AEROSPACE STANDARD

AS81824	REV. C

Issued 1998-08
Reaffirmed 2009-04
Revised 2013-11

Superseding AS81824B

(R) Splice, Electric, Crimp, Copper, Environment Resistant

FSC 5940

RATIONALE

Full revision required to incorporate qualifying activity requirements, update references, address government related terminology, and technical issues as needed.

1. SCOPE

The AS81824 specification covers environment resistant, permanent crimp type, splices having heat shrinkable insulating sleeve and meltable environmental seals or heatless sealing sleeves. The splices may be used with tin, nickel, and silver plated conductors in applications where the total temperature of the splice application does not exceed 200 °C or as specified in the detail specification.

1.1 The splice is designed to accommodate single and multiple wire combinations in one or more sealant openings. See detailed specifications for guidance.

2. REFERENCES

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of the other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS-QQ-N-290 Nickel Plating (Electrodeposited)

AMS1424 Deicing/Anti-Icing Fluid, Aircraft, SAE Type I

AMS-DTL-23053 Insulation Sleeving, Electrical, Heat Shrinkable, General Specification For

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http://www.sae.org/technical/standards/AS81824C

AIR1351	Manufacturers' Identification of Aerospace Electrical and Electronic Wiring Devices and Accessories
AS7928	Terminals, Lug: Splices, Conductor: Crimp Style, Copper, General Specification For
AS22759	Wire, Electrical, Fluoropolymer-Insulated, Copper or Copper Alloy
AS22759/11	Wire, Electrical, Fluoropolymer-Insulated, Extruded TFE, Silver-Coated Copper Conductor, 600 Volt
AS50861	Wire, Electric, Polyvinyl Chloride Insulated, Copper or Copper Alloy
AS81044	Wire, Electrical, Crosslinked Polyalkene, Crosslinked Alkane-Imide Polymer, or Polyarlyene Insulated, Copper or Copper Alloy
*AS81824/1	Splice, Electric, Permanent, Crimp Style Copper, Insulated, Environment Resistant, Class 1
*AS81824/3	Splice, Coaxial Cable, Electric, Permanent, Crimp Style Copper, Insulated, Environment Resistant, Class 1
*AS81824/4	Splices, Electric, Permanent, Crimp Style, Copper, Insulated, Environment Resistant, Splice, Shield, Solder Type, Insulated, Class 1
*AS81824/5	Splices, Electric, Permanent, Crimp Style, Copper, Insulated, Environment Resistant, Kit, Shielded Cable, Class 1
* AS81824/6	Splice, Electric, Permanent, Crimp, Nickel Plated Insulated Wires, Environmental Class 1, 175 °C
* AS81824/7	Splice, In-Line, Electric, Crimp, SN/CU, Environmental, Heat-Shrinkable Sleeve (150 °C), 1 x 3 Sealant Opening
* AS81824/8	Splice, In-Line, Electric, Crimp, NI/CU, Environmental, Heat-Shrinkable Sleeve (175 °C), 1 x 3 Sealant Opening
* AS81824/9	Splice, In-Line, Electric, Crimp, SN/CU, Environmental, Heat-Shrinkable Sleeve (150 °C), 3 x 3 Sealant Opening
* AS81824/10	Splice, In-Line, Electric, Crimp, NI/CU, Environmental, Heat-Shrinkable Sleeve (175 °C), 3 x 3 Sealant Opening
*AS81824/11	Splice, Electric, Permanent, Crimp Style, NI/CU, Insulated, Environment Resistant, Class 1, 200 °C Max, 1 x 1 Sealant Opening
*AS81824/12	Splice, Electric, Permanent, Crimp Style, Tin-Coated Copper, Insulated, Environment Resistant, Class 1, 150 °C, Heatless Sealing
*AS81824/13	Splice, Stub, Electric, Permanent, Crimp Style, Nickel/Copper, Insulated, Environment Resistant, 175 °C Max

*AS81824 detail specifications

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2.2 ASQ Publications

Available from American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203, Tel: 800-248-1946 (United States or Canada)) or +1-414-272-8575 (International), www.asq.org.

ANSI/ASQC Z1.4 SAMPLING PROCEDURES AND TABLES FOR INSPECTION BY ATTRIBUTES

2.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B1	Wire, Copper, Hard-Drawn
ASTM B75/B75M	Tube, Seamless Copper
ASTM B152/B152M	Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B272	Copper Flat Products with Finished (Rolled Or Drawn) Edges (Flat Wire and Strip)
ASTM B280	Tube, Copper, Seamless, for Air Conditioning and Refrigeration Field Service
ASTM B339	Pig Tin
ASTM B545	Tin, Electrodeposited Coatings of
ASTM D1974/D1974M	Fiberboard Boxes, Methods of Closing, Sealing, and Reinforcing, Standard Practice for
ASTM D5486/D5486M	Standard Specification For Pressure-Sensitive Tape For Packaging, Box Closure, And Sealin
ASTM D2671	Standard Test Methods for Heat-Shrinkable Tubing for Electrical use
ASTM D5118/D5118M	Standard Practice for Fabrication of Fiberboard Shipping Boxes

2.4 NCSL Publications

NCSL International, 2995 Wilderness Place, Suite 107, Boulder, CO 80301-5404, Tel: 303-440-3339, www.ncsli.org.

