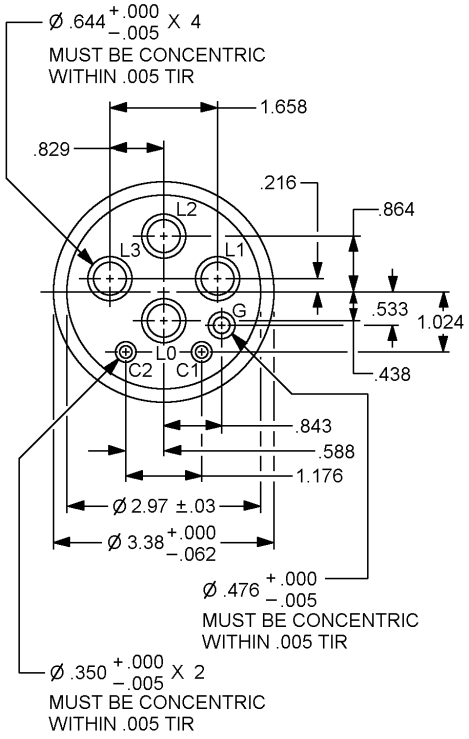
Cable and set screws sizes per contact and ampacity				
Contact	120 AMPS		200 AMPS	
	Cable	Set screw	Cable	Set screw
L1	#1/0	9/16-18 UNF 2A x 13/32 LG	#4/0	5/8-18 UNF 2A X 15/32 LG
L2	#1/0	9/16-18 UNF 2A x 13/32 LG	#4/0	5/8-18 UNF 2A X 15/32 LG
L3	#1/0	9/16-18 UNF 2A x 13/32 LG	#4/0	5/8-18 UNF 2A X 15/32 LG
L0	#1/0	9/16-18 UNF 2A x 13/32 LG	#1/0	9/16-18 UNF 2A X 13/32 LG
G	#4 AWG	5/16-24 UNF 2A X 11/32 LG	#2 AWG	7/16-20 UNF 2A X 3/8 LG
C1 OR F	#12 AWG	#10-24 UNC 2A X 3/16 LG	#12 AWG	#10-24 UNC 2A X 3/16 LG
C2 OR E	#12 AWG	#10-24 UNC 2A X 3/16 LG	#12 AWG	#10-24 UNC 2A X 3/16 LG



Inches	mm	Inches	mm
.015	0.381	.500	12.70
.016	0.406	.562	14.28
.030	0.762	1.19	30.23
.031	0.787	2.25	57.15
.06	1.524	2.575	65.41
.063	1.600	3.125	79.38
.093	2.362	3.16	80.26
.094	2.388	3.218	81.737
.110	2.794	3.50	88.90
.125	3.175	7.03	178.6
.245	6.223	8.22	208.8
.375	9.525		

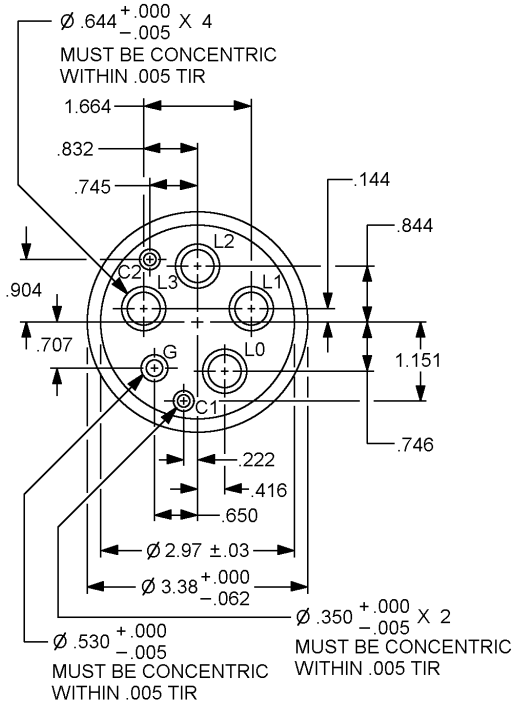
See notes at end of figure A-21.

FIGURE A-2. Typical insert, PIN contacts, series 1, non-hazardous.



