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DEPARTMENT OF DEFENSE
STANDARD PRACTICE

FIBER OPTIC CABLING SYSTEMS REQUIREMENTS AND MEASUREMENTS

(Part 4: TEST SAMPLE CONFIGURATION AND FABRICATION REQUIREMENTS)

(PART 4 OF 5 PARTS)

FOREWORD

1. This Department of Defense Standard Practice is approved for use by the Defense Supply Center Columbus, Defense Logistics Agency, and is available for use by all Departments and Agencies of the Department of Defense.

2. Comments, suggestions or questions on this document should be addressed to Defense Supply Center Columbus, ATTN: VAT, Post Office Box 3990, Columbus, OH 43218-3990, or emailed to FiberOpticGroup@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.daps.dla.mil.

3. This standard practice provides detailed information and guidance to personnel concerned with ensuring standardization of fiber optic cable topologies (optical fiber cabling and associated components) on military mobile vehicles used in air, land, and sea applications. In general, the requirements and methods specified herein are not identifiable to any specific mobile vehicle class or type, but are intended to standardize and minimize variations in requirements, test setups, test measurement procedures, test sample fabrication configurations, and other aspects that must be addressed for completeness. Where specified, constrains for usage or platform types will be listed. The term "platform" will be used to refer to the military mobile vehicles in general or, where designated, one particular class (such as "aircraft platform") or one particular type within that class (such as "F-35").

4. In order to provide flexibility in the use and update of the different aspects for requirements and methods, this standard practice is issued in five parts; as follows:

   Part 1: Design, maintenance and installation requirements. This part addresses design requirements for platforms that use cable harnesses as the means to transport data through optical fiber among communication network and end user equipment. Larger platforms that route trunk cables through cableways and drop cables to the end user (application equipment), can cite applicable requirements in Part 1 of the Standard Practice and augment them with use of MIL-HDBK-2051 and MIL-STD-2042 as appropriate. Surface ships and submarines, are to use MIL-HDBK-2051 and MIL-STD-2042 in lieu of Part 1 of this Standard Practice.

   Part 2 Optical measurements. Part 2 of this standard addresses further details to refine or bound (constrain) the performance of each optical test measurement addressed. The test methods, such as those in a TIA-455 series standard or military standard/specification, are cited in part 2. This part of the standard practice augments the test method in the standard or specification to ensure consistency with setup and measurement procedure. This consistency minimizes variations when comparing data obtained from different test laboratories (including commercial, vendor, Government, and Government contractor).

   Part 3 Physical, mechanical environmental, and material measurements. Part 3 of this standard addresses further details to refine or bound (constrain) the performance of each physical, mechanical, environmental and material test measurement or inspection addressed. The test methods, such as those in a TIA-455 series standard or military standard/specification, are cited in part 3. This part of the standard practice augments the test method to ensure consistency with setup, measurement procedure, data recording/analysis, and other factors critical to conducting or evaluating test performance. This consistency minimizes variations when comparing data obtained from different test laboratories (including commercial, vendor, Government, and Government contractor).

   Part 4 Test sample configuration and fabrication requirements. Part 4 of this standard addresses further details to refine or bound (constrain) the configuration and fabrication of test samples for the fiber optic components addressed. Fabrication methods, such as those in the Shipboard installation standard, MIL-STD-2042, or in the general series aircraft maintenance manual, NAVAIR 01-1A-505-4/T.O. 1-1A-14-4/TM 1-1500-323-24-4, are cited in part 4. This part of the standard practice augments the fabrication method to ensure consistency with use of the same components (such as cable types) and processes and augments the component specification to ensure consistency of the test sample configuration.

Part 5 Design phase and legacy measurements. Tests that are more unique to the design phase are addressed in Part 5 of this standard practice. Also, Part 5 addresses some test methods cited in former DOD-STD-1678. The test methods cited in DOD-STD-1678 are considered obsolete; however, a few military specifications and commercial standards still refer to some of the test methods. These test methods are provided in this part of the standard with the recommended replacement method. These latter test methods are listed under the constraint that they be used only with the specific military specifications or commercial standards in which they are cited. The intent is to delete each DOD-STD-1678 test method from that standard practice in Part 5 once its reference from military specification or commercial standard is removed.

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1. SCOPE

1.1 Scope. Part 4 of this standard practice augments the specified fabrication method to ensure consistency with use of the same components (such as cable types) and processes. Mainly, this augmentation provides details to refine or bound (constrict) the requirements for the test sample configuration and fabrication. This part of the standard practice test sample may be referred to as Device Under Test or DUT in this Standard Practice.

1.1.1 Applicability. The test sample configuration and fabrication, such as those in a TIA-455 series standard or military standard/specification, are cited elsewhere. This part of the standard practice augments by further refining or bounding the requirements found in the TIA-455 series standard or military standard/specification to ensure consistency with test sample configuration and fabrication. This consistency minimizes variations when comparing data obtained from different test laboratories (including commercial, vendor, Government, and Government contractor) and product from different vendors. The rapidly changing state of the art in fiber optic technology makes it essential that some degree of flexibility be exercised in enforcing this document. When there is a conflict between this document and the platform specification or contract, the platform specification or contract shall take precedence. Where obsolescence or other issues are such that the configuration or fabrication requirements specified for the refinement or bound (constraint) herein cannot be implemented, users shall submit a description of the issue along with a request for clarification or with proposal for redefining the requirement to consider for incorporation into this standard practice to: Defense Supply Center Columbus, ATTN: VAT, Post Office Box 3990, Columbus, OH 43218-3990, or emailed to FiberOpticGroup@dla.mil.

1.2 Intended uses for Part 4.

1.2.1 Primary use of Part 4. Part 4 of this standard practice was prepared primarily to ensure consistency in the configuration and fabrication of test samples used in qualification testing.

1.2.2 Supplemental use. Part 4 of this standard practice contains information for test sequences that shall be used during qualification. These test sequences specify the type and number of test samples that shall be used for each inspection (test). The intent is to ensure consistency in test sample configuration and sample size.

1.2.3 General constraints on use. Part 4 of this standard practice is not intended to be used in lieu of a test laboratory specifying test sample configurations and sample sizes applicable to each specific test procedure.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, and 5 of this standard practice. This section does not include documents cited in other sections of this standard practice or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, and 5 of this standard practice, whether or not they are listed.