NCSL Z540-3 Requirements For The Calibration Of Measuring And Test Equipment

2.5 U.S. Government Publications

Available from DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6396, http://quicksearch.dla.mil/.

SD-6	Provisions Governing Qualification
UU-B-36	Bags, Paper, (Grocers)
MIL-STD-129	Miltary Marking for Shipment and Storage
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
P-D-410	Dishwashing Compound, Hand (Synthetic Detergent, Solid and Liquid Form)
PPP-B-566	Boxes, Folding, Paperboard
PPP-B-676	Boxes, Set-Up

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MIL-STD-2073-1 Military Packaging, Standard Practice for

A-A-3174 Plastic Sheet, Polyolefin

MIL-PRF-5606 Hydraulic Fluid, Petroleum Base, Aircraft, Missile and Ordnance

MIL-DTL-5624 Turbine Fuel, Aviation, Grades JP-4 and JP-5

MIL-PRF-7808 Lubricating Oil, Aircraft Turbine Engine Synthetic Base

MIL-PRF-22191 Barrier Materials, Transparent, Flexible, Heat-Sealable

MIL-DTL-22520 Crimping Tools, Terminal, Hand, Wire Termination General Specification for

MIL-PRF-23699 Lubricating Oil, Aircraft Turbine Engines, Synthetic Base, NATO Code Numbe 0-156

MIL-DTL-81381 Wire, Electric, Polyimide-Insulated, Copper or Copper Alloy

MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Type, JP-8 (NATO F-34) and JP-8+100 (NATO F-37)

MIL-PRF-87937 Cleaning Compound, Aerospace Equipment

3. REQUIREMENTS

3.1 Detail Specification

The product requirements shall be as specified herein and in accordance with the applicable detail specification. In the event of any conflict between the requirements of this specification and the detail specification, the latter shall govern.

3.2 Qualification

A qualified component shall be a product that has been tested and has passed the qualification tests specified herein, and has been listed on or approved for listing on the applicable Qualified Products List (see Section 4 and 6.3).

3.3 Materials

The materials used shall be specified herein:

3.3.1 Metals

The metal crimp splice shall be fabricated from copper conforming to ASTM B280, ASTM B75/B75M, ASTM B272, ASTM B152/B152M, or ASTM B1 or as specified in the detail specification.

3.3.2 Plating

The metal crimp splice shall be plated with tin or nickel over its entire surface in accordance with ASTM B545, ASTM B339, or AMS-QQ-N-290 respectively. Mercury shall not be used in the fabrication of the metal crimp splice.

3.3.3 Sealing Sleeve

3.3.3.1 Insulation Material

The insulation sleeve shall be as specified by the detail specification and be a translucent, heat shrinkable, cross-linked thermoplastic in accordance with applicable AMS-DTL-23053 detail specification, except when heatless sealing method is used (see AS81824/12).

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3.3.3.2 Sealing Material

Unless otherwise specified in detailed specification, the sealing material shall be a thermally stabilized thermoplastic, homogeneous and essentially free from flaws, defects, pinholes, seams, cracks, and inclusions. The material shall have a melt viscosity suitable to meet the performance requirements when using an air convection heat source.

3.3.3.3 Insulation and sealing materials may vary as defined in the detailed specification.

3.4 Design and Construction

Unless otherwise specified (see AS81824/12), the splice assembly shall consist of a sealing sleeve and a metal crimp splice. The sealing sleeve shall be heat shrinkable and shall contain the insulation sleeve and the sealing material. The splice shall conform in all respects to the design, dimensions, and construction specified herein and on the applicable detail specification. Each splice size shall be designed for attachment to the wire size range specified on the applicable detail specification by having the metal crimp splice reshaped around the conductor or conductors using a MIL-DTL-22520 tool and the sealing sleeve recovered over the spliced assembly with a manufacturer's recommended heating tool - convection air, infrared, or equivalent. The metal crimp barrel and the AS81824/12 assembled splice shall be capable of being crimped on a installed wire mounted in any direction and the metal crimp barrel shall exhibit no evidence of fracturing, spalling, or protruding sharp edges as a result of the reshaping operation.

3.4.1 Wire Acceptance

Each size splice shall be designed for attachment to one or multiple conductor diameters specified on the applicable detail specification. The wire(s) insertion shall be facilitated by bell mouth or chamfer on the metal splice barrel.

3.4.2 Insulation

The sealing sleeve shall exhibit no evidence of splitting as a result of the heating or sleeve crimping operation.

3.5 Performance

The splice shall conform to the following requirements:

3.5.1 Sleeve and Adhesive Materials

3.5.1.1 Dimensions (see 4.7.1)

The sealing sleeve component of the splice assembly shall conform to the dimensions of the applicable detail specification.

