

INCH-POUND

MIL-PRF-121G
w/AMENDMENT 1
10 October 2019
SUPERSEDING
MIL-PRF-121G
30 April 2001

PERFORMANCE SPECIFICATION

BARRIER MATERIALS, GREASEPROOF, WATERPROOF, FLEXIBLE, HEAT-SEALABLE

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

1. SCOPE

1.1 Scope. This specification establishes the requirements for heat-sealable, greaseproof, waterproof, flexible barrier material used for the preservation of military supplies and equipment (see 6.1).

1.2 Classification. The barrier materials will be of the following types as specified (see 6.2):

- Type I - Medium duty
- Type II - Light duty

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.

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division Lakehurst, Code 4.1.2.2, Mail Stop 120-3, Route 547, Joint Base MDL, NJ 08733-5100 or emailed to michael.sikora@navy.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.dla.mil>.

AMSC N/A

FSC 8135

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2.2 Government documents.

2.2.1 Specifications and standards. The following specifications and standards 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 STANDARD

MIL-STD-3010 - Test Procedures for Packaging Materials and Containers

(Copies of these documents are available online at <https://quicksearch.dla.mil> or <https://assist.dla.mil>.)

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 these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY FOR QUALITY (ASQ)

ASQ-Z1.4 - Procedures, Sampling and Tables for Inspection by Attributes. (DoD adopted)

(Copies of this document are available at www.asq.org.)

ASTM INTERNATIONAL

ASTM-D471 - Standard Test Method for Rubber Property-Effect of Liquids
ASTM-D689 - Standard Test Method for Internal Tearing Resistance of Paper
ASTM-D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting

(Copies of this document are available online at www.astm.org.)

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI-T403 - Bursting Strength of Paper

(Copies of this document are available online at www.tappi.org.)

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.

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3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Material. Barrier materials shall be made from such materials and by such processes as to ensure compliance with the performance requirements of this specification.

3.3 Construction. The barrier materials shall be constructed of one or more plies in any manner that ensures compliance with the performance requirements of this specification.

3.3.1 Splices. A roll shall not contain more than 2 splices (3 pieces). Splices within rolls shall be even, extend the entire width of the roll, and shall not come apart during unwinding of the roll. Splices shall be flagged at both ends of each splice with colored markers.

3.4 Form. The barrier material shall be furnished in rolls.

3.4.1 Rolls. Unless otherwise specified (see 6.2), the width of roll material shall be 36 inches, with a tolerance of plus 1/4 inch or minus 1/8 inch. The average length of roll material shall be not less than 200 yards. The length of any individual roll shall be not less than 195 yards. The roll material shall be uniformly wound on non-returnable cores. The core's inside diameter shall be not less than 3 inches, with a tolerance of plus 1/8 inch. The length of the core shall be equal to the width of the roll material, with a tolerance of plus 1/8 inch. The core shall be rigid to prevent distortion of the roll during use and shipment conditions. Each roll shall be restrained to prevent unwinding (see 4.3.2.1).

3.5 Sealing. The material shall exhibit no delamination of the heat-sealed area when sealed according to the manufacturer's recommended conditions (see 4.5). Each roll of barrier material shall include a tag secured to the roll core with the sealing instructions for heat-sealing on continuous and jaw-type sealing equipment. The tag shall be visible upon opening the unit package (see 4.3.2.1).

3.6 Identification of material. The specification number, type, manufacturer's name, manufacturer's designation, month and year of manufacture, and lot number shall be clearly and legibly marked using water-resistant ink on the backing surface of the material. The color of the markings shall be red. This complete group of markings shall be continuous lengthwise and the distance between groups of markings shall be not greater than 6 inches. A complete group of markings shall appear once in each 12 inches of width of the roll. The letters and figures shall be not less than 1/8 inch high (see 4.3.2.1).

