

MILITARY SPECIFICATION

CONNECTORS AND ASSEMBLIES, ELECTRICAL, AIRCRAFT GROUNDING 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 electrical aircraft grounding connectors and grounding assemblies, including plugs, receptacles, grounding clamp, connectors, jumper cable assemblies, and other accessories.

1.2 Classification.

1.2.1 Grounding assemblies. Grounding assemblies shall be classified as follows:

- Type I - Plug and clamp connectors, both attached to specified cable.
- Type II - Plug attached to specified cable.
- Type III - Clamp connector attached to specified cable.
- Type IV - Jumper assembly, lug to lug.

1.2.2 Other components. Other components shall be classified by name only.

2. APPLICABLE DOCUMENTS

2.1 Government specifications and standards. Unless otherwise specified, the following specifications and standards, of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

- FF-S-200 - Setscrews: Hexagon Socket and Spline Socket, Headless.
- QQ-W-470 - Wire, Steel, Carbon, Spring, Music.

MILITARY

- MIL-T-7928 - Terminals, Lug and Splice, Crimp-style, Copper.
- MIL-C-55330 - Connectors, Electrical and Fiber Optic, Packaging of.
- MIL-W-83420 - Wire Rope, Flexible, for Aircraft Control.

(See supplement 1 for list of specification sheets.)

STANDARDS

FEDERAL

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

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
- MIL-STD-889 - Dissimilar Metals.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Aeronautical Systems Division, ASD/ENES, Wright-Patterson AFB, OH 45433, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

MIL-STD-1285 - Marking of Electrical and Electronic Parts.
 MIL-STD-1344 - Test Methods for Electrical Connectors.
 MIL-STD-45662 - Calibration Systems Requirements.
 MS20615 - Rivet, Solid-universal Head, Brass, Copper and
 Nickel-copper Alloy.
 MS51963 - Setscrew-Hexagon Socket, Cup Point, Alloy Steel, Cadmium
 Plated, UNC-3A, Plain and Self-Locking.
 MS171466 - Pin-spring, Corrosion Resistant Steel (Asg).

(Copies of specifications, standards, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.1.1 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein.

AIR STANDARDIZATION COORDINATING COMMITTEE (ASCC)

AIR STD 12/25 - Earthing/Grounding Plug and Socket.

NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANAG 3632 - Electrical Safety Connections for Aircraft and Ground Support Equipment.

(Application for copies should be addressed to Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS are the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A304 - Alloy Steel Bar to End Quench Hardenability Requirements.
 ASTM B633 - Electrodeposited Coatings of Zinc on Iron and Steel.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B46.1 - Surface Texture.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 46 - Aircraft-Fuel Nozzle Grounding Plugs and Sockets.

(Application for copies should be addressed to the American Standards Institute, 1430 Broadway, New York, NY 10018.)

SOCIETY FOR AUTOMOTIVE ENGINEERS (SAE)

SAE 1020 (AMS 5032) - Steel, Wire 0.18-0.23C.
 SAE 8620 (AMS 6274) - Steel Bars, Forgings and Tubing 0.50CR-0.55NI-0.20MO.

(Application for copies should be addressed to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

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

3.2 Qualification. Unless otherwise specified (see 3.1), connectors furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.5 and 6.3).

3.3 Material. Unless otherwise specified, material shall be as specified herein and on the individual specification sheets (see 3.1). When a specific material is not designated, a material shall be used that permits the connector to meet the requirements of this specification. All materials used shall be suitable for connector usage within a temperature range of -55°C through $+85^{\circ}\text{C}$ (see 4.3).

3.3.1 Corrosion resistance. All materials used in the fabrication of the connectors shall be corrosion resistant and where necessary they shall be stress-corrosion resistant or treated so as to be corrosion or stress-corrosion resistant.

3.3.2 Dissimilar metals. Dissimilar metals shall be used in accordance with MIL-STD-889.

3.4 Design and construction. The connectors shall be designed and constructed for rough handling and service under all weather conditions as may be encountered on a concrete flight line. The design requirements shall be as specified herein and on the individual specification sheets.

3.4.1 Grounding clamp connector. The configuration of the grounding clamp connector shall be as specified herein and on the individual specification sheets. The internal construction and internal contour are optional.

3.4.1.1 Clamping range. The grounding clamp connector shall clamp onto any rod ranging from .375 to .750 inch nominal diameter.

3.4.1.2 Cable connection. Each connector handle shall have provisions for attaching the grounding cable. The connection shall be of such strength that it meets the requirements specified herein.

3.4.1.2.1 Setscrews. When required, hexagon socket type setscrews conforming to FF-S-200 or MS51963, or equal, shall be provided.

3.4.1.3 Spring: The spring shall be made of music wire in accordance with QQ-W-470, or equal. Diameter and heat treatment shall be as required to meet requirements. The spring shall be stress relieved, zinc plated in accordance with ASTM B633, and coated with yellow chromate dip. Optional material and treatment may be used provided they meet all the requirements herein.