3.5.1.2 Copper Mirror Corrosion (see 4.8.9)

Unless otherwise specified in detail specification, the sealing sleeve component shall show no corrosion on the copper mirror.

3.5.1.3 Fungus Resistance (see 4.8.10)

Unless otherwise specified in the detail specification, the sleeving component shall be fungus resistant in accordance with AMS-DTL-23053.

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3.5.1.4 Sleeve without Adhesive Unrestrictive Recovery (see 4.7.2)

The sleeve shall be in accordance with the unsupported sleeve or manual supported requirement.

a. Unsupported sleeve requirement: The maximum ID dimension of the sleeving shall be considered acceptable when the wall of the sleeving is expanded by the insertion of the gage rod, when there is no visible air space between the end of the sleeving and the rod, or when the gage rod cannot be inserted in the sleeving.

b. Manual supported sleeve requirement: The maximum ID dimension of the sleeving shall be considered acceptable only if the sleeving is snug on the mandrel and there is no air space between the mandrel and the sleeving.

3.5.1.5 Sleeve Longitudinal Change (see 4.7.3)

The longitudinal change shall be within +5% and -15% after unrestricted recovery.

3.5.2 Splice Assemblies

The splice assemblies shall conform to the following requirements when attached to each of the specified wire size combinations with the applicable tooling specified (see 3.4).

3.5.2.1 Voltage Drop (see 4.8.1)

a. Single wire splices (the same wire size): The millivolt drop across the splice shall not exceed the millivolt drop of an equivalent length of wire by more than the value specified in Table 1.

b. Multiple wire splices (various wire sizes): The millivolt drop across the splice shall not exceed the millivolt drop of the average reference voltage when tested in accordance with the Multiple Wire Voltage Drop Test (see 4.8.1b).

3.5.2.2 Current Cycling (see 4.8.2)

a. Single wire splices (the same wire sizes): The voltage drop shall be as specified in 3.5.2.1a.

b. Multiple wire splices (various wire sizes): The voltage drop shall be as specified in 3.5.2.1b.

3.5.2.3 Insulation Resistance (see 4.8.3):

The insulation resistance shall be not less than 5000 megohms.

3.5.2.4 Dielectric withstanding Voltage (see 4.8.4)

The splice shall show no evidence of damage, arcing, or breakdown and the leakage current shall be less than 2 milliamperes.

3.5.2.5 Tensile Strength (see 4.8.5)

The smallest wire in a wired crimp joint shall not break or separate from the splice to which it is attached before the minimum tensile strength specified in Table 1 is reached.

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TABLE 1 - TEST REQUIREMENTS

Wire Size (nominal)	Test Current (amperes)	Tensile Strength Pounds (minimum)	Maximum Voltage Drop (mV) Millivolt Drop of Equivalent Length of Wire Plus Splice (see 4.8.1)	
			Initial	After Test
26	3	7	6	10
24	4.5	10	4	8
22	9	15	2	4
20	11	19	2	4
18	16	38	2	4
16	22	50	2	4
14	32	70	2	4
12	41	110	2	4

3.5.2.6 Environmental Conditioning (see 4.8.6)

Splice assemblies shall meet the applicable performance requirements listed, when tested in accordance with Tables 4 and 5. Discoloration of the sealing sleeve materials during these tests shall not be cause for rejection (see 4.8.6).

3.5.2.7 Flammability (see 4.8.7)

The splice shall be self-extinguishing within 5 seconds after removal from the flame (see 4.8.7).

3.5.2.8 Blocking (see 4.8.8)

The individual splices in the test bundle shall not stick together (see 4.8.8).

3.6 Identification of Product (see 4.7.1)

The splice shall be color coded in accordance with the applicable detail specification for identification purposes. Color coding shall be readily discernible though the insulation sleeve after installation. The crimp barrel shall be marked with the supplier symbol in accordance AIR1351.

3.7 Workmanship (see 4.7.1)

The metal crimp splice shall be free from blistering, pitting, or peeling of plating, cracks, and other defects which may affect serviceability. Slight burrs are permitted on machined stamped or cut surfaces. Integral inserts of the sealing sleeve, if used, shall be held within the sleeve with sufficient force to prevent dislodging during normal installation.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

Unless otherwise specified herein, in the contract or in the purchase order, the supplier is responsible for the performance of all contract inspection requirements. Except as otherwise specified herein, in the contract or in the purchase order, the supplier may use any facilities suitable for the performance of the inspection requirements. The Qualifying Activity has the right to perform any of the inspections set forth in the standard where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

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4.1.1 Responsibility for Compliance

All items must meet all technical requirements of the product standard. The inspection set forth in this standard shall become a part of the supplier's overall inspection system or quality program. The absence of any general or specific inspection requirements in the standard shall not relieve the supplier of the responsibility of assuring that all products comply with all requirements of the contract or purchase order. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the purchaser to acceptance of defective material.

4.1.2 Inspection Equipment and Facilities

Test and measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspections shall be established and maintained by the supplier. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with ANSI/NCSL Z540-3 or equivalent standards.