Inches	mm
.005	.127
.030	.762
.062	1.575
.216	5.486
.350	8.890
.438	11.13
.476	12.09
.573	14.55
.588	14.94
.644	16.36
.829	21.06
.843	21.41
.864	21.95
1.024	26.01
1.176	29.87
1.658	42.11
2.97	75.44
3.38	85.85

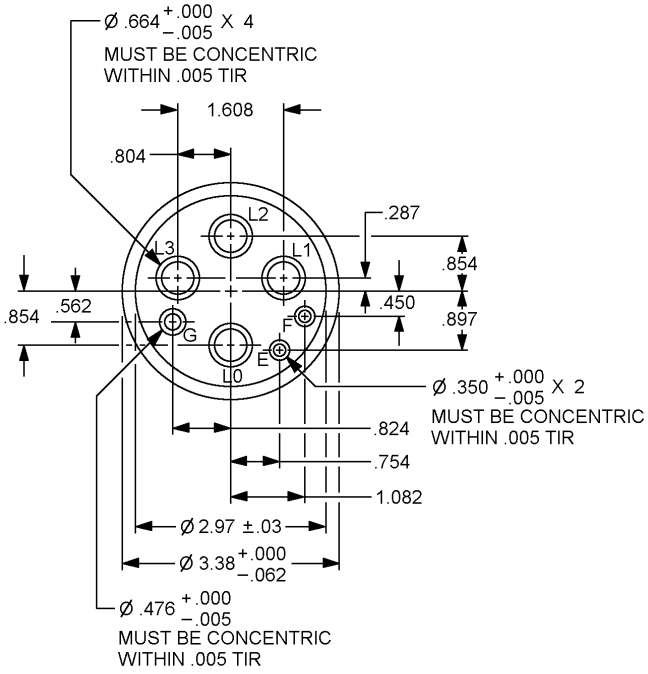
FIGURE A-3. Type A (P).

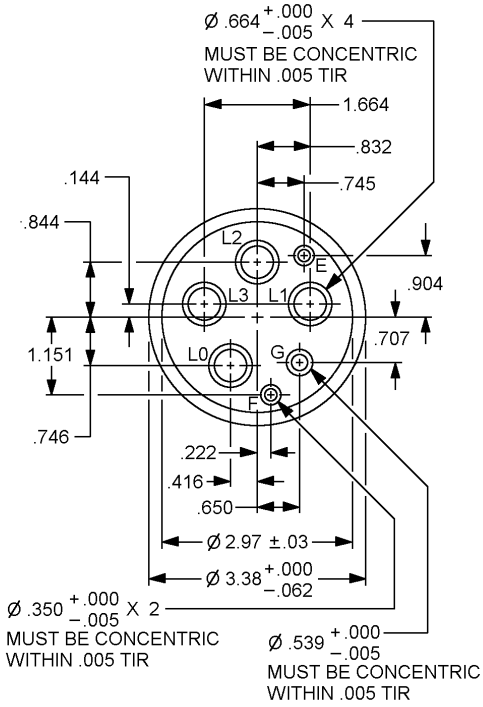


Inches	mm
.005	.127
.030	.762
.062	1.575
.144	3.658
.222	5.639
.350	8.890
.416	10.57
.530	13.46
.644	16.36
.650	16.51
.707	17.96
.745	18.92
.746	18.95
.832	21.13
.844	21.44
.904	22.96
1.151	29.24
1.664	42.27
2.97	75.44
3.38	85.85

FIGURE A-4. Type B (P).

See notes at end of figure A-21.





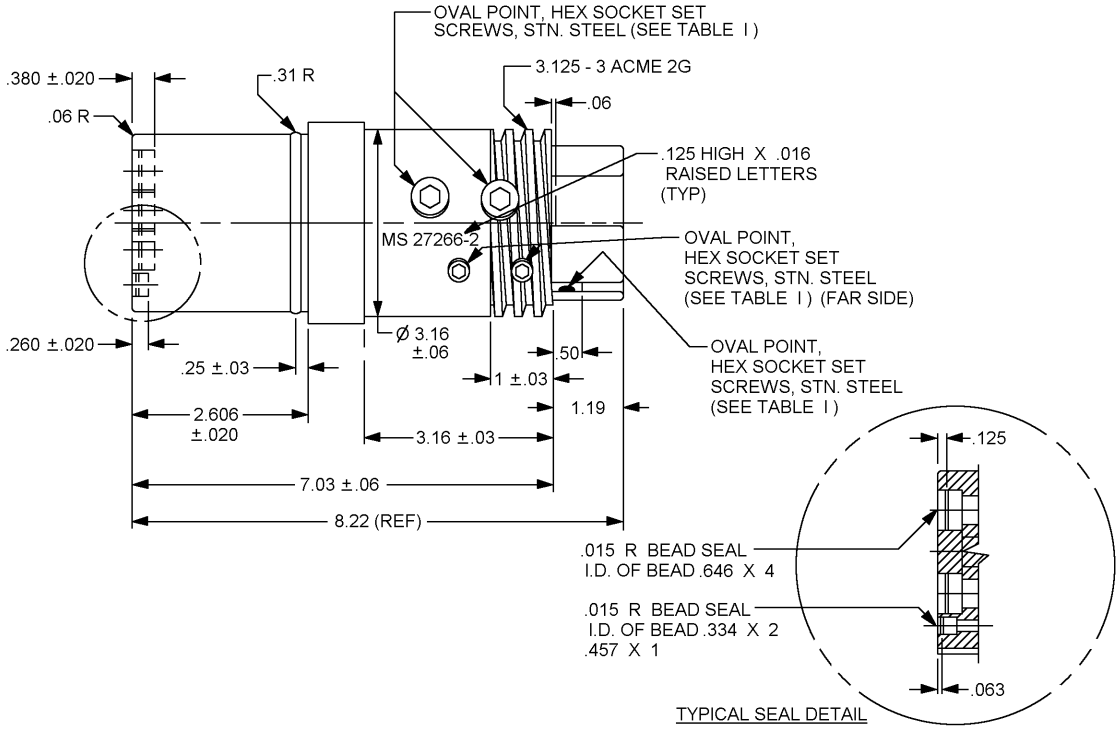
Inches	mm
.005	.127
.030	.762
.062	1.575
.287	7.290
.350	8.890
.450	11.43
.476	12.09
.562	14.27
.664	16.87
.754	19.15
.804	20.42
.824	20.93
.854	21.70
.897	22.79
1.082	27.48
1.608	40.84
2.97	75.44
3.38	85.85