2.2 Government documents.

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

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-2042	-	Fiber Optic Cable Topology Installation, Standard Methods for Naval Ships, Parts 1 to 6.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-49291	-	Fiber, Optical, (Metric) General Specification for
MIL-PRF-24623	-	Splice, Fiber Optic Cable General Specification for (Metric)
MIL-PRF-29504	-	Termini, Fiber Optic Connector, Removable, General Specification for

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

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

DEPARTMENT OF DEFENSE DRAWINGS

NAVSEA Drawing 53711-8283255	-	Termini, Fiber Optic, MIL-PRF-29504/4 & /5, Test Sample Configurations/Fabrication & Specific Methods/Practices.
NAVSEA Drawing 53711-8283458	-	Termini, Fiber Optic, MIL-PRF-29504/14 & /15, Test Sample Configurations/Fabrication & Specific Methods/Practices.
NAVSEA Drawing 53711-8283460	-	Termini, Fiber Optic, MIL-PRF-29504/18, Test Sample Configurations/Fabrication & Specific Methods/Practices.
NAVSEA Drawing 53711-8328898	-	Mechanical Splice, Fiber Optic, Aircraft, Test Sample Configurations/Fabrication & Specific Methods/Practices.

(A copy of the NAVSEA Drawings can be obtained at web site: https://fiberoptics.nswc.navy.mil/ in the NAVSEA Drawing section under Component Information. If unable to access this Web Site, request an application by e-mail to NSWC DD Warfare Systems Department at: DLGR_NSWC_Foweb@navy.mil.)

DEPARTMENT OF DEFENSE PUBLICATIONS

NAVAIR 01-1A-505-4/ T.O. 1-1A-14-4/ TM 1-1500-323-24-4	-	Aircraft Fiber Optic Cabling, Technical Manual, Installation and Testing Practices.

(A copy of this Government General Series Technical Manual can be obtained at web Site: https://jswag.navair.navy.mil. At the home page select “Document Library” (on left side), then select the “JFOWG” folder followed by the “Maintenance Documents.)

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z136.2 - Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources.

(Copies are available from http://www.ansi.org or the American National Standards Institute, 1430 Broadway, New York, NY 10018-3308.)

ELECTRONICS INDUSTRY ALLIANCE/TELECOMMUNICATIONS INDUSTRY ASSOCIATION (EIA/TIA)

TIA-440 - Fiber Optic Terminology.

(Copies are available from http://www.global.ihs.com or to Global Engineering Documents, 1990 M Street NW, Suite 400, Washington, DC 20036.)

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

3. DEFINITIONS

3.1 General fiber optics terms. Definitions for general fiber optics terms used in this standard practice are in accordance with TIA-440. Definitions for other terms as they are used in this standard practice are given in the following paragraphs.

3.2 Acronyms. The following acronyms are used in this standard practice:

DUT	Device under test
FOCT	Fiber optic cable topology
QPL	Qualified Products List

3.3 Qualification testing, general. Formal testing designed to demonstrate that the software and hardware of a system meet specified requirements. General qualification testing may be accomplished at any time during the life of a system, such as during prototype development, manufacturing, shipment, storage, installation, and operation. Most often this qualification testing is conducted to determine the extent to which a system passes a specified set of performance criteria.

3.4 Qualification testing, QPL process. For purposes of this standard practice, qualification testing is refined and bounded to the term as used for Government Qualified Products List (QPL) testing or inspection. This testing is performed to determine if the FOCT (fiber optic cable topology) component or DUT (device under test) meets the requirements specified in the fiber optic component applicable military specification. Physical, optical, mechanical, environmental, and material testing is performed in specified test sequences. One parameter is tested at a time. Successful completion places the DUT onto the QPL for that FOCT component military specification. Other terminology is to be used in lieu of qualification for any prototype development, manufacturing, shipment, storage, installation, and operational testing.

4. GENERAL REQUIREMENTS

4.1 Test sample configurations.

4.1.1 Connectors and splices. Cable assembly configuration normally consists of 10 meters of cable with the DUT in the middle (at 5 meters) and single ferrule connectors on the ends to mate with the optical instrumentation. For insertion loss tests on multiple termini connectors where a cut-back must be done, a 13 meter length of cable is used with the DUT placed 8 meters from the launch end of the cable. This allows 3 cut-backs to be performed, each cut-back being one meter long. If a specific mechanical or environmental test requires longer lengths to reach optical measurement instrumentation, added test jumpers may be used after receipt of Government approval. Test sample configurations for multiple termini connectors, termini for multiple termini connectors, and aircraft mechanical splices are further identified in this Standard Practice.

4.1.2 Optical fiber and cable. DUT lengths are generally over 1,000 meters for optical fiber and 500 meters for fiber optic cable. These lengths are required to permit sufficient optical measurement resolution for deviations in optical performance during testing. Some mechanical and environmental tests permit cutting the DUT into multiple sections for testing. Mechanical tests are mostly performed on short lengths (usually less than 10 meters) and environmental tests on longer lengths (150 to 500 meters for fiber optic cable, over 1000 meters for optical fiber). Due to these different lengths, the optical transmittance measurements (for change in optical transmittance) are done in dB for mechanical tests and in dB/km for environmental tests.

4.2 Safety compliance during DUT assembly fabrication.

4.2.1 Fiber optic safety precautions. The fiber optic safety precautions listed in ANSI Z136.2 and subordinate Work Package 004 01 of NAVAIR 01-1A-505-4/T.O. 1-1A-14-4/TM 1-1500-323-24-4 shall apply. Verify, at a minimum, that operating/test personnel are aware of 4.2.1a through 4.2.1m.

a. Keep all food and beverages out of the work area. If fiber particles are ingested they can cause internal injury.

b. Do not smoke while working with fiber optic systems.

c. Always wear safety glasses with side shields. Treat fiber optic splinters the same as glass splinters.

d. Never look directly into the end of fiber cables until you are positive that there is no light source at the other end. Use a fiber optic power meter to make certain the fiber is dark.

e. Do not touch the ends of the fiber, as they may be razor sharp. Rinse hands thoroughly under running water to rinse away any glass shards.

f. Contact wearers must not handle their lenses until they have thoroughly rinsed and then washed their hands.

g. In the event glass shards enter the eye or penetrate the skin seek medical attention immediately.

CAUTION: Do not rub your eye. Only authorized medical personnel should attempt removal of glass shards from the eye. Do not attempt removal of glass from the eye yourself!

h. Do not touch your eyes while working with fiber optic systems until your hands have been thoroughly cleaned.

i. Clean hands thoroughly first by rinsing hands under running water to rinse away any glass shards after handling and repairing fiber. Then wash normally. Wear protective gloves if at all possible.

j. Keep all combustible materials safely away from heat sources.

k. Ultraviolet (UV) safety glasses shall be worn when using the UV curing lamp.

l. Only work in well-ventilated areas.

m. Avoid skin contact with epoxies.

4.3 Consensus for test sample fabrication and sample size. Part 4 of this Standard Practice is a compilation of existing requirements previously released in the form of other documents. Consensus was obtained among various Government activities, responsible for specifying the performance of fiber optic cabling components and systems/networks, on the requirements documented herein. These same Government activities shall be the means to reach consensus on standardization of new/revised requirements, identify new requirements and new technologies that permit its rapid introduction, and provide those requirements to update Part 4 of this Standard Practice.