4.2 Classification of Inspection

The examination and testing of splices shall be classified as follows:

a. Component-materials inspection (see 4.3).

b. Qualification inspection (see 4.5).

c. Quality conformance inspection (see 4.6).

4.3 Component-Materials Inspection

Component-materials inspection shall consist of verification that the component materials listed in Table 2 used in fabricating the splices are in accordance with the applicable specification or requirements prior to such fabrication.

TABLE 2 - COMPONENT-MATERIALS INSPECTION

Component Material	Requirement Paragraph
Metals	3.3.1
Plating	3.3.2
Insulation materials	3.3.3.1
Sealing inserts	3.3.3.2

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4.4 Inspection Conditions

Unless otherwise specified herein, all inspections shall be made at ambient temperature, and humidity as specified in the general requirements of MIL-STD-202.

4.4.1 Assembly to Conductors (qualification specimens)

Unless otherwise specified in the detail specification, the splices shall be attached on wire, conforming to AS22759/11 or AS22759/12 by the testing activity using the specified tooling (see 3.4). For single wire splices, the specified number of sample units for testing shall be selected and divided between the minimum and the maximum wire size within the wire range listed on the applicable detail specification for the size splice to be qualified. These sizes will qualify all sizes specified for the splice by similarity (see 4.5.3). For multiple wire splices, all dash numbers for each multiple wire combination will be tested for initial qualification. Unless otherwise required by a specific test group (see Tables 3 and 4), the leads shall be at least 12 inches in length.

4.4.2 Temperature Stabilization

Voltage drop measurements shall be made after the temperature of the wire has stabilized. Temperature stabilization shall be determined by three consecutive readings within ±1 °C at intervals of 3 minutes each. All tests performed after exposure to high or low temperature shall be conducted after splices have been conditioned for at least 1 hour at the inspection conditions specified (see 4.4).

4.4.3 Water Bath

Unless otherwise specified in the applicable test method, a water bath containing 0.5% of an anionic wetting agent (P-D-410) and 5.0% sodium chloride shall be used whenever immersion is specified. Free ends of leads shall be a minimum of 4 inches from the top surface of water.

4.5 Qualification Inspection

Initial qualification inspection shall be in accordance with Table 3. Sequential testing is required for each group unless otherwise specified in the table. The qualifying activity shall perform or witness the particular tests as specified in Table 3 (see Groups I and V) and the supplier shall perform the remaining tests. All test laboratories require qualifying activity approval.

4.5.1 Initial Qualification Inspection Procedure

A request for qualification shall be made to the qualifying activity (see 6.3) prior to initiating testing. Testing cannot begin until the supplier has received an authorization letter. The supplier is recommended to provide the qualifying activity a test plan based on the authorization letter to ensure the supplier and qualifying activity maintain communication and document changes as needed. The qualifying activity shall not approve a component that does not meet the requirements specified herein. The qualifying activity has the authority to impose specific specification test requirements to resolve test failures/discrepancies and to waive testing to verify specific product manufacturing changes or qualifications by similarity. Any change in the supplier's process control inspections, quality conformance inspections, or manufacturing control drawings (editorial changes are acceptable) without the express approval of the qualifying activity may result in loss of qualification for that product.

4.5.2 Initial Qualification Samples

For each component tested the supplier shall use the same materials, manufacturing procedures, and methods of inspection as would be used to provide the component to a purchaser. Splices shall be assembled as specified in 4.4.1 for testing. All splice sizes (dash number) in each detail specification (see 3.1) for which qualification is sought shall be submitted for qualification testing except as noted for qualification by similarity (see 4.5.3).

a. For the qualifying activity tests, 20 unwired specimens (14 for testing and 6 spares) for each part number shall be separately packaged and forwarded to the address designated in the letter of authorization (see 6.3). Sufficient wire shall be provided to perform the designated tests. Each sample shall be identified by marking each package with the following information:

   Sample for qualification
   Specification AS81824
   Part number _____
   SPLICE, ELECTRIC, PERMANENT, CRIMP STYLE, COPPER, INSULATED, ENVIRONMENT RESISTANT
   Class _____
   Name of supplier
   Supplier's part number
   Submitted (date) under authorization (reference letter authorizing the inspection)

b. For the supplier tests, 24 specimens shall be tested in accordance with Table 3 for each part number.

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TABLE 3 - INITIAL QUALIFICATION INSPECTION

