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METRIC
MIL-PRF-24794
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PERFORMANCE SPECIFICATION

MATERIAL, INDEX MATCHING, FIBER OPTICS

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available 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 MIL-S-24623 mechanical splices.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 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).

SPECIFICATIONS

MILITARY

MIL-S-24623/4 - Splice, Fiber Optic, Housing, Fiber.

STANDARDS

FEDERAL

FED-STD-313 - Material Safety Data Sheets, Preparation and Submission of.

MILITARY

MIL-STD-129 - Marking for Shipment and Storage.

MIL-STD-2196 - Glossary, Fiber Optics.

MIL-STD-45662 - Calibration Systems Requirements.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Defense Printing Service Detachment Office, Building 4D (Customer Service), 700 Robbins Avenue, Philadelphia, PA, 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issue 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.

ASTM D570 - Standard Test Method for Water Absorption of Plastics.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1137.)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: NASA/Parts Project Office (NPPPO) NASA Goddard Space Flight Center, Code 310.1 Greenbelt, MD 20771 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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(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.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards), 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 4.3.

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 Material Safety Data Sheet (see 6.7). The contracting activity shall be provided a material safety data sheet (MSDS) at the time of contract award. The MSDS shall be provided in accordance with the requirements of FED-STD-313. The MSDS shall be included with each shipment of the material covered by this specification.

3.4 Composition. The index matching material shall be either a silicone or aliphatic hydrocarbon material.

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

3.5.1 Appearance (see 4.5.1). The index matching material shall be clear and transparent.

3.5.2 Index of refraction (see 4.5.2). The index matching material shall have an index of refraction of 1.46 ± 0.01 .

3.5.3 Shelf life (see 4.5.3). 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 4.5.3). The index matching material shall meet the requirements of 3.5.1 and 3.5.2 after storage.

3.5.5 Operating temperature (see 4.5.4). The index matching material shall meet the requirements of 3.5.2 when exposed to operating temperature extremes between -28°C and $+85^{\circ}\text{C}$.

3.5.6 Flow resistance (see 4.5.5). The index matching material shall not flow at elevated temperatures.

3.5.7 Water absorption (see 4.5.6). The index matching material shall meet the requirements of 3.5.1.

3.5.8 Identification and marking (see 4.5.7). All containers shall be marked in accordance with MIL-STD-129. 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 4.5.8). 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.

3.6 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.

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4. QUALITY ASSURANCE PROVISIONS

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

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspections set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be utilized when performing the tests specified herein. The calibration system used to control the accuracy of the measuring and test equipment shall be established and maintained in accordance with MIL-STD-45662.

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

- a. First article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.3 First article inspection. First article inspection shall consist of all the tests listed in table I. 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. A minimum of two units shall be submitted.

4.3.2 Inspection routine. The sample shall be subjected to the inspections specified in table I in the order shown.

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TABLE I. First article inspection.

Inspection	Requirement	Test	Sample size
Identification and marking	3.5.8	4.5.7	All units
Workmanship	3.5.9	4.5.8	All units
Appearance	3.5.1	4.5.1	All units
Index of refraction	3.5.2	4.5.2	<u>1</u> /
Shelf life	3.5.3	4.5.3	<u>2</u> /
Storage temperature	3.5.4	4.5.3	<u>3</u> /
Operating temperature	3.5.5	4.5.4	<u>1</u> /
Flow resistance	3.5.6	4.5.5	<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.

4.3.3 Failures. One or more failures shall be sufficient cause for refusal to grant first article approval. When first article test units are taken from a larger lot, and the first article is disapproved, none of the units from that lot shall be delivered.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the inspections and tests specified for group A inspection (table II), Group B inspection (table III), and Group C inspection (table IV), as specified (see 6.2).

4.4.1 Group A inspection. Group A inspection shall consist of the tests listed in table II conducted in the order shown.

TABLE II. Group A inspection.

