AEROSPACE STANDARD

AS6506™	REV. A
Issued 2018-09 Revised 2019-07 Reaffirmed 2024-10 Superseding AS6506	

Fusion Splice for Aerospace Fiber Optic Cables

RATIONALE

Aerospace fiber optic cables frequently need to be spliced, both for original installation and for repair. Standards exist for mechanical splices in fiber cables, but none has yet been created for fusion spliced cables. Fusion splices can offer superior performance in insertion loss, return loss, and mechanical and environmental stability, suitable for long-term/permanent installation in aircraft. The industry needs agreed-upon performance standards for fiber optic cable fusion splices in aerospace service.

This revision corrects an error in paragraphs 4.5.3 and 4.5.5. The original language of 4.5.5 failed to specify that it was intended to apply to the cumulative changes in insertion loss over all the tests in any one test group. Paragraph 4.5.3 applies to the change in insertion loss in any one test. Obviously the requirement of 4.5.3 should be smaller than that of 4.5.5: 0.05 dB versus 0.10 dB, but the numbers were reversed. This revision corrects the error.

AS6506A has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

This document defines performance standards which fiber optic cable splices must meet to be accepted for use in aerospace platforms and environments.

2. REFERENCES

The documents listed in 2.1 are relevant to the requirements of this document. The documents listed in 2.2 are provided for information purposes only and do not form a part of the requirements of this document.

2.1 Applicable Documents

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 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 the 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.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or + 1 724-776-4970 (outside USA), www.sae.org.

AIR1351	Manufacturers' Identification of Aerospace Electrical and Electronic Wiring Devices and Accessories
AIR6282	Fiber Optic Harsh Environment Test Methods Cross Reference Document
ARP5061	Guidelines for Testing and Support of Aerospace, Fiber Optic, Inter-Connect Systems
AS4373	Test Methods for Insulated Electric Wire
AS5675	Characterization and Requirements for New Aerospace Fiber Optic Cable Assemblies – Jumpers, End Face Geometry, Link Loss Measurement, and Inspection
AS6479	Splicer, Fusion, Fiber Optic, Aerospace
MA5405	Splices, Fiber Optics, For Aerospace Inter-Connection Systems

2.1.2 Military Standards

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, https://quicksearch.dla.mil.

MIL-STD-130N	Identification Marking of U.S. Military Property
MIL-STD-810G	Test Methods Standard
MIL-STD-1678	Fiber Optics Test Methods and Instrumentation
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
SD-6	Provisions Governing Qualification

2.1.3 ANSI Accredited Publications

Copies of these documents are available online at http://webstore.ansi.org/.

ANSI Z136.2	Standard for the Safe Use of Lasers

2.1.4 TIA/EIA Publications

Copies are available from IHS Global Inc., tel. 800-854-7179 (U.S. and Canada), +1-303-397-7956 (outside U.S. and Canada), http://global.ihs.com.

EIA-364-10	Fluid Immersion Test Procedure for Electrical Connectors
EIA-364-14 TP-14B	Ozone Exposure Test Procedure for Electrical Connectors
TIA/EIA-440B	Fiber Optic Terminology
TIA/EIA-455	Fiber Optic Test Procedures
TIA/EIA-455-1	Cable Flexing for Fiber Optic Interconnecting Devices
TIA/EIA-455-2	Impact Test Measurements for Fiber Optic Devices

TIA/EIA-455-3	Temperature Effects Measurement Procedure for Optical Fiber, Optical Cable, and Other Passive Components
TIA/EIA-455-4	Temperature Life Test for Fiber Optic Components
TIA/EIA-455-5	Humidity Test for Fiber Optic Components
TIA/EIA-455-6	Cable Retention Test Procedure for Fiber Optic Cable Interconnecting Devices
TIA/EIA-455-8	(FOTP-8) Measurement of Splice or Connector Loss and Reflectance Using an OTDR (ANSI/TIA/EIA-455-8-2000)
TIA/EIA-455-11	Vibration Test for Connecting Devices and Cables
TIA/EIA-455-12	Fluid Immersion Test for Fiber Optic Components
TIA/EIA-455-13	Visual and Mechanical Inspection of Fibers, Cables, Connectors, and Other Devices
TIA/EIA-455-14	Shock Test (Specified Pulse)
TIA/EIA-455-15	Altitude Immersion
TIA/EIA 455-16	Salt Spray (Corrosion) Test for Fiber Optic Components
TIA/EIA-455-20	(FOTP-20) Measurement of Change in Optical Transmittance
TIA/EIA-455-26	Crush Resistance of Fiber Optic Interconnecting Devices
TIA/EIA-455-32	Fiber Optic Device Discontinuities
TIA/EIA-455-34	(FOTP-34) Interconnection Device Insertion Loss Test (ANSI/TIA/EIA-455-34A 95)
TIA/EIA 455-35	Fiber Optic Component Dust (Fine Sand) Test
TIA/EIA-455-36	Twist Test for Connecting Devices
TIA/EIA-455-49	Measurement for Gamma Irradiation Effects on Optical Fibers and Cables
TIA/EIA-455-56	Test Method for Evaluating Fungus Resistance of Optical Waveguide Fibers and Cables
TIA/EIA-455-71	Measurement of Temperature Shock Effects on Components
TIA/EIA-455-98	Fiber Optic Cable External Freezing Test
TIA/EIA-455-107	Return Loss for Fiber Optic Components
TIA/EIA-455-171	(FOTP-171) Attenuation by Substitution Measurement for Short-Length Multimode Graded-Index and Single-Mode Optical Fiber Cable Assemblies (ANSI/TIA/EIA-455-171-A)
TIA-526-7	(OFSTP-7) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
TIA-526-14	(OFSTP-14) Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant

2.1.5 Other Standards

DOT/FAA/AR-00/12 Chapter 1, “Vertical Bunsen Burner Test”

2.2 Related Publications

The following documents are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or + 1 724-776-4970 (outside USA), www.sae.org.

AIR6031 Fiber Optic Cleaning

ARP5061 Guidelines for Testing and Support of Aerospace, Fiber Optic, Inter-connect Systems

AS5750 Loss Budget Specification for Fiber Optic Links

2.2.2 Military Specifications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, http://quicksearch.dla.mil.

A-A-59799 Commercial Item Description: Fusion Splicer and Cleaver, Optical Fiber

MIL-PRF-49291 Optical Fiber, (Metric) General Specification for

MIL-PRF-85045 Cables, Fiber Optic, (Metric) General Specification for

NAVAIR 01-01A-505-4 Installation & Testing Practices, Aircraft Fiber Optic Cabling

2.2.3 ARINC Publications

Available from ARINC, 2551 Riva Road, Annapolis, MD 21401-7435, Tel: 410-266-4000, www.arinc.com.

ARINC 805 Fiber Optic Test Procedures

ARINC 806 Maintenance and Repair of Fiber Optic Cables

2.2.4 RTCA Publications

Available from RTCA, Inc., 1150 18th Street, NW, Suite 910, Washington, DC 20036, Tel: 202-833-9339, www.rtca.org.