Examination or Test	Requirement Paragraph	Test Method Paragraph
Group I (10 uninstalled splices) 1/ 2/		
Material certification	3.3.1, 3.3.2, 3.3.3.1	4.3
Visual and dimensional examination	3.5.1	4.7.1
Identification of product	3.6	4.7.1
Workmanship	3.7	4.7.1
Group II (3 uninstalled sealing sleeves)		
Unrestricted Recovery	3.5.1.4	4.7.2
Longitudinal change	3.5.1.5	4.7.3
Group III (2 uninstalled sealing sleeve) 1/		
Copper mirror corrosion (1 specimen)	3.5.1.2	4.8.9
Fungus Resistance (1 specimen)	3.5.1.3	4.8.10
Group IV (4 splice assemblies)	3.5.2.1	4.8.1
Voltage Drop (initial) 4/	3.5.2.2	4.8.2
Current cycling	3.5.2.1	4.8.1
Voltage drop (after test)		
Group V (4 splice assemblies) 2/		
Environmental conditioning	3.5.2.6	4.8.6
Altitude immersion (3 cycles)	--	4.8.6.1
Insulation resistance	3.5.2.3	4.8.3
Immersion	--	4.8.6.2
Altitude immersion (1 cycle)	--	4.8.6.1
Insulation resistance	3.5.2.3	4.8.3
Temperature cycling	--	4.8.6.3
Altitude immersion (1 cycle)	--	4.8.6.1
Insulation resistance	3.5.2.3	4.8.3
Moisture resistance	--	4.8.6.4
Vibration 3/	--	4.8.6.6
Altitude immersion (1 cycle)	--	4.8.6.1
Insulation resistance	3.5.2.3	4.8.3
Heat aging	--	4.8.6.7
Altitude immersion (1 cycle)	--	4.8.6.1
Insulation resistance	3.5.2.3	4.8.3
Dielectric withstanding voltage	3.5.2.4	4.8.4
Voltage drop (after test)	3.5.2.1	4.8.1
Tensile strength	3.5.2.5	4.8.5
Group VI (2 splice assemblies)		
Flammability	3.5.2.7	4.8.7
Group VII (6 splice assemblies)		
Fluid immersion	--	4.8.6.5
Altitude immersion (1 cycle)	--	4.8.6.1
Insulation resistance	3.5.2.3	4.8.3
Dielectric withstanding voltage	3.5.2.4	4.8.4
Group VIII (7 splice assemblies)		
Blocking	3.5.2.8	4.8.8

1/ Group sequence not required (Two separate specimens).
2/ Qualifying Activity test groups
3/ Initial qualification only
4/ The wire sizes in each assembly shall be as specified for the current cycling test

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4.5.3 Initial Qualification by Similarity

The qualifying activity and the supplier may agree on other similarity test samples (see 4.4.1) and sequences not specified herein provided the products and test requirements associated with the agreed upon similarity are specified herein. In all cases Group I shall be performed on all sizes. The qualifying activity may accept data generated under oversight of a user activity, provided the requirements used to generate the data are equal to or greater than the requirements specified herein.

4.5.4 Initial Qualification Test Report

The qualifying activity shall provide the supplier with a data package of results for all tests performed in accordance with Table 3. The qualifying activity test methods and procedures shall be made available to the supplier upon request. The supplier shall provide a test report to the qualifying activity for the tests specified in Table 3. The test report shall be signed by the manufacturing authority responsible for ensuring compliance to the specification requirements. The supplier may combine the qualifying activity test data with the supplier's test data for one final qualification test report. The final test report and/or data package shall remain on file with the supplier for a minimum period of 6 years and be available to the qualifying activity upon request. The supplier qualification test report shall contain, as a minimum the following information.

a. The quantitative results for tests specified in Table 3 and the authorization letter.

b. For components qualified by similarity, a tabulated comparison between the dimensions specified herein and each manufacturer's controlled drawings.

c. Corrective Action Reports (as applicable).

4.5.5 Failures

Any failure of a specific type splice shall be cause for refusal to grant qualification to that part number and all part numbers submitted by similarity to that part number.

4.5.6 Retention of Qualification

Retention of qualification inspection shall occur every 36 months after the initial qualification date. The Qualifying Activity may shift the reporting date to accommodate testing schedules, but no later than 18 months from the retention of qualification due date.

a. No Production Certification: If no production of the qualified products has occurred for the entire reporting period, the Supplier may provide a certification to the Qualifying Activity that no changes in the product materials, design, manufacturing processes, or site of production have occurred since the initial Qualification Inspection (see 4.5). Certification for more than one reporting period shall not be permitted. The Supplier shall contact the Qualifying Activity to determine the conditions of the Certification. The Supplier may be required to submit the Certification on a specified form provided by the Qualifying Activity.

b. Component Production: If a qualified component has been produced in the retention period, the component or a component from that family qualified by similarity shall be submitted (see 4.5.3). Retention of Qualification consists of the tests specified in Table 4 and shall be performed or witnessed by the Qualifying Activity.

4.5.7 Retention of Qualification Test Samples

Retention of qualification test sample shall be the same as the initial qualification samples (4.5.2a).

