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SUPERSEDING
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MILITARY SPECIFICATION

ADHESIVE, DEXTRIN, FOR USE IN AMMUNITION CONTAINERS

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

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers four classes of vegetable dextrin adhesive intended for use in the manufacture of spirally-wound containers, and in the fabrication of chipboard spacers to be used in such containers, for use in packing ammunition and components.

1.2 Classification. Vegetable dextrin adhesive shall be of the following classes as specified (see 6.2):

Class 1 - A liquid adhesive in prepared form.

Class 2 - A cold-water-soluble type which must be mixed with water before use.

Class 3 - A prepared dry adhesive which must first be cooked with water before use.

Class 4- Dextrin base in dry form to which additional optional chemical ingredients may be added during preparation with water before use (see 3.2).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Director, US Army Materials and Mechanics Research Center, ATTN: DRXMR-SMS, Watertown, MA 02172 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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SPECIFICATIONS

FEDERAL

- RR-S-366 - Sieve, Test.
- UU-S-48 - Sacks, Shipping, Paper.
- PPP-D-729 - Drums, Shipping and Storage, Steel, 55-Gallon.

MILITARY

- MIL-B-20390 - Board, Ammunition Container.

STANDARDS

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-129 - Marking for Shipment and Storage

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturer in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- D 1174 - Test for Effect of Bacterial Contamination on Permanence of Adhesive Preparation and Adhesive Bonds.

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

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Material. The vegetable components of classes 1, 2, 3 and 4 shall be manufactured from dextrin produced from starch.

3.2 Optional ingredients. In the preparation of the adhesive from dextrin the following chemical ingredients, in addition to water, may be used.

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Group A (alkaline chemicals). Sodium tetraborate (borax, sodium metaborate, sodium hydroxide, sodium metasilicate, sodium carbonate (soda ash), trisodium phosphate. The proportion of these ingredients may be varied in order to obtain the best working properties in the adhesive for the particular conditions of use. The maximum pH of 9.5 permitted in table I (3.3) limits the amounts of alkaline materials which may be used.

Group B (fillers). Clay, talc, diatomaceous earth, or wood-flour, fillers, may be used as required. The adhesion test (see 3.4) limits the maximum amounts of fillers that may be used in any given case.

Group C (preservatives). The adhesives shall be preserved with formaldehyde, phenol or any phenol derivative not derived from heavy materials. The total amount of preservative shall not exceed 0.5 percent of the adhesive used (see 4.5.1).

Group D (defoamers). Defoamers may be used. Mineral, animal and vegetable oils or sulfonated derivatives thereof, and silicones are suitable materials. Up to a total of 1.0 percent based on the adhesive as used should be sufficient. These optional ingredients may be used by the manufacturer of the prepared adhesive classes 1, 2 and 3 and supplied to the manufacturer of spiral tubes. These specifications are not to be construed to prevent the manufacturer of spiral tubes from adding these ingredients in the preparation for use of class 4 adhesives or, if necessary, for further modification as required in the cases of class 1, 2, and 3 adhesives.

3.3 Chemical and physical properties. The dextrin adhesives as used shall conform to the requirements of table I.

TABLE I. Properties

Property	Requirement	Test Paragraph
Water, percent	75.0 maximum	4.5.2
Grit and dirt, percent	0.2 maximum	4.5.3
pH of water solution	8.5 \pm 1.0	4.5.4

3.4 Adhesion (fiber failure). The samples shall show a fiber failure of not less than 75 percent of the bonded area when tested as specified in 4.5.5.2 and 4.5.5.3.

3.5 Workmanship. Workmanship shall be in accordance with best commercial practice. The finished product shall be of uniform composition.

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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 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 the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2 Lot. A lot shall consist of adhesive dextrin from the same batch or blending operation. In the event of a continuous process a lot shall consist of not more than 3000 pounds of material subjected to the same processing operations and conditions.