DO-160 Environmental Conditions and Test Procedures for Airborne Equipment

2.2.5 ASQ Publications

Available from American Society of Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203. Tel: 800-248-1946 (United States or Canada), 001-800-514-1546 (Mexico) or + 1-414-272-8575 (all other locations), www.asq.org.

ASQC Z1.4 Sampling Procedures and Tables for Inspection by Attributes

2.2.6 TIA/EIA Publications

Copies are available from IHS Global Inc., tel. 800-854-7179 (U.S. and Canada), +1-303-397-7956 (outside U.S. and Canada), http://global.ihs.com.

EIA-364 Electrical Connector/Socket Test Procedures Including Environmental Classifications

2.2.7 ANSI Accredited Publications

Copies of these documents are available online at http://webstore.ansi.org/.

NCSL Z540 General Requirements for Calibration Laboratories and Measuring and Test Equipment

3. SAFETY

3.1 Fiber Handling

When handling bare optical fibers, care should be taken to prevent pieces of fiber from puncturing the skin or breakage causing fragments to fly into the user's eye. Safety glasses should be worn when working with fibers, and fiber ends should be disposed of carefully. Glass fibers are small enough to puncture and stay under the surface of the skin. Besides being an irritant, bits of glass fibers can be quite difficult to remove, being nearly invisible in tissue. It is particularly important to keep stray bits out of the eyes, where removal is even more difficult. During fiber cable installation and repair, all snipped or cleaved pieces of optical glass fibers should be stowed in appropriate disposal containers. Placing fibers on an adhesive tape strip can be risky and should not be done. In addition, all cables with protruding bare fibers should be adequately covered or positioned to preclude accidental puncture. Your best defense against injury by fibers is common sense. Eating and drinking around fibers must also be considered risky. And since fiber fragments can stick to skin due to its oil, thoroughly wash your hands before touching your face or eyes after working with fibers. Waste pieces of optical fiber must never be put in ordinary garbage for routine disposal.

3.2 Eye Safety from Radiation

Although the optical power present in most fiber installations can be fairly low, the small dimensions of fiber cores and semiconductor sources makes it possible for radiant intensities to attain quite high values. If an optical cable is disconnected or broken and the exposed end is examined, there may be risk of eye damage, particularly if a magnifier or other visual aid is used. All systems should be assumed to be on, until test equipment can verify the status of optical sources. Moreover, in applications that require higher intensity optical sources, system designers should include additional safety precautions, such as safety goggles, to ensure the safety of maintenance personnel.

Please refer to ANSI Z136.2, American National Standard for the Safe Use of Lasers, for additional eye safety precautions.

3.3 Lasers

The lasers used as fiber sources typically operate at 850, 1300, and 1550 nm wavelengths, which are all in the infrared part of the light spectrum. These first two wavelengths along with visible light are focused by the eye's lens onto the retina. Retinal receptors are sensitive to the range of wavelengths between 400 and 700 nm, but not to wavelengths outside that range. Herein lies the danger. Although a person cannot perceive the intense light from the laser, it is still being focused on the sensitive retinal tissue. At the focal point, the energy density can be high enough to burn the tissue, resulting in loss of visual activity or in blind spots in the person's visual field. This is possible even though lasers for fiber use are actually of low power compared to other laser types. Lasers are classified into four general categories depending on their operating wavelength, output power, and whether they are pulse or continuous wave.

3.3.1 Class 1

Class 1 lasers are considered "eye-safe" in that no eye damage would result even from prolonged exposure to the direct beam. Because shorter wavelength light, especially wavelengths shorter than 550 nm, is more heavily absorbed by the retina, the maximum allowable output power of Class 1 lasers generally increases with increasing wavelength. As laser emission at wavelengths greater than 1400 nm is absorbed by the cornea, no focusing onto the retina occurs and the Class 1 laser maximum allowable output power increases dramatically.

3.3.2 Class 2

Class 2 lasers are those for which the aversion response will generally protect a person from the output. Class 2 lasers therefore include only those emitting visible radiation. Many fiber identifiers fall into this category. Class 2 lasers are very uncommon in fiber systems, however.

3.3.3 Class 3

Class 3 lasers are medium power and produce radiation that can cause eye damage when viewed directly, or when a magnified or specular reflection is viewed. A diffuse reflection is usually not a hazard.

3.3.4 Class 4

Class 4 lasers are high in radiant power and are not usually used in communications/data cable plant applications. Lasers used with fiber communications systems are well below the energy levels that would cause skin burns, but the danger to eyesight is very real. The danger is highest at optical output ports, where power is coming directly from the laser.

4. TECHNICAL REQUIREMENTS

The splices shall comply with the requirements herein. In the event of a conflict between this standard and the detail specification which defines the unique technical requirements, the detail specification shall govern. However, some requirements, as noted below, are mandatory; they cannot be waived in any detail specification under this standard. Unless otherwise specified by contract or purchase order, product purchased to this standard will be supplied to the latest revision in effect at issuance of the contract or purchase order.

This specification covers design and performance requirements of fused fiber optic splices for optical interconnection systems in aerospace vehicles and provides a guide to qualification of such devices. Fusion splices and splice cable restorations are expected to out-perform mechanical splices; therefore, the optical requirements (see 4.5) are generally 5 to 10 times more demanding.

Fiber optic cable design characteristics are uniquely related to various aerospace vehicle applications. Likewise, fusion splices are necessarily designed for specific cable types. Evaluation of the splice performance shall be performed with the cable type for which it was intended as defined in the splice detail specification. Typically, fiber optic cable splices have unique assembly instructions. Splices that are qualified to the same detail specification must be assembled using the same procedure and tools. All assembly instructions shall be presented and documented in accordance with this specification.

4.1 Part Number Structure

The part number structure for each splice shall be as follows:

AS6506: Procurement standard

AS6506/1: Detail specification

AS6506/1-001: Assembly type and size

4.2 Condition of Listing

Splices will be specified in this document when requested for the purpose of specifying the splice in an end-user, government, or non-government standards body optical distribution system.

4.3 Visual and Mechanical Examination (see 6.1)

4.3.1 Materials

Materials shall be as specified in the detail specification. When the detail specification does not specify a material, the material properties shall be in compliance with the manufacturer's engineering drawing. The manufacturer shall certify that all materials are in compliance with this specification and all relevant engineering drawings. If a change in material occurs after initial qualification, the manufacturer is required to perform an engineering analysis to determine if requalification is necessary. An Engineering Analysis Report shall be provided to the Qualifying Activity at the next periodic qualification inspection.

4.3.2 Design and Dimensions

Design, dimensions, and markings shall be as specified in the detail specification. The splice, as specified in the detail specification, or its packaging, at a minimum shall be marked with the part number (see 4.1) and the manufacturer's symbol. The manufacturer's symbol shall be listed in AIR1351.

The splice diameter shall be no larger than two times the cable diameter, and the length of any rigid portion of the splice shall be no longer than 75 mm.