3.7 Workmanship. Barrier material surfaces shall be free from any foreign matter. The barrier material edges shall be cut and trimmed of any selvage. Barrier material shall be free from holes, tears, cuts, sharp creases, wrinkles, or other imperfections (see 4.3.2.1).

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3.8 Performance requirements. The performance of the barrier materials shall meet the requirements specified in table I, when tested in accordance with 4.6.

TABLE I. Performance requirements.

PROPERTY	REQUIREMENT	TEST PARAGRAPH REFERENCE
Seam Strength 1. As received material sealed & tested: a. At room temperature (separation-inches) b. At 100°F and at 160°F (separation-inches) 2. Sealed before aging at 160°F for 12 days and tested: a. At room temperature (separation –inches) b. At 100°F and at 160°F (separation-inches) 3. Sealed after aging at 160°F for 12 days and tested: a. At room temperature (separation-inches) b. At 100°F and at 160°F (separation-inches)	No separation No separation No separation No separation No separation No separation	4.6.2
Waterproofness (as received and aged)	No delamination No evidence of water leakage	4.6.4
Oil Resistance (as received and aged)	No delamination No evidence of oil leakage	4.6.1
Puncture Resistance Type I Type II	6 lbs (min) 4 lbs (min)	4.6.1
Tensile Breaking Strength Type I Type II	25 lbs/in. width (each direction) (min. avg.) 17 lbs/in. width (each direction) (min. avg.)	4.6.1
Tearing Resistance Type I Type II	150 gms. (each direction) (min. avg.) 100 gms. (each direction) (min. avg.)	4.6.1
Resistance to Curl	No curl in excess of 5%	4.6.1
Aging Resistance	No delamination	4.6.3
Low Temperature Flexibility	No delamination, cracking, or ply separation	4.6.5
Blocking Resistance	No blocking, delamination, or rupture	4.6.1
Contact Corrosivity	No induced corrosion in the contact area	4.6.1
Water Resistance of Marking	Markings shall remain clear and legible	4.6.1
Bursting Strength Type I Type II	45 psi (min) 30 psi (min)	4.6.1

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4. VERIFICATION

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

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 First article inspection. First article inspection shall consist of the examinations specified in 4.3.2.1 and the tests specified in 4.6.

4.3 Conformance inspection. Conformance inspection shall consist of the required examinations specified in 4.3.2.1 and the tests listed in table II.

TABLE II. Conformance tests.

TEST	PARAGRAPH
Seam Strength (as received only)	4.6.2
At room temperature	
At 100 °F	
At 160 °F	
Waterproofness (as received only)	4.6.4
Oil Resistance (as received only)	4.6.1
Puncture Resistance	4.6.1
Type I	
Type II	
Curl Resistance	4.6.1
Bursting Strength	4.6.1

4.3.1 Sampling for conformance inspection. Unless otherwise specified, sampling for inspection shall be performed in accordance with the provisions specified in ASQC-Z1.4.

4.3.2 Examination of the end item. For the purpose of determining the sample size in accordance with ASQC-Z1.4, the lot size (see 6.5) shall be expressed in units of rolls for examinations specified in 4.3.2.1.

4.3.2.1 Examination of the end item for construction, form, identification, sealing, and workmanship. The sample unit for the end item inspection shall be one roll. The sample unit shall be visually inspected and measured to ensure it meets the requirements specified in 3.3 through 3.7.

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4.4 Test conditions. Unless otherwise specified in the test methods herein, the physical tests contained in this specification shall be conducted in an atmosphere having a relative humidity (RH) of 50 ± 5 percent and at a room temperature that shall have a range from 70 to 76 °F. Material shall be considered in equilibrium after exposure to the above conditions for a minimum of 24 hours.