Inches	mm
.005	.127
.030	.762
.062	1.575
.144	3.658
.222	5.639
.350	8.890
.416	10.57
.539	13.69
.650	16.51
.664	16.87
.707	17.96
.745	18.92
.746	18.95
.832	21.13
.844	21.44
.904	22.96
1.151	29.24
1.664	42.27
2.97	75.44
3.38	85.85

See notes at end of figure A-21.

FIGURE A-5. Type C (P).

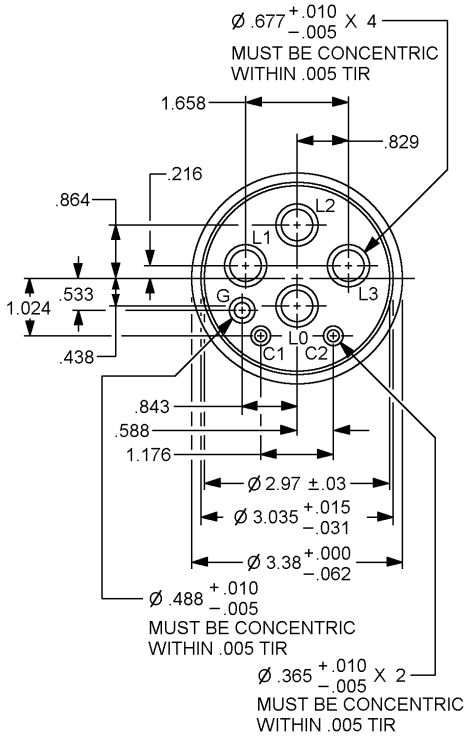
FIGURE A-6. Type D (P).

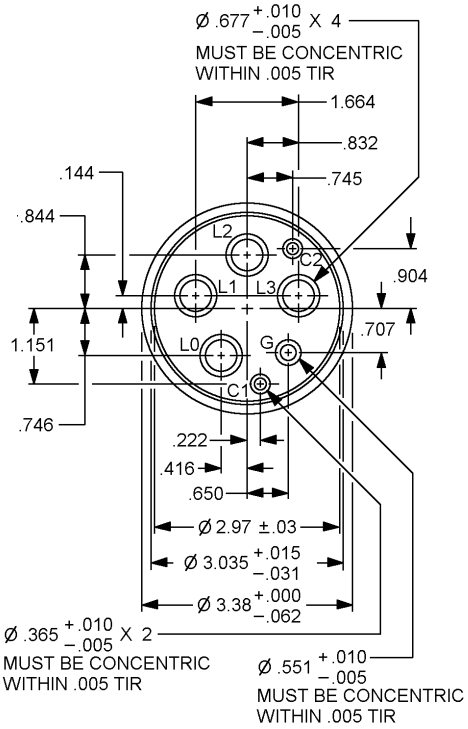


Inches	mm	Inches	mm
.015	.381	.380	9.652
.016	.406	.457	11.61
.020	.508	.500	12.70
.030	.762	.646	16.41
.060	1.524	1.00	25.40
.063	1.600	1.19	30.23
.125	3.175	2.606	66.19
.250	6.350	3.125	79.38
.260	6.604	3.16	80.26
.310	7.874	7.03	178.6
.334	8.484	8.22	208.8

See notes at end of figure A-21.

FIGURE A-7. Typical insert, socket contacts, series 1, non-hazardous.