4.4 Assembly Instructions (see 6.2)

Each splice or its package shall be provided with concise, clearly written instructions containing the following information as applicable:

a. Title

b. Splice specification part number (see 4.1)

c. Cable specification or part number(s) for which it is qualified

d. Manufacturer's part number

e. National stock number (if available)

f. Detailed assembly instructions including illustrations

g. Piece part numbers when applicable for replacement

h. Detailed accessory drawings sufficient to enable proper use

i. Accessory part numbers when applicable for replacement

j. Installation tools (cleaving, crimping, polishing pucks, etc.)

k. Address, email address, and telephone number of manufacturer

4.5 Optical Performance (see 6.3)

4.5.1 Insertion Loss (IL)

Unless otherwise specified, the splice when assembled shall not exceed an insertion loss of 0.05 dB when tested in accordance with 6.3.2.

4.5.2 Return Loss (RL)

The return loss of the splice when assembled shall be no less than 60 dB when tested in accordance with 6.3.3.

4.5.3 Temporary Change in Optical Transmittance

Unless otherwise specified, the temporary change in optical transmittance of the splice due to exposure to any mechanical or physical test (i.e., during the extremes of exposure) shall not exceed 0.10 dB when tested in accordance with 6.3.4.

4.5.4 Intermittent Optical Discontinuity

Momentary changes in optical transmittance shall not exceed 0.5 dB in magnitude and 1 μs in duration when tested in accordance with 6.3.5.

4.5.5 Permanent Change in Optical Transmittance

The permanent change in optical transmittance of the splice after exposure to any mechanical or physical test shall not exceed 0.05 dB when tested in accordance with 6.3.4.

4.6 Temperature Cycling

One of two requirements shall apply and cannot be waived in any detail specification: either temperature cycling (4.6) or thermal shock (4.24).

The splice shall be subjected to temperature cycling in accordance with 6.4, and it shall comply with the optical performance requirements of 4.5.3 and 4.5.5. As an alternative, at the direction of the Qualifying Authority the thermal shock test (4.7) may be performed instead.

4.7 Tensile Strength

The splice shall be subjected to the tensile strength test (see 6.5) and will comply with the minimum tensile strength requirement specified in the detail specification. The splice shall comply with the change in optical transmittance requirements of 4.5.3 continuously throughout the test and with 4.5.5 after the test.

4.8 Altitude Immersion

The splice shall be subjected to altitude immersion in accordance with 6.6 and comply with optical performance requirements of 4.5.3 and 4.5.5. There shall be no incursion of water into the splice as inspected per 6.26.

4.9 Cable Flexing

The assembled splice shall be subjected to the cable flexing test in accordance with 6.7 and shall comply with the optical performance requirements of 4.5.3 and 4.5.5.

4.10 Cable Twist

The assembled splice shall be subjected to the cable twist test in accordance with 6.8 and shall comply with the optical performance requirements of 4.5.3 and 4.5.5.

4.11 Impact

When specified, the splices shall be subjected to the impact test in accordance with 6.9 and shall comply with the optical performance requirements of 4.5.3 and 4.5.5. There shall be no physical damage which might affect compliance with any other detail of this standard.

4.12 Crush

When specified, the splices shall be subjected to the crush test in accordance with 6.10 and shall comply with the optical performance requirements of 4.5.3 and 4.5.5. There shall be no physical damage which might affect compliance with any other detail of this standard.

4.13 Axial Compressive Loading

When specified, the splices shall be subjected to the axial compressive loading test in accordance with 6.11 and shall comply with the optical performance requirements of 4.5.3 and 4.5.5. There shall be no physical damage which might affect compliance with any other detail of this standard.

4.14 Thermal Aging

The splice shall be subjected to the thermal aging test in accordance with 6.12, at the maximum operating temperature specified in the detail specification and will comply with the optical performance requirements of 4.5.3 and 4.5.5.

NOTE: The splice must not be tested at any temperature higher than the maximum rated temperature of the fiber optic cable on which it is installed. Failure of the cable, if any, does not constitute failure of the splice.

4.15 Freezing Water Immersion (Ice Crush)

The splice shall be subjected to the freezing water immersion test in accordance with 6.13 and shall comply with the optical performance requirements of 4.5.3 and 4.5.5.

4.16 Humidity/Thermal Cycling

The splice shall be subjected to the humidity test in accordance with 6.14 and will comply with the optical performance requirements of 4.5.3 and 4.5.5.

4.17 Salt Spray

Salt spray endurance is applicable only for splices with metal parts. If applicable, the splice shall be subjected to the salt spray test in accordance with 6.15 and will comply with the optical performance requirements of 4.5.3 and 4.5.5. There shall be no physical damage which might affect compliance with any other detail of this standard.

4.18 Sand and Dust

If applicable, the splice shall be subjected the blowing sand and dust test in accordance with 6.16 and will comply with the optical performance requirements of 4.5.3 and 4.5.5. There shall be no physical damage which might affect compliance with any other detail of this standard.

4.19 Fluid Immersions

The splices shall be subjected to the fluids immersion test in accordance with 6.17 and will comply with the optical performance requirements of 4.5.3 and 4.5.5. There shall be no physical damage which might affect compliance with any other detail of this standard.

4.20 Vibration/Temperature Cycling

The splice shall be subjected to vibration/temperature cycle testing in accordance with 6.18 at the maximum and minimum operating temperatures specified in the detail specification. The splice shall comply with the change in optical transmittance requirement of 4.5.3 continuously throughout the test and with 4.5.5 after completion of the test.

NOTE: Unspliced optical cables themselves, even MIL-spec (e.g., MIL-PRF-85045) exhibit changes in optical transmittance in some environments such as extreme temperature variation. It is vital to isolate transmittance changes due to the cable from those which may be due to the splice by including an unspliced “control cable” in such tests and interpreting any changes in transmittance in the spliced cables in light of parallel changes in the unspliced cable.

4.21 Flammability

When specified the splice shall be subjected to the flammability test in accordance with 6.19. This test shall only be performed ***after*** the splice has been examined for any degradation from preceding tests in the group. The splice shall be self-extinguishing within 5 seconds after removal from the flame. Flame from combustion of the cable shall not be considered a failure of the splice. There are no optical requirements.

4.22 Nuclear Radiation

When specified the splice shall be subjected to the gamma radiation test in accordance with 6.20 and shall comply with the optical performance requirements of 4.5.3 and 4.5.5.

4.23 Fungus

When specified the splice shall be subjected to the fungus test in accordance with 6.21. There shall be no growth of fungus which might affect the ability of the splice to complying with any detail of this standard. There are no optical requirements during this exposure.

4.24 Thermal Shock

This requirement is an alternative to the temperature cycling requirement 4.6. At least one is mandatory; the second is optional.

The splice shall be subjected to thermal shock in accordance with 6.22, and it shall comply with the optical performance requirements of 4.5.3 and 4.5.5.

4.25 Vibration and Discontinuities

The assembled splice shall be subjected to the vibration test in accordance with 6.23 and will comply with the optical performance requirements of 4.5.4 (no optical discontinuities) during the exposure and 4.5.5 afterward.