4.5 Sealing instructions for first article and conformance testing.

a. All seals for test purposes shall be not less than 1/2-inch wide and shall be effected on a jaw-type heat-sealer (or equivalent as approved by the approving activity) utilizing the sealing conditions recommended by the manufacturer. The upper sealing conditions for production line sealing operations with respect to commercially available sealing equipment and commercially practicable fabrication time are a temperature setting of 525 °F, a 3-second dwell time, and a pressure of 60 pounds per square inch (see 6.3).

b. In securing the three 1-inch seam strength specimens from their respective samples (see 4.6.2.2.1), specimens shall not be removed:

- (1) From points in the sealed sample where seal overlapping has occurred.
- (2) From points in the sealed sample that are within 1 inch of either end of the sealer jaw during the sealing operation.

4.6 Verification of performance requirements.

4.6.1 Test methods. Unless otherwise specified, the tests in table III shall be conducted in accordance with the identified test methods.

TABLE III. Test methods.

TESTS	MIL-STD-3010 TEST METHOD NO.	ASTM TEST METHOD NO.	TAPPI TEST METHOD NO.	SPECIAL REQUIREMENT OR EXCEPTION NOTE
Oil Resistance	3015	--	--	<u>1/</u>
Water resistance of markings	3027	--	--	<u>2/</u>
Puncture resistance	2065	--	--	<u>3/</u>
Blocking resistance	3003 Procedure D	--	--	--
Resistance to curl	2015	--	--	<u>4/</u>
Contact corrosivity	3005	--	--	<u>5/</u>
Tensile breaking strength	--	D882	--	--
Tearing resistance	--	D689	--	<u>6/</u>
Bursting Strength	--	--	T403	--

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- 1/ Only oil conforming to ASTM Oil Number 3, as specified in ASTM-D471, and a di-2-ethylhexyl sebacate synthetic oil shall both be used. Test shall be conducted on three as received specimens and three specimens taken from material aged in accordance with 4.6.2.
- 2/ Three specimens shall be tested; each one containing a complete set of markings selected from different rows of markings.
- 3/ Test shall be run on five specimens. The heat-sealable face of the barrier material shall be in contact with the probe. The average value for the five specimens tested shall meet the requirements listed in table I. Elongation test data is not required.
- 4/ Three specimens shall be tested. Specimens shall not be suspended but shall be placed on a horizontal test surface for 24 hours.
- 5/ Three specimens shall be tested. If corrosion is evident in the blank area, the test shall be repeated with a new test panel. Corrosion in the intermediate area shall not invalidate the test nor be cause for rejection.
- 6/ Five of the ten specimens in each direction shall be tested with one face toward the knife and the remaining specimens shall be tested with the opposite face toward the knife.

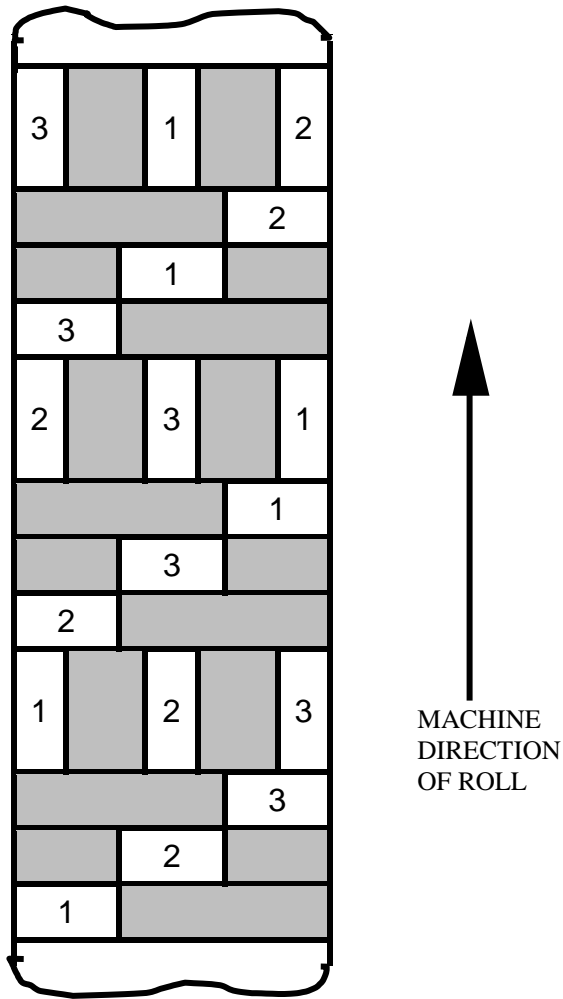
4.6.2 Seam strength.