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TABLE 4 - RETENTION OF QUALIFICATION REQUIREMENT

Examination or Test	Requirement Paragraph	Test Method Paragraph
Group I (10 uninstalled splices)		
Material certifications	3.3.1, 3.3.2, 3.3.3.1	4.3
Visual and dimensional examination	3.5.1	4.7.1
Identification of Product	3.6	4.7.1
Workmanship	3.7	
Group V (4 splice assemblies)		
Environmental conditioning	3.5.2.6	4.8.6
Altitude immersion (3 cycles)	--	4.8.6.1
Insulation resistance	3.5.2.3	4.8.3
Immersion	--	4.8.6.2
Altitude immersion (1 cycle)	--	4.8.6.1
Insulation resistance	3.5.2.3	4.8.3
Temperature cycling	--	4.8.6.3
Altitude immersion (1 cycle)	--	4.8.6.1
Insulation resistance	3.5.2.3	4.8.3
Moisture resistance	--	4.8.6.4
Altitude immersion (1 cycle)	--	4.8.6.1
Insulation resistance	3.5.2.3	4.8.3
Heat aging	--	4.8.6.7
Altitude immersion (1 cycle)	--	4.8.6.1
Insulation resistance	3.5.2.3	4.8.3
Dielectric withstanding voltage	3.5.2.4	4.8.4
Voltage drop (after test)	3.5.2.1	4.8.1
Tensile strength	3.5.2.5	4.8.5

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4.5.8 Retention of Qualification Test Report

The qualifying activity shall provide the supplier a data package of all tests results performed in accordance with Table 4. The qualifying activity test method procedures shall be made available to the supplier upon request. The supplier shall provide a test report to the qualifying activity for the tests specified in Group A and B (see 4.6, Table 5, and Table 6). The test report shall be signed by the manufacturing authority responsible for ensuring compliance to the specification requirements. The supplier may combine the qualifying activity test data with the supplier's test data into one final qualification test report. The final test report and/or data package shall remain on file with the supplier for a minimum period of 6 years and be available to the qualifying activity upon request.

The supplier test report shall contain as a minimum the following information.

a. A summary of quantitative pass or fail results for tests specified in Group A and B, and the authorization letter.

b. Corrective Action Reports (as applicable).

4.5.9 Retention of Qualification Failures

Any failure of a specific type splice shall be cause for refusal to grant qualification to that part number and all part numbers previously approved by similarity to that part number.

4.6 Quality Conformance Inspection

4.6.1 Inspection of Product for Delivery

Inspection of product for delivery shall consist of Group A inspection (see 4.6.2). Except as specified in 4.6.3.2, delivery of products which have passed Group A inspection shall not be delayed pending the results of Groups B inspection (see Table 6).

4.6.1.1 Inspection Lot

An inspection lot, as far as practicable, shall consist of all splices of a single size and composition; manufactured under essentially the same conditions and offered for inspection at one time.

4.6.2 Group A Inspection

Group A inspection shall consist of the examination and test specified in Table 5 and shall be made on the same set of sample units, in the order shown. After the visual examination, the lot shall be divided and tensile strength tests performed as specified in 4.8.5.

4.6.2.1 Sampling Plan

The procedure for continuous production sampling is to select a sampling plan from ANSI/ASQC Z1.4 for normal inspection, based on the specified Acceptance Quality Level (AQL) shown in Table 5 Major and minor defects shall be as defined herein (see 6.4.3, 6.4.4, and Table 5). A manufacturer's normal quality control tests and production tests may be used to fulfill Group A inspection, provided they at least equal the quality required by Table 5.

4.6.2.2 Rejected Lots

If an inspection lot is rejected, the supplier shall withdraw the lot and may then rework it to correct the defects or screen out the defective units. Such lots shall be kept separate from new lots and shall be re-inspected. Such lots shall be re-inspected using tightened inspection.

TABLE 5 - GROUP A INSPECTION

Examination or Test	Requirement Paragraph	Method Paragraph	AQL (% Defective)		Sampling Plan
			Major	Minor	
Material certifications 1/	3.3.1, 3.3.2, 3.3.3.1	4.3	N/A	N/A	N/A
Visual and dimensional examination	3.4	4.7.1	1.0	4.0	S-4
Identification of Product	3.6				
Workmanship	3.7				
Tensile strength	3.5.2.5	4.8.5	0	0	S-1

1/ Confirmation of certifications required

4.6.3 Group B Inspection

Group B inspection: Group B inspection shall consist of the tests specified in Table 6. Group B inspection shall be made on splices selected from inspection lots which have passed Group A inspection.

TABLE 6 - GROUP B INSPECTION

Test	Requirement Paragraph	Method Paragraph
Altitude immersion (1 cycle)	--	4.8.6.1
Insulation resistance	3.5.2.3	4.8.3
Dielectric withstanding voltage	3.5.2.4	4.8.4
Voltage drop	3.5.2.1	4.8.1

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4.6.3.1 Sampling Plan

Six months after the date of notification of qualification, and after each subsequent 6 month period, fifteen splices shall be selected from those covered by a single detail specification and having the same size. A manufacturer's normal quality control tests and production tests may be used to fulfill all or part of Group B inspection; however, all of the Group B inspection shall be completed as specified.

4.6.3.2 Failures

If one or more units fail to pass Group B inspection, the sample shall be considered to have failed. The supplier shall take corrective action on the materials or process, or both, as warranted and on all units of product which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action has been taken. After the corrective action has been taken, Group B and/or Group A (see Table 5) inspection, as applicable, shall be repeated on additional units. Final acceptance shall be withheld until the Group B re-inspection, as applicable, has shown that the corrective action was successful. The corrective action shall be submitted to the qualifying activity as part of the retention of qualification (see 4.5.8b).

