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5 January 1976
SUPERSEDING
MIL-A-3167
31 March 1950

MILITARY SPECIFICATION

ADHESIVES (FOR PLASTIC INHIBITORS)

This specification is approved for use by all departments and agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers adhesives for use with ethyl cellulose or cellulose acetate molded plastic inhibitors. (See 6.1)

1.2 Classification. The adhesives covered by this specification shall be furnished in the following types and classes, as specified (see 6.2):

Type I - - Cellulose Nitrate
- Class 1
- Class 2

Type II - - Cellulose Acetate
- Class 1
- Class 2
- Class 3
- Class 4

Type III - - Solvent Adhesive
- Class 1
- Class 2

2. APPLICABLE DOCUMENTS

* 2.1 The following documents of the issues in effect on date of invitation for bids or request for proposals form a part of this specification to the extent specified herein. In the event of conflict between this specification and any document referenced herein, requirements of this specification shall apply.

SPECIFICATIONS

Federal

	O-A-51	Acetone, Technical
*	O-D-306	Diacetone Alcohol, Technical (Acetone-free)
*	TT-B-838	Butyl Acetate, Normal (For Use in Organic Coatings)
*	PPP-B-585	Box, Wood, Wirebound
*	PPP-B-621	Box, Wood, Nailed and Lock-Corner
*	PPP-B-636	Box, Shipping, Fiberboard

Military

*	MIL-C-124	Containers (Cans, Pails, and Drums) Metal (For Other Than Subsistence Items)
*	MIL-N-244	Nitrocellulose
	MIL-I-3166	Inhibitors, Web and End (Plastic)

STANDARDS

Federal

*	FED-STD-141	Paint, Varnish, Lacquer and Related Materials, Methods of Inspection, Sampling and Testing

Military

	MIL-STD-129	Marking for Shipment and Storage

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

* 2.2 Other publication. The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated the issue in effect on date of invitation for bids or request for proposals shall apply. In the event of conflict between this specification and any document listed herein, requirements of this specification shall apply.

* American Society for Testing and Materials (ASTM)

D 1744	Water in Liquid Petroleum Products by Karl Fischer Reagent, Test for

(Application for copies should be addressed to the American Society for Testing and Materials, 1901 Race Street, Philadelphia, PA 19103.)

Code of Federal Regulations

49 CFR 170-190	Department of Transportation, Hazardous Materials Regulations

(Copies are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC. 20402.)

Consolidated Classification Committee

Consolidation Freight Classification Rule 41

(Application for copies should be addressed to the Consolidated Classification Committee, 202 Chicago Union Station, Chicago, IL 60606.)

3. REQUIREMENTS

3.1 Materials.

3.1.1 Raw Materials. The raw materials for use in adhesives covered by this specification shall be as follows:

3.1.1.1 Cellulose nitrate. The cellulose nitrate shall have a nitrogen content of 12 ± 0.2 percent. (See 4.3.7.)

3.1.1.2 Ethyl lactate. The ethyl lactate shall be a water-white liquid free from suspended matter conforming to the following requirements:

Specific gravity at 25°/25°C 1.020 to 1.036.

Nonvolatile, maximum: 0.0059 gram/ml.

Water: No turbidity when one volume is mixed with 19 volumes of 60°B gasoline at 20°C.

Distillation range:

Below 102°C--None.

Below 139°C--Not more than 10 percent.

Below 155°C--Not less than 90 percent.

Above 173°C--None (4.3.5).

Acidity: Free Acid as lactic, not more than 0.08 percent. (See 4.3.8)

Purity: Ester content as ethyl lactate not less than 96 percent (See 4.3.9)

* 3.1.1.2.1 Ethyl Lactate (type III, class 2 only.) The ethyl lactate shall be water-white liquid free from suspended matter conforming to the following requirements:

Ethyl lactate, % by wt	98.0 (min.)
Specific gravity, 25°/25°C	1.030 to 1.035
Distillation range	125.0° to 170.0°C
Moisture	Miscible without turbidity with 19 volumes of 60°C API gasoline at 20°C
Acidity, calculated as lactic acid, % by wt.	0.08 (max.)
Odor	Nonresidual
Nonvolatile matter	0.02 gram/100 ml. (max.)
Suspended matter	Substantially none

* 3.1.1.3 Butyl acetate. The butyl acetate shall conform to TT-B-838.