4.26 Mechanical Shock

The assembled splice shall be subjected to the mechanical shock test in accordance with 6.24 and shall comply with the optical performance requirements of 4.5.4 (no optical discontinuities) during the exposure and 4.5.5 afterward.

4.27 Ozone

When specified the assembled splice shall be subjected to the ozone exposure test in accordance with 6.25 and shall comply with the optical performance requirements of 4.5.3 and 4.5.5.

4.28 Post-Test Examination

At the end of each test group, and more frequently when specified or if damage or degradation becomes apparent, the splice shall be subjected to careful visual examination in accordance with 6.26. There shall be no evidence of cracking, crazing, change in dimensions, change in color or finish, looseness of parts, or any other degradation that could affect function.

After Group 1, or whichever group includes the altitude immersion test, the post-test examination shall include dissection. No water may be found to have penetrated into the splice which could cause adverse effects or wick into the cable strength members.

5. QUALITY ASSURANCE PROVISIONS

Qualification is required to confirm that products procured to this standard are in compliance with requirements. Qualification does not assure that the manufacturer's processes are under control, only that at the time of examination the products tested met the requirements of the specification.

5.1 Responsibility for Inspection

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

5.2 Responsibility for Compliance

All items must meet all technical requirements of the detail specification. The inspections set forth in this standard shall become a part of the supplier's overall inspection system or quality program. The absence of any 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. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the purchaser to accept defective material.

5.3 Test Equipment and Inspection 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 AS9100 or equivalent standards.

5.4 Test Report

If the Qualifying Activity undertakes some of the tests, it shall provide a certified data package, based on Table 1, to the manufacturer for inclusion in the final test report. Qualifying Activity laboratory test procedures will be provided to the supplier upon request. The supplier shall combine the Qualifying Activity laboratory data with the remaining requirements specified by the Qualifying Activity test authorization letter into a final report certified by an officer of the supplier. The size, type, and supplier's name and part number of the cables used to qualify the splices shall be included in the qualification test report. All test data shall be compiled in accordance with an acceptable method, such as chapter 4 of SD-6. Results of tests performed, including the number and mode of failures, shall be reported. Where test measurements are required, the values shall be reported.

5.5 Classification of Inspections

The inspections specified herein are classified as follows:

a. Initial qualification inspection (see 5.7)

b. Periodic qualification inspection (see 5.8)

c. Quality conformance inspection (see 5.9)

5.6 Inspection Conditions

Unless otherwise specified herein, all inspection shall be performed in accordance with the ambient conditions specified in EIA-364.

5.7 Initial Qualification Inspection

Initial qualification inspection shall be in accordance with Table 1. Sequential testing is required for each test group. All test facilities require Qualifying Activity approval. The Qualifying Activity and supplier will immediately notify each other of any failure in order to determine the necessary steps to correct the failure. The failure and corrective action shall be included in the final test report.

5.7.1 Qualification Request

A request for qualification shall be made to the Qualifying Activity prior to initiating testing. Testing cannot begin until the supplier has received an authorization letter. The supplier may be required to provide the Qualifying Activity with a test plan based on the authorization letter to ensure that the supplier and Qualifying Activity coordinate activities, maintain communication, and document changes as needed.

5.7.2 Test Deviations

The Qualifying Activity has the authority to modify the specification test requirements to resolve test failures/discrepancies and to waive testing if appropriate to verify specific product manufacturing changes or qualifications by similarity.

5.7.3 Sample Representation

For each component tested, the supplier shall use the same materials, manufacturing procedures, and methods of inspection as used to provide the component to a purchaser. 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.

5.7.4 Qualification by Similarity

Qualification by similarity shall be authorized by the Qualifying Activity. One component size (designation) may qualify similar component sizes if the dimensions controlled by the supplier for the size being subjected to qualification inspection are insignificantly different from the sizes being qualified by similarity. Additional qualification by similarity may be authorized by the Qualifying Activity when justified by the supplier. Failure of a component to conform to a requirement shall be cause for refusal to grant qualification approval for that group of components represented by the similarity sample.

5.7.5 Qualification Test Sample

The splices shall be assembled in accordance with the assembly instruction for qualification testing. Unless otherwise specified in the detail specification or similarity approved by the Qualifying Activity, the total number of specimens listed in Table 1 or 2 shall be tested for each type splice described in the detail specification. The number of specimens shall be as shown in the tables for initial or periodic qualification testing.

Table 1 - Initial qualification tests

Inspection	Requirement Paragraph	Test Paragraph	Sample Size
Group 1			10
Visual and mechanical examination	4.3	6.1	10
Assembly Instructions	4.4	6.2	10
Insertion loss (IL)	4.5.1	6.3-6.3.2	10
Return loss (RL)	4.5.2	6.3.1, 6.3.3	10
Thermal cycling	4.6	6.4	10
Tensile strength	4.7	6.5	10
Altitude immersion	4.8	6.6	10
Post-test examination incl. dissection	4.28	6.26	10
Group 2			10
Visual and mechanical examination	4.3	6.1	10
IL	4.5.1	6.3-6.3.2	10
RL	4.5.2	6.3.1, 6.3.3	10
Cable flexing	4.9	6.7	10
Cable twist	4.10	6.8	10
Impact	4.11	6.9	10
Crush	4.12	6.10	10
Axial compressive loading	4.13	6.11	10
Thermal aging (thermal life)	4.14	6.12	10
Freezing water/ice crush	4.15	6.13	10
Post-test examination	4.28	6.26	10
Group 3			10*
Visual and mechanical examination	4.3	6.1	10
IL	4.5.1	6.3-6.3.2	10
RL	4.5.2	6.3.1, 6.3.3	10
Humidity/thermal cycling	4.16	6.14	10
Salt spray	4.17	6.15	10
Sand and dust	4.18	6.16	10
Fluid immersions*	4.19	6.17	1 in each fluid*
Vibration and thermal cycling	4.20	6.18	10
Post-test examination	4.28	6.26	10
Flammability	4.21	6.19	1
Group 4			10
Visual and mechanical examination	4.3	6.1	10
IL	4.5.1	6.3-6.3.2	10
RL	4.5.2	6.3.1, 6.3.3	10
Nuclear radiation	4.22	6.20	10
Fungus	4.23	6.21	1
Thermal shock	4.24	6.22	10
Vibration and discontinuities	4.25	6.23	10
Mechanical shock and discontinuities	4.26	6.24	10
Ozone	4.27	6.25	1
Post-test examination	4.28	6.26	10

*Number of samples in Group 3 shall be at least 10 but more if necessary to provide one for each of the fluids used in the fluid immersion test.

5.7.6 Initial Qualification Test Report

All test data shall be compiled in accordance with an acceptable method, such as chapter 4 of SD-6. Where test measurements are required, the values shall be reported. The supplier shall furnish the Qualifying Activity one certified test report containing the following information:

a. The quantitative results for tests specified in Table 1 and the authorization letter. Upon request from the supplier, the Qualifying Activity will provide certified Table 1 test results for the test report.

b. Material and detail specification certifications as applicable (see 4.3).

c. For components qualified by similarity, a tabulated comparison of the dimensions specified in the detail specification and on each manufacturing control drawing.

d. All failures as result of the testing and corresponding appropriate corrective actions.