4.6.2.1 Seam strength sampling. Samples measuring 6 by 12 inches shall be selected from the test material as shown on figure 1.

4.6.2.2 Seam strength as received.

4.6.2.2.1 Preparation of test specimen. The six sections for this test (see figure 1) shall be folded in half with the crease parallel to the long axis. The open or unfolded length shall be heat-sealed by clamping in the sealer and drawing a sharp-penciled line on the backing along the edge of the sealer jaw after sealing. The folded length shall be cut off 1/2 inch from the end. From each of the six sections, three adjacent 1-inch-wide specimens shall be cut perpendicular to the seam (see 4.5). One of the specimens from each section shall be tested at room temperature (see 4.4), one from each section tested at 100 °F, and the remaining one from each section tested at 160 °F. After heat-sealing and prior to the application of the specified weights, the specimens in all cases shall be exposed for one hour to the test conditions specified in 4.4.

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KEY

- 1 – 6 inch by 12 inch sample for "As Received" testing
- 2 – 6 inch by 12 inch sample for "Sealed Before Aging" testing
- 3 – 6 inch by 12 inch sample for "Sealed After Aging" testing

FIGURE 1. Sampling method for seam strength test.

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4.6.2.2.2 Test at room temperature. The six 1-inch-wide specimens selected for this test (see 4.6.2.2.1) shall be opened and one end of each specimen shall be clamped so that the other end of the specimen hangs freely. A 2-1/2 pound weight shall then be carefully attached to the free end of the specimen so as not to impact load the seal. The weight shall be allowed to act for 5 minutes, whereupon the weight shall be removed, and the specimen examined for separation of the heat-sealed faces. Any evidence of delamination of one ply away from the other in the heat-sealed area shall be cause for rejection. The evaluation shall be limited to the heat-sealed area specified in 4.6.2.2.1.

4.6.2.2.3 Test at 100 °F. The six 1-inch-wide specimens selected for this test (see 4.6.2.2.1) shall be tested the same as those specimens tested at room temperature (see 4.6.2.2.2) except that specimens shall be clamped in a forced draft circulating air oven maintained at 100 ± 2 °F with a weight of 2 pounds \pm 1/2 ounce acting on the free end of the specimen for 1 hour. The rate of air circulation shall be held to the minimum required to maintain uniform temperature throughout the oven. In no case shall the rate of air circulation cause any movement of the weighted specimens. The weights shall be attached after the specimens and test clamp fixtures have been placed in the oven. The weights shall be removed prior to taking the specimen from the oven in order to avoid excessive loading due to swaying action. After one hour, the weights shall be removed and the specimen examined for separation of the heat-seal faces. Any evidence of delamination of one ply away from the other in the heat-sealed area specified in 4.6.2.2.1 shall be cause for rejection.

4.6.2.2.4 Test at 160 °F. The six 1-inch-wide specimens selected for this test (see 4.6.2.2.1) shall be tested the same as those at 100 °F (see 4.6.2.2.3) except that the weight shall be 10 ounces \pm 1/2 ounce and the temperature in the forced draft circulating air oven shall be 160 ± 2 °F. The rate of air circulation shall be held to the minimum required to maintain uniform temperature throughout the oven. In no case shall the rate of air circulation cause any movement of the weighted specimens.