3.4.1.4 Jaw inserts. Jaw inserts shall be 4130 steel conforming to ASTM A304 condition optional, carburized and case hardened 0.010 inch minimum depth. Optional SAE 1020 or 8620 steel may be used. Steel shall be zinc plated in accordance with ASTM B633. Retaining pins shall conform to MS171466 or equal, if used.

3.4.1.5 Rivets. Rivets shall be in accordance with MS20615, or equal. Brass rivets shall be zinc plated in accordance with ASTM B633.

3.4.2 Grounding plug. The configuration of the grounding plug shall be as specified herein and on the individual specification sheets. Material shall be as specified on the individual specification sheets.

3.4.2.1 Threads. Threads shall be in accordance with FED-STD-H28.

3.4.2.2 Surface texture. Surface texture of the grounding plug shall be in accordance with ANSI B46.1.

3.4.2.3 Grips. The incorporation of grips on grounding plugs shall be considered optional. When grips are used, they shall not interfere with the insertion or general operation of the grounding plug.

3.4.2.4 Caps. Caps shall be included with the grounding plug.

3.4.3 Connecting cables and jumper cable assemblies. The construction of connecting cables and jumper cable assemblies shall be as specified herein and on the individual specification sheets. Connecting cables shall be tested only when inserted into a grounding assembly. Jumper cable assemblies shall be tested as a separate part.

3.4.3.1 Wire. Grounding wire shall be as specified on the individual specification sheets.

3.4.3.2 Terminal lugs. Unless otherwise specified, copper terminal lugs shall be in accordance with MIL-T-7928 (see 3.1).

3.4.3.3 Tools. Tools used for construction of cable assemblies shall be as specified on the individual specification sheets.

3.4.4. Grounding receptacles. Grounding receptacles shall either be a one-piece or a two-piece unit. Two-piece receptacles shall be composed of a grounding insert and a receptacle housing. All grounding receptacles shall be as specified herein and on the individual specification sheets. When tested, the grounding receptacle shall be fully assembled. All receptacles shall be capable of mating with all plugs under this specification, and the plugs specified by AIR STD 12/25, ISO 46, and NATO STANAG 3632.

3.4.4.1 Grounding inserts. All grounding inserts shall be capable of mating with the receptacle housing of 3.4.4.2. In addition, all inserts shall have external threads per FED-STD-H28 which are compatible with the internal threads of the receptacle housing.

3.4.4.2 Receptacle housing. All receptacle housings shall be capable of mating with the grounding inserts of 3.4.4.1. The receptacle housing shall have internal threads per FED-STD-H28 which are compatible with the external threads of the grounding inserts. Unless otherwise specified, O-rings shall be supplied with each housing (see 3.1).

3.4.4.2.1 Drain-holes. Drain holes, if provided, shall be designed such that any fluid trapped in the housing may escape to the outside of the aircraft.

3.4.4.2.2 Jam-nut mounting. Unless otherwise specified, jam-nut mounting shall be provided on the mounting threads of the housing, such that the drain-holes are vertically orientated, if provided.

3.5 Performance. The connectors shall meet the performance requirements specified herein.

3.5.1 Insertion and withdrawal force. When tested as specified in 4.7.2, the insertion force shall not exceed 10 pounds, and the withdrawal force from the detent shall be 8 ± 2 pounds, and shall be 6 pounds maximum after leaving the detent.

3.5.2 Hand-grip force. When tested as specified in 4.7.3, the hand-grip force required to open the grounding clamp connector shall not exceed 70 pounds.

3.5.3 Sideload. When tested as specified in 4.7.4, the connector shall withstand a force of 20 pounds in any direction perpendicular to the axis of insertion, without distortion or other visible damage.

3.5.4 Torque. When tested as specified in 4.7.5, there shall be no stripping of the coupling threads.

3.5.5 Engagement (plugs and receptacles). When tested as specified in 4.7.6, there shall be no free rotation about or free movement along the connector insertion axis by the grounding plug or test plug.

3.5.6 Resistance. Resistance values shall be specified on the individual specification sheets (see 3.1).

3.5.6.1 Contact resistance. When tested as specified in 4.7.7.1, the resistance of the mated connectors shall not exceed the value specified.

3.5.6.2 Clamp connector resistance. When tested as specified in 4.7.7.2, the clamp connector resistance shall not exceed the value specified.

3.5.6.3 Assembly resistance. When tested as specified in 4.7.7.3, the resistance of the assembly shall not exceed the value specified.

3.5.7 Cable attachment. When tested as specified in 4.7.8, the cable shall remain attached to the clamp connector for 5 seconds under 50 pounds of axial cable force without breaking, becoming loose, or distorting the connector such that it will not meet the requirements specified herein.

3.5.8 Clamp release force. When tested as specified in 4.7.9, the force required to release the grounding clamp connector from the rod shall meet the requirements specified herein.