5.8 Periodic Qualification or Re-Qualification Inspection

Periodic re-qualification inspection shall be performed in accordance with Table 2 sequentially for each test group at 36-month intervals from the original approval date. The submission date may be modified by the Qualifying Activity to accommodate test activity schedules. Upon request from the supplier, the Qualifying Activity will provide certified Table 2 test results in the form of a data package.

5.8.1 Design Changes

Whenever there is a change in splice design, the supplier will notify the Qualifying Activity immediately. The Qualifying Activity will then determine if re-qualification inspection needs to be performed prior to the periodic re-qualification date.

5.8.2 Failures and Corrective Actions

All failures shall be documented in a certified data package. The supplier will provide corrective action to the Qualifying Activity. The Qualifying Activity has the authority to require additional testing based on the corrective action. Failure to submit the corrective action(s) within 30 days after receiving notification of failure may result in loss of qualification for the product.

Table 2 - Periodic re-qualification tests

Inspection	Requirement Paragraph	Test Paragraph	Sample Size
Group 1			10
Visual and mechanical examination	4.3	6.1	10
Assembly Instructions	4.4	6.2	10
IL	4.5.1	6.3-6.3.2	10
Thermal cycling	4.6	6.4	10
Tensile strength	4.7	6.5	10
Altitude immersion	4.8	6.6	10
Group 2			10
IL	4.5.1	6.3-6.3.2	10
Tensile Strength	4.7	6.5	10
Cable flexing	4.9	6.7	10
Cable twist	4.10	6.8	10
Impact	4.11	6.9	10
Crush	4.12	6.10	10
Axial compressive loading	4.13	6.11	10
Group 3			10*
IL	4.5.1	6.3-6.3.2	10
Salt Spray	4.17	6.15	10
Humidity/thermal cycling	4.16	6.14	10
Fluid immersions*	4.19	6.17	1 per fluid*
Vibration and thermal cycling	4.20	6.18	10
Group 4			10
IL	4.5.1	6.3-6.3.2	10
Freezing water/ice crush	4.15	6.13	10
Thermal shock	4.24	6.22	10
Vibration and discontinuities	4.25	6.23	10
Mechanical shock and discontinuities	4.26	6.24	10

*Number of samples in Group 3 shall be at least 10 but more if necessary to provide one for each of the fluids used in the fluid immersion test.

5.9 Quality Conformance Inspection

For each production lot each splice shall be examined in accordance with Table 3.

Table 3 - Quality conformance tests

Inspection	Requirement Paragraph	Test Paragraph
Visual and mechanical examination	4.3	6.1
Assembly Instructions	4.4	6.2
IL	4.5.1	6.3-6.3.2

NOTE: Supplier in-process controls may be used to meet these inspections.

6. TEST METHODS

6.1 Visual and Mechanical Examination (see 4.3)

6.1.1 Materials (see 4.3.1)

The component manufacturer shall review all material properties requirements in the detail specification and engineering drawing and provide individual certifications for each material. When a material is considered proprietary, the material shall be coded for certification purposes. A summary approach for certification may be used rather than detail certifications for each material. If material changes or changes in the properties of previously approved materials have occurred, an Engineering Analysis Report must be developed and submitted to the Qualifying Activity to determine the need for additional qualification action.

6.1.2 Design and Dimensions (see 4.3.2)

Measure and report the splice dimensions to the next smallest digit specified by the detail specification. The splice shall be examined for compliance with the marking requirements. Markings shall be in compliance with 4.1. If the manufacturer's mark is not already listed in AIR1351, the manufacturer shall show evidence that the symbol has been applied for listing in AIR1351.

6.2 Assembly Instruction Analysis (see 4.4)

The assembly instruction shall be reviewed to determine if the required information is provided and in the order shown, and reported compliant or non-compliant. If assembly instructions are not compliant, they may be brought into compliance before resuming qualification testing.

6.3 Optical Performance Tests (see 4.5)

The graded index multi-mode optical tests shall be performed at 850 nm and/or 1300 nm using the launch conditions specified in 6.3.1, AS5675, and ARP5061. The 140 micron step index multi-mode optical tests shall be performed at 850 nm and/or 1300 nm using the launch conditions specified in 6.3.2. The single mode optical test shall be performed at 1310 nm and/or 1550 nm using the launch conditions specified in 6.3.3. If the detail specification specifies a wavelength of operation, the splices shall be tested at that wavelength.

6.3.1 Launch Conditions

6.3.1.1 Graded-Index Multimode Fiber Launch Conditions

a. Launch specification AS62 (M90) for 0.275 NA fiber (OM1)

The launch conditions for 62.5/125 µm fiber (OM1) with a numerical aperture of 0.275 NA are as shown in Tables 4A through 4C.

Table 4A - AS62 launch specification - 62.5/125 µm, 0.275 NA

Parameter	Specification	Comment
Wavelength (Center)	850 nm ± 30 nm 1300 nm ± 30 nm	Wavelength per system requirement. Affects accuracy little in short systems.
Spectral Width (FWHM)	<140 nm	Not critical. Any smaller spectral width should be accepted. Non-coherent light only for optical power meter (OPM) tests. Coherent light for OTDR test allowed.

Table 4B - AS62 launch specification - far field pattern

Far Field Pattern	Power (%)	Max (NA)	Min (NA)
	5%	0.275	0.250
	15%	0.255	0.230
	75%	0.130	0.100
Far field skewing		<3 degrees	

Table 4C - AS62 launch specification - near field pattern

Near Field Pattern	Power (%)	Max (μm)	Min (μm)
	5%	63	57
	15%	59	53
	75%	35	29
Core eccentricity (Core to ferrule circumference)		<3 μm	

NOTE: For steady-state modal distribution in 62.5/125-μm, 0.275-NA, fiber the launch condition tends towards an 85/85 underfill and may be specified for new applications designated as AS62Eq (Eq for "Equilibrium").

b. Launch specification AS50 for 0.20 NA fiber (OM2 – OM4)

The launch conditions for 50/125-μm fiber with a numerical aperture of 0.20 NA are as shown in Tables 5A through 5C.

Table 5A - AS50 launch specification - 50/125 micron, 0.20 NA

Parameter	Specification	Comment
Wavelength (Center)	850 nm ± 30 nm 1300 nm ± 30 nm	Wavelength per system requirement. Affects accuracy little in short systems
Spectral Width (FWHM)	<140 nm	Not critical Any smaller spectral width should be accepted Non-coherent light only for OPM tests Coherent light for OTDR test allowed

Table 5B - AS50 launch specification - far field pattern

Far Field Pattern	Power (%)	Max (NA)	Min (NA)
	5%	0.150	0.170
	15%	0.134	0.150
	75%	0.057	0.072
Far field skewing		<3 degrees	

Table 5C - AS50 launch specification - near field pattern

Near Field Pattern	Power (%)	Max (µm)	Min (µm)
	5%	39	43
	15%	34	38
	75%	14	18
Core eccentricity (core to ferrule circumference)		<3 µm	

NOTE: For steady-state modal distribution in 50/125 µm, 0.20 NA fiber, the launch condition tends towards a 70/70 underfill and may be specified for new applications designated as AS50Eq (Eq for “Equilibrium”).