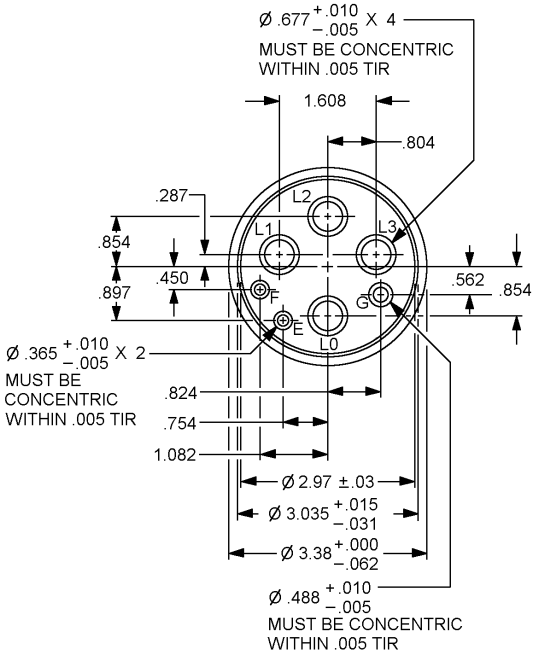
Inches	mm
.005	.127
.010	.254
.015	.381
.030	.762
.031	.787
.062	1.575
.216	5.486
.365	9.271
.438	11.13
.488	12.40
.533	13.54
.588	14.94
.677	17.20
.829	21.06
.843	21.41
.864	21.95
1.024	26.01
1.176	29.87
1.658	42.11
2.97	75.44
3.035	77.09
3.38	85.85

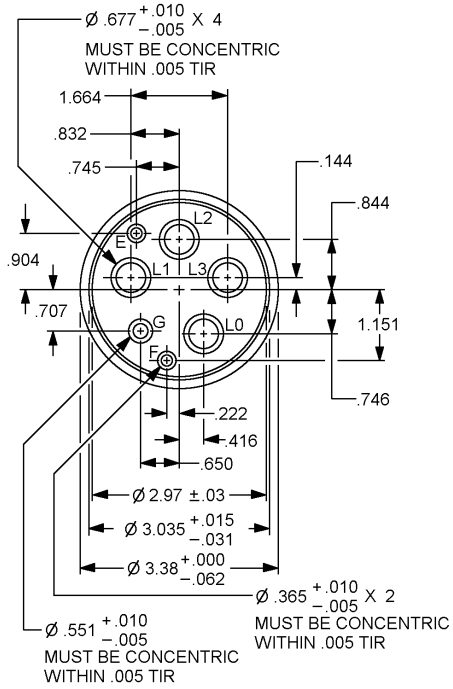
Inches	mm
.005	.127
.010	.254
.015	.381
.030	.762
.031	.787
.062	1.575
.144	3.658
.222	5.639
.365	9.271
.416	10.57
.551	14.00
.650	16.51
.677	17.20
.707	17.96
.745	18.92
.746	18.95
.832	21.13
.844	21.44
.904	22.96
1.151	29.24
1.664	42.27
2.97	75.44
3.035	77.09
3.38	85.85

See notes at end of figure A-21.

FIGURE A-8. Type A (S).

FIGURE A-9. Type B (S).





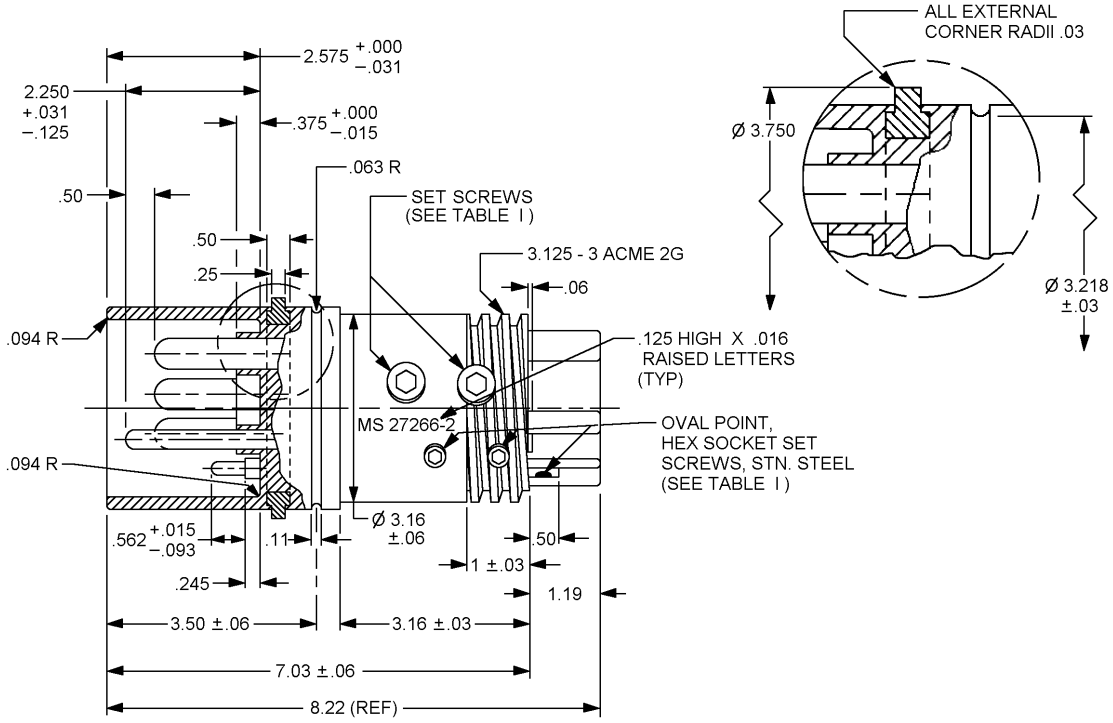
Inches	mm
.005	.127
.010	.254
.015	.381
.030	.762
.031	.787
.062	1.575
.287	7.290
.365	9.271
.450	11.43
.488	12.40
.562	14.28
.677	17.20
.754	19.15
.804	20.42
.824	20.93
.854	21.69
.897	22.78
1.082	27.48
1.608	40.84
2.97	75.44
3.035	77.09
3.38	85.85