5. DETAILED REQUIREMENTS.

FIBER OPTIC TEST SAMPLE CONFIGURATIONS, FABRICATION, AND SPECIFIC METHODS/PRACTICES

5.1 Connection (connector, termini and mechanical splices) requirements. Requirements for the fiber optic test sample configurations, fabrication and specific methods/practices shall be implemented as specified in 5.1.1 through 5.1.4.

5.1.1 MIL-PRF-29504/4 and MIL-PRF-29504/5 termini. Test sample configurations and fabrication shall be performed to Requirement 4101.

5.1.2 MIL-PRF-29504/14 and MIL-PRF-29504/15 termini. Test sample configurations and fabrication shall be performed to Requirement 4102.

5.1.3 MIL-PRF-29504/18 terminus. Test sample configurations and fabrication shall be performed to Requirement 4103.

5.1.4 MIL-PRF-24623/7 mechanical splice. Test sample configurations and fabrication shall be performed to Requirement 4104.

5.2 Optical Fiber and Cable Requirements. Requirements for the fiber optic test sample configurations, fabrication and specific methods/practices shall be implemented as specified in 5.2.1.

5.2.1 MIL-PRF-49291 optical fiber. Test sample configurations and fabrication shall be performed to Requirement 4201.

6. NOTES

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

6.1 Intended use. The test sample configurations and fabrication requirements depicted in this standard practice are intended for qualification testing; however, they are applicable for other types of test or evaluation programs that require citing the configuration and fabrication for fiber optic cabling components used on military mobile vehicles also identified as platforms.

6.2 Acquisition requirements. Acquisition documents should specify the following:

Title, number, and date of this standard practice.

6.3 Subject term (key word) listing.

Test sample configuration
Test sample fabrication requirements
Fiber optic cabling

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

6.5 Supersession data. The five parts of MIL-STD-1678 replace superseded DOD-STD-1678 with completely new fiber optic requirements and measurements. With the exception of some legacy material in Part 5 of MIL-STD-1678, none of the fiber optic test and measurement material comprising superseded DOD-STD-1678 has been included. With the exceptions noted in Part 5 of this standard practice, this standard practice should be applied in lieu of the legacy methods in superseded DOD-STD-1678.

REQUIREMENTS

FIBER OPTIC TEST SAMPLE CONFIGURATIONS,

FABRICATIONS, AND SPECIFIC METHOD/PRACTICES

CONNECTION (CONNECTOR, TERMINI, AND MECHANICAL SPLICES) REQUIREMENTS

4101 - 4104

REQUIREMENT 4101

FIBER OPTIC TEST SAMPLE CONFIGURATIONS, FABRICATION, AND SPECIFIC METHODS/PRACTICES FOR MIL-PRF-29504/4 AND MIL-PRF-29504/5 TERMINI

1. PURPOSE

1.1 Purpose. This requirement standardizes configurations, fabrication, and specific methods/practices for the components to be used in the assembly/fabrication of fiber optic the test sample (DUT assembly) for MIL-PRF-29504/4 and MIL-PRF-29504/5 termini and, by extension for fiber optic applications, MIL-DTL-38999 connectors. The DUT assemblies are intended to be used as part of qualification testing, but can be used in developmental, prototype, production, rework, and modification programs on military platform fiber optic cable assemblies. To ensure that the risk to the Government of accepting bad optical measurement data is low, to minimize test variations and to permit more accurate comparison of test results from multiple sources, a “standardized” approach is specified for DUT assembly configurations, fabrication, and specific methods/practices.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, and 5 of this standard practice. This section does not include documents cited in other sections of this standard practice or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, and 5 of this standard practice, whether or not they are listed.

2.2 Government documents.

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

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-29504	-	Termini, Fiber Optic Connector, Removable, General Specification for.
MIL-DTL-38999	-	Connectors, Electrical, Circular, Miniature, High Density, Quick Disconnect (Bayonet, Threaded, and Breech Coupling), Environment Resistant, Removable Crimp and Hermetic Solder Contacts, General Specification for.

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

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

DEPARTMENT OF DEFENSE DRAWINGS

NAVSEA Drawing 53711-8283255	-	Termini, Fiber Optic, MIL-PRF-29504/4 & /5, Test Sample Configurations/ Fabrication & Specific Methods/Practices.

(A copy of NAVSEA Drawing 53711-8283255 can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the NAVSEA Drawing section under Component Information. If unable to access this Web Site, request an application by e-mail to NSWC DD Warfare Systems Department at DLGR_NSWC_Foweb@navy.mil.)

DEPARTMENT OF DEFENSE PUBLICATIONS

NAVAIR 01-1A-505-4/- T.O. 1-1A-14-4/ TM 1-1500-323-24-4	Aircraft Fiber Optic Cabling, Technical Manual, Installation and Testing Practices.

(A copy of this Government General Series Technical Manual can be obtained at website: https://jswag.navair.navy.mil. At the home page select “Document Library” (on left side), then select the “JFOWG” folder followed by the “Maintenance Documents.)

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

3. DEFINITIONS.

3.1 Cable, fiber optic. A fiber optic cable is a cable that contains optical fibers. The cable may be of a tight buffer or a loose tube design.

3.2 Cable bundle, fiber optic. Single fiber cables grouped together and secured by lacing tape. The cable bundle can be placed in convoluted tubing, used in various protected harness configurations or used as is in an open cable harness configuration.

3.3 Cable, loose tube. A fiber optic cable design is one configured with one or more optical fibers are fitted loosely within a tube, giving the optical fibers freedom to move. This mobility and isolation from the tube minimizes the effects of external forces on the performance of the link. The isolation allows cable expansion and contraction with temperature independent of the optical fibers.

3.4 Cable, tight buffer. A fiber optic cable design is one configured with an additional protective coding (additional buffer layer) is applied directly over a coated (buffered) fiber. Buffer material helps preserve the fiber’s inherent strength and provides increased mechanical protection. A tight buffer cable allows cable placement in tighter bends, more roughed handling (such as better crush and impact resistance).

3.5 Cabling, fiber optic. Fiber optic cabling is a term used to include single fiber cable, multiple fiber cable, fiber optic cable bundles, and fiber optic cable harnesses. The (optical) fiber is the optical conduit or waveguide transmission media, whereas metallic conductor (wire) is used in an electrical cable. Cable structure is added to make the fibers easier to handle and maintain. The fiber is a thin piece of glass (with a diameter usually around 125 micrometers) that contains and transports the light signals.

3.6 Connector, fiber optic. A device that permits repeated mating and couples the optical power between two optical fibers or two groups of optical fibers. A fiber optic connector must maintain fiber alignment without significant loss of optical power.

3.7 Optical fiber. An optical fiber is a thin cylindrical dielectric (non-conductive) waveguide used to send light energy for communication. Optical fibers consist of three parts: The core, the cladding, and the coating or buffer. The choice of optical fiber materials and fiber design depends on operating conditions and intended application.