3.1.1.4 Methyl phthalyl ethyl glycolate. Methyl phthalyl ethyl glycolate shall be water-white liquid, free from suspended matter, conforming to the following requirements:

Specific gravity at 25°/25°C: 1.220 ± 0.005.

Boiling Point: 189°C at 5 mm.

3.1.1.5 Cellulose acetate. The cellulose acetate shall have an apparent acetyl content of 35.8 to 39.4 percent. (See 4.3.10)

* 3.1.1.6 Diacetone alcohol. The diacetone alcohol shall conform to the requirements of O-D-306.

3.1.1.7 Acetone. The acetone shall conform to O-A-51.

3.1.1.8 Ethylene glycol monomethyl ether. Ethylene glycol monomethyl ether shall be a water-white liquid, free from suspended matter, conforming to the following requirements:

Specific gravity at 20°/20°C: 0.961 to 0.966.

Distillation range:

Below 118°C--None.

Below 120°C--Not more than 3 percent.

Below 125°C--Not less than 96 percent.

Above 126°C--None.

3.1.1.9 Ethylene glycol monoethyl ether. Ethylene glycol monoethyl ether shall be a water-white liquid free from suspended matter conforming to the following requirements:

Specific gravity at 25°/25°C: 0.927 to 0.933.

Distillation range:

Below 128°C--None.

Below 136°C--Not less than 95 percent.

Above 137°C--None.

3.1.2 Finished materials.

3.1.2.1 Composition. The composition of the finished material shall be as specified in table I.

3.1.2.2 Characteristics. The adhesives shall conform to the characteristics shown in table II.

3.2 Adhesion. The adhesives covered by this specification shall adhere web and end molded plastic inhibitors (MIL-I-3166) to cruciform grains of double-base powder when tested in accordance with 4.3.11.

3.3 Workmanship. Shall be such that the ingredients are intimately compounded and processed in accordance with the best commercial practice.

* 4. Quality Assurance Provisions.

* 4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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 supplies and services conform to prescribed requirements.

*

Table I

COMPOSITION OF FINISHED MATERIAL

Ingredient	Percent by weight							
	Type I		Type II				Type III	
	Class 1	Class 2	Class 1	Class 2	Class 3	Class 4	Class 1	Class 2
Cellulose nitrate (dry solids)----	2.5	3.3	-	-	-	-	-	-
Ethyl lactate---	35.0	45.5	-	59.0	-	-	60.0	36.8 [1]
Butyl acetate---	62.35	51.0	-	39.0	-	-	40.0	63.2 [1]
Methyl phthalyl (ethyl glycolate)	.15	.2	-	-	-	-	-	-
Cellulose acetate (dry solids)---	-	-	5.0	2.0	-	-	-	-
Diacetone alcohol	-	-	95.0	-	-	-	-	-
Acetone----	-	-	-	-	100	-	-	-
Ethylene glycol mono-methyl ether	-	-	-	-	-	60	-	-
Ethylene glycol mono-ethyl ether	-	-	-	-	-	40	-	-

[1] Variation of 2.2% permitted.

Table II

CHARACTERISTICS OF FINISHED MATERIAL

Type	Class	Nonvolatile (percent)	Viscosity at 25° C (centipoises)	Specific gravity 25°/25° C
I-----	1	2.65 ± 0.10	220 to 300	0.920 to 0.940
I-----	2	3.50 ± 0.10	700 to 1,000	0.945 to 0.960
II----	1	5.00 ± 0.10	400 to 500	0.945 to 0.955
II----	2	2.00 ± 0.10	1.1 to 0.9	0.955 to 0.975
II----	4[1,2]	None	-	0.947 to 0.953
III---	1	None	0.8 to 0.9	0.955 to 0.975
III---	2[3]			

[1]Distillation range shall be as follows:

Percent by volume	°C (corrected for barometer)
5	124.8 ± 0.5
10	125.8 ± 0.7
50	127.5 ± 0.5
90	129.8 ± 1.0

[2]The percent moisture shall not exceed 1 percent by weight. (See 4.3.6.)
[3]No test required on finished material.