6.3.1.2 Launch Conditions for 140 µm Step Index Multi-Mode Fiber

The launch conditions for 100/140-µm fiber with a numerical aperture of 0.29 NA are as shown in Tables 6A through 6C, per AS100 (M80).

Table 6A - AS100 Launch specification - 100/140 µm, 0.29 NA

Parameter	Specification	Comment
Wavelength (Center)	850 nm ± 30 nm 1300 nm ± 30 nm	Wavelength per system requirement. Affects accuracy little in short systems
Spectral Width (FWHM)	<140 nm	Not critical Any smaller spectral width should be accepted Non-coherent light only for OPM tests Coherent light for OTDR test allowed

Table 6B - AS100 launch specification - far field pattern

Far Field Pattern	Power (%)	Max (NA)	Min (NA)
	5%	0.255	0.245
	15%	0.225	0.210
	75%	0.120	0.100
Far field skewing		<3 degrees	

Table 6C - AS100 launch specification - near field pattern

Near Field Pattern	Power (%)	Max (µm)	Min (µm)
	5%	95	80
	15%	85	70
	75%	45	30
Core eccentricity		<5 µm	

6.3.1.3 Single Mode Launch Conditions (OS1 and OS2)

For single mode fiber no special launch conditions are required with the exception that the source power shall be at least 10 dB above the minimum sensitivity of the receiver.

6.3.2 Insertion Loss (IL) (see 4.5.1)

Insertion loss shall be measured in accordance with TIA-455-34, Interconnection Device Insertion Loss Test, unless otherwise specified on specification sheet. Any calibrated optical power detection method may be used if the method is sufficiently sensitive to measure the differential power levels as specified in the individual mechanical and environment requirements of Section 6 and if the method provides repeatable readings (less than 3% variation). An acceptable test set-up is shown in Figure 1.

Alternatively, TIA-455-8 (OTDR) may be used in place of TIA-455-34. This may be of particular value if different loss mechanisms within the test cables may be suspected.

6.3.3 Return Loss (RL) (see 4.5.2)

Return loss shall be measured in accordance with TIA-455-107, Return Loss for Fiber Optic Components, unless otherwise specified in the detail specification. Any calibrated optical power detection method may be used if the method is sufficiently sensitive to measure the differential power levels as specified in the individual mechanical and environment requirements of Section 6 and if the method provides repeatable readings (less than 3% variation).

The nominal test set-up shown in Figure 1 should be used for both insertion loss and return loss measurements of each splice, as it is made.

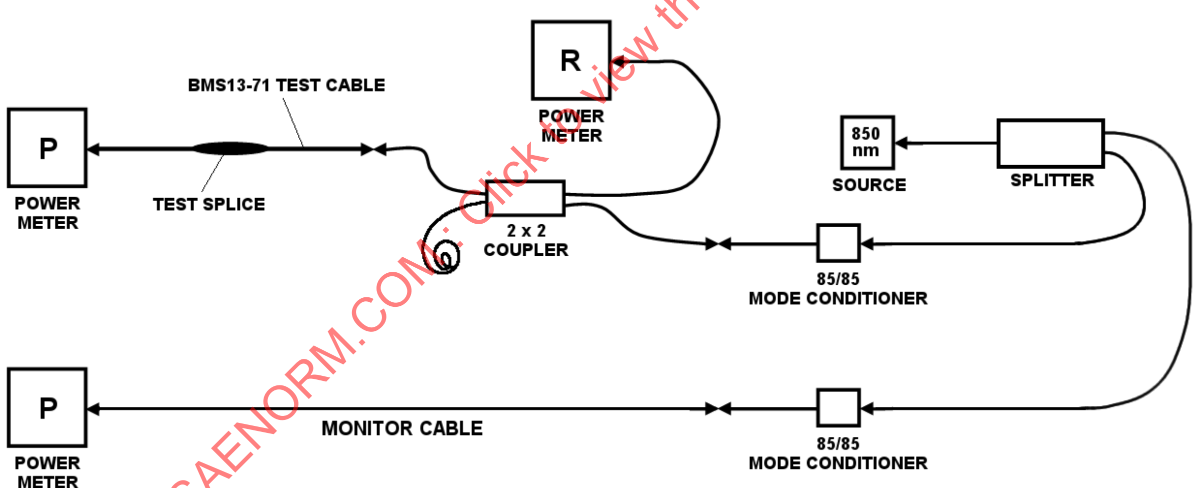

Figure 1 - Nominal insertion and return loss test set-up, with monitor cable to normalize any launched power drift

6.3.4 Change in Optical Transmittance Test (see 4.5.3 and 4.5.5)

The change in optical transmittance of each splice shall be measured in accordance with TIA-455-20, Measurement of Change in Optical Transmittance, utilizing a control or monitor fiber cable reference of the same type as the spliced cables, as shown in Figure 1, to evaluate the change in transmittance due to exposure of the cable to environmental and physical tests. The reference fiber shall be used to calibrate the light source power output just prior to making all measurements. Any optical power detection method may be used if the method is sufficiently sensitive to measure the differential power levels as specified in the individual mechanical and environment requirements of Section 6 and the method provides repeatable readings (less than 3% variation).

6.3.5 Optical Discontinuities (see 4.25 and 4.26)

Unless otherwise specified, any optical discontinuities during the vibration and mechanical shock tests shall be measured in accordance with TIA-455-32, Fiber Optic Device Discontinuities, again using a monitor or control cable to rule out discontinuities unrelated to a splice. Equipment is commercially available that is capable of detecting and logging discontinuities greater than 0.5 dB and greater than 1 µs in 12 channels simultaneously, suitable for test group 4.

6.4 Thermal Cycling (see 4.6)

Either this test or the thermal shock test (6.22) is mandatory; one of them cannot be omitted in a detail specification under this standard.

Unless otherwise specified the splice shall be tested in accordance with TIA-455-3, Temperature Effects Measurement Procedure for Optical Fiber, Optical Cable, and Other Passive Components, again using a monitor or control cable to rule out changes unrelated to a splice. A calibrated test chamber shall be used which can achieve and maintain a temperature at the minimum and maximum operating temperature specified in the detail specification to a tolerance of ± 2 °C. Unless otherwise specified the minimum temperature shall be -55 °C and the maximum temperature shall be +100 °C; however, the minimum and maximum shall not exceed the rated temperature range of the cable on which the splice is being tested. The chamber shall be designed to permit an average temperature change rate of 10 °C per minute minimum. There shall be a minimum of 25 full cycles, the actual number to be specified in the detail specification. A single temperature cycle shall be defined as:

a. Pause at room temperature for 15* minutes

b. Ramp temperature down to the minimum required temperature at the specified rate

c. Pause at the minimum required temperature for 15* minutes

d. Ramp temperature up to room temperature at the specified rate

e. Pause at room temperature for 15* minutes

f. Ramp temperature up to the maximum required temperature at the specified rate

g. Pause at the maximum required temperature for 15* minutes

h. Ramp temperature down to room temperature at the specified rate

*Dwell time may need to be adjusted up depending on unit mass and location of thermocouples to ensure the unit reaches the required temperatures before the end of each pause. Dwell time may need to be increased as validated by thermocouple(s) on the DUT(s).