3.5.8.1 Initial. The grounding clamp connector shall meet the initial clamp release force requirements of table I.

3.5.8.2 Post clamping life test. When tested as specified in 4.7.10, the grounding clamp connector shall meet the post clamping life test requirements of table I.

TABLE I. Clamp release force.

Rod diameter (nominal) inches (mm)	Clamp release force initial (pounds-minimum)	Clamp release force post clamping life test (pounds-minimum)
0.375 (9.53)	20	17.0
0.500 (12.70)	30	25.5
0.625 (15.88)	40	34.0
0.750 (19.05)	50	42.5

3.5.9 Clamping life. When tested as specified in 4.7.10, the clamp connector shall meet the clamp release force requirements of 3.5.8 and the clamp connector resistance requirements of 3.5.6.2.

3.5.10 Vibration. When tested as specified in 4.7.11, there shall be no physical or mechanical damage to the connector. The connector shall meet the contact resistance requirements of 3.5.6.1 and the insertion and withdrawal force requirements of 3.5.1.

3.5.11 Durability. When tested as specified in 4.7.12, there shall be no evidence of mechanical damage. The connector shall then meet the insertion and withdrawal force requirements of 3.5.1, and the contact resistance requirements of 3.5.6.1.

3.5.12 Tensile strength. When tested as specified in 4.7.13, the jumper cable assembly shall withstand an axial force specified in the applicable specification sheets (see 3.1). It shall then meet the assembly resistance requirements of 3.5.6.3.

3.5.13 Flexibility. When tested as specified in 4.7.14, the jumper cable assembly shall meet the tensile strength requirement of 3.5.12 without breaking or stranding, and shall meet the assembly resistance requirements of 3.5.6.3.

3.5.14 Crush. When tested as specified in 4.7.15, there shall be no evidence of mechanical damage, and the plugs shall meet the insertion and withdrawal force requirements of 3.5.1 and the contact resistance requirements of 3.5.6.1.

3.5.15 Humidity. When tested as specified in 4.7.16, there shall be no evidence of corrosion, and the following requirements shall be met, as applicable:

- a. Clamp release force (see 3.5.8.1).
- b. Contact resistance (see 3.5.6.1).
- c. Clamp connector resistance (see 3.5.6.2).
- d. Assembly resistance (see 3.5.6.3).
- e. Insertion and withdrawal force (see 3.5.1).

3.5.16 Temperature cycling. When tested as specified in 4.7.17, there shall be no evidence of physical damage, and the following requirements shall be met, as applicable:

- a. Clamp release force (see 3.5.8.1).
- b. Contact resistance (see 3.5.6.1).
- c. Clamp connector resistance (see 3.5.6.2).
- d. Assembly resistance (see 3.5.6.3).
- e. Insertion and withdrawal force (see 3.5.1).

3.5.17 Drop. When tested as specified in 4.7.18, the clamp connector shall function properly, and the following requirements shall be met:

- a. Clamp release force (see 3.5.8.1).
- b. Clamp connector resistance (see 3.5.6.2).

3.5.18 Altitude-low temperature. When tested as specified in 4.7.19 there shall be no evidence of physical damage, and the receptacles shall meet the insertion and withdrawal test of 3.5.1, the contact resistance test of 3.5.6.1, and the assembly resistance test of 3.5.6.3, as applicable.

3.5.19 Dust. When tested as specified in 4.7.20, the following requirements shall be met, as applicable:

- a. Insertion and withdrawal force (see 3.5.1).
- b. Contact resistance (see 3.5.6.1).
- c. Clamp connector resistance (see 3.5.6.2).
- d. Assembly resistance (see 3.5.6.3).

3.5.20 Fluid immersion. When tested as specified in 4.7.21, there shall be no damage to the O-ring nor shall any of the test fluid escape through to the back of the test apparatus.

3.5.21 Ozone exposure. When tested as specified in 4.7.22, there shall be no evidence of damage due to ozone exposure, and the following requirements shall be met, as applicable:

- a. Contact resistance (see 3.5.6.1).
- b. Tensile strength (see 3.5.12).
- c. Assembly resistance (see 3.5.6.3).
- d. Insertion and withdrawal force (see 3.5.1).

3.5.22 Salt spray. When tested as specified in 4.7.23, there shall be no evidence of corrosion, and the following requirements shall be met, as applicable:

- a. Clamp release force (see 3.5.8.1).
- b. Contact resistance (see 3.5.6.1).
- c. Clamp connector resistance (see 3.5.6.2).
- d. Assembly resistance (see 3.5.6.3).
- e. Insertion and withdrawal force (see 3.5.1).

3.5.23 Lightning current. When tested as specified in 4.7.24, assemblies shall be capable of carrying the current applied for the amount of time specified.

3.6 Marking. Marking shall be in accordance with MIL-STD-1285, with the part number marked on the cable or jumper assembly, by means of an identification band, or on the plug, receptacle, or clamp connector for individual parts.