3.8 Optical fiber, multimode. A multimode optical fiber is one that supports the propagation of more than one bound mode (electromagnetic wave).

3.9 Optical fiber, single mode. A small core optical fiber where one bounded electromagnet wave of light will propagate at the wavelength of interest.

3.10 Termination. The process performed for placing a connector, terminus, splice, or other device at the end of an optical waveguide. This placement optically minimizes leakage/losses and reflection. Terminations are used to join or connect two adjacent optical waveguide ends or to terminate the fiber at either a source (electrical to optical conversion) or receiver (optical to electrical conversion) where the light leaves the optical waveguide and continues in a non-waveguide mode of propagation.

3.11 Wire. "A usually pliable metallic strand or rod made in many lengths and diameters, sometimes clad and often electrically insulated, used chiefly for structural support or to conduct electricity." Source: American Heritage Dictionary, College Edition.

4. Configurations. In the context of Requirement 4101, the component being tested (device under test or DUT) is the MIL-PRF-29504/4 and MIL-PRF-29504/5 termini and, by extension for fiber optic applications, the MIL-DTL-38999 connectors. The test sample or DUT assembly is the DUT with the other fiber optic components that comprise these assembled components. Configurations for DUT assemblies that shall be used for qualification conform to specific type, size, and other fiber optic component parameters that serve to constrain and standardize on the DUT assembly make-up. Processes that shall be used for fabrication (assembly including termination) with specific methods/practices are standardized also. Configurations used and fabrications performed shall be those as specified in NAVSEA Drawing 53711-8283255 with further constrains cited in 4.1 and 4.2.

4.1 Termination. The terminus termination process of the test sample fabrication shall be in accordance with appendix A of NAVSEA Drawing 53711-8283255.

4. 2 Connector accessories configuration. The backshell configurations to use as part of the test sample have not been standardized to date. Refer to the qualifying activity for backshell configurations to be used.

4.3 Connector accessories assembly. The connector accessories assembly process shall be in accordance with Work Package WP 011 03 Of NAVAIR 01-1A-505-4, T.O. 1-1A-14-4, TM 1-1500-323-24-4.

5. Implementation. Test samples (DUT assemblies) shall be prepared for both "Qualification, except interoperability" and for "Interoperability" as specified NAVSEA Drawing 53711-8283255 (see 5.1 and 5.2 for intent).

5.1 Qualification, except interoperability. DUT assemblies for termini qualification shall consist of un-terminated termini, termini as part of a single fiber cable, and termini as a part of a multiple termini connector. Likewise, DUT assemblies for connector qualification shall consist of un-terminated connectors and termini as a part of a multiple termini connector.

5.2 Interoperability. DUT assemblies for termini interoperability shall consist of un-terminated termini, un-terminated connectors, termini as part of a single fiber cable, and termini as a part of a multiple termini connector.

6. NOTES.

6.1 Intents behind standardization efforts.

6.1.1 Decrease matrix of test samples to be tested. Parties involved wanted to see termini tested with various ferrule hole diameters, ferrule material, strain relief capture mechanisms, epoxy types, cable types (tight buffer, loose tube, polyimide coated fiber), and fiber types. The number of test samples required became impracticably large. Government determined the test sample configurations that would be considered minimum, but acceptable. These test sample configurations are described in this drawing.

6.1.2 Multiple party testing considerations. The incentive to minimize test variables, resulting in a level playing field for multiple parties testing, leads the Government to establish a baseline. This baseline includes considerations for fabrication of test samples, methods to employ launch conditions and use of specific test practices in addition to specifics for test sample configurations.

REQUIREMENT 4101

6.1.3 Optical performance. Revision of the optical performance requirements was one area of consideration for Revision C to the MIL-PRF-29504/4 and MIL-PRF-29504/5 termini specification sheets. Test data needed to determine the extent to which the optical performance parameters could be tightened was not available. Testing to be performed first needed to standardize on test sample configurations, test sample fabrication (including the fiber optic components/materials used), method to achieve launch condition and specific test practices in order to reduce test variables.

6.2 Interoperability. Separate test sample configurations are required for interoperability testing. These test sample configurations are in addition to the ones to be used for the other qualification tests.

REQUIREMENT 4101

REQUIREMENT 4102

FIBER OPTIC TEST SAMPLE CONFIGURATIONS, FABRICATION, AND SPECIFIC METHODS/PRACTICES FOR MIL-PRF-29504/14 AND MIL-PRF-29504/15 TERMINI

1. PURPOSE

1.1 Purpose. This requirement standardizes configurations, fabrication and specific methods/practices for the components to be used in the assembly (fabrication) of fiber optic the test sample (DUT assembly) for MIL-PRF-29504/14 and MIL-PRF-29504/15 termini and, by extension for fiber optic multiple termini connector applications, MIL-PRF-28876 connectors. The DUT assemblies are intended to be used as part of qualification testing, but can be used in developmental, prototype, production, rework, and modification programs on military platform fiber optic cable assemblies. To ensure that the risk to the Government of accepting bad optical measurement data is low, to minimize test variations and to permit more accurate comparison of test results from multiple sources, a "standardized" approach is specified for DUT assembly configurations, fabrication, and specific methods/practices.

2. APPLICABLE DOCUMENTS

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DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-29504	-	Termini, Fiber Optic Connector, Removable, General Specification for.
MIL-PRF-28876	-	Connectors, Fiber Optic, Circular, Plug and Receptacle Style, Multiple Removable Termini, General Specification for.

DEPARTMENT OF DEFENSE STANDARD

MIL-STD-2042	-	Fiber Optic Cable Topology Installation, Standard Methods for Naval Ships.

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

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DEPARTMENT OF DEFENSE DRAWINGS

NAVSEA Drawing 53711-8283458	-	Termini, Fiber Optic, MIL-PRF-29504/14 & /15, Test Sample Configurations/Fabrication & Specific Methods/Practices.

(A copy of NAVSEA Drawing 53711-8283458 can be obtained at Website: https://fiberoptics.nswc.navy.mil/ in the NAVSEA Drawing section under Component Information. If unable to access this Web Site, request an application by e-mail to NSWC DD Warfare Systems Department at DLGR_NSWC_Foweb@navy.mil.

2.3 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the test 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 specific exemption has been obtained.

3. DEFINITIONS.

3.1 Cable, fiber optic. A fiber optic cable is a cable that contains optical fibers. The cable may be of a tight buffer or a loose tube design.

3.2 Cable bundle, fiber optic. Single fiber cables grouped together and secured by lacing tape. The cable bundle can be placed in convoluted tubing, used in various protected harness configurations or used as is in an open cable harness configuration.

3.3 Cable, loose tube. A fiber optic cable design is one configured with one or more optical fibers are fitted loosely within a tube, giving the optical fibers freedom to move. This mobility and isolation from the tube minimizes the effects of external forces on the performance of the link. The isolation allows cable expansion and contraction with temperature independent of the optical fibers.