4.6.3.3 Disposition of Samples

Samples which have been subjected to Group B inspection shall not be delivered on the contract or order.

4.6.4 Inspection of Preparation for Delivery

The sampling and inspection of the preservation-packaging and interior package marking shall be in accordance with the groups A and B quality conformance inspection requirements and MIL-STD-2073-1. The sampling and inspection of the packing and marking for shipment and storage shall be in accordance with the quality assurance provisions of the applicable container specification and the marking requirements of MIL-STD-129.

4.7 Examinations

4.7.1 Visual and Dimensional Examination

Splices shall be examined to verify that the materials, design, construction, identification of product, workmanship, and physical dimensions are in accordance with this specification and the applicable detail specification. Dimensions shall conform to the applicable detail specification. Classification of defects for visual and dimensional examination shall be as specified in Table 7. No major or minor or defects are permitted for qualification testing.

TABLE 7 - CLASSIFICATION OF DEFECTS

Examination of product	Major	Minor
Dimensions		
Overall length of metal crimp splice	X	
Outside diameter of metal crimp splice	X	
Inside diameter of sealing sleeve	X	
Location of sealing material	X	
All other dimensions		X
Materials	X	
Workmanship		X
Marking	X	
Missing components	X	
All other criteria		X

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Visual Examinations:

a. Dimensions (as specified in the detail specification): Dimensions shall be measured with calibrated micrometers using standard laboratory methodology.

b. Sleeve thickness (when specified): The sleeving shall be split lengthwise into two hemicylindrical pieces. A smooth gage rod shall be selected, measured and placed in contact with the inside surface of the sleeving. The total thickness of the gage rod plus sleeving wall shall then be measured. The maximum and minimum wall thickness shall be calculated by subtracting the gage rod measurement from the measurement of the gage rod plus sleeving wall.

c. Identification of product: Visually examine for color coding.

d. Workmanship: Visually examine with a 3X microscope for blistering, pitting, or peeling of plating, cracks, and other defects which may affect serviceability.

4.7.2 Unrestricted Recovery

a. Unsupported method: Lay a 6 inch length of the splice sleeving material specified in the detail specification on a tray in an oven at the temperature and for the time specified in the AMS-DTL-23053 detail specification sheet defining that material. If sleeving is not defined by AMS-DTL-23053, refer to detailed specification for testing details. If the sleeving becomes tacky in the oven, a small amount of powdered talc may be placed on the tray to prevent sticking. Select a smooth gage rod that has a diameter equal (minus 0, plus 0.002 inch, or 2%, whichever is less) to the maximum acceptable sleeving ID after unrestricted shrinkage. The maximum ID dimension of the sleeving shall be considered acceptable when the wall of the sleeving is expanded by the insertion of the gage rod, when there is no visible air space between the end of the sleeving and the rod, or when the gage rod cannot be inserted in the sleeving.

b. Manual Supported method: Select a smooth, clean, metallic mandrel that has a diameter equal to the maximum acceptable sleeving ID (after unrestricted shrinkage) minus 0, plus 0.002 inch or 2%, whichever is less. Slip a 6 inch length of sleeving material specified in the detail specification sheet on the mandrel and heat in an oven at the temperature and for the time specified in the applicable AMS-DTL-23053 detail specification sheet defining that material.

4.7.3 Longitudinal Change

The longitudinal change of the AMS-DTL-23053 sleeving material specified in the detail sheet shall be determined in accordance with ASTM D2671, by measuring in the “as supplied” condition and after the unrestricted shrinkage specified in 4.7.2. If sleeving is not defined by AMS-DTL-23053, refer to detailed specification for testing details

4.8 Test Methods

4.8.1 Voltage Drop

a. Single Wire Splices Voltage Drop Test (the same wire size): Measurements shall be made by puncturing the insulation of the current carrying conductor on each end of the splice 1/16 inch back from the ends of the sealing sleeve. The distance between the two test points shall be noted. Measurement of the current carrying conductor shall be made by puncturing the conductor insulation the same distance between test points as that noted for the splice measurement. The millivolt drop of the equivalent length of wire may be determined by averaging four readings taken on 10 inch lengths of wire selected at random throughout the supply of wire to be used for subsequent tests. The millivolt drop through the crimp termination and the current carrying conductor shall be measured while the specified test current (see Table 1) is being applied, and after the temperature of the wire has stabilized (see 4.4.2).

b. Multiple Wire Splices Voltage Drop Test (various wire sizes): The required reference voltage drop shall be determined by averaging four specimens of applicable combination wires with soldered crimp splices using an appropriate solder and flux. The reference millivolt measurement shall be made by puncturing the largest wire insulation on both sides of the crimp 1/16 inch back from the ends of the sealing sleeve.