4.3 Sampling.

4.3.1 For examination. A random sample of filled containers shall be selected in accordance with level 1 of MIL-STD-105.

4.3.2 For tests. For each lot an 8-ounce sample of the prepared adhesive as used shall be taken from the reservoir which supplies the glue pot on the winding machine, or a sample for sampling and testing purposes shall be prepared from base material according to procedures to be employed when the adhesive is actually to be used. If the adhesive is used warm, as compared to room temperature, such a change of procedure should be allowed for the tests. The sample should be kept in an airtight container and labelled so that it can be identified. Failure of the sample to meet the requirements and tests of this specification shall be cause for rejection of the lot.

4.4 Examination. Examination of packaging, packing and marking. Sample units selected in accordance with 4.3.1 shall be examined for the defects and at the acceptable quality level shown in table II.

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TABLE II. Examination of packaging, packing and marking

Category	Container	AQL percent	Defect	Method of Inspection
Class 1				
	Critical:		None defined	
Major	Drum (see 5.1.1.1 or 5.1.3.1 and 5.3)	2.5		
101			Improper type	Visual
102			Improper size	Visual
103			Wrong type of closure	Visual
104			Improper lining (if required).....	Visual
105			Improper fill ^{1/}	Approved scale ^{2/}
106			Leakage.....	Visual
107			Improper closing.....	Visual
108			Improper marking.....	Visual
Class 2,3 or 4				
Major	Bags (se 5.1.1.2 or 5.1.2.2, 5.1.3.2 and 5.3)	2.5		
109			Improper type.....	Visual
110			Improper size.....	Visual
111			Not properly closed..	Visual
112			Improper weight.....	Approved scale ^{2/}
113			Improper marking.....	Visual

^{1/}The actual weight of a drum filled with the minimum required quantity of adhesive shall be the basis for determining the acceptable fill of subsequent drums.

^{2/}Approved by procuring activity.

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4.5 Tests.

4.5.1 Certification of preservatives. The supplier shall certify that the preservatives conform to the requirements of 3.2 (group C). The certificate shall be signed by a responsible agent of the certifying organization and shall be accompanied by evidence of this agent's authority to bind his principal. The Government reserves the right to check test the adhesive submitted by the supplier under certification.

The efficiency of the preservatives may be determined by the methods described in ASTM D 1174. No similar standard test method is available for fungal contamination, but this presents no problem since fungi do not ordinarily attack dextrans.

4.5.2 Water percent. An accurately-weighed sample of approximately 2 grams of ready-to-use adhesive shall be transferred to a tared weighing bottle approximately 60mm (2.5 inches) in diameter, and spread as evenly as possible over the bottom of the bottle. The bottle and contents shall be weighed and then heated in an electric oven at 100°C to 105°C (212° to 221°F) for approximately 16 hours. The bottle shall be removed from the oven, cooled in a desiccator, and weighed to constant weight. The loss in weight due to percentage of water in the sample shall be calculated to determine compliance with 3.3 as follows:

$$\text{Percent water} = \frac{W1 \times 100}{W2}$$

Where:

W1 = loss in weight, grams

W2 = weight of sample, grams

4.5.3 Grit and dirt. A 50.0-gram sample shall be weighed in a tared 500-ml. beaker. Two hundred ml. of distilled water shall be added and the resulting mixture shall be stirred until the added water is uniformly incorporated. This mixture shall be poured through a clean, previously-dried and weighed No. 80 U.S. Standard sieve conforming to RR-S-366. The residue shall be washed with a minimum of five 50-ml. portions of hot water. The sieve shall be dried in an electric oven at 100°C to 105°C (212° to 221°F) for 2 hours. The sieve shall be removed from the oven, cooled in a desiccator, and weighed to constant weight. The increase in weight due to percentage of grit, sand or dirt in the sample shall be calculated on a moisture-free basis to determine compliance with 3.3 as follows:

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$$\text{Percent grit and dirt} = \frac{A \times 100}{B}$$

Where:

A = increase in weight of sieve, gms.