4.2 Sampling.

4.2.1 Size of lots. For the purpose of sampling, a lot shall consist of a single type and class of adhesive produced as a unit of manufacture, and offered for inspection at one time.

4.2.2 Sampling procedure. From each lot of adhesive, a 1-quart sample shall be taken in accordance with FED-STD-141 for test.

4.3 Tests. Tests on the adhesive except for the acetone shall be conducted in accordance with methods described in the following paragraphs. For Navy purchases, the tests shall be conducted at a Government laboratory unless otherwise specified.

4.3.1 Tests for components. Unless otherwise covered by applicable test methods in this specification the properties of the adhesive components shall be determined by standard methods.

4.3.2 Specific gravity. Specific gravity shall be determined in accordance with method 401 of FED-STD-141 except that the determination shall be made at the temperatures specified in 3.1.1 and 3.1.2 for the respective components and adhesives.

4.3.3 Viscosity. Viscosity shall be determined by means of a suitable viscosimeter with readings converted to centipoises.

4.3.4 Solids content (nonvolatile). Solids content shall be determined in accordance with method 404.1 of FED-STD-141.

* 4.3.5 Distillation range. Distillation range shall be determined in accordance with method 430.1 of FED-STD-141 except that a thermometer of the proper range and graduated to 1/5°C shall be used.

* 4.3.6 Moisture. Moisture shall be determined by the Karl Fischer method in accordance with ASTM D 1744.

* 4.3.7 Nitrogen. Nitrogen shal be determined in accordance with MIL-N-244.

* 4.3.8 Acidity. Acidity shall be determined in accordance with method 525.2 of FED-STD-141.

* 4.3.9 Ester content. Ester content shall be determined in accordance with method 5 17.1 of FED-STD-141.

4.3.10 Acetyl content (apparent). The sample to be tested shall be dried to constant weight (about 2 hours) at 100° to 105°C and cooled in a dessicator. Place duplicate 1-gram portions of the sample accurately weighed in Erlenmeyer flasks, add 40 ml of ethyl alcohol (75 percent) to each flask and stopper the flasks. Heat for 30 minutes at about 55°C on a water bath

to swell the fibers. Add about 40 ml of 0.5 N sodium hydroxide accurately measured from a burette to each flask, stopper loosely, and heat at about 55°C for approximately 15 minutes. Tightly stopper and allow the flasks to stand for 48 hours. Back titrate the excess sodium hydroxide with standard 0.5N hydrochloric acid using phenolphthalien as an indicator. After reaching a temporary endpoint allow the flasks to stand at least 30 minutes so the sodium hydroxide can diffuse from the fibers. Add 0.5 N hydrochloric acid at intervals until all free sodium hydroxide has been neutralized. Care must be used at this point or poor check values will be obtained. Calculate the apparent acetyl content as follows:

$$\text{Apparent acetyl content} = \frac{VN - V_1N_1}{W} \times 4.305$$

where

V=millimeters of sodium hydroxide solution used
N=normality of sodium hydroxide solution
V_1=millimeters of hydrochloric acid required for titration of the sample
N_1=normality of the hydrochloric acid
W=grams of sample used

If duplicate determinations differ by more than 0.5 percent apparent acetyl the analysis shall be repeated.

4.3.11 Appearance (bubble formation). Four web inhibitors conforming to type I of MIL-I-3166 shall be adhered to the webs of cruciform-shape double-base powder and thereafter conditioned at room temperature (77°± 2°F) for 24 hours. The assembly shall then be stored for 72 hours in an oven maintained at 130°±10°F, removed from the oven, and cooled to room temperature. Examination shall reveal no bubble formation nor unbonded edges.

