

METRIC

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 SUPERSEDING
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PERFORMANCE SPECIFICATION

MATERIAL, INDEX MATCHING, FIBER OPTICS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements of an index matching material for use in fiber optic mechanical splices (for example, MIL-S-24623/4).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, 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 listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

HANDBOOKS

DEPARTMENT OF DEFENSE

MIL-HDBK-454 - General Guidelines for Electronic Equipment

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA, 19111-5094.)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Department of the Navy, Naval Sea Systems Command, SEA 05Q, 2531 Jefferson Davis Highway, Arlington, VA 22242-5160, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 6070

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MIL-PRF-24794A

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D542	-	Standard Test Method for Index of Refraction of Transparent Organic Plastics. (DoD adopted)
ASTM D570	-	Standard Test Method for Water Absorption of Plastics. (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

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

TIA/EIA-455-56 -	Test Method for Evaluating Fungus Resistance of Optical Fiber and Cable. (DoD adopted)
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(Application for copies should be addressed to the Telecommunications Industry Association, 2500 Wilson Boulevard, Arlington, Virginia, 22201.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.4 Order of precedence. 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. REQUIREMENTS

3.1 Acquisition requirements. The individual item requirements shall be as specified herein and in accordance with the acquisition documents. In the event of any conflict between the requirements of this specification and the acquisition documents, the latter shall govern.

3.2 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.4.

3.3 Materials. The index matching material shall not produce toxic, corrosive, or explosive byproducts. The material is subject to a toxicological data and formulations review and inspection, for safety of the material, by the Government.

3.3.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the

MIL-PRF-24794A

operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.4 Composition. The index matching material shall be chemically stable over the specified operating and storage temperature ranges.

3.5 Performance requirements. The performance requirements shall be defined in terms of the mechanical, environmental, and chemical properties.

3.5.1 Appearance (see 4.6.1). The index matching material shall be clear and transparent.

3.5.2 Index of refraction (see 4.6.2). The index matching material shall have an index of refraction of 1.46 ± 0.01 .

3.5.3 Shelf life (see 4.6.3). The index matching material shall have a shelf life not less than 36 months at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ (see 6.6). The 36 month period commences on the date of the adhesive manufacture. The index matching material shall meet the requirements of 3.5.1 and 3.5.2.

3.5.4 Storage temperature (see 4.6.3). The index matching material shall meet the requirements of 3.5.1 and 3.5.2 after storage.

3.5.5 Operating temperature (see 4.6.4). The index matching material shall meet the requirements of 3.5.1 when exposed to operating temperature extremes between -28°C and $+85^{\circ}\text{C}$.

3.5.6 Flow resistance (see 4.6.5). The index matching material shall not flow at elevated temperatures. During the flow resistance test, uniform displacement of the entire index matching material sample (as contrasted with the flow of material) is not considered a failure.

3.5.7 Water absorption (see 4.6.6). The index matching material shall meet the requirements of 3.5.1.

3.5.8 Identification and marking (see 4.6.7). All containers shall be marked. The markings shall be permanent and clearly visible and legible. Marking information shall include the Part or Identifying Number (PIN), CAGE code, manufacturer's name, and date of manufacture.

3.5.9 Workmanship (see 4.6.8). All index matching material shall be uniform in color and free from dirt, metallic particles, and other foreign material or any quality defects detrimental to the performance of the material.

3.5.10 Fungus Resistance (see 4.6.9) When tested in accordance with 4.6.9, index matching materials shall show sparse or very restricted microbial growth and reproduction with minor or inhibited substrate utilization. There shall be little or no chemical, physical, or structural change detectable.

3.6 Shipping. Index matching material shall not be shipped on any order to this specification if the shipping date is greater than 12 months from the manufacturing date.

MIL-PRF-24794A

4. VERIFICATION

4.1 General. Material delivered to this specification shall meet all requirements herein. The manufacturer shall perform the necessary tests and inspections in order to insure compliance with this specification.

4.1.1 Test equipment and inspection facilities. Requirements for test equipment and inspection facilities shall be as identified in the contract (see 6.3.1).

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

- a. First contract inspection (see 4.3).
- b. First article inspection (see 4.4).
- c. Conformance inspection (see 4.5).