B = weight of initial sample, gms.

4.5.4 pH of water solution. The pH of the adhesive as used shall be determined at $25^{\circ} \pm 1^{\circ}\text{C}$ ($77^{\circ} \pm 1.8^{\circ}\text{F}$) by means of a pH meter which reads directly in pH units with an accuracy within 0.1 pH unit (see 6.3) to determine compliance with 3.3. The pH meter shall be equipped with a glass electrode, and saturated calomel electrode, and shall be calibrated with standard buffer solutions. The buffer solutions having pH values listed below may be prepared from stock solutions A and B as follows:

Solution A. A 0.1 molar solution of potassium dihydrogen phosphate shall be prepared by dissolving 13.61 gm of the material, ACS grade, in distilled water and diluting to 1 liter.

Solution B. A 0.05 molar solution of sodium tetraborate (borax) shall be prepared by dissolving 19.10 gm of the material, ACS grade, in distilled water and diluting to 1 liter.

Buffer solutions. Buffer solutions in 10-ml. quantities shall be prepared in accordance with the following table to obtain pH values at $25^{\circ} \pm 1^{\circ}\text{C}$ ($77^{\circ} \pm 1.8^{\circ}\text{F}$).

TABLE III. Stock solution, ml.

pH of solution	Solution A	Solution B
6.0 ± 0.1	8.77	1.23
7.0 ± 0.1	6.23	3.77
8.0 ± 0.1	4.65	5.35
9.0 ± 0.1	1.75	8.25

4.5.5 Adhesion tests.

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4.5.5.1 Preparation of specimens. Test specimens shall be prepared from ammunition container board conforming to the requirements of MIL-B-20390 (either Type I or II) (see 6.4). The container board shall be conditioned for 24 hours at a temperature of $75^{\circ} \pm 5^{\circ}\text{F}$ and a relative humidity of 50 ± 5 percent. The conditioned container board shall be cut into four rectangular pieces each 12 by $2\frac{1}{8}$ inches. A continuous thin film, approximately 1 inch wide, of the adhesive as used shall be applied, with a clean dry brush, along the 12-inch side of two of the specimens. Within 10 seconds a second specimen of the container board shall be placed on the adhesive film on each of the first two specimens to form two sandwiches 12 inches long and $2\frac{1}{8}$ inches wide. A load of 50 pounds shall be evenly applied to cover the 12 inch by 1 inch area of the joint, and maintained for 24 hours at a temperature of $75^{\circ} \pm 5^{\circ}\text{F}$ and a relative humidity of 50 ± 5 percent. Twelve shear test specimens 1 inch wide shall be cut across the glue joint from each sandwich, and the specimens cut from each end shall be discarded.

4.5.5.2 After exposure to normal atmospheric conditions. Within one hour after preparation, 10 of the specimens prepared as specified in 4.5.5.1 shall be exposed to a temperature of $75^{\circ} \pm 5^{\circ}\text{F}$ and a relative humidity of 50 ± 5 percent for a period of 24 hours. Within two minutes after removal from the control chamber, the specimens shall be tested for fiber failure as specified in 4.5.5.4 to determine compliance with 3.4.

4.5.5.3 After exposure to elevated temperatures. Within one hour after preparation, 10 specimens as obtained from 4.5.5.1 shall be exposed to a temperature of $160^{\circ} \pm 2^{\circ}\text{F}$ ($71.1^{\circ} \pm 1.1^{\circ}\text{C}$) and a relative humidity of 20 ± 5 percent for a period of 24 hours. Within two minutes after removal from the oven, the specimen shall be tested for fiber failure as specified in 4.5.5.4 to determine compliance with 3.4.