3.4 Cable, tight buffer. A fiber optic cable design is one configured with an additional protective coding (additional buffer layer) is applied directly over a coated (buffered) fiber. Buffer material helps preserve the fiber's inherent strength and provides increased mechanical protection. A tight buffer cable allows cable placement in tighter bends, more roughed handling (such as better crush and impact resistance).

3.5 Cabling, fiber optic. Fiber optic cabling is a term used to include single fiber cable, multiple fiber cable, fiber optic cable bundles, and fiber optic cable harnesses. The (optical) fiber is the optical conduit or waveguide transmission media, whereas metallic conductor (wire) is used in an electrical cable. Cable structure is added to make the fibers easier to handle and maintain. The fiber is a thin piece of glass (with a diameter usually around 125 micrometers) that contains and transports the light signals.

3.6 Connector, fiber optic. A device that permits repeated mating and couples the optical power between two optical fibers or two groups of optical fibers. A fiber optic connector must maintain fiber alignment without significant loss of optical power.

3.7 Optical fiber. An optical fiber is a thin cylindrical dielectric (non-conductive) waveguide used to send light energy for communication. Optical fibers consist of three parts: the core, the cladding, and the coating or buffer. The choice of optical fiber materials and fiber design depends on operating conditions and intended application.

3.8 Optical fiber, multimode. A multimode optical fiber is one that supports the propagation of more than one bound mode (electromagnetic wave).

3.9 Optical fiber, single mode. A small core optical fiber where one bounded electromagnet wave of light will propagate at the wavelength of interest.

3.10 Termination. The process performed for placing a connector, terminus, splice, or other device at the end of an optical waveguide. This placement optically minimizes leakage/losses and reflection. Terminations are used to join or connect two adjacent optical waveguide ends or to terminate the fiber at either a source (electrical to optical conversion) or receiver (optical to electrical conversion) where the light leaves the optical waveguide and continues in a non-waveguide mode of propagation.

3.11 Wire. "A usually pliable metallic strand or rod made in many lengths and diameters, sometimes clad and often electrically insulated, used chiefly for structural support or to conduct electricity." Source: American Heritage Dictionary, College Edition.

4. Configurations. In the context of Requirement 4102, the component being tested (device under test or DUT) is the MIL-PRF-29504/14 and MIL-PRF-29504/15 termini and, by extension for fiber optic multiple termini connector applications, the MIL-PRF-28876 connectors. The test sample or DUT assembly is the DUT with the other fiber optic components that comprise these assembled components. Configurations for DUT assemblies that shall be used for qualification conform to specific type, size, and other fiber optic component parameters that serve to constrain and standardize on the DUT assembly make-up. Processes that shall be used for fabrication (assembly including termination) with specific methods/practices are standardized also. Configurations used and fabrications performed shall be those as specified in NAVSEA Drawing 53711-8283458 with further constrains cited in 4.1 and 4.2.

4.1 Termination. The terminus termination process of the test sample fabrication shall be in accordance with Part 5 of MIL-STD-2042.

4.2 Connector accessories assembly. The connector accessories assembly process shall be in accordance with Part 5 of MIL-STD-2042.

5. Implementation. Test samples (DUT assemblies) shall be prepared for both “Qualification, except interoperability” and for “Interoperability” as specified NAVSEA Drawing 53711-8283458 (see 5.1 and 5.2 for intent).

5.1 Qualification, except interoperability. DUT assemblies for termini qualification shall consist of un-terminated termini, termini as part of a single fiber cable, and termini as a part of a multiple termini connector. Likewise, DUT assemblies for connector qualification shall consist of un-terminated connectors and termini as a part of a multiple termini connector.

5.2 Interoperability. DUT assemblies for termini interoperability shall consist of un-terminated termini, un-terminated connectors, termini as part of a single fiber cable, and termini as a part of a multiple termini connector.

6. NOTES.

6.1 Intents behind standardization efforts.

6.1.1 Multiple party testing considerations. The incentive to minimize test variables, resulting in a level playing field for multiple parties testing, leads the Government to establish a baseline. This baseline includes considerations for fabrication of test samples, methods to employ launch conditions, and use of specific test practices in addition to specifics for test sample configurations.

6.2 Interoperability. Separate test sample configurations are required for interoperability testing. These test sample configurations are in addition to the ones to be used for the other qualification tests.

REQUIREMENT 4102

REQUIREMENT 4103

FIBER OPTIC TEST SAMPLE CONFIGURATIONS, FABRICATION, AND SPECIFIC METHODS/PRACTICES FOR MIL-PRF-29504/18 TERMINUS

1. PURPOSE

1.1 Purpose. This requirement standardizes configurations, fabrication, and specific methods/practices for the components to be used in the assembly/fabrication of fiber optic the test sample (DUT assembly) for the MIL-PRF-29504/18 terminus and, by extension for fiber optic multiple termini connector applications, MIL-PRF-64266 connectors. The DUT assemblies are intended to be used as part of qualification testing, but can be used in developmental, prototype, production, rework, and modification programs on military platform fiber optic cable assemblies. To ensure that the risk to the Government of accepting bad optical measurement data is low, to minimize test variations, and to permit more accurate comparison of test results from multiple sources, a "standardized" approach is specified for DUT assembly configurations, fabrication, and specific methods/practices.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, and 5 of this standard practice. This section does not include documents cited in other sections of this standard practice or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, and 5 of this standard practice, whether or not they are listed.

2.2 Government documents.

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

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-29504	-	Termini, Fiber Optic Connector, Removable, General Specification for.
MIL-PRF-64266	-	Connectors, Fiber Optic, Circular, Plug and Receptacle Style, Multiple Removable Genderless Termini, Environment Resisting General Specification for.

DEPARTMENT OF DEFENSE STANDARD

MIL-STD-2042	-	Fiber Optic Cable Topology Installation, Standard Methods for Naval Ships.

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

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

DEPARTMENT OF DEFENSE DRAWINGS

NAVSEA Drawing 53711-8283460	-	Termini, Fiber Optic, MIL-PRF-29504/18, Test Sample Configurations/Fabrication & Specific Methods/Practices.

(A copy of NAVSEA Drawing 53711-8283460 can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the NAVSEA Drawing section under Component Information. If unable to access this Web Site, request an application by e-mail to NSWC DD Warfare Systems Department at DLGR_NSWC_Foweb@navy.mil.

DEPARTMENT OF DEFENSE PUBLICATIONS

NAVAIR 01-1A-505-4/- T.O. 1-1A-14-4/ TM 1-1500-323-24-4	Aircraft Fiber Optic Cabling, Technical Manual, Installation and Testing Practices.