Inches	mm
.005	.127
.010	.254
.015	.381
.003	.762
.031	.787
.062	1.575
.144	3.658
.222	5.639
.365	9.271
.416	10.57
.551	14.00
.650	16.51
.677	17.20
.707	17.96
.745	18.92
.746	18.95
.832	21.13
.844	21.44
.904	22.96
1.151	29.24
1.664	42.27
2.97	75.44
3.035	77.09
3.38	85.85

See notes at end of figure A-21.

FIGURE A-10. Type C (S).

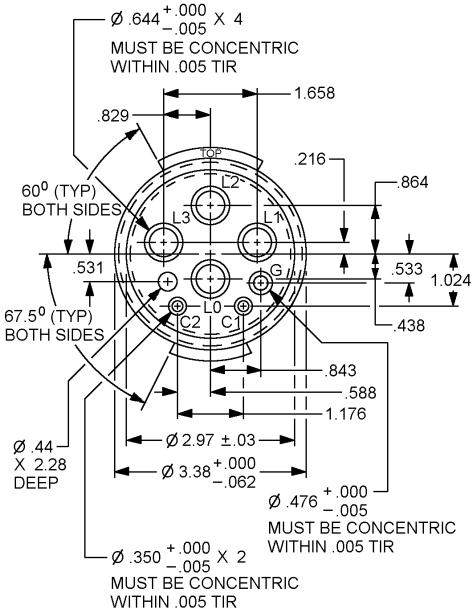
FIGURE A-11. Type D (S).



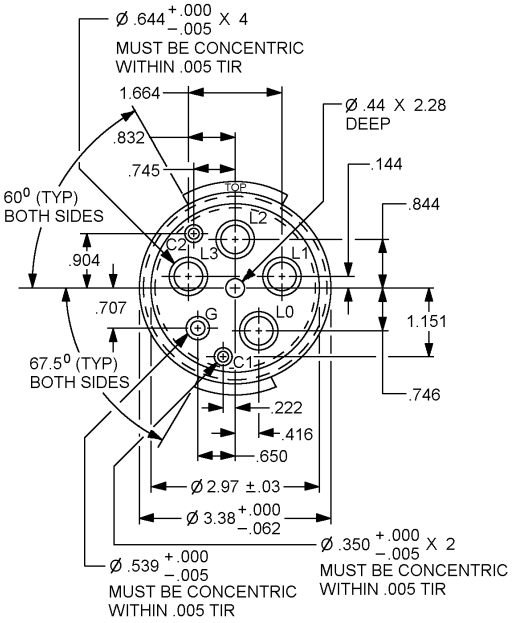
Inches	mm	Inches	mm
.015	.381	.500	12.70
.016	.406	.562	14.27
.030	.762	1.00	25.40
.031	.787	1.19	30.23
.006	1.524	2.25	57.15
.063	1.600	2.575	65.40
.093	2.362	3.125	79.37
.094	2.388	3.16	80.26
.110	2.794	3.218	81.74
.125	3.175	3.50	88.90
.245	6.223	3.75	95.25
.250	6.350	7.03	178.6
.375	9.525	8.22	208.8

See notes at end of figure A-21.

FIGURE A-12. Typical insert, PIN contacts, series 2, hazardous.



