

MIL-A-81236(WP)
29 March 1965
SUPERSEDING
WS 1708
6 November 1962

MILITARY SPECIFICATION
ADHESIVE; EPOXY RESIN
WITH POLYAMIDE CURING AGENT

This specification has been approved by the
Bureau of Naval Weapons, Department of the Navy

1. SCOPE

1.1 Scope. This specification covers one type of adhesive consisting of an epoxy resin and a polyamide curing agent.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

Federal

QQ-A-362

**Aluminum Alloy, Plate and Sheet,
Alclad 2024**

Military

MIL-P-116

Preservation, Methods of

STANDARDS

Federal

**Federal Test Method
Standard No. 175**

Adhesives; Methods of Testing

Military

MIL-STD-129

Marking for Shipment and Storage

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(When requesting any of the above documents, give the title and complete designation of the item shown above. Copies of this specification and other unclassified specifications, standards and publications required by contractors in connection with specific procurement functions may be obtained from the Commanding Officer, Naval Supply Depot (CDS), 5801 Tabor Avenue, Philadelphia, Pennsylvania, 19120.)

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.

PUBLICATIONS

American Society for Testing and Materials

ASTM D 1084-60	Method of Test for Consistency of Adhesives
ASTM D 1652-62T	Method of Test for Epoxy Content of Epoxy Resins
ASTM D 891-59	Method of Test for Specific Gravity of Industrial Aromatic Hydrocarbons and Related Materials

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

3. REQUIREMENTS

3.1 Data requirements. No data is required by this specification or be applicable documents referenced in Section 2 unless specified in the contract or order (see 6.2).

3.2 Material. The material shall be a two-part thermosetting adhesive containing a base material of the epoxy resin type and a polyamide curing agent.

3.3 Physical and chemical properties. The physical and chemical properties shall be as specified in Table I.

Table I - Physical and Chemical Properties

Property	Minimum	Maximum
Epoxy Resin		
Viscosity at 25 degrees Centigrade (C), poises	110	160
Density at 25 degrees C, gm/ml	1.15	1.21
Epoxide equivalent, gm/eq	187	191
Polyamide curing agent		
Viscosity at 75 degrees C, poises	2	6
Density at 25 degrees C, gm/ml	0.94	1.00
Amine value	350	400

3.3.1 Adhesive properties. The mixed adhesive shall have the following properties:

3.3.1.1 Curability. When the epoxy resin and curing agent are mixed, the blend shall cure to a Shore "D" hardness of 75 ± 10 in not more than 16 hours at 110 ± 5 degrees Fahrenheit (F).

3.3.1.2 Tensile shear strength. The cured system shall have a minimum tensile shear strength of 1500 pounds per square inch (psi) at 75 ± 5 degrees F when cured for not more than 16 hours at 110 ± 5 degrees F.

3.4 Workmanship. The material shall be uniform in quality and shall be free from impurities and other defects that could adversely affect its use.

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 supplies and services conform to prescribed requirements.

4.2 Classification of inspections. Inspection of the adhesive shall be classified as follows:

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- a. **Preproduction inspection (see 4.4)**
- b. **Quality conformance inspection (see 4.5)**

4.3 Sampling

4.3.1 Preproduction sample. A preproduction sample of sufficient quantity of adhesive components manufactured in accordance with 3.1 shall be subjected to three each of the preproduction tests detailed in 4.4 at an activity designated by the procuring activity. Further production of the adhesive by the supplier prior to the approval of the preproduction sample, shall be at the supplier's risk

4.3.2 Quality conformance inspection sampling. Unless otherwise specified, sufficient material shall be taken from each lot to perform the tests as specified in 4.5.

4.3.3 Inspection lot. A lot of resin or curing agent shall consist of all material presented for acceptance at one time and produced in a single manufacturing batch under homogeneous conditions of manufacture.

4.4 Preproduction inspection. The preproduction sample shall satisfactorily pass the quality conformance inspections as specified in 4.5.

4.5 Quality conformance inspection

4.5.1 Visual examination. Visually examine all containers in the lot to determine compliance with 3.4 and Section 5.

4.5.2 Viscosity test. The viscosity of the epoxy resin base and polyamide curing agent shall be determined in accordance with ASTM D 1084-60.

4.5.3 Density test. The density of the epoxy resin base and polyamide curing agent shall be determined in accordance with ASTM D 891-59.