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4.8.2 Current Cycling

a. Single wire splices (the same wire size): The test specimens shall be attached to 3 foot lengths of the largest accommodated wire then subjected to 50 current cycles. Each cycle shall consist of 30 minutes at 125% of the test current specified in Table 1, followed by 15 minutes at no load. After the test assembly has returned to room temperature, the voltage drops shall be measured at test current specified in Table 1.

b. Multiple wire splices (various sizes): The test specimens shall be attached to 3 foot lengths of the largest accommodated single wire on one side and the maximum number of wires the splice will accommodate on the other side. This pattern shall alternate to connect the required number of specimens per Table 3. The current for the maximum single wire as defined in Table 1 shall be applied for the number of cycles and duration defined for the single wire splice (see 4.8.2a). Voltage drop shall be measured for the largest wire and compared to the soldered equal configuration as described for the multiple splice voltage drop test (see 4.8.1b).

4.8.3 Insulation Resistance

Splices shall be tested in accordance with Method 302 of MIL-STD-202. For multiple wire splices, the test shall be performed on the largest wire size on each side. The following details shall apply:

a. Test condition: A.

b. Conditioning of splices: Splices shall be immersed in a bath as specified for at least 1 hour (see 4.4.3).

c. Points of measurement: Between splice leads and water bath.

d. Electrification time: 1 minute.

4.8.4 Dielectric Withstanding Voltage

Splices shall be tested in accordance with Method 301 of MIL-STD-202. For multiple wire splices, the test shall be performed on the largest wire size on each side. The following details shall apply:

a. Conditioning of splices: Splices shall be immersed in a bath as specified (see 4.4.3).

b. Magnitude and nature of potential: 2500 volts (RMS).

c. Points of measurement: Between splice leads and water bath.

4.8.5 Tensile Strength

a. One wire splice (the same wire size): The splice shall be placed in a standard tensile-testing machine so that the splice is centered between and at least 3 inches from, the jaws. Sufficient force shall be applied to pull the wire out of the splice or breaks the wire or the splice. The travel speed of the head shall be 1 inch per minute. The clamping surfaces of the jaws may be serrated to provide sufficient force.

b. Multiple wire splice (only wire size 26 and 24): The smallest wire on each side shall be attached to opposing grips of the pull tester with the splice unattached in the approximate center and pulled with a head speed of 1.00 inch ± 0.25 inch per minute. Sufficient force shall be applied to pull one of the wires out of the splice or break one of the wires or break the splice. If the splice breaks, the tensile value for the smallest wire attached to the pull tester grips will apply.

c. Multiple wire splice (wire sizes larger than 24): Two specimens with the smallest wire on each side and two specimens with largest wire on each side shall be attached to opposing grips of the pull tester with the splice unattached in the approximate center and pulled with a head speed of 1.00 inch ± 0.25 inch per minute. Sufficient force shall be applied to pull one of the wires out of the splice or breaks one of the wires or breaks the splice. If the splice breaks, the tensile value for the smallest wire attached to the pull tester grips will apply.

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4.8.6 Environmental Conditioning

The splices shall be exposed to each of the conditions in the sequence shown in Tables 3 and 4.

4.8.6.1 Altitude Immersion

The splices, immersed in a solution as specified (see 4.4.3) shall be placed in a suitable chamber; the free ends shall be within the chamber and shall not be sealed. The chamber pressure shall be reduced to 75 000 feet (26.78 mm of Hg) and maintained for 30 minutes. The specimen shall be bent at 90 degrees minimum of 2 inches away from the splice where the bent wire sections (free ends) shall be placed along the side wall of the vessel. Care shall be taken to not disturb the splice joint under test. The chamber shall then be returned to ambient pressure. This shall constitute 1 cycle. A total of three cycles shall be run. The insulation resistance shall be measured after the third cycle.

4.8.6.2 Immersion

The splices shall be tested in accordance with Method 104, test condition C, of MIL-STD-202.

4.8.6.3 Temperature Cycling

The splices shall be tested in accordance with Method 107; test condition C of MIL-STD-202 except that the temperature for step 3 shall be maximum rated temperature of the splice.

4.8.6.4 Moisture Resistance

The splices shall be tested in accordance with Method 106 of MIL-STD-202 except sub-cycle 7b shall not be required.

4.8.6.5 Fluid Immersion

The splices shall be immersed in the fluids specified in Table 8 at the temperature and time period listed. A separate splice shall be immersed in each of the required fluids. All fluid immersion samples shall be subjected to the subsequent tests.

4.8.6.6 Vibration

Splices shall have terminal lugs conforming to AS7928 attached to the ends of the leads. For multiple-wire splice ends, the terminal shall be crimped on all wire leads. The terminal crimp barrel size for the multiple-conductor leads shall be based on the maximum conductor CMA of the terminal. One terminal shall be rigidly mounted to a test fixture, 1 inch in height, securely fastened to the vibrating platform. The opposite end of the assembly shall be clamped to a stationary support so that the center of the splice is 6 inches from the vibrating platform and all slack is removed from the wire with minimum tension on the crimp joint. The splices shall be vibrated in accordance with Method 201 of MIL-STD-202 for 18 hours on each of two axes mutually perpendicular to each other and to the axis of the wire. For a multiple wire sample, all wires attached shall be terminated to a single terminal lug. The terminal lug used shall be chosen to accommodate the combined CMA of the combined wires.

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