Inches	mm
.005	.127
.030	.762
.062	1.575
.216	5.486
.350	8.890
.438	11.13
.440	11.18
.476	12.09
.531	13.49
.533	13.54
.588	14.94
.644	16.36
.829	21.06
.843	21.41
.864	21.95
1.024	26.01
1.176	29.87
1.658	42.11
2.28	57.91
2.97	75.44
3.38	85.85

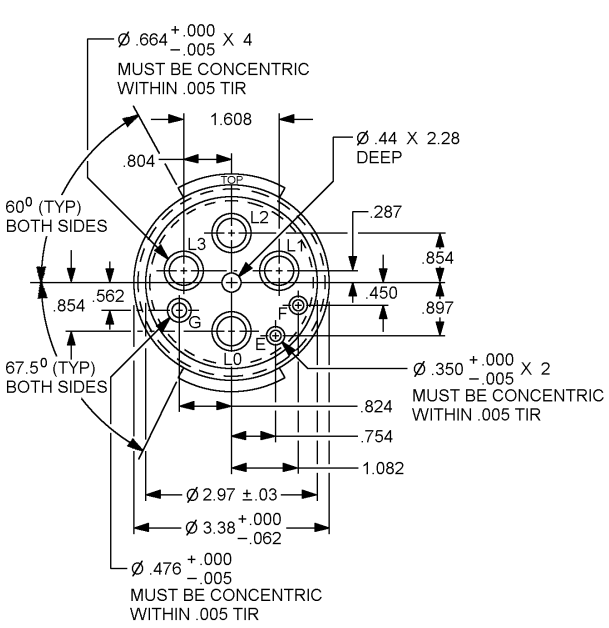


Inches	mm
.005	.127
.030	.762
.062	1.575
.144	3.658
.222	5.639
.350	8.890
.416	10.57
.440	11.18
.539	13.69
.644	16.36
.650	16.51
.707	17.96
.745	18.92
.746	18.95
.832	21.13
.844	21.44
.904	22.96
1.151	29.24
1.664	42.27
2.28	57.91
2.97	75.44
3.38	85.85

See notes at end of figure A-21.

FIGURE A-13. Type E (P).

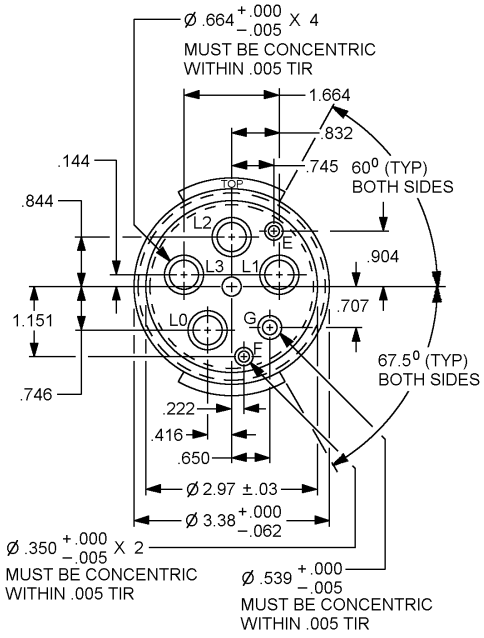
FIGURE A-14. Type F (P).



Inches	mm
.005	.127
.030	.762
.062	1.575
.287	7.290
.350	8.890
.440	11.18
.450	11.43
.476	12.09
.562	14.27
.664	16.87
.754	19.15
.804	20.42
.824	20.93
.854	21.69
.897	22.78
1.082	27.48
1.608	40.84
2.28	57.91
2.97	75.44
3.38	85.85