The splice shall be monitored for change in transmittance continuously and after the conclusion of the test (see 6.3.4).

At the discretion of the Qualifying Authority, the thermal shock test (see 6.22) may be performed instead of the thermal cycling test.

6.5 Tensile Strength Test (see 4.7)

This test is mandatory; it cannot be omitted in any detail specification under this standard.

The splice shall be tested in accordance with TIA-455-6, Cable Retention Test Procedure for Fiber Optic Interconnecting Devices, Procedure 1. Do not use Procedure II (cutting open the cable jacket to access and grip the cable strength members) because the cable's integrity must be maintained for the subsequent altitude immersion test.

6.5.1 Test Equipment

The testing equipment shall include the following:

a. Mandrels, clamps, jaws, or other holding devices that will not distort the splice while gripping the fiber optic cables on either end of it.

b. A mechanism to separate the holding devices at a constant rate of 1 in/min ± 1/4 in/min.

c. A calibrated weight to apply the specified load. Alternatively, a calibrated tension gauge may be used to register the amount of tension being exerted between the cable ends. Unless otherwise specified all aerospace cable splices shall be tested to 20 pounds (90 N) tension.

6.5.2 Test Procedure

Prior to testing the splices, an unspliced length of the same cable on which the splices are installed shall be examined by performing the tensile strength test procedure specified for the splice assembly. The cable shall be pulled to the maximum tensile load specified in the detail specification and tested optically per 6.3.4.

Each splice assembly in turn shall then be connected to the tensile tester. Activate the tensile equipment so that the axial force is applied to the assembly at a speed of 1 in/min ± 1/4 in/min. Once the required tensile load is reached sustain it for 1 minute, then completely relieve the load.

6.5.3 Perform the optical transmittance test during and after the tensile strength test (see 6.3.4).

6.6 Altitude Immersion (see 4.8)

6.6.1 Altitude Chamber

Unless otherwise specified, the splice shall be tested in accordance with TIA-455-15, Altitude Immersion. The altitude immersion test chamber shall be a sealed chamber capable of maintaining an absolute pressure of 2.54 cm of mercury or lower, with sealed feedthroughs capable of admitting at least six fiber cables (five under test plus one control) both in and out.

6.6.2 Test Container

The test container for positioning the splice assemblies shall have the following minimum dimensions: 2 inches wide, 9 inches long, and 3 inches deep. A salt water solution shall be placed in the container to a depth that will completely cover the assemblies at all times during the altitude immersion test. The salt solution shall be prepared by dissolving 5 ± 1 parts by weight of non-iodized commercial table salt in 95 parts by weight of distilled water. No material shall be added to, and no contaminant shall be present in, the container or solution which may prevent wetting of the test sample by the solution.

6.6.3 Sample Preparation

The test samples shall be placed in the container in the chamber in such a manner that the splice assemblies will be entirely immersed in the salt solution. The uppermost point of each splice shall be 2.54 cm (1 inch) minimum below the surface of the solution. The cable shall be arranged so as to prevent any high attenuation which might incorrectly indicate splice degradation. Each test cable shall be routed through the feedthroughs to optical source and detector in such a way that minimum attenuation is induced by the pressure of the feedthroughs or sharp bending.

6.6.4 Altitude Immersion Cycling

The chamber shall be sealed. The chamber pressure shall be lowered from room ambient to an absolute pressure of 2.54 cm + 0.0 cm to 0.5 cm (1 inch) of mercury (75000 feet) within 5 minutes and shall be maintained at this level for 30 minutes minimum. The chamber pressure shall then be cycled (or returned) to room ambient pressure within 1 minute and shall be maintained at room ambient pressure for 30 minutes minimum. The foregoing shall constitute one cycle. Two additional cycles shall be performed (three cycles total). The splice assembly shall remain fully immersed in the salt solution during the three cycles and for final post-test optical performance measurements (see 6.3.4). Optical transmittance measurements shall be taken continuously before, during, and after the test.

6.6.5 Post-Test Evaluation

Within 24 hours at ambient, or after 2 to 3 hours at 120 °F (49 °C), insure that the outsides of the samples are dry, then dissect each one and examine it under at least 3X magnification to determine if any fluid penetrated inside (see 6.26).

6.7 Cable Flexing (see 4.9)

Unless otherwise specified the splice shall be tested in accordance with TIA-455-1, Cable Flexing for Fiber Optic Interconnecting Devices, again using a monitor or control cable to rule out changes unrelated to a splice. This test is not mandatory; it may be omitted in the detail specification.

Referring to TIA-455-1, apply 50 cycles of flex to the cable at the point at which it emerges from one end of the splice. The tensile load applied shall be 4.45 N (1 pound). As specified, the fixture and procedure are designed to test the ability of the splice or its strain relief to support the cable in lateral bending under load. Therefore, the bending mandrel should support the cable and prevent it from bending more sharply than its specified minimum bend radius, or 10 times the cable radius if not otherwise specified. For 2 mm diameter cable the minimum mandrel radius should therefore be 10 mm (0.39 inch). It should be noted that many cables in aerospace applications have a minimum bend radius of 1 inch, and if so the fixture mandrel shall be designed accordingly.

Optical transmittance measurements shall be taken continuously per 6.3.4 before, during, and after the test.

6.8 Cable Twist (see 4.10)

Unless otherwise specified the splice shall be tested in accordance with TIA-455-36, Twist Test for Connecting Devices, again using a monitor or control cable to rule out changes unrelated to a splice. This test is not mandatory; it may be omitted in the detail specification.

Referring to TIA-455-36, unless otherwise specified, apply 50 cycles of twist, each ±180 degrees from its neutral position, to the cable at a point 12 inches below the point at which it emerges from one end of the splice. The tensile load applied shall be 4.45 N (1 pound).

Optical transmittance measurements shall be taken continuously per 6.3.4 before, during, and after the test.

6.9 Impact (Shock Drop) (see 4.11)

When specified the splice shall be tested in accordance with TIA-455-2, Impact Test Measurements for Fiber Optic Devices, method A, again using a monitor or control cable to rule out changes unrelated to a splice. This test is not mandatory; it may be omitted in the detail specification.

Optical transmittance measurements shall be taken continuously per 6.3.4 before, during, and after the test.

6.10 Crush (see 4.12)

When specified the splice shall be tested in accordance with TIA-455-26, Crush Resistance of Fiber Optic Interconnecting Devices (with the exception that the sample shall be a splice), again using a monitor or control cable to rule out changes unrelated to a splice. This test is not mandatory; it may be omitted in the detail specification. The test load shall be 280 pounds (1250 N), and the number of loads shall be 1 (one). Rubber pads shall not be used on the two bearing surfaces.

Optical transmittance measurements shall be taken continuously per 6.3.4 before, during, and after the application and removal of load.

6.11 Axial Compressive Loading (see 4.13)

This test is not mandatory; it may be omitted in the detail specification. If the two ends of the splice assembly are essentially identical, only one end of each splice needs be tested. The control cable shall be tested in parallel to rule out changes unrelated to the splice.

6.11.1 The test cable onto which the splice is assembled shall be gripped over a length equal to at least three cable diameters, starting one cable diameter from the splice enclosure or the strain relief if it is external to the enclosure. The splice enclosure shall likewise be gripped so as not to alter any of its mechanical properties.

6.11.2 The gripped cable and splice enclosure shall be forced together along the cable axis where the cable enters the splice assembly. The force shall be as indicated in Table 7. Care shall be taken that the cable does not buckle under load. The loading and unloading rates shall be linear in time, each completed in less than 10 seconds. The time spent under full compressive load shall be at least 1 minute. No tensile load shall be applied.

6.11.3 Any suitable test fixture may be used, provided it properly grips the splice enclosure and cable, allows control and measurement of the applied compressive axial force, and allows visual observation of the region where the cable enters the splice assembly. The test fixture must also allow for the performance of any optical tests called for while the splice assembly is subject to the compressive axial load.

6.11.4 Measure the distance between the fixture clamp and the enclosure or strain relief before the load is applied and while the full load is applied. The difference is the compression due to load.

6.11.5 Monitor splice attenuation continuously before, during, and after load application per 6.3.4.

6.11.6 Remove the load.

6.11.7 Perform post-test examination per 6.26.

Table 7 - Force required for compressive axial loading

Nominal Cable Diameter (mm)	Compressive Axial Force (N)
0-2.9	10
3-5.9	20
6-9.9	50
10-19.9	100
20 and larger	200

6.12 Thermal Aging Test (see 4.14)

Unless otherwise specified, splices shall be subjected to the test specified in TIA-455-4, Fiber Optic Component Temperature Life Test, Condition D. This test is mandatory; no detail specification under this standard may omit this test or an equivalent thermal aging test.

The cable shall be secured at each end in such a way as to minimize attenuation due to compression or bending. The spliced cable shall hang freely from a horizontal bar in the chamber without the splice touching the bottom or sides of the chamber. The cable/splice assembly shall then be subjected to the maximum operating temperature as specified in the detail specification for 1000 hours. Unless otherwise specified, the test temperature shall be 100 °C. Note however that the test temperature can be no higher than the maximum rated temperature of the cable. The optical performance test (see 6.3.4) shall be performed continuously during the exposure and for at least 1 hour after the samples have returned to room temperature. If a failure occurs, inspect and compare the control cable characteristics against the cable specification before dissecting the splice.

6.13 Freezing Water Immersion (Ice Crush) Test (see 4.15)

The splice shall be tested in accordance with TIA-455-98, Fiber Optic Cable External Freezing Test, method A. This test is mandatory; no detail specification under this standard may omit this test or an equivalent freezing water immersion test.

The cable shall be loosely coiled, and the splice shall be completely immersed in water. The vessel containing the water need not be sealed. Optical performance shall be measured continuously and for at least 1 hour after conclusion of the exposure in accordance with 6.3.4. After the samples have dried post-test, the samples shall be examined for leakage per 6.26.

As an alternative, MIL-STD-1678-5, Method 5504, may be followed.

6.14 Humidity Test (see 4.16)

The cable/splice assembly shall be tested in accordance with TIA 455-5, Humidity Test for Connecting Devices, method A, test condition A (96 hours). This test is mandatory; no detail specification under this standard may omit this test or an equivalent humidity exposure test. The optical performance test (see 6.3.4) shall be performed continuously and for at least 15 minutes after completion of the humidity test.

6.15 Salt Spray Test (see 4.17)

When specified, the cable/splice assembly shall be tested in accordance with TIA 455-16, Salt Spray (Corrosion) Test for Fiber Optic Components, test condition C (48 hours). If the splice contains no metal parts, this test may be omitted. The optical performance test (see 6.3.4) shall be performed continuously and for at least 1 hour after completion of the salt spray test. After the test the sample shall be cleaned and examined for signs of damage or degradation per 6.26.

6.16 Sand and Dust Test (see 4.18)

When specified, the cable/splice assembly shall be tested in accordance with TIA 455-35, Fiber Optic Component Dust (Fine Sand) Test. The optical performance test (see 6.3.4) shall be performed continuously and for at least 1 hour after completion of the sand and dust test. After the test, the sample shall be cleaned and examined for signs of damage or degradation per 6.26.

6.17 Fluid Immersions Test (see 4.19)

Unless otherwise specified 12 cable/splice assemblies shall be tested in accordance with TIA-455-12, Fluid Immersion Test for Fiber Optic Components, Table III, or EIA-364-10 (equivalent). This test is mandatory; no detail specification under this standard may omit this test or an equivalent aviation fluids exposure test.

Note that the number of samples in Group 3 must be determined by the number of fluids to be tested: one sample per fluid. The optical performance test (see 6.3.4) shall be performed continuously and at the completion of each fluid test. After each exposure each sample shall be cleaned and examined for signs of damage or degradation per 6.26.

The detail specification may specify an alternate array of aviation fluids and exposure regimens. One acceptable alternative is published in AS4373. However, any schedule of test fluids must comprise at least 10 and must at a minimum include the following:

a. Aircraft turbine fuel: Jet-A, JP-5, JP-8, or equivalent

b. Water

c. Isopropyl alcohol

d. Hot hydraulic fluids

e. Hot lubricating oils

f. Aircraft cleaning fluid

g. Runway de-icing or aircraft anti-icing fluid

6.18 Vibration/Temperature Cycle Test (see 4.20)

The splice shall be tested through the following three exposures of vibration combined with thermal cycling over the nominal operating temperature range. This test is mandatory; no detail specification under this standard may omit this test or an equivalent vibration/temperature cycle test.

6.18.1 Temperature Cycling

A test chamber, or insulated box mounted on the shaker table, shall be used which can achieve the minimum and maximum operating temperatures specified in the detail specification within a tolerance of ±5 °C. The chamber shall be designed to permit a minimum temperature change rate of 5 °C per minute. It shall be capable of a minimum of one full temperature cycle as specified below per 2 hours of vibration test. Temperature cycling shall continue through the entire vibration test and if necessary after the vibration has stopped in order to complete the required number of full temperature cycles.

6.18.2 A single temperature cycle shall be defined as:

a. Pause at room temperature for 5* minutes

b. Ramp temperature down to the minimum required temperature

c. Pause at the minimum required temperature for 5* minutes

d. Ramp temperature up to room temperature

e. Pause at room temperature for 5* minutes

f. Ramp temperature up to the maximum required temperature