4.3 First contract inspection. First contract inspection (see 6.4.1) is applicable only on the first acquisition of a particular product under this specification. First contract inspections (see 6.4.1) shall consist of the tests listed in table I and shall be conducted in conjunction with first article inspections. The material submitted for testing shall be representative of the production process.

4.3.1 Sample. The sample submitted shall be a number of units of the same PIN sufficient to complete all of the inspections.

4.3.2 Inspection routine. The sample shall be subjected to the inspections specified in table I. The tests identified in table I may be performed at the same time as the tests identified in table II.

4.3.3 Failures. One or more failures shall constitute first contract inspection failure.

TABLE I. First contract inspection.

Inspection	Requirement	Test	Sample size
Fungus	3.5.10	4.6.9	<u>1/</u>

1/ Three specimens shall be used from the first contract sample.

4.4 First article inspection. First article inspection shall consist of all the tests listed in table II. The material submitted for testing shall be representative of the production process.

4.4.1 Sample. The sample submitted shall be a number of units of the same PIN sufficient to complete all of the inspections.

4.4.2 Inspection routine. The sample shall be subjected to the inspections specified in table II. The tests identified in table I may be performed at the same time as the tests identified in table II.

MIL-PRF-24794A

4.4.3 Failures. One or more failures shall constitute first article inspection failure.

TABLE II. First article inspection.

Inspection	Requirement	Test	Sample size
Identification and marking	3.5.8	4.6.7	All units
Workmanship	3.5.9	4.6.8	All units
Appearance	3.5.1	4.6.1	All units
Index of refraction	3.5.2	4.6.2	<u>1</u> /
Shelf life	3.5.3	4.6.3	<u>2</u> /
Storage temperature	3.5.4	4.6.3	<u>3</u> /
Operating temperature	3.5.5	4.6.4	<u>1</u> /
Flow resistance	3.5.6	4.6.5	<u>1</u> /
Water absorption	3.5.7	4.6.6	<u>1</u> /

1/ Three specimens shall be used from units selected at random from the first article sample.

2/ Nine specimens shall be used from units selected at random from the first article sample.

3/ The same specimens shall be used as are used in the shelf life inspection.

4.5 Conformance inspection. Conformance inspection shall consist of the inspections and tests specified for group A inspection (table III), Group B inspection (table IV), and Group C inspection (table V), as specified (see 6.2). Requirements for alternate forms of conformance inspection shall be as identified in the contract (see 6.3.2).

4.5.1 Group A inspection. Group A inspection shall consist of the tests listed in table III conducted in the order shown.

TABLE III. Group A inspection.

Inspection	Requirement	Test
Identification and marking	3.5.8	4.6.7

MIL-PRF-24794A

4.5.1.1 Sampling plan. Group A inspections shall be performed on 100 percent of the product supplied under this specification.

4.5.1.2 Failures. One or more failures shall constitute group A inspection failure of the sample unit.

4.5.1.3 Disposition of sample units. Samples that have failed group A inspection shall not be shipped or submitted for group B testing.

4.5.2 Group B inspection. Group B inspection shall consist of the tests listed in table IV conducted in the order shown. Group B inspection shall be made on sample units that have passed group A inspection.

TABLE IV. Group B inspection.

Inspection	Requirement	Test
Workmanship	3.5.9	4.6.8
Appearance	3.5.1	4.6.1

4.5.2.1 Sampling plan. Three sample units shall be selected from each lot of material supplied under this specification.

4.5.2.2 Failures. One or more failures shall constitute group B inspection failure of the lot.

4.5.2.3 Rejected lots. Requirements regarding the rework of rejected lots shall be as identified in the contract (see 6.8.1).

4.5.2.4 Disposition of sample units. Samples that have failed group B inspection shall not be shipped or submitted for group C testing.

4.5.3 Periodic inspection. Periodic inspection shall consist of group C inspection. Except where the results of these inspections show noncompliance with the applicable test requirements (see 4.5.3.1.4), delivery of products which have passed group B shall not be delayed pending the results of these first article verification inspections.

4.5.3.1 Group C inspection. Group C inspection shall consist of the inspections specified in table V in the order shown. Group C inspections shall be made on units that have passed the group B inspection.