4.6.2.3 Seam strength sealed before aging.

4.6.2.3.1 Test specimens. The six sections for this test (see figure 1) shall be folded in half with the crease parallel to the long axis. The open or unfolded length shall be heat-sealed by clamping in the sealer and simultaneously drawing a sharp-penciled line on the backing along the edge of the sealer jaw. The folded length of the test section shall then be cut off 1/2 inch from the end. After heat-sealing, the samples shall be aged in a circulating air oven maintained at 160 ± 2 °F for 12 consecutive days (288 hours). After aging, 1-inch-wide specimens, as specified in 4.6.2.2.1, shall be cut from the sections for test at room temperature, 100 °F, and 160 °F.

4.6.2.3.2 Test at room temperature. The six 1-inch-wide specimens selected for this test (see 4.6.2.3.1) shall be tested as specified in 4.6.2.2.2.

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4.6.2.3.3 Test at 100 °F. The six 1-inch-wide specimens selected for this test (see 4.6.2.3.1) shall be tested as specified in 4.6.2.2.3.

4.6.2.3.4 Test at 160 °F. The six 1-inch-wide specimens selected for this test (see 4.6.2.3.1) shall be tested as specified in 4.6.2.2.4.

4.6.2.4 Seam strength sealed after aging.

4.6.2.4.1 Test specimens. The six sections for this test (see figure 1), in the flat unsealed condition as taken from the sample roll, shall be aged in a circulating air oven maintained at 160 ± 2 °F for 12 consecutive days (288 hours). After removal from the oven, the unsealed sections shall be returned to room temperature. Test specimens shall then be prepared as specified in 4.6.2.2.1.

4.6.2.4.2 Test at room temperature. The six 1-inch-wide specimens selected for this test (see 4.6.2.4.1) shall be tested as specified in 4.6.2.2.2.

4.6.2.4.3 Test at 100 °F. The six 1-inch-wide specimens selected for this test (see 4.6.2.4.1) shall be tested as specified in 4.6.2.2.3.

4.6.2.4.4 Test at 160 °F. The six 1-inch-wide specimens selected for this test (see 4.6.2.4.1) shall be tested as specified in 4.6.2.2.4.

4.6.3 Aging resistance. Three specimens, 36 by 6 inches, cut from across the roll of material, at points which shall be not less than 1 yard apart, shall be used for this test.

4.6.3.1 Procedure. The specimens shall be subjected to the following aging cycle:

8 hours in a humidity chamber at 100 ± 2 °F and 90 to 95 percent RH, followed by 16 hours in a circulating air oven at 160 ± 2 °F.

The aging cycle shall be repeated every weekday for five consecutive days. The specimens shall remain in the circulating air oven at 160 ± 2 °F on Saturday, Sunday, and holidays, except that holidays shall not exceed a total of two days over the entire aging period. The aging procedure shall continue for fourteen consecutive days. The specimens shall be folded loosely, hung, rolled loosely, or laid flat in the test chamber during the aging period. At the conclusion of the aging period the specimens shall be returned to room temperature and examined, particularly at all edges, for delamination brought about by the aging exposure. There shall be no prying or picking of the plies when examining the amount of ply separation. For purposes of this test, delamination shall occur if ply separation at any one given point extends in more than 1/2 inch from the edge with an edge length separation greater than 1-inch. Satisfactory specimens shall be returned for use in conducting the “aged” portion of waterproofness and oil resistance testing.

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4.6.4 Waterproofness.

4.6.4.1 Preparation of test specimens. Five 6 by 8 inch pouches shall be fabricated from as received material using the material's sealing conditions. Five additional pouches shall be similarly prepared using barrier material that was aged in accordance with 4.6.3. Each pouch shall be filled with white filter paper and a final heat-seal closure effected. The bags shall then be immersed under a one-inch head of water containing Aerosol O.T. and a water-soluble red dye to aid in determining leakage. The water shall be maintained at 73 ± 5 °F and the length of immersion shall be not less than 72 hours. At the conclusion of the test, the bag shall be removed, allowed to drain, opened at one end and the filter paper shall be examined for dye staining. Staining of the filter paper or delamination of the barrier material shall constitute a failure.