3.7 Aircraft grounding identification. Grounding receptacles installed in aircraft bodies shall be identified either by decalcomania or painted ground symbol. Decalcomania shall be as specified on the individual specification sheets. Dimensions and colors of the painted symbol shall be as specified (see 3.1).

3.8 Workmanship. The connector and assemblies shall be constructed and finished in a workmanlike manner. Particular attention shall be given to neatness and thoroughness of welding, riveting, brazing, plating, assembly, and freedom of parts from burrs and sharp edges.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 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 contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662.

4.1.2 Test connectors. When required, connectors shall be mated with a connector specified as a mating connector per this specification. Approval of the test connector for use in the test shall not constitute acceptance of the part number represented by the test connector. In the event of failure of the test connector, a new one shall be substituted and the test continued. Rejection of a test connector will not constitute a failure of the connector under test.

4.1.3 Test apparatus. When required, the receptacle shall be installed in a test apparatus in which the aluminum panel thickness is .030 inch \pm .005 (.76 \pm .13 mm), and the apparatus in which the receptacle is inserted shall have a minimum area of 4 inches long by 4 inches wide. Test points are between the back end of the plug and a point on the panel 2 inches \pm .01 (30.80 \pm .25 mm) from the axis of the receptacle.

4.2 Classification of inspections. The inspections specified herein are classified as follows:

- a. Materials inspection (see 4.3).
- b. Qualification inspection (see 4.5).
- c. Quality conformance inspection (see 4.6).

4.3 Materials inspection. Materials inspection shall consist of certification supported by verifying data that the materials meet the requirements for fabricating the connectors and assemblies (see 3.3) and as specified (see 3.1).

4.4 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the ambient test conditions as specified in MIL-STD-1344.

4.5 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 3.2 and 6.3) on sample units produced with equipment and procedures normally used in production.

4.5.1 Sample size. Sample size shall be as specified herein.

4.5.1.1 Connectors and jumper cable assemblies. Sample sizes for connectors and jumper cable assemblies shall be 12 specimens (group I), which shall be subdivided into equal groups (groups II, III and IV) for testing purposes (see table II).

4.5.1.2 Grounding assemblies. Sample size shall consist of 10 specimens, with 12 tested as individual parts (plugs and grounding clamp connectors only), and 6 tested as a full assembly as specified in group III of table III.

4.5.2 Inspection routine. The samples shall be subjected to the tests specified in tables II and III in order shown. In the event that a company testing for qualification on grounding assemblies is qualified for plugs, clamp connectors, or both, testing on that qualified part may be waived. Likewise, qualification of grounding assemblies will extend qualification to plugs, clamp connectors, or both, provided that the company involved manufactures the specific part in question.

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

4.5.4 Retention of qualification. To retain qualification, the contractor shall forward a report at 12-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of:

- a. A summary of the results of the tests performed for inspection of product for delivery group A, indicating as a minimum the number of lots that have passed and the number that have failed. The results of tests of all reworked lots shall be identified and accounted for.
- b. The results of tests performed for periodic inspection group B, including the number and mode of failures. The test report shall include results of all periodic inspection tests performed and completed during the 24-month period. If the test results indicate nonconformance to specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.

Failure to submit the report within 30 days after the end of each 12-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 12-month period that the inspection data indicates failure of the qualified product to meet the requirements of this specification.

In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during 2 consecutive reporting periods, there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit a representative product of each style, to testing in accordance with the qualification inspection requirements.

4.6 Quality conformance inspection.

4.6.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A inspection.

TABLE II. Qualification inspection, connectors and jumper assemblies.

Inspection	Plug	Receptacle	Clamp connector	Jumper assembly	Requirement paragraph	Test paragraph
<u>Group I (12 specimens)</u>						
Visual and mechanical inspection- - - - -	X	X	X	X	3.1,3.3,3.4,3.6, 3.8	4.7.1
Insertion and withdrawal force- - - -	X	X			3.5.1	4.7.2
Handgrip force- - - -			X		3.5.2	4.7.3
Sideloadng - - - - -		X			3.5.3	4.7.4
Torque- - - - -		X			3.5.4	4.7.5
Engagement- - - - -	X	X			3.5.5	4.7.6
Contact resistance- -	X	X			3.5.6.1	4.7.7.1
Clamp connector resistance- - - -			X		3.5.6.2	4.7.7.2
Assembly resistance -				X	3.5.6.3	4.7.7.3
<u>Group II (4 specimens)</u>						
Cable attachment- - -			X		3.5.7	4.7.8
Clamp release force (initial) - - - - -			X		3.5.8.1	4.7.9
Clamp release force (after conditioning)			X		3.5.8.2	4.7.9
Clamping life - - - -			X		3.5.9	4.7.10
Vibration - - - - -		X			3.5.10	4.7.11
Durability - - - - -	X	X			3.5.11	4.7.12
Tensile strength- - -				X	3.5.12	4.7.13
Flexibility - - - - -				X	3.5.13	4.7.14
Crush - - - - -	X				3.5.14	4.7.15
<u>Group III (4 specimens)</u>						
Humidity - - - - -	X	X	X	X	3.5.15	4.7.16
Temperature cycling -	X	X	X	X	3.5.16	4.7.17
Drop - - - - -			X		3.5.17	4.7.18
Altitude-low temperature		X <u>1/</u>		X	3.5.18	4.7.19
Dust - - - - -	X	X	X	X	3.5.19	4.7.20
Fluid immersion - - -		X <u>1/</u>			3.5.20	4.7.21
Ozone exposure- - - -		X		X	3.5.21	4.7.22
Salt spray- - - - -	X	X	X	X	3.5.22	4.7.23
<u>Group IV (4 specimens)</u>						
Lightning current				X <u>1/</u>	3.5.23	4.7.24