(A copy of this Government General Series Technical Manual can be obtained at website: https://jswag.navair.navy.mil. At the home page select “Document Library” (on left side), then select the “JFOWG” folder followed by the “Maintenance Documents.)

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3. DEFINITIONS.

3.1 Cable, fiber optic. A fiber optic cable is a cable that contains optical fibers. The cable may be of a tight buffer or a loose tube design.

3.2 Cable bundle, fiber optic. Single fiber cables grouped together and secured by lacing tape. The cable bundle can be placed in convoluted tubing, used in various protected harness configurations, or used as is in an open cable harness configuration.

3.3 Cable, loose tube. A fiber optic cable design is one configured with one or more optical fibers are fitted loosely within a tube, giving the optical fibers freedom to move. This mobility and isolation from the tube minimizes the effects of external forces on the performance of the link. The isolation allows cable expansion and contraction with temperature independent of the optical fibers.

3.4 Cable, tight buffer. A fiber optic cable design is one configured with an additional protective coding (additional buffer layer) is applied directly over a coated (buffered) fiber. Buffer material helps preserve the fiber’s inherent strength and provides increased mechanical protection. A tight buffer cable allows cable placement in tighter bends, more roughed handling (such as better crush and impact resistance).

3.5 Cabling, fiber optic. Fiber optic cabling is a term used to include single fiber cable, multiple fiber cable, fiber optic cable bundles, and fiber optic cable harnesses. The (optical) fiber is the optical conduit or waveguide transmission media, whereas metallic conductor (wire) is used in an electrical cable. Cable structure is added to make the fibers easier to handle and maintain. The fiber is a thin piece of glass (with a diameter usually around 125 micrometers) that contains and transports the light signals.

3.6 Connector, fiber optic. A device that permits repeated mating and couples the optical power between two optical fibers or two groups of optical fibers. A fiber optic connector must maintain fiber alignment without significant loss of optical power.

3.7 Optical fiber. An optical fiber is a thin cylindrical dielectric (non-conductive) waveguide used to send light energy for communication. Optical fibers consist of three parts: The core, the cladding, and the coating or buffer. The choice of optical fiber materials and fiber design depends on operating conditions and intended application.

3.8 Optical fiber, multimode. A multimode optical fiber is one that supports the propagation of more than one bound mode (electromagnetic wave).

3.9 Optical fiber, single mode. A small core optical fiber where one bounded electromagnet wave of light will propagate at the wavelength of interest.

REQUIREMENT 4103

3.10 Termination. The process performed for placing a connector, terminus, splice. or other device at the end of an optical waveguide. This placement optically minimizes leakage/losses and reflection. Terminations are used to join or connect two adjacent optical waveguide ends or to terminate the fiber at either a source (electrical to optical conversion) or receiver (optical to electrical conversion) where the light leaves the optical waveguide and continues in a non-waveguide mode of propagation.

3.11 Wire. "A usually pliable metallic strand or rod made in many lengths and diameters, sometimes clad and often electrically insulated, used chiefly for structural support or to conduct electricity." Source: American Heritage Dictionary, College Edition.

4. Configurations. In the context of Requirement 4103, the component being tested (device under test or DUT) is the MIL-PRF-29504/18 termini and, by extension for fiber optic multiple termini connector applications, the MIL-PRF-64266 connectors. The test sample or DUT assembly is the DUT with the other fiber optic components that comprise these assembled components. Configurations for DUT assemblies that shall be used for qualification conform to specific type, size, and other fiber optic component parameters that serve to constrain and standardize on the DUT assembly make-up. Processes that shall be used for fabrication (assembly including termination) with specific methods/practices are standardized also. Configurations used and fabrications performed shall be those as specified in NAVSEA Drawing 53711-8283460 with further constrains cited in 4.1 through 4.5.

4.1 Termination, temperature range 1. The terminus termination process of the test sample fabrication shall be in accordance with appendix A of NAVSEA Drawing 53711-8283460.

4.2 Termination, temperature range 2. The terminus termination process of the test sample fabrication shall be in accordance with Work Package WP 010 04 of NAVAIR 01-1A-505-4, T.O. 1-1A-14-4, TM 1-1500-323-24-4.

4.3 Connector accessories configuration. The backshell configurations to use as part of the test sample have not been standardized to date. Refer to the qualifying activity for backshell configurations to be used.

4.4 Connector accessories assembly, temperature range 1. The connector accessories assembly process shall be in accordance with appendix C of NAVSEA Drawing 53711-8283460.

4.5 Connector accessories assembly, temperature range 2. The connector accessories assembly process shall be in accordance with Work Package WP 011 03 Of NAVAIR 01-1A-505-4, T.O. 1-1A-14-4, TM 1-1500-323-24-4.

5. Implementation. Test samples (DUT assemblies) shall be prepared for both "Qualification, except interoperability" and for "Interoperability" as specified NAVSEA Drawing 53711-8283460 (see 5.1 and 5.2 for intent).

5.1 Qualification, except interoperability. DUT assemblies for termini qualification shall consist of un-terminated termini, termini as part of a single fiber cable, and termini as a part of a multiple termini connector. Likewise, DUT assemblies for connector qualification shall consist of un-terminated connectors and termini as a part of a multiple termini connector.

5.2 Interoperability. DUT assemblies for termini interoperability shall consist of un-terminated termini, un-terminated connectors, termini as part of a single fiber cable, and termini as a part of a multiple termini connector.

6. NOTES.

6.1 Intents behind standardization efforts.

6.1.1 Decrease matrix of test samples to be tested. Parties involved wanted to see termini tested with various ferrule hole diameters, ferrule material, strain relief capture mechanisms, epoxy types, cable types (tight buffer, loose tube, polyimide coated fiber), and fiber types. The number of test samples required became impracticably large. Government determined the test sample configurations that would be considered minimum, but acceptable. These test sample configurations are described in this drawing.

6.1.2 Multiple party testing considerations. The incentive to minimize test variables, resulting in a level playing field for multiple parties testing, leads the Government to establish a baseline. This baseline includes considerations for fabrication of test samples, methods to employ launch conditions, and use of specific test practices in addition to specifics for test sample configurations.

6.2 Interoperability. Separate test sample configurations are required for interoperability testing. These test sample configurations are in addition to the ones to be used for the other qualification tests.

REQUIREMENT 4103

REQUIREMENT 4104

FIBER OPTIC TEST SAMPLE CONFIGURATIONS, FABRICATION, AND SPECIFIC METHODS/PRACTICES FOR MIL-PRF-24623/7 MECHANICAL SPLICE

1. PURPOSE

1.1 Purpose. This requirement standardizes configurations, fabrication, and specific methods/practices for the components to be used in the assembly (fabrication) of fiber optic the test sample (DUT assembly) for the MIL-PRF-24623/7 mechanical splice. The DUT assemblies are intended to be used as part of qualification testing, but can be used in developmental, prototype, production, rework, and modification programs on military platform fiber optic cable assemblies. To ensure that the risk to the Government of accepting bad optical measurement data is low, to minimize test variations and to permit more accurate comparison of test results from multiple sources, a "standardized" approach is specified for DUT assembly configurations, fabrication, and specific methods/practices.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, and 5 of this standard practice. This section does not include documents cited in other sections of this standard practice or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, and 5 of this standard practice, whether or not they are listed.