Inspection	Requirement	Test
Identification and marking	3.5.8	4.5.7

4.4.1.1 Sampling plan. Group A inspections shall be performed on 100 percent of the product supplied under this specification. There shall be no failures.

4.4.1.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, if applicable, and resubmit them for inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.4.1.3 Disposition of sample units. Samples that have failed group A inspection shall not be delivered on contract or purchase order or submitted for group B testing.

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

TABLE III. Group B inspection.

Inspection	Requirement	Test
Workmanship	3.5.9	4.5.8
Appearance	3.5.1	4.5.1

4.4.2.1 Sampling plan. Three sample units shall be selected from each lot of material supplied under this specification. There shall be no failures.

4.4.2.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, if applicable, and resubmit them for inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.4.2.3 Disposition of sample units. Samples that have failed group B inspection shall not be delivered on contract or purchase order or submitted for group C testing.

4.4.3 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 4.4.3.1.4), delivery of products which have passed group B shall not be delayed pending the results of these first article verification inspections.

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

TABLE IV. Group C inspection.

Inspection	Requirement	Test
Index of refraction	3.5.2	4.5.2
Shelf life	3.5.3	4.5.3
Storage temperature	3.5.4	4.5.3
Operating temperature	3.5.5	4.5.4
Flow resistance	3.5.6	4.5.5
Water absorption	3.5.7	4.6.6

4.4.3.1.1 Sampling plan. Every 36 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.

4.4.3.1.2 Failures. If one or more specimen or sample units fail to pass group C inspection, the sample shall be considered to have failed.

4.4.3.1.3 Disposition of sample units. Sample units that have been submitted to group C inspection shall not be delivered on contract or purchase order.

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4.4.3.1.4 Noncompliance. If a sample fails to pass group C inspection, the contractor shall 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 shall be discontinued until corrective action, acceptable to the contracting activity has been taken. After the corrective action has been taken, group C inspection shall 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 B inspections may be reinstituted; however, final acceptance shall be withheld until the group C inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and the corrective action taken shall be furnished to the contracting activity.

4.5 Methods of inspection.

4.5.1 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.

4.5.2 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).

4.5.3 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 4.5.1 and 4.5.2.

4.5.4 Operating temperature (see 3.5.5). The index matching material shall be prepared as specified in 4.5.1 and subjected to the temperatures and durations specified in table V. 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.

TABLE V. Operating temperature test schedule.

Step	Temperature	Duration
1	Maintain room ambient	4 hours
2	Increase temperature to $+85^{\circ}\text{C}$	Not specified
3	Maintain $+85^{\circ}\text{C} \pm 2^{\circ}\text{C}$	4 hours
4	Reduce temperature to -28°C	Not specified
5	Maintain $-28^{\circ}\text{C} \pm 2^{\circ}\text{C}$	4 hours
6	Increase temperature to room ambient	Not specified

4.5.5 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.

4.5.6 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 D542 for guidance). After exposure the material shall be tested in accordance with 4.5.1.

4.5.7 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.

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

5. PACKAGING

5.1 Packaging requirements. The index matching material shall be packaged as required (see 6.2) and packed to ensure that the material is received in undamaged condition when shipped by a common carrier.

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. Data required.

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

6.4 Definitions. Definitions of terms shall be in accordance with MIL-STD-2196.

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

Basic specification number M24794-1

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 MSDSs. Contracting officers will identify those activities requiring copies of completed MSDSs prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313.

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6.8 Subject term (key word) listing.

Fiber optics
Fiber optic connectors
Adhesive
Acrylate

CONCLUDING MATERIAL

Custodians:

Army - CR
Navy - SH
NASA - NA

Review activities:

Army - MI
Navy - AS, EC, YD
Air Force - 17, 19, 80, 85, 99
DLA - ES

Preparing activity:

Navy - SH

Agent:

DLA - ES

(Project 6070-N003)

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.

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I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-M-24794

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)

8. PREPARING ACTIVITY

a. NAME

b. TELEPHONE (Include Area Code)

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