* 4.3.12 Adhesion. Using the samples prepared and conditioned in accordance with 4.3.11 and after examination for bubbles, the molded web inhibitor shall be pulled from the webs of the powder grain with a suitable pulling tool. Powder shall be pulled loose with the inhibitor. A similar sample shall be prepared and conditioned in accordance with 4.3.11 using a previously tested and approved adhesive for comparison. The performance of the adhesive as compared with the previously tested and approved adhesive shall be the means for determining conformance to this adhesion requirement.

4.4 Rejections. Lots of adhesives which are submitted for the requirements of this specification and do not pass the tests in 4.3 shall be rejected.

4.5 Resubmission. A lot that has been rejected under the provisions of this specification may be resubmitted for inspection and testing provided the contractor (after being informed of the reasons for rejection) submits a signed statement that he has corrected the deficiencies noted.

5. PREPARATION FOR DELIVERY

* 5.1 Packaging.

* 5.1.1 Level C. Adhesives shall be furnished in 5-gallon rectangular cans or in 55-gallon drums as specified in the contract or order.

* 5.1.1.1 Five-gallon cans shall conform to the requirements for type I of MIL-P-124.

* 5.1.1.2 Fifty-five-gallon drums shall conform to the requirements of specification 17E of 49 CFR 170-190.

5.2 Packing.

* 5.2.1 Level A. Two 5-gallon cans shall be packed in a nailed wood box or wirebound box conforming to the requirements of specification PPP-B-621 or PPP-B-585, respectively.

5.2.1.1 Fifty-five-gallon drums will require no further packing.

* 5.2.2 Level C. Two 5-gallon cans shall be packed in a nailed wood box or wirebound box conforming to the requirements of specification PPP-B-621 or PPP-B-585, respectively; or one 5-gallon can shall be packed in corrugated fiber box or solid fiber box conforming to the requirements of PPP-B-636. Fiberboard boxes shall comply with the latest edition of Consolidated Freight Classification Rule 41, section 6. No strapping will be required.

5.2.2.1 Fifty-five-gallon drums will require no further packing.

* 5.3 Marking. In addition to any special marking required by the contract or order, shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The adhesives covered by this specification are intended for use in adhering web and end plastic inhibitors to cruciform-shape double-base powder grains.

* 6.1.1 Type I. Type I, classes 1 and 2, adhesives are for use in adhering ethyl cellulose inhibitors as specified in MIL-I-3166. Class 2 may be diluted with up to 30 percent by weight of butyl acetate, conforming to TT-B-838.

6.1.2 Type II. Type II, classes 1, 2, 3, and 4 adhesives, are for use in adhering cellulose acetate inhibitors as specified in MIL-I-3166. Class I may be diluted up to 20 percent by weight with acetone conforming to O-A-51.

* 6.1.3 Type III. Type III, class 1, adhesive may be used to adhere either ethyl cellulose or cellulose acetate inhibitors as specified in MIL-I-3166.

6.1.3.1 Type III, class 2. The type III, class 2, adhesive is intended for cementing ethyl-cellulose plastic to propellent powder, or to other ethyl-cellulose plastic.

* 6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification
b. Desired type and class of adhesive (see 1.2)
c. The size of shipping containers (see 5.1)
d. Whether level A or level C packing is required (see 5.2)

6.2.1 Invitations for bids should state that adhesives which differ from the requirements of this specification will be considered provided that complete information is furnished with the bid concerning formulation and properties of the proposed adhesive together with the applicable methods of test.

6.3 It has been found necessary to blend cellulose nitrate (600-1,000 sec.) to 600 sec. with a cellulose nitrate of a lower viscosity to meet the requirements of type I classes 1 and 2.

* 6.4 The margins of this specification are marked with asterisks to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. 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 and relationship to the last previous issue.

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(Project No. 8040-N086)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

OMB Approval No. 22-R255

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DOCUMENT IDENTIFIER AND TITLE

MIL-A-3167A(OS), Adhesives (For Plastic Inhibitors)

NAME OF ORGANIZATION AND ADDRESS

CONTRACT NUMBER

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

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A. GIVE PARAGRAPH NUMBER AND WORDING.

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