2.2 Government documents.

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

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-24623	-	Splice, Fiber Optic Cable General Specification for (Metric).

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

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

DEPARTMENT OF DEFENSE DRAWINGS

NAVSEA Drawing 53711-8328898	-	Mechanical Splice, Fiber Optic, Aircraft, Test Sample Configurations/Fabrication & Specific Methods/Practices.

(A copy of NAVSEA Drawing 53711-8328898 can be obtained at Web Site: https://fiberoptics.nswc.navy.mil/ in the NAVSEA Drawing section under Component Information. If unable to access this Web Site, request an application by e-mail to NSWC DD Warfare Systems Department at DLGR_NSWC_Foweb@navy.mil.)

DEPARTMENT OF DEFENSE PUBLICATIONS

NAVAIR 01-1A-505-4/ T.O. 1-1A-14-4/ TM 1-1500-323-24-4	-	Aircraft Fiber Optic Cabling, Technical Manual, Installation and Testing Practices.

(A copy of this Government General Series Technical Manual can be obtained at website: https://jswag.navair.navy.mil. At the home page select "Document Library" (on left side), then select the "JFOWG" folder followed by the "Maintenance Documents.)

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3. DEFINITIONS.

3.1 Cable, fiber optic. A fiber optic cable is a cable that contains optical fibers. The cable may be of a tight buffer or a loose tube design.

3.2 Cable bundle, fiber optic. Single fiber cables grouped together and secured by lacing tape. The cable bundle can be placed in convoluted tubing, used in various protected harness configurations or used as is in an open cable harness configuration.

3.3 Cable, loose tube. A fiber optic cable design is one configured with one or more optical fibers that are fitted loosely within a tube, giving the optical fibers freedom to move. This mobility and isolation from the tube minimizes the effects of external forces on the performance of the link. The isolation allows cable expansion and contraction with temperature independent of the optical fibers.

3.4 Cable, tight buffer. A fiber optic cable design is one configured with an additional protective coding (additional buffer layer) is applied directly over a coated (buffered) fiber. Buffer material helps preserve the fiber's inherent strength and provides increased mechanical protection. A tight buffer cable allows cable placement in tighter bends, more roughed handling (such as better crush and impact resistance).

3.5 Cabling, fiber optic. Fiber optic cabling is a term used to include single fiber cable, multiple fiber cable, fiber optic cable bundles, and fiber optic cable harnesses. The (optical) fiber is the optical conduit or waveguide transmission media, whereas metallic conductor (wire) is used in an electrical cable. Cable structure is added to make the fibers easier to handle and maintain. The fiber is a thin piece of glass (with a diameter usually around 125 micrometers) that contains and transports the light signals.

3.6 Connector, fiber optic. A device that permits repeated mating and couples the optical power between two optical fibers or two groups of optical fibers. A fiber optic connector must maintain fiber alignment without significant loss of optical power.

3.7 Optical fiber. An optical fiber is a thin cylindrical dielectric (non-conductive) waveguide used to send light energy for communication. Optical fibers consist of three parts: The core, the cladding, and the coating or buffer. The choice of optical fiber materials and fiber design depends on operating conditions and intended application.

3.8 Optical fiber, multimode. A multimode optical fiber is one that supports the propagation of more than one bound mode (electromagnetic wave).

3.9 Optical fiber, single mode. A small core optical fiber where one bounded electromagnet wave of light will propagate at the wavelength of interest.

3.10 Termination. The process performed for placing a connector, terminus, splice, or other device at the end of an optical waveguide. This placement optically minimizes leakage/losses and reflection. Terminations are used to join or connect two adjacent optical waveguide ends or to terminate the fiber at either a source (electrical to optical conversion) or receiver (optical to electrical conversion) where the light leaves the optical waveguide and continues in a non-waveguide mode of propagation.

3.11 Wire. "A usually pliable metallic strand or rod made in many lengths and diameters, sometimes clad and often electrically insulated, used chiefly for structural support or to conduct electricity." Source: American Heritage Dictionary, College Edition.

REQUIREMENT 4104

4. Configurations. In the context of Requirement 4104, the component being tested (device under test or DUT) is the MIL-PRF-24623/7 mechanical splice. The test sample or DUT assembly is the DUT with the other fiber optic components that comprise these assembled components. Configurations for DUT assemblies that shall be used for qualification conform to specific type, size, and other fiber optic component parameters that serve to constrain and standardize on the DUT assembly make-up. Processes that shall be used for fabrication (assembly including termination) with specific methods/practices are standardized also. Configurations used and fabrications performed shall be those as specified in NAVSEA Drawing 53711-8328898 with further constrains cited in 4.1.

4.1 Termination, general process. The mechanical splice termination process of the test sample fabrication shall be in accordance with appendix A of NAVSEA Drawing 53711-8328898.

5. Implementation. Test samples (DUT assemblies) shall be prepared for “Qualification” as specified NAVSEA Drawing 53711-8328898 (see 5.1 for intent).

5.1 Qualification. DUT assemblies for mechanical splice qualification shall consist of un-terminated mechanical splice, mechanical splice as part of a single fiber cable assembly, and mechanical splice outside a cable harness.

6. NOTES.

6.1 Intents behind standardization efforts.

6.1.1 Multiple party testing considerations. The incentive to minimize test variables, resulting in a level playing field for multiple parties testing, leads the Government to establish a baseline. This baseline includes considerations for fabrication of test samples, methods to employ launch conditions, and use of specific test practices in addition to specifics for test sample configurations.

FIBER AND CABLE REQUIREMENTS

4201

FIBER OPTIC TEST SAMPLE CONFIGURATIONS, FABRICATION, AND SPECIFIC METHODS/PRACTICES FOR MIL-PRF-49291 OPTICAL FIBER

1. PURPOSE

1.1 Purpose. This requirement standardizes configurations, fabrication, and specific methods/practices for the components to be used in the assembly (fabrication) of fiber optic the test sample (DUT assembly) for the MIL-PRF-49291 optical fiber. The DUT assemblies are intended to be used as part of qualification testing, but can be used in developmental, prototype, production, rework, and modification programs on military platform fiber optic cable assemblies. To ensure that the risk to the Government of accepting bad optical measurement data is low, to minimize test variations and to permit more accurate comparison of test results from multiple sources, a "standardized" approach is specified for DUT assembly configurations, fabrication, and specific methods/practices.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, and 5 of this standard practice. This section does not include documents cited in other sections of this standard practice or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, and 5 of this standard practice, whether or not they are listed.