MIL-PRF-24794A

TABLE V. Group C inspection.

Inspection	Requirement	Test
Index of refraction	3.5.2	4.6.2
Shelf life	3.5.3	4.6.3
Storage temperature	3.5.4	4.6.3
Operating temperature	3.5.5	4.6.4
Flow resistance	3.5.6	4.6.5
Water absorption	3.5.7	4.6.6

4.5.3.1.1 Sampling plan. Every 60 months, a number of units of the same PIN, sufficient to complete all of the inspections, which have passed group B inspection, shall be selected.

4.5.3.1.2 Failures. One or more specimen or sample unit failures shall constitute group C inspection failure.

4.5.3.1.3 Disposition of sample units. Sample units that have been submitted to group C inspection shall not be shipped..

4.5.3.1.4 Noncompliance. Requirements regarding failure of group C inspection shall be as identified in the contract (see 6.8.2).

4.6 Methods of inspection.

4.6.1 Appearance (see 3.5.1). The index matching material shall be placed between two microscope slides and formed into a layer with a thickness of approximately 0.5 mm (0.02 inch). The material shall be visually inspected for conformance to 3.5.1.

4.6.2 Index of refraction (see 3.5.2). The index matching material shall be tested using an Abbe refractometer and a sodium light source, or equivalent (refer to ASTM D542 for guidance).

4.6.3 Shelf life/storage temperature (see 3.5.3 and 3.5.4). The index matching material shall be exposed to a temperature of $+85^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 240 hrs. After exposure, the material shall be subjected to the tests specified in 4.6.1 and 4.6.2.

4.6.4 Operating temperature (see 3.5.5). The index matching material shall be prepared as specified in 4.6.1 and subjected to the temperatures and durations specified in table VI. The humidity shall be controlled during the temperature reduction and the low temperature exposure steps to eliminate the formation of frost on the material. The index matching material shall be visually examined during the high temperature exposure, during the low temperature exposure, and after the test for conformance to 3.5.1.

MIL-PRF-24794A

TABLE VI. Operating temperature test schedule.

Step	Temperature	Duration
1	Maintain room ambient	4 hours (min)
2	Ramp to $-28^{\circ}\text{C} + 0^{\circ}\text{C}$, -3°C	2 hours
3	Maintain $-28^{\circ}\text{C} + 0^{\circ}\text{C}$, -	2 hours (min)
4	Ramp to $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$	2 hours
5	Maintain $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$	2 hours (min)
6	Ramp to $85^{\circ}\text{C} + 3^{\circ}\text{C}$, -0°C	2 hours
7	Maintain $85^{\circ}\text{C} + 3^{\circ}\text{C}$, -0°C	2 hours (min)
8	Ramp to $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$	2 hours

4.6.5 Flow resistance (see 3.5.6). The index matching material shall be tested as follows. A glass microscope slide shall be cleaned using soapy water, rinsed in deionized water, rinsed in acetone, and dried using a clean lint free cloth. A line shall be drawn across one side of the slide, using a permanent ink marker, dividing the side of the slide into two parts of approximately equal area. One to two grams of index matching material shall be applied to slide so that the material just touches the edge of the line. The slide shall be placed in a vertical position with the index matching material above the permanent line. The slide shall be maintained at a temperature of $+100^{\circ}\text{C}$ for 24 hours. The slide shall be returned to room ambient temperature and then visually examined for conformance with the requirements of 3.5.6.

4.6.6 Water absorption (see 3.5.7). The index matching material shall be exposed to 100 percent humidity at $+35^{\circ}\text{C}$ for 24 hours (refer to ASTM D570 for guidance). After exposure the material shall be tested in accordance with 4.6.1.

4.6.7 Identification and marking (see 3.5.8). The index matching material containers shall be visually examined for conformance with the requirements of 3.5.8.

4.6.8 Workmanship (see 3.5.9). The index matching material shall be visually examined for conformance with the requirements of 3.5.9.

4.6.9 Fungus resistance (see 3.5.10). Index matching materials not listed as fungus inert in guideline 4 of MIL-HDBK-454 shall be tested in accordance with TIA/EIA-455-56.