X - Test is applicable.

1/ - Unless otherwise specified.

4.6.1.1 Inspection lot. An inspection lot shall consist of all specimens of the same configuration produced under essentially the same conditions, and offered for inspection at one time.

4.6.1.2 Group A inspection. Group A inspection shall consist of the inspections specified under group I in table II. Group A inspection for grounding assemblies shall consist of the inspections shown under groups I and II in table III as applicable, plus the assembly resistance test.

4.6.1.2.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality levels (AQL) shall be 1.0 and 2.5 (percent defective) for major or minor defects, respectively. Major and minor defects shall be as defined in MIL-STD-105.

4.6.2 Periodic inspection. Periodic inspection shall consist of group B inspection. Except where the results of this inspection show noncompliance with the applicable requirements (see 4.6.4), delivery of products which have passed group A shall not be delayed pending the results of the periodic inspections.

4.6.2.1 Group B inspection. Group B inspection shall consist of the inspections shown in table II and III, as applicable, in the order specified. Group B inspection shall be made on sample units selected from lots which have passed the group A inspection.

4.6.2.1.1 Sampling plan. Sample specimens from those covered by a single specification sheet shall be selected at random from items produced every 24 months. Number of samples shall be in accordance with 4.5.1 herein.

TABLE III. Qualification inspection, grounding assemblies.

Inspection	Requirement paragraph	Method paragraph
Group I ^{1/} Plugs (see table II) - - - - -	3.1	---
Group II ^{2/} Grounding clamp connector (see table II) - - - - -	3.1	---
<u>Group III (6 specimens)</u>		
Assembly resistance - - - - -	3.5.6.3	4.7.7.3
Humidity - - - - -	3.5.15	4.7.16
Temperature cycling- - - - -	3.5.16	4.7.17
Dust - - - - -	3.5.19	4.7.20
Salt spray - - - - -	3.5.22	4.7.23

^{1/} Type I and II grounding assemblies only.

^{2/} Type I and III grounding assemblies only.

4.6.2.1.2 Failures. If any sample units fail to pass group B inspection, the entire sample shall be considered to have failed.

4.6.2.1.3 Disposition of sample units. Sample units which have been subjected to group B inspection shall not be delivered on the contract.

4.6.3 Noncompliance. If a sample fails to pass group B inspection, the manufacturer shall notify the qualifying activity and the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions 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 B 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). Group A inspection may be reinstated; however, final acceptance and shipment shall be withheld until the group B inspection has shown that the 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.

4.6.4 Inspection of packaging. The sampling and inspection of the preservation, packing, and container marking shall be in accordance with the requirements of MIL-C-55330.

4.7 Methods of inspection.

4.7.1 Visual and mechanical inspection. Specimens shall be inspected to verify that the dimensions, materials, design, construction, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3, 3.4, 3.6, and 3.8).

4.7.2 Insertion and withdrawal force (see 3.5.1). The connectors shall be tested in accordance with method 2013 of MIL-STD-1344. The following conditions shall apply:

- a. Insertion force for receptacles shall be tested with a test plug at maximum pin diameter (see 4.1.2).
- b. Withdrawal force for receptacles shall be tested first with a test plug at maximum pin diameter, then with a test plug at minimum pin diameter.
- c. Withdrawal speed shall be constant at 10 ± 4 inches (254 ± 102 mm) per minute.
- d. Repeat the test using the ISO 46 and NATO STANAG 3632 plugs at maximum pin diameter. The forces may deviate from the requirement by a factor of 2.

4.7.3 Handgrip force (see 3.5.2). The grounding clamp connector shall be connected to and removed from a $.750 \pm .010$ inch ($19.05 \pm .25$ mm) diameter rod, with the force required to open the clamp measured across the handles at a point $.500 \pm .125$ inch (12.7 ± 3.2 mm) from the end.

4.7.4 Sideload (see 3.5.3). The receptacle shall be mated with a test plug, on which a force of 20 pounds shall be applied one inch from the face of the receptacle and in two directions mutually perpendicular to the axis of insertion.