4.6.5 Low temperature flexibility. Twenty 4 by 12 inch test specimens shall be drawn from the sample roll of barrier material, ten in each principal direction. Clamps to facilitate subsequent handling of the specimens shall be placed at both ends of each specimen. The specimens shall be placed in a test chamber maintained at -25 ± 2 °F for at least one hour. Placement of the specimens in the chamber shall allow full air circulation against all surfaces of each specimen. Each specimen shall be individually removed from the chamber and immediately drawn lengthwise over a 1/4 inch diameter stainless steel mandrel while maintaining the specimen in a bend of approximately 180 degrees throughout the test. This flexing operation shall be conducted rapidly and should be completed within 3 seconds after removal of the specimen from the cold chamber. The test shall be conducted on five specimens from each principal direction with the heat-sealable face against the mandrel. The remaining ten specimens shall be similarly tested with the opposite face in contact with the mandrel. Each specimen shall be observed for evidence of delamination, cracking, or ply separation.

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 materiel 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 Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

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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 barrier materials covered by this specification are intended for use in specialized military methods of preservation. The combination of all performance characteristics of MIL-PRF-121; flexibility; waterproofness; contact corrosivity; greaseproofness; seam strength and fabrication; puncture, bursting, aging, blocking, and curl resistance; delamination; water resistance of markings provide the necessary requirements for protection from exposure to the extremes of the navy/naval aviation environment. Navy/naval aviation items are exposed to high moisture, high salt concentration, transfer at sea, rough handling, and minimal storage conditions. There are no commercial equivalents that meet the physical, mechanical, and corrosion requirements necessary to protect materiel that is exposed to the operational naval aviation environment. Specifically, MIL-STD-2073-1, Methods of Preservation 20 and 33, use MIL-PRF-121 as a primary source of barrier materials that provide waterproof and greaseproof protection for applicable items encountering the above conditions. MIL-PRF-121 provides one of the building blocks for applying specialized military preservation techniques approved under MIL-STD-2073-1.

6.1.1 Type I (limited use). Type I materials are to be used for Methods of Preservation 31, 32, and 33 where the combined weight inside the barrier bag does not exceed 10 pounds. Type I should be limited for use in bags whose inside length plus width does not exceed 42 inches.

6.1.2 Type II (limited use). Type II materials should be limited to use as an intimate wrap or bag.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. If required, the specific issue of individual documents referenced.
- c. Type of material (see 1.2).
- d. If first article inspection is required (see 3.1).
- e. Length and width of rolls required, if other than standard size (see 3.4).
- f. Packaging requirements (see 5.1).

6.3 Heat-seal equipment. In the interest of standardization and for ease of manipulation, all seals for test under this specification should be effected on a jaw-type heat-sealer. This, however, should not be construed as an indication of Governmental preference in regard to sealing equipment. It is not intended that the operating temperature of heat-sealing equipment be

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limited to 525 °F or less. While equipment may be operated at temperatures exceeding 525 °F to accomplish a satisfactory seal, the barrier material should also be capable of being heat-sealed at temperatures of 525 °F or less.

6.4 First article test samples. Samples for first article inspection should consist of a sample of the barrier material which has been produced by the contractor using the same production process, procedures, and equipment that is going to be used in fulfilling the contract.

6.5 Conformance inspection lot. For purposes of sampling, an inspection lot for examinations and tests should consist of all material made by the same process from the same components by one manufacturer and submitted for delivery at one time.

6.6 Subject term (key word) listing.

Corrosion protection
Delamination
Packaging
Preservation
Sealable material

6.7 Amendment notations. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

CONCLUDING MATERIAL

Custodians:
Army – SM
Navy – AS
Air Force – 11
DLA – GS

Preparing activity:
Navy – AS
(Project 8135-2019-002)

Review activities:
Army – AT, CR, EA, GL, MI
Navy – MC, OS, SA, SH
Other – DS

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