MIL-PRF-24794A

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. Packaging data retrieval is available from the managing Military Departments' or Defense Agencies' automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The index matching material covered by this specification is intended for use with fiber optic splices in fixed plant, tactical, and shipboard applications.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of the individual documents referenced (see 2.1).
- c. Type of packaging required (syringes, 30 ml high density polyethylene containers, or 173 ml high density polyethylene containers).
- d. When first article is required (see 3.1).
- e. Requirements for test and inspection facilities (see 6.3.1).
- f. Requirements for alternate forms of conformance testing (see 6.3.2).
- g. Requirements regarding rework of rejected lots (see 6.8.1).
- h. Requirements regarding failure of group C inspection (see 6.8.2).
- i. Is Material Safety Data Sheet required? (See 6.7)

6.3 First article. When first article inspection is required, the items should be a first article sample. The first article should consist of a minimum of 4 units. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government

MIL-PRF-24794A

approval is presently appropriate for the pending contract. Unless specifically requested to do so in the solicitation, bidders should not submit alternate bids.

6.3.1 Test equipment and inspection facilities. Provisions for test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspections must be the responsibility of the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment must be in accordance with ANSI/NCSL Z540-1.

6.3.2 Alternate forms of conformance inspection. Requests for alternate forms of quality conformance inspection (see 4.5) must be submitted to the contracting officer. Alternate forms of quality conformance inspection may be used upon written approval by the contracting officer.

6.4 Definitions. Definitions of terms shall be in accordance with TIA/EIA-440.

6.4.1 First contract. The first contract is considered to be the first contract under which a manufacturers' material is supplied to any acquiring activity under this specification.

6.4.2 First contract inspection. First contract inspections are inspections required in addition to first article inspections for the first contract in which this specification is invoked. First contract inspections are intended to evaluate basic material properties that are primarily a function of the product formulation, not the product manufacturing process.

6.5 PIN. The PIN for this adhesive should contain the following:

	M24794-1
Basic specification number	_____
Basic product identifier	_____

6.6 Shelf life. Products procured to this specification should not be used for fiber optic termination purposes under any conditions if the date of manufacture has passed by more than 36 months. If products procured to this specification are exposed to temperatures higher or lower than the temperatures specified in 3.5.1, the shelf life may be different than that specified and the manufacturer should be contacted to determine the appropriate shelf life under the actual storage conditions.

6.7 Material safety data sheets. The material covered by this specification contains material(s) which may be hazardous to personnel and a Material Safety Data Sheet (MSDS) is needed for employee safety programs. Contracting officers will identify those activities requiring copies of completed MSDS prepared in accordance with FED-STD-313. In order to obtain the MSDS, FAR clause 52.223-3 must be in the contract.

MIL-PRF-24794A

6.8 Conformance inspection.

6.8.1 Rejected lots. If a group B inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units (if applicable), and resubmit the lot for inspection.

6.8.2 Noncompliance. If a sample fails to pass group C inspection, the contractor must notify the contracting activity of the failure and take corrective action on the materials and processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, and which are considered subject to the same failure. Acceptance of the product will be discontinued until corrective action, acceptable to the contracting activity has been taken. After the corrective action has been taken, group C inspection must be repeated on additional sample units (all inspection tests or the inspection test which the original sample failed, at the option of the contracting activity). Group A and group B inspections may be reinstated; however, final acceptance will be withheld until the group C inspection has shown that the corrective action was successful.

6.9 Subject term (key word) listing.

Fiber optic connectors
Adhesive
Acrylate

6.10 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.

Custodians:

Army - CR
Navy - SH
Air Force - 11
NASA - NA

Preparing activity:

Navy - SH

Agent:

DLA - CC

Review activities:

Army - MI, SC
Navy - AS
Air Force - 02, 13, 19, 33, 93, 99
DLA - CC

(Project 6070-0005)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL**INSTRUCTIONS**

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-PRF-24794A

2. DOCUMENT DATE (YYMMDD)

3. DOCUMENT TITLE

MATERIAL, INDEX MATCHING, ONE PART, FIBER OPTICS

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION**6. SUBMITTER**

a. NAME (Last, First, Middle initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)

7. DATE SUBMITTED
(YYMMDD)

(1) Commercial

(2) AUTOVON
(If applicable)

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