4.7.5 Torque (see 3.5.4). The mounting nut on the receptacle shall be tightened with a torque of 20 inch pounds until the nut rotation has stopped. The nut shall then be loosened and the threads inspected.

4.7.6 Engagement (plugs and receptacles (see 3.5.5). The connector shall be mated with a test connector and a torque of one inch-pound shall be applied to the base of the plug in attempt to rotate the plug in the receptacle. The plug shall then be tested for free movement in the directions of insertion and withdrawal.

4.7.7 Resistance (see 3.5.6). The test shall be in accordance with method 3004 of MIL-STD-1344. Test current shall be 10 ± 1 amperes and the duration of current flow shall be 10 seconds minimum. Inability of the specimen to withstand this current shall constitute a failure. Voltmeter probes shall be placed at both ends of the specimen where current is applied.

4.7.7.1 Contact resistance (see 3.5.6.1). Test connectors and test apparatus shall be used (see 4.1.2 and 4.1.3). Test points are between the back end of the plug and at a point on the panel $2 \pm .01$ inches ($51.8 \pm .3$ mm) from the axis of the receptacle. This test shall be repeated using the ISO 46 and NATO STANAG 3632 plugs at minimum pin diameters.

4.7.7.2 Clamp connector resistance (see 3.5.6.2). The grounding clamp connector shall be attached to a steel rod of .750 \pm .010 inch (19.05 \pm .25 mm) diameter. A test wire conforming to MIL-W-83420 shall be attached to the handle. Test current shall be applied from the steel rod to the wire with each contact point within .500 inch (12.7 mm) from the clamp connector.

4.7.7.3 Assembly resistance (see 3.5.6.3). Test current shall be applied at both ends of the assembly. Assemblies with plugs shall be mated and the current applied on the test apparatus, while assemblies with grounding clamp connectors shall have clamp connectors attached to steel rods of .750 \pm .010 inch (19.05 \pm .25 mm) diameter and current shall be applied .500 \pm .125 inch (12.7 \pm 3.2 mm) from the jaw of the clamp.

4.7.8 Cable attachment (see 3.5.7). The clamp connector cable attachment provisions shall be tested by applying a tensile force between the clamp connector and an attached cable using a standard tensile testing machine. The test shall be made with a head speed of one inch per minute. With the same cable attached the grounding clamp connector shall pass the clamp connector resistance requirement of 3.5.6.2.

4.7.9 Clamp release force (clamp connectors only) (see 3.5.8). Using a test setup as shown on figure 1, the force required to free the rod in the grounding clamp connector shall be determined.

4.7.10 Clamping life (see 3.5.9). With an 18-inch length of cable attached to one handle of the grounding clamp connector by normal attachment provisions, the clamp connector shall be clamped onto a 0.750 inch (19.05 mm) nominal diameter drill rod which is securely held in a horizontal position. Sufficient force shall be applied to the cable end to disengage the clamp connector from the rod permitting the jaws to snap shut. This constitutes one cycle. The connector shall be subjected to 5,000 such cycles. The grounding clamp connector shall then successfully pass the clamp release force requirement of 3.5.8 and the clamp connector resistance requirement of 3.5.6.2.

4.7.11 Vibration (see 3.5.10). The test shall be performed in accordance with method 2005 of MIL-STD-1344. The following conditions shall apply:

- a. Test condition IV.
- b. Test apparatus shall be used for receptacles (see 4.1.3).
- c. After completion of the test, the insertion and withdrawal test of 4.7.2 and the contact resistance test of 4.7.7.1 shall be performed.

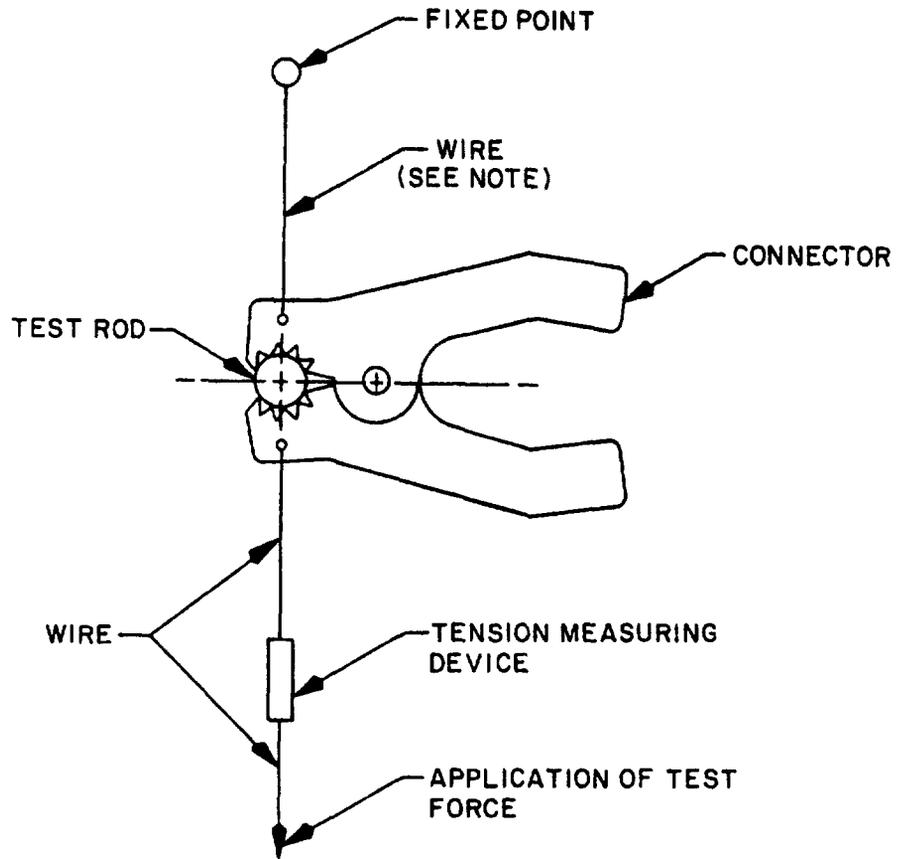
4.7.12 Durability (see 3.5.11). The test shall be performed in accordance with method 2016 of MIL-STD-1344. The following conditions shall apply:

- a. Test preparation: Connectors shall be mated.
- b. 5,000 cycles shall be completed.
- c. After completion of the test, the insertion and withdrawal force test of 4.7.2 and the contact resistance test of 4.7.7.1 shall be performed.

4.7.13 Tensile strength (see 3.5.12). The test shall be performed in accordance with method 211 of MIL-STD-202. The following conditions shall apply:

- a. Test condition: A.
- b. Test load: As specified in the individual specification sheets.

4.7.14 Flexibility (see 3.5.13). One end of the jumper cable assembly shall be held stationary under a tension of 2 \pm .1 pound while the other end of the jumper is rotated in a circle which forms the base of a cone having an included angle of 22° \pm 2°. A cycle shall consist of one complete revolution; 300,000 cycles shall be performed. After completion of the test, the tensile strength test of 4.7.13 and the assembly resistance test of 4.7.7.3 shall be performed.



NOTE: Wires shall be attached to roll pins if used.

FIGURE 1. Clamp release force test.

4.7.15 Crush (see 3.5.14). The test shall be performed in accordance with method 2008 of MIL-STD-1344. The following conditions shall apply:

- a. One load shall be applied to the plug itself in two mutually perpendicular axes from the insertion axis.
- b. After completion of the test, the insertion and withdrawal force test of 4.7.2 and the contact resistance test of 4.7.7.1 shall be performed.

4.7.16 Humidity (see 3.5.15). The test shall be performed in accordance with method 1002 of MIL-STD-1344. The following conditions shall apply:

- a. Test condition: Type II up to but excluding step 7a.
- b. Test preparation: Connectors shall be unmated.
- c. Test apparatus shall be used for receptacles (see 4.1.3).
- d. After completion of the test, the clamp release force test of 4.7.9, the contact resistance test of 4.7.7.1, the clamp resistance test of 4.7.7.2, the insertion and withdrawal force test of 4.7.2, and the assembly resistance test of 4.7.7.3 shall be performed, as applicable.

4.7.17 Temperature cycling (see 3.5.16). The test shall be performed in accordance with method 1003 of MIL-STD-1344. The following conditions shall apply:

- a. Test condition. A-3.
- b. Test preparation: Connectors shall be unmated.
- c. Test apparatus shall be used for receptacles (see 4.1.3).
- d. After completion of the test, the clamp release force test of 4.7.9, the contact resistance test of 4.7.7.1, the clamp connector resistance test of 4.7.7.2, the insertion and withdrawal force test of 4.7.2, and the assembly resistance test of 4.7.7.3 shall be performed, as applicable.

4.7.18 Drop (see 3.5.17). The grounding clamp connector shall be dropped onto solid concrete from a height of 10 feet with a random free fall. The clamp connector shall be dropped 25 times. After completion of the test, the clamp release force test of 4.7.9 and the clamp connector resistance test of 4.7.7.2 shall be performed, as applicable.

4.7.19 Altitude-low temperature (see 3.5.18). The test shall be performed in accordance with method 1011 of MIL-STD-1344. The following conditions shall apply:

- a. Test apparatus shall be used for receptacles (see 4.1.3).
- b. After completion of the test, the contact resistance test of 4.7.7.1, the insertion and withdrawal force test of 4.7.2, and the assembly resistance test of 4.7.7.3 shall be performed, as applicable.

4.7.20 Dust (see 3.5.19). The test shall be performed in accordance with method 110 of MIL-STD-202. The following conditions shall apply:

- a. Test apparatus shall be used for receptacles (see 4.1.3).
- b. Test preparation: Connectors shall be unmated.
- c. After completion of the test, the clamp release force test of 4.7.9, the contact resistance test of 4.7.7.1, the clamp connector resistance test of 4.7.7.2, the insertion and withdrawal force test of 4.7.2, and the assembly resistance test of 4.7.7.3 shall be performed, as applicable.