2.2 Government documents.

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

DEPARTMENT OF DEFENSE SPECIFICATIONS

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

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

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3. DEFINITIONS

3.1 Cable, fiber optic. A fiber optic cable is a cable that contains optical fibers. The cable may be of a tight buffer or a loose tube design.

3.2 Cable bundle, fiber optic. Single fiber cables grouped together and secured by lacing tape. The cable bundle can be placed in convoluted tubing, used in various protected harness configurations or used as is in an open cable harness configuration.

3.3 Cable, loose tube. A fiber optic cable design is one configured with one or more optical fibers are fitted loosely within a tube, giving the optical fibers freedom to move. This mobility and isolation from the tube minimizes the effects of external forces on the performance of the link. The isolation allows cable expansion and contraction with temperature independent of the optical fibers.

3.4 Cable, tight buffer. A fiber optic cable design is one configured with an additional protective coding (additional buffer layer) is applied directly over a coated (buffered) fiber. Buffer material helps preserve the fiber's inherent strength and provides increased mechanical protection. A tight buffer cable allows cable placement in tighter bends, more roughed handling (such as better crush and impact resistance).

3.5 Cabling, fiber optic. Fiber optic cabling is a term used to include single fiber cable, multiple fiber cable, fiber optic cable bundles and fiber optic cable harnesses. The (optical) fiber is the optical conduit or waveguide transmission media, whereas metallic conductor (wire) is used in an electrical cable. Cable structure is added to make the fibers easier to handle and maintain. The fiber is a thin piece of glass (with a diameter usually around 125 micrometers) that contains and transports the light signals.

3.6 Connector, fiber optic. A device that permits repeated mating and couples the optical power between two optical fibers or two groups of optical fibers. A fiber optic connector must maintain fiber alignment without significant loss of optical power.

3.7 Optical fiber. An optical fiber is a thin cylindrical dielectric (non-conductive) waveguide used to send light energy for communication. Optical fibers consist of three parts: The core, the cladding, and the coating or buffer. The choice of optical fiber materials and fiber design depends on operating conditions and intended application.

3.8 Optical fiber, multimode. A multimode optical fiber is one that supports the propagation of more than one bound mode (electromagnetic wave).

3.9 Optical fiber, single mode. A small core optical fiber where one bounded electromagnet wave of light will propagate at the wavelength of interest.

3.10 Termination. The process performed for placing a connector, terminus, splice, or other device at the end of an optical waveguide. This placement optically minimizes leakage/losses and reflection. Terminations are used to join or connect two adjacent optical waveguide ends or to terminate the fiber at either a source (electrical to optical conversion) or receiver (optical to electrical conversion) where the light leaves the optical waveguide and continues in a non-waveguide mode of propagation.

3.11 Wire. "A usually pliable metallic strand or rod made in many lengths and diameters, sometimes clad and often electrically insulated, used chiefly for structural support or to conduct electricity." Source: American Heritage Dictionary, College Edition.

4. Configurations. In the context of Requirement 4201, the component being tested (device under test or DUT) is the MIL-PRF-49291 optical fiber. The test sample or DUT assembly is the DUT in the configuration of the optical fiber that remains on the spool, the various different lengths of optical fiber cut from each spool, or both. Point in the test sequence that the DUT assembly lengths of optical fiber are cut from the spool is addressed in 4.1. Point in the test sequence that the DUT assemblies of optical fiber remaining on the spool are placed in loose coils is addressed in 4.2.

4.1 Cut lengths from spools. Prior to the start of testing for Group 1, cut specified quantities and lengths of optical fiber from each spool (see 5.1). For environmental testing, it is recommended to place these lengths in pans so that each grouping of test samples (cut lengths) can be removed quickly from the environmental chamber at the specified time. Record lengths cut from the spool so that length of optical fiber remaining on the spool is known.

4.2 Place optical fiber on spools into loose coils. Prior to the start of testing for Group 3, remove the optical fiber from the spools and place them in loose coils. None of the loose coils shall exceed the minimum long term bend diameter of the optical fiber. Recommendation is to place loose coils into pans (see 6.2.1).

4.3 Pans used for environmental testing. Pans used shall be light weight, be sufficiently large so as not to exceed the minimum long term bend diameter of the optical fiber and not retain heat (see 6.2.1). The floors of the pans shall contain drainage holes to allow any condensation drainage from the pans. Pans shall be sufficiently small as to allow pans to be "staggered" or partially covered so that no condensation from higher elevation pans run into those lower in the environmental chamber.

REQUIREMENT 4201

5 Implementation. Test samples (DUT assemblies) shall be prepared for "Qualification" as specified in 5.1. DUT assemblies for optical fiber qualification shall consist of optical fiber on spools (or for the environmental testing in loose coils) and cut lengths of optical fiber.

5.1 Optical fiber lengths cut from spool. Sample lengths are to be prepared (cut) before Group 1. Place cut lengths in pans recommended if undergoing environmental testing (see 6.2.2). For each test listed below, the quantity and length for each test are specified.

a. Mechanical strippability: Each spool, 2 samples, 3 foot long.

b. Mechanical strippability-post temperature-humidity: Each spool, 2 samples, 3 foot long.

c. Mechanical strippability-post life aging: Each spool, 2 samples, 3 foot long.

d. Dynamic tensile strength: Each spool, 30 samples, 6.5 foot long (no humidity).

e. Nuclear radiation resistance: Each spool, 1 sample, 200 meters long on spool.

f. Fungus resistance: Each spool, 1 sample, 1 foot long.

6. NOTES

6.1 Intents behind standardization efforts.

6.1.1 Multiple party testing considerations. The incentive to minimize test variables, resulting in a level playing field for multiple parties testing, leads the Government to establish a baseline. This baseline includes considerations for fabrication of test samples, methods to employ launch conditions and use of specific test practices in addition to specifics for test sample configurations.

6.2 Intent behind configurations.

6.2.1 Placement of loose coils and cut lengths in pans for environmental testing. Recommendation is made to place the loose coils in pans for testing. Except for ends of fiber, the loose coil is not disturbed after coiling. This eases handling and transport. Cut lengths may be placed in different pans for easy removal at various test times, or segregated in groups in the same pan. One type pan that is light weight, retained little heat and exceeds bend diameter requirements is a large, aluminum foil type turkey pan.

6.2.2 Placement of fiber optic connectors onto fiber ends. For loose coils of cable undergoing environmental testing, termination of optical fiber ends with instrument port compatible connectors is recommended. Other means of connection or joining; including use of bare fiber adapters, mechanically only crimped connectors, mechanical splices, and fusion splices; were found to be added sources of error for a variety of reasons. Total cost for troubleshooting outweighed time and expense for connector termination.

Custodians:
Army - CR
Navy - SH
Air Force - 85
DLA - CC

Preparing activity:
DLA - CC

(Project 60GP-2008-043)

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