4.5.5.4 Adhesion (fiber failure). The fiber failure shall be tested by grasping the projecting ends of the specimens with one thickness between the thumb and forefinger of each hand. The joint shall be separated by gently pulling the ends apart with a rolling motion from the top downward, using the back of the knuckles as a fulcrum.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A, B or C as specified (see 6.1).

5.1.1 Level A.

5.1.1.1 Class 1 Adhesive. The adhesive shall be furnished in 55-gallon drums conforming to PPP-D-729. Containers shall have a fully-removable-head closure (type III) except when the viscosity of the adhesive is such that it will readily flow from a small opening under which conditions a closed top container with a nozzle and screw cap closure, or flange and plug closure may be used. Drums shall be lined with suitable material whenever corrosion resistance is required.

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5.1.1.2 Class 2, 3 and 4 adhesive. The adhesive shall be packed in multi-wall bags conforming to table II of UU-S-48.

5.1.2 Level B.

5.1.2.1 Class 1 adhesive. Same as level A (5.1.1.1).

5.1.2.2 Class 2, 3, and 4 adhesive. The adhesive shall be packed in domestic-use sacks conforming to UU-S-48.

5.1.3 Level C.

5.1.3.1 Class 1 adhesive. The adhesive shall be preserved and packaged in a manner which shall afford protection against deterioration and damage during shipment from the supply source to the first receiving activity. Containers shall have a fully-removable head closure except when the viscosity of the adhesive is such that it will flow from a small opening, under which conditions a closed-top container with a nozzle and screwcap closure or flange-and-plug closure may be used. The supplier's commercial practice will be acceptable when it fulfills the above requirements.

5.1.3.2 Class 2, 3, and 4 adhesive. The adhesive shall be preserved and packaged in a manner which shall afford adequate protection against deterioration and damage during shipment from the supply source to the first receiving activity. The supplier's commercial practice will be acceptable when it fulfills the above requirements.

5.2 Packing. Not applicable. Units packaged as above are suitable for use as shipping containers.

5.3 Marking. In addition to any special marking required by the contract or purchase order, shipments shall be marked in accordance with the requirements of MIL-STD-129.

6. NOTES

6.1 Intended use. The dextrin adhesive is intended for use in spirally-wound outer cover and neck tubes and spirally-wound inner tubes of ammunition containers described in MIL-C-2439, Container, Ammunition, Fiber, Spirally Wound. It is also used in gluing chipboard spacers for use in these containers.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Class of material (see 1.2).
- (c) Unit quantity.
- (d) Selection of applicable level of packaging.
- (e) Whether special marking is required (see 5.3).

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6.2.2 Data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract.

When the provisions of DAR 7-104.9 (n) (2) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraphs.

<u>Paragraph No.</u>	<u>Data requirement title</u>	<u>Applicable DID No.</u>
4.5.1	Certification Data Report	UDI-T-23264

(Copies of data item description required by the contractors in connection with specific acquisition function should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

6.3 Almost any commercially available pH meter will meet the requirements of 4.5.4. A typical bench instrument is Model 9608 supplied by Beckman Instruments, Inc. and available as Federal Stock No. 6630-965-0500, or National Stock No. 6630-00-965-0500. Most portable instruments are also acceptable (see 4.5.4).

6.4 Ammunition container board. Possible source of supply for container board conforming to MIL-B-20390 and used in testing the adhesive strength of the dextrin adhesive (see 4.5.5.1) are as follows:

United Ammunition Container Co.
P. O. Box 297, Milan, TN 38358
P. O. Box 674, Atlanta, TX 75551

Brandywine Paper Co.
131 Wallace Avenue
Downington, PA 19335

Whippany Paper Board Co., Inc.
10 North Jefferson Road
Whippany, NJ 07981

Packaging Corporation of America
1603 Orrington Avenue
Evanston, IL 60204

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Custodians:

Army - MR

Navy - OS

Air Force - 99

Preparing activity:

Army - MR

Project No. 8040-0420

Review activities:

Army - AR

Air Force - 84

User activity:

Navy - SA

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