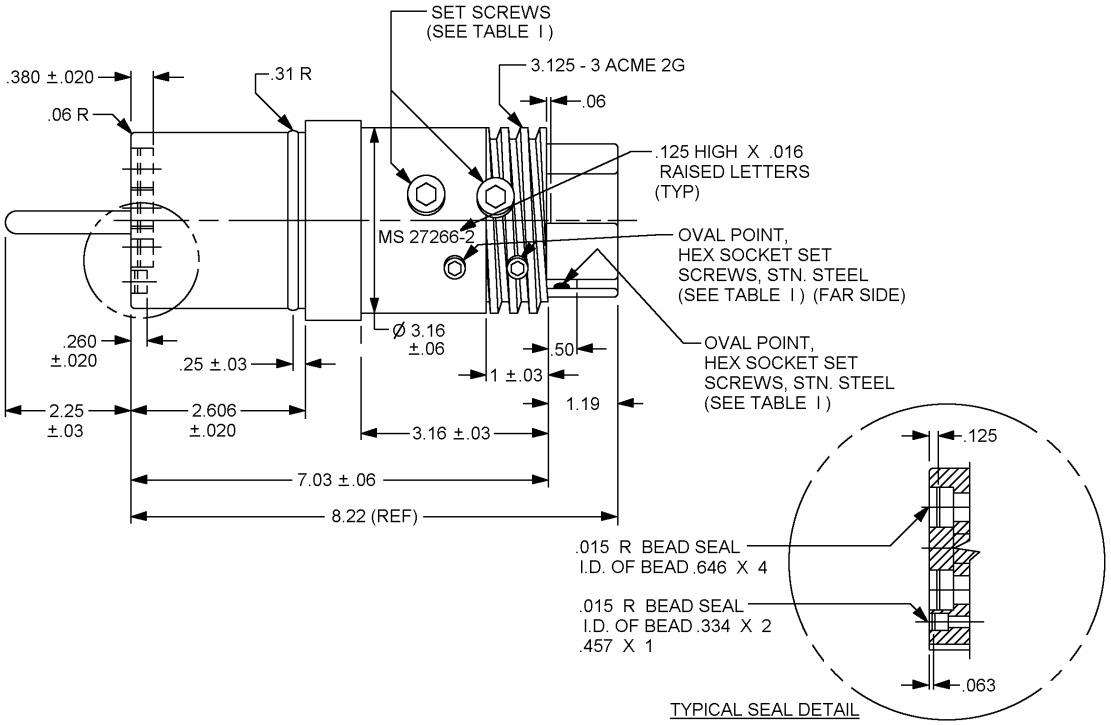
See notes at end of figure A-21.

FIGURE A-15. Type G (P).



Inches	mm
.005	.127
.030	.762
.062	1.575
.144	3.658
.222	5.639
.350	8.890
.416	10.57
.539	13.69
.650	16.51
.664	16.87
.707	17.96
.745	18.92
.746	18.95
.832	21.13
.844	21.44
.904	22.96
1.151	29.24
1.664	42.27
2.97	75.44
3.38	85.85

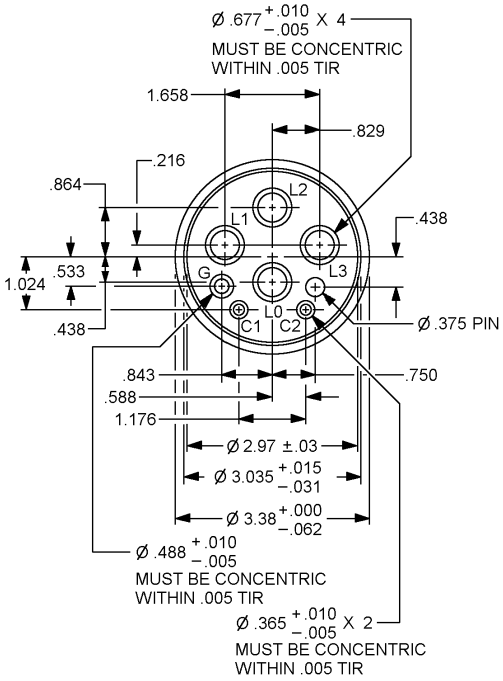
FIGURE A-16. Type H (P).



Inches	mm	Inches	mm
.015	.381	.457	11.61
.016	.406	.500	12.70
.020	.508	.646	16.41
.030	.762	1.00	25.40
.060	1.524	1.19	30.23
.063	1.600	2.25	57.15
.125	3.175	2.606	66.19
.205	6.350	3.125	79.37
.260	6.604	3.16	80.26
.310	7.874	7.03	178.6
.334	8.484	8.22	208.8
.380	9.652		

See notes at end of figure A-21.

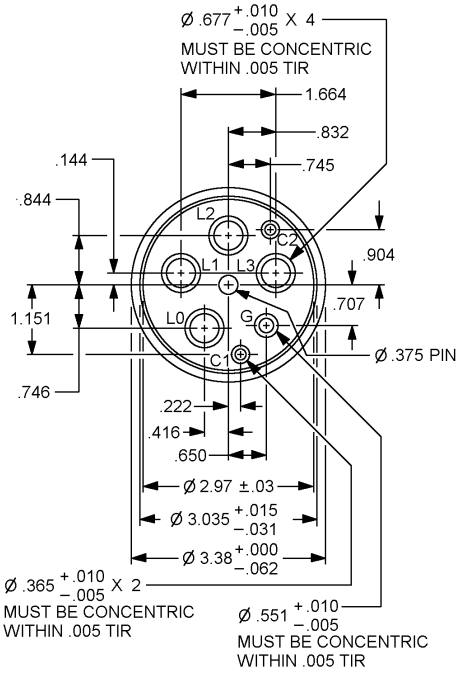
FIGURE A-17. Typical insert, socket contacts, series 2, hazardous.