4.7.21 Fluid immersion (see 3.5.20). The test shall be performed in accordance with method 1016 of MIL-STD-1344. The following conditions shall apply:

- a. Test apparatus shall be used for receptacles (See 4.1.3).
- b. Test preparation: Receptacles shall be unmated.

4.7.22 Ozone exposure (see 3.5.21). The test shall be performed in accordance with method 1007 of MIL-STD-1344. The following conditions shall apply:

- a. Test apparatus shall be used for receptacles (see 4.1.3).
- b. Test preparation: Receptacles shall be unmated.
- c. After completion of the test, the tensile strength test of 4.7.13, the contact resistance test of 4.7.7.1, the insertion and withdrawal test of 4.7.2, and the assembly resistance test of 4.7.7.3 shall be performed, as applicable.

4.7.23 Salt spray (see 3.5.22). The test shall be performed in accordance with method 1001 of MIL-STD-1344. The following conditions shall apply:

- a. Test condition: C.
- b. Test preparation: Connectors shall be unmated.
- c. Test apparatus shall be used for receptacles (see 4.1.3).
- d. After completion of the test, the clamp release force test of 4.7.9, the contact resistance test of 4.7.7.1, the clamp resistance test of 4.7.7.2, the insertion and withdrawal test of 4.7.2, and the assembly resistance test of 4.7.7.3 shall be performed, as applicable.

4.7.24 Lightning current (see 3.5.23). One lightning charge shall be applied across the specimen. The following conditions shall apply:

- a. Current shall be determined by taking the ratio of the voltage applied across the specimen to minimum measured resistance, or with a current measuring device.
- b. Peak current shall be 100,000 amperes.
- c. The rate of rise of current shall be 20,000 amperes per microsecond.
- d. Duration of current at 50,000 amperes and above shall be not less than 20 microseconds, and at or above 90,000 amperes shall be from 5 to 10 microseconds.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-C-55330.

6. NOTES

6.1 Intended use. Connectors and assemblies are intended for use in grounding aircraft, maintenance trucks, fuel trucks, and any other apparatus where there exists the possibility of an electrical potential difference between aircraft and other apparatus during the process of loading or unloading volatile materials. In addition, these components are intended for use in grounding out lightning strikes on aircraft or apparatus in contact with the aircraft.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Title, number, and date of the applicable specification sheet, and the complete part number (see 3.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable qualified products list, 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 for the products covered by this specification. The activity responsible for the qualified products list is ASD/ENES, WPAFB, OH 45433; however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center (DESC-E), Engineering Standardization Directorate, Dayton, OH 45444.

6.4 Definitions.

6.4.1 Grounding assembly. A grounding assembly is that combination of grounding plug, cable, terminal, or grounding clamp connector used in connecting an aircraft and associated vehicle to ground or to each other.

6.4.2 Grounding clamp connector. A grounding clamp connector is a spring loaded device designed to be connected to a direct or indirect source of ground potential by clamping.

6.4.3 Jumper assembly. A jumper assembly is that combination of grounding wire and terminals used for the purpose of connecting different parts of aircraft for the purpose of providing a continuous path of grounding conduction.

6.4.4 Grounding plug. A grounding plug is that component of a grounding assembly which mates with a grounding receptacle to provide grounding from aircraft to grounding assembly.

6.4.5 Grounding receptacle. A grounding receptacle is that component, mateable with the grounding plug, which is installed on aircraft or other systems requiring grounding. It may be a one piece part, or it may consist of a receptacle housing which is installed in the body itself and contains internal threads, and the insert, which mates with the grounding plug and has external threads compatible with the threads on the housing.

6.4.6 Decalcomania. The decalcomania is the sign applied at the grounding receptacle to indicate where the grounding plug shall be inserted to accomplish the grounding process.

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

Certain provisions of this specification are the subject of International Standardization Agreements ASCC AIR STD 12/25, NATO STANAG 3632, and ISO 46. When revision or cancellation of this specification is proposed which will affect or violate the international agreements concerned, the preparing activity will take appropriate reconciliation action through international standardization channels, including departmental standardization offices, if required.

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Navy - AS
Air Force - 11

Preparing activity:
Air Force - 11

(Project 5935-3142)

Review activities:

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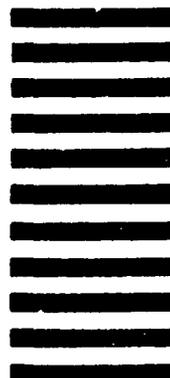
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5 PROBLEM AREAS

a. Paragraph Number and Wording

b. Recommended Wording

c. Reason/Rationale for Recommendation

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7a. NAME OF SUBMITTER (Last, First, MI) - Optional

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