

MIL-A-52194A(MR)  
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SUPERSEDING  
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MILITARY SPECIFICATION  
ADHESIVE, EPOXY (FOR BONDING  
GLASS REINFORCED POLYESTER)

1. SCOPE

1.1 This specification covers the requirements for a two-part, epoxy-based adhesive, suitable for bonding glass-reinforced polyester where no peel or cleavage is anticipated (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on the date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

- QQ-S-634 - Steel, Bar, Carbon, Cold Finished (Standard Quality)
- PPP-C-96 - Cans, Metal, 28 Gage and Lighter
- PPP-P-704 - Pails, Shipping, Steel (1 through 12 Gallon)

STANDARDS

MILITARY

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

FSC 8040

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

2.2 Other publications. The following documents form 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 proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS

D 950-54 - Test for Impact Strength of Adhesives

D 1002-64 - Test for Strength Properties of Adhesives in Shear by Tension Loading (Metal to Metal)

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

3. REQUIREMENTS

3.1 Material. The material shall be a two-component, room-temperature curing, epoxy-based adhesive consisting of an epoxy resinous base and a hardener. The hardener shall be of the type and quantity necessary to produce an adhesive meeting the requirements of this specification.

3.2 Form. Both the resinous base and the hardener shall be in paste form.

3.3 Instructions for use. The supplier shall provide complete instructions for using the adhesive. The instructions shall be furnished with each unit package of adhesive materials and shall include the following information:

- (a) Storage stability. Indicate the optimum storage temperature and conditions for the materials, and the expected storage life of the materials under these conditions.
- (b) Mixing proportions. State the proportions of base to hardener required to produce an adhesive conforming to all properties specified in table I. The proportions shall be by weight.
- (c) Mixing techniques. Describe clearly the necessary techniques for mixing the recommended proportions of base and hardener.

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- (d) In addition to the above information each instruction sheet or label shall contain a caution as follows:

"CAUTION: Contents may irritate the skin, mucous membranes, and lungs. Use with adequate ventilation. Use clean clothes daily. Use respiratory, eye, and skin protection during mixing. Protect the skin during pouring or laying-up operations. Prohibit smoking in working area. Keep substance away from food and food products. Wash hands thoroughly before smoking or eating. In case of accident: Flush eyes with water for 15 minutes. Remove substance from skin with alcohol or acetone; then wash area with soap and water. See a physician."

3.4 Physical and mechanical properties. The properties of the adhesive and of adhesive bonded specimens shall be in accordance with the requirements and test paragraph methods specified in table I.

Table I. Property requirements for adhesive and adhesive bonded specimens

Property	Value required	Paragraph reference to applicable test
Shear strength, psi		4.6.2
at $-54^{\circ} \pm 2^{\circ}\text{C}$ ( $-65 \pm 3.6^{\circ}\text{F}$ )		
average (minimum)	1790	
individual value (minimum)	1500	
at $23^{\circ} \pm 1.1^{\circ}\text{C}$ ( $73.4^{\circ} \pm 2^{\circ}\text{F}$ )		
average (minimum)	1360	
individual value (minimum)	1100	
at $71^{\circ} \pm 2^{\circ}\text{C}$ ( $160^{\circ} \pm 3.6^{\circ}\text{F}$ )		
average (minimum)	290	
individual value (minimum)	250	
Impact strength, ft.-lb.		4.6.3
1/2 square inch bonded area, average (minimum)	18.0	
individual value (minimum)	15.0	
Viscosity 5 minutes after mixing resinous base and hardener at $23^{\circ} \pm 1.1^{\circ}\text{C}$ ( $73.4^{\circ} \pm 2^{\circ}\text{F}$ ) poises (minimum)	1400	4.6.4
Viscosity 45 minutes after mixing resinous base and hardener at $23^{\circ} \pm 1^{\circ}\text{C}$ ( $73.5^{\circ} \pm 2^{\circ}\text{F}$ ) and $50 \pm 4\%$ R.H. poises (maximum)	3900	4.6.4

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3.4.1 Storage life. After 6 months storage at normal room temperature (21.1°C to 26.7°C) (70° to 80°F) in their original containers, the base and the hardener when mixed in accordance with the manufacturer's instructions (see 3.3) shall be capable of forming an adhesive which shall meet the requirements of this specification when tested in accordance with 4.6.

3.5 Workmanship. Both the resinous base and hardener shall be free from foreign matter, homogeneous, and processed as required in accordance with the best practice for high quality material (see 4.5.1).

#### 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, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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 a quantity of the adhesive components (base and hardener), each produced in one batch of the same chemical ingredients by the same process, and presented for acceptance at one time.

4.3 Classification of tests. Unless otherwise specified, sampling and all visual and dimensional inspection shall be done at the manufacturer's plant. All testing shall be performed in accordance with 4.6 and shall be classified as follows:

- (a) Lot acceptance tests (see 4.3.1)
- (b) Periodic lot-check tests (see 4.3.2)

4.3.1 Lot acceptance tests. Lot acceptance tests shall be made on each lot of material and shall be the basis for the acceptance or rejection of the lot. The lot acceptance tests shall consist of the examination specified in 4.5, plus the following tests:

- (a) Shear strength at 23°C (see 4.6.2)
- (b) Initial viscosity at 23°C (see 4.6.4)
- (c) Viscosity after 45 minutes at 23°C (see 4.6.4)

4.3.2 Periodic lot-check tests. Lot-check tests shall be made on the first lot of adhesive materials furnished under this specification, and on every 20th lot of the same materials thereafter, or once every 2 years, whichever is the more frequent. Unless otherwise specified by the procuring activity, the periodic lot-check tests shall consist of all tests specified in Paragraph 4.6.

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#### 4.4 Sampling.

4.4.1 Sampling for visual examination. A random sample of unit packages shall be selected from each lot in accordance with MIL-STD-105 at inspection level I, to verify compliance with all requirements of this specification not covered by tests (see 4.5). The unit of product shall be one unit package (see 5.1.1.1).

4.4.2 Sampling for tests. A representative 1-quart sample of epoxy resinous-base material shall be selected for tests from each lot. In addition, a sample of hardener representative of the lot shall be selected in sufficient quantity to activate the resinous base material. The samples of both components shall be used to prepare the adhesive specimen for all required tests (see 4.6).

#### 4.5 Examination

4.5.1 Visual. Sample units selected in accordance with 4.4.1 shall be examined for defects at the acceptable quality levels shown in table II.

4.5.2 Packaging, packing and marking. Examination shall be for the defects and at the acceptable quality levels shown in table II.

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Table II - Classification of defects

Item	AQL Percent	Classification of defects	Defect	Method of inspection
Resinous base and hardener (see 3.5 and 4.4.1)	2.5	Major 101	Foreign matter	Visual
		Major 102	Not homogeneous	Visual
Unit package (see 4.4.1, 5.1.1.1 and 3.3)	2.5	Major 103	Containers of resin and hardener not packaged as unit	Visual
		Major 104	Unit packages not held together properly	Visual
		Major 105	Missing or improper instruction sheet	Visual
Unit container (see 4.4.1 and 5.1.1.2.)	2.5	Major 106	Improper type	Visual
		Major 107	Improper sizes	Visual
		Major 108	Resin and hardener not packaged in proper proportions	Visual
		Major 109	Improper fill <sup>2/</sup>	Approved scale <sup>2/</sup>
		Major 110	Leakage	Visual
		Major 111	Improper closure	Visual
Box open (see 4.4.1 and 5.2)	2.5	Major 112	Improper type	Visual <sup>2/</sup>
		Major 113	Lack of, or improper strapping	Visual
Box closed (see 4.4.1 and 5.2 and 5.3)	2.5	Major 114	Gross weight max.	Approved scale <sup>2/</sup>
		Major 115	Improper marking	Visual
		Major 116	Improperly closed	Visual

<sup>1/</sup>The actual weight of a container filled with the minimum required quantity of adhesive shall be the basis for determining the acceptable weight of subsequent containers.

<sup>2/</sup>Approved by procuring activity

<sup>3/</sup>When applicable

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4.6 Test procedures. Unless otherwise specified, all tests shall be conducted at  $23^{\circ} \pm 1.1^{\circ}\text{C}$  ( $73.4^{\circ} \pm 2^{\circ}\text{F}$ ). The average value for the number of specimens tested and the minimum value, when applicable, for a single specimen tested shall conform to the requirements of this specification (see 3.4).

4.6.1 Preparation of specimen. An epoxy-based adhesive shall be prepared from the sample components selected in accordance with 4.4.2. Unless otherwise specified, the mixing techniques shall be in compliance with the supplier's instructions. The adhesive specimen shall be used for all required tests.

4.6.2 Shear strength. Ten specimens shall be tested at each of the required temperatures in accordance with ASTM test method D 1002-64 except for the following:

- (a) Individual specimens shall consist of steel panels measuring 1 by 4 inches.
- (b) The steel panels shall be of No. 16 U.S. Standard gage ( $0.0613 \pm 0.003$  inch thick) steel conforming to Composition 1020 of QQ-S-634.
- (c) Overlap length shall be 0.50 inch.
- (d) All specimens shall be cured 7 days at room temperature, using only contact pressure.
- (e) Before testing at  $-54 \pm 2^{\circ}\text{C}$  and  $71^{\circ} \pm 2^{\circ}\text{C}$ , the specimens shall be exposed to the required temperatures for a minimum of 4 hours.

4.6.3 Impact strength. Ten specimens shall be tested in accordance with ASTM test method D 950-54 except that:

- (a) Steel conforming to QQ-S-634, composition 1020 shall be used to prepare the specimens.
- (b) The dimensions of the upper block shall be reduced to 0.70 by 0.70 by 0.375 inch.
- (c) All specimens shall be cured 7 days at room temperature, using only contact pressure.

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4.6.4 Viscosity. The viscosity of a 270-gram sample of base resin and hardener shall be determined with a Brookfield viscometer (or equal) using a number 7 spindle at 4 rpm. Measurements shall be taken at  $23^{\circ} \pm 1.1^{\circ}\text{C}$  ( $73.4 \pm 2^{\circ}\text{F}$ ) for both (a) the viscosity of the specimen 5 minutes after mixing of the base resin and hardener and (b) the viscosity of the specimen 45 minutes after mixing in accordance with the requirements of this specification (see 3.4). The temperature of the resin and hardener mixture may rise to  $25^{\circ}\text{C}$  ( $77^{\circ}\text{F}$ ) after 5 minutes at  $23^{\circ}\text{C}$  due to the exothermic reaction. The viscometer shall be used according to the manufacturer's instructions unless otherwise specified by the procuring activity (see 6.2).

4.6.5 Storage life. The material stored in accordance with 3.4.1 shall be visually examined for signs of gelation or hardening. If such signs are found, the suspected material may be subjected to any test or tests specified in this specification to confirm the deterioration.

#### 4.7 Rejection.

4.7.1 Examination. A lot shall be rejected when the number of nonconforming units of a sample examined in accordance with 4.5 exceeds the acceptance number specified for that sample.

4.7.2 Tests. A lot shall be rejected for failure to comply with any of the test requirements of this specification, when tested in accordance with 4.6.

### 5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be Level A or Level C as specified (see 6.2).

#### 5.1.1 Level A

5.1.1.1 Unit package. The epoxy resinous base and the hardener shall each be packaged in its own container; the containers shall be packaged in a unit that shall prevent accidental separation, but permit easy separation for mixing purposes. The proportional quantities of resinous base and hardener in each unit package shall be in accordance with the supplier's recommendations for mixing.

5.1.1.2 Packaging. Unless otherwise specified by the procuring activity, both the resinous base and the hardener shall be furnished (a) in 1-pint, 1-quart, or 1-gallon cans conforming to PPP-C-96, type V, class 2; or (b) in 5-gallon lug-cover steel pails conforming to PPP-P-704, type II, as specified (see 6.2).



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5.1.2 Level C. Unit package shall be in accordance with 5.1.1.1. Unit containers shall be in accordance with the supplier's commercial practice. Packages shall be protected against deterioration during shipment and any subsequent interval prior to use.

5.2 Packing. Packing shall be Level A or Level C, as specified (see 6.2).

5.2.1 Level A. Units packaged in accordance with 5.1.1.1 shall be packed to conform to the overseas shipment requirement of PPP-C-96, Appendix. Five-gallon pails will require no overpacking.

5.2.2 Level C. Packing shall be in accordance with commercial practice adequate to ensure acceptance and safe delivery by the carrier for the mode of transportation employed.

5.3 Marking. When labels are used, marking shall be protected by a coat of clear transparent varnish to assure identification after storage. Containers shall be marked in accordance with the requirements of MIL-STD-129, plus any special marking specified by the procuring activity (see 6.2). In addition, the following marking shall appear on each container:

- (a) Storage instructions
- (b) Date packaged (month and year)
- (c) Lot number and date of last lot-check test.
- (d) A caution, as follows:

"Caution: Contents irritating. Avoid prolonged or repeated skin contact. Wash hands before eating or smoking. Keep materials away from food and food products. In case of skin contamination, cleanse with alcohol or acetone followed by soap and water washing. Remove contaminated clothing. See a physician."

NOTE: The caution of 3.3(d) may be substituted for that of 5.3(d).

## 6. NOTES

6.1 Intended use. This specification was prepared to cover material for bonding the two halves of plastic gunstocks. The adhesive is intended for use in applications where its paste consistency is necessary (a) to prevent adhesive drain-off during cure, or (b) to bond adherend surfaces that are not plane. The adhesive is not intended for use where service temperatures exceed 200°F. The properties required by this specification apply only to reproducible material and should not be used as design data.

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6.2 Ordering data. Procurement documents shall specify the following:

- (a) Title, number, and date of this specification.
- (b) Instruction for using viscometer, if any (see 4.6.4).
- (c) Selection of applicable level of packaging (see 5.1).
- (d) Size of containers (see 5.1.1.2).
- (e) Selection of applicable level of packing (see 5.2).
- (f) Special marking if required (see 5.3).

Custodian:  
Army - MR

Preparing activity:  
Army - MR

Review activities:  
Army - MD, ME, MU,

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User activities:  
Army - EL, MI

Code "C"

Review/User information is current as of the date of this document; draft circulation should be based on the information in the current DODISS.

## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

*(See Instructions - Reverse Side)*

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION <i>(Mark one)</i> <input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER <i>(Specify):</i> _____
b. ADDRESS <i>(Street, City, State, ZIP Code)</i>	
5. PROBLEM AREAS	
a. Paragraph Number and Wording:	
b. Recommended Wording:	
c. Reason/Rationale for Recommendation:	
6. REMARKS	
7a. NAME OF SUBMITTER <i>(Last, First, MI) - Optional</i>	b. WORK TELEPHONE NUMBER <i>(Include Area Code) - Optional</i>
c. MAILING ADDRESS <i>(Street, City, State, ZIP Code) - Optional</i>	8. DATE OF SUBMISSION (YYMMDD)