Inches	mm
.005	.127
.010	.254
.015	.381
.030	.762
.031	.787
.062	1.575
.144	3.658
.222	5.639
.365	9.271
.375	9.525
.416	10.57
.551	14.00
.650	16.51
.677	17.20
.707	17.96
.745	18.92
.746	18.95
.832	21.13
.844	21.44
.904	22.96
1.151	29.24
1.664	42.27
2.97	75.44
3.035	77.09
3.38	85.85

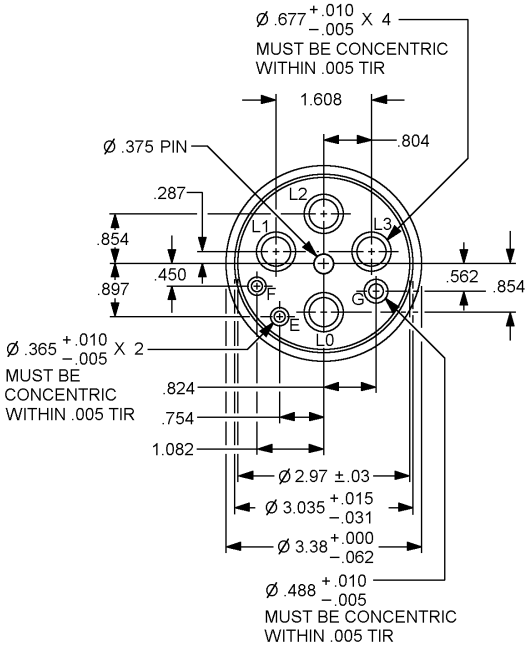
See notes at end of figure A-21.

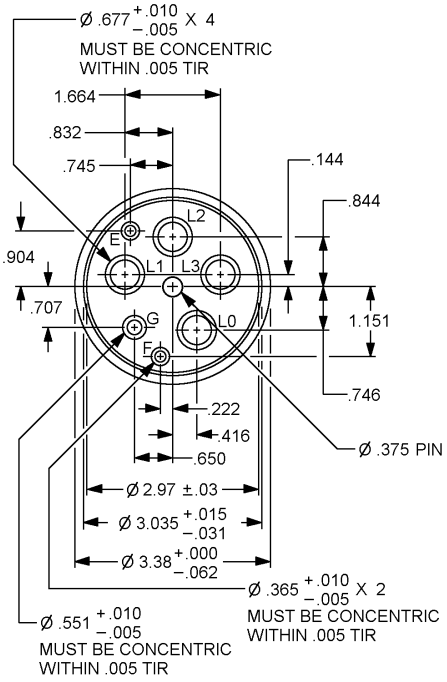
FIGURE A-18. Type E (S).



Inches	mm
.005	.127
.010	.254
.015	.381
.030	.762
.031	.787
.062	1.575
.144	3.658
.222	5.639
.365	9.271
.375	9.525
.416	10.57
.551	14.00
.650	16.51
.677	17.20
.707	17.96
.745	18.92
.746	18.95
.832	21.13
.844	21.44
.904	22.96
1.151	29.24
1.664	42.27
2.97	75.44
3.035	77.09
3.38	85.85

FIGURE A-19. Type F (S).





Inches	mm
.005	.127
.010	.254
.015	.381
.030	.762
.031	.787
.062	1.575
.287	7.290
.365	9.271
.375	9.525
.450	11.43
.488	12.40
.562	14.27
.677	17.20
.754	19.15
.804	20.42
.824	20.93
.854	21.69
.854	21.69
.897	22.79
1.082	27.48
1.608	40.84
2.97	75.44
3.035	77.09
3.38	85.85

Inches	mm
.005	.127
.010	.254
.015	.381
.030	.762
.031	.787
.062	1.575
.144	3.658
.222	5.639
.365	9.271
.375	9.525
.416	10.57
.551	14.00
.650	16.51
.677	17.20
.707	17.96
.745	18.92
.746	18.95
.832	21.13
.844	21.44
.904	22.96
1.151	29.24
1.664	42.27
2.97	75.44
3.035	77.090
3.38	85.85

See notes at end of figure A-21.

FIGURE A-20. Type G (S).

FIGURE A-21. Type H (S).

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. All connectors are rated at 600 V ac.
4. All plugs conform to MIL-DTL-38159.
5. Male plugs designed for use in hazardous areas will plug into female receptacles in non-hazardous areas having the same electrical rating.
6. Dimensions shall be in accordance with the applicable section of this specification.
7. Front face of pin insert shown (socket insert opposite).

CONCLUDING MATERIAL

Custodians:
Air Force - 11
DLA - CC

Preparing activity:
DLA - CC

Review activity:
Air Force - 99

(Project 5935-4434-000)

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