4.5.4 Epoxide equivalent test. The epoxide equivalent of the epoxy resin shall be determined in accordance with ASTM D 1652-62T.

4.5.5 Amine value test. The amine value of the polyamide curing agent shall be determined by titration of a solution of the sample with 0.5 normal (N) hydrochloric acid.

Apparatus. The following apparatus shall be used:

- a. Analytical balance, minimum sensitivity 0.1 milligram (mg)
- b. Buret, 50-milliliter (ml)
- c. Flask, Erlenmeyer, pyrex, 125 ml
- d. Stirrer, magnetic, with chemically inert stirring bar

Reagents. The following reagents shall be used:

- a. Bromcresol green solution, 100 mg of indicator (sodium salt) in 100 ml water
- b. Hydrochloric acid solution, 0.5N (standardized to three decimal places)
- c. Solvent (equal parts by volume of toluene and n-butanol)
- d. Ethanol, 95 percent

Procedure. The following procedure shall be used to determine amine value:

- a. Dissolve 800 mg of the sample in 20 ml of solvent. The sample may be warmed to speed solution but must not be boiled. Add 30 ml of ethanol to clarify the solution. If the solution should become cloudy before the end point of titration, an additional 10 ml of ethanol may be added.
- b. Add 3 ml of indicator solution to the sample solution and titrate with hydrochloric acid to an initial end point. Allow the titrated solution to stand several minutes until the green color returns. Then add additional indicator and titrate again, drop by drop, to a permanent yellow end point.
- c. Calculate the amine value as follows:

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$$\text{Amine value} = \frac{V \times N \times 56.1}{W}$$

where:

V = Volume of hydrochloric acid, ml

N = Normality of hydrochloric acid

W = Sample weight, grams

4.5.6 Preparation of sample. The mixed adhesive, consisting of three parts by weight of epoxy resin and two parts by weight of polyamide curing agent, shall be tested as follows:

4.5.6.1 Curability test. The curability of the mixed adhesive shall be determined in accordance with the following:

Curability. The epoxy resin and curing agent shall be mixed in the specified proportions and the mixture cast as a 1/4- to 1/2-inch thick slab. The mixture shall be degassed and cured for not more than 16 hours at 110 ± 5 degrees F. After cooling, the Shore "D" hardness shall be determined.

4.5.6.2 Tensile shear strength test. The tensile shear strength test shall be determined in accordance with Federal Standard Number 175, method 1033, except that:

- a. The finished specimens shall be conditioned at 75 ± 5 degrees F and 50 ± 10 percent relative humidity for a minimum of 16 hours.
- b. The specimen shall be dry tested at 75 ± 5 degrees F and 50 ± 10 percent relative humidity.
- c. Wet test shall not be required. The adherends shall be aluminum conforming to QQ-A-362.
- d. Jaw separation shall be 0.1 inch per minute.

4.6 Acceptance criteria

4.6.1 Preproduction. Failure of any sample to comply with any requirement of this specification shall be cause for rejection of the sample.

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4.6.2 **Quality conformance.** Failure of any sample to meet any requirement of this specification shall be cause for rejection of the lot.

5. PREPARATION FOR DELIVERY

5.1 **Preservation, packaging and packing.** Unless otherwise specified by the procuring activity, the preservation, packaging and packing shall be in accordance with MIL-P-116, method III.

5.2 **Marking.** Each container shall be marked in accordance with MIL-STD-129. Marking shall include, but not be limited to, the following information:

- a. Manufacturer's name and location
- b. Material trade name
- c. Net weight or volume
- d. Lot number, batch number and date of manufacture
- e. Shelf life or storage limitations
- f. Number and revision letter of this specification

6. NOTES

6.1 **Intended use.** The material purchased in accordance with this specification is intended to be used as an adhesive in rocket motors.

6.2 **Ordering data.** Procurement documents should specify, but not be limited to, the following information:

- a. Title, number and revision letter of this specification
- b. Minimum lot size, if applicable
- c. Place of delivery
- d. Size of container
- e. Request for test data
- f. Whether preproduction sample is required

6.3 **Definitions - amine value.** Amine value is the milligrams of potassium hydroxide equivalent to the amine alkalinity in one gram of sample.

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b. ADDRESS (Street, City, State ZIP Code)

5. PROBLEM AREAS

a. Paragraph Number and Wording

b. Recommended Wording

c. Reason/Rationale for Recommendation

6. REMARKS

7a. NAME OF SUBMITTER (Last First